TECHNICAL WHITE PAPER

Protect Your Oracle Database in the Cloud

Explore Purity CloudSnap™ Hybrid Recovery for Oracle.

Contents

Introduction

One of the leading features that differentiates Pure Storage FlashArray™ from competitors is the Purity Snapshot technology. Irrespective of volume size, you can create Purity Snapshots nearly instantly and they consume very little additional space. Once created, Purity Snapshots are independent entities and do not rely on the existence of any previous snapshots, or even the source volumes from which they were created. And creating numerous snapshots does not result in performance degradation while reading and writing from the source volume.

Before Purity//FA 5.0, you could replicate Purity Snapshots only to another FlashArray. Now, with Pure's portable snapshot technology, you can move Purity Snapshots freely (or "off-load" them) in a space and network bandwidth-efficient manner to FlashBlade™, third-party NFS servers, and the cloud. With Purity CloudSnap™, a FlashArray appliance can now send Purity Snapshots directly to the cloud.

Purpose

The purpose of this technical white paper is to showcase the simplicity and power of Purity CloudSnap and how it can fit in your organization's Oracle database protection and recovery strategy. It will walk through the steps required to set up offloading of Oracle snapshot backups from a FlashArray to AWS S3 storage using Purity CloudSnap, as well as restoring it back on another FlashArray.

Audience

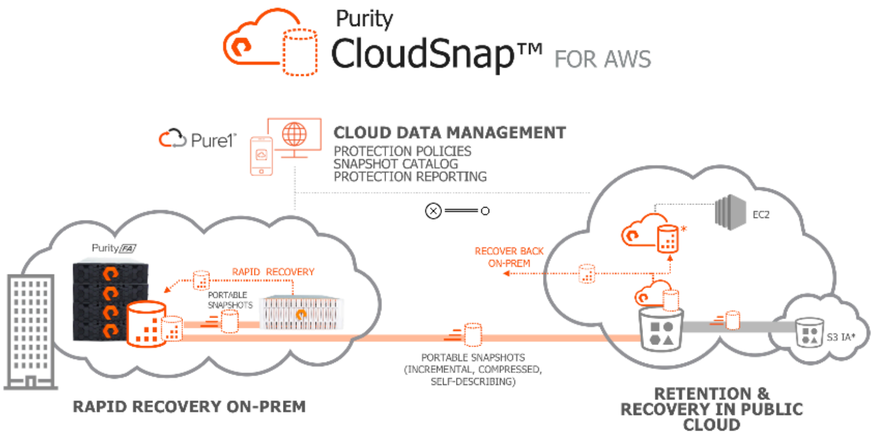
The target audience for this document includes, but is not limited to, Oracle database administrators, storage administrators, IT managers, and others who are interested in learning more about Purity CloudSnap and how it can complement their existing on-premises Oracle data protection and recovery strategy. A working knowledge of Oracle, Linux, AWS, server, storage, and networks is assumed but is not a prerequisite to read this document.

CloudSnap Overview

Purity CloudSnap provides simple, built-in "self-backup to cloud" protection for FlashArray appliances using Pure's portable snapshot technology. The portable snapshot technology encapsulates both metadata and data into the snapshot, making it portable so it can be offloaded from a Pure FlashArray to the cloud in a format that is recoverable to any FlashArray or to a Pure Cloud Block Store virtual FlashArray appliance.

Pure first introduced its portable snapshot technology via the Snap-to-NFS feature in Purity//5.1, which enabled a FlashArray to offload snapshots to a Pure FlashBlade and to any other NFS server. Pure has extended this technology to enable data protection in the cloud.

- In Purity//FA 5.2, CloudSnap was introduced to offload snapshots directly to an AWS S3 bucket.
- In Purity//FA 5.3, Pure added support for AWS S3 IA (infrequent access) as well as offloading snapshots to Microsoft Azure Blob. (This paper primarily focuses on AWS S3, but the concepts are the same and would apply to Azure Blob.)



Pure portable snapshot technology is deeply integrated with the Purity Operating Environment. It preserves data compression on the wire and in the cloud, thereby saving network bandwidth as well as storage space.

Pure portable snapshots preserve data reduction across snapshots of a volume. After the first snapshot of a volume is offloaded, it becomes the baseline and subsequent snapshots only send delta changes. The snapshot-differencing engine that runs within the Purity Operating Environment uses the local copy of the snapshot to compute the delta changes. Because this drastically reduces the network round trips that would otherwise be required, it reduces network congestion and provides data-access cost savings.

When it comes to restore, Purity knows which blocks already exist on the FlashArray, so it only needs to pull back missing blocks to rebuild the complete snapshot on the FlashArray.

Key Benefits

Simplicity

- Once the configured as an offload target in FlashArray, the S3 bucket appears like any other replication target.
- CloudSnap is natively managed via Pure FlashArray's GUI, CLI, and REST interfaces.
- CloudSnap is integrated with the Pure1® Snapshot Catalog and provides users with a global view of all their snapshots.

Efficiency

- CloudSnap requires less space consumption in the S3 bucket, reduces network utilization, and requires smaller backup windows.

Security

- Data is sent to the cloud over https: and stored in an encrypted format in the S3 bucket.

Cost Savings

- Because CloudSnap is built into Purity, you don't need to buy additional backup software or hardware, nor use an additional management interface.

- CloudSnap is aware of the cost-model of each public-cloud platform and makes cost-model-based decisions to reduce infrastructure costs. For example, in the case of AWS, if a snapshot needs to be stored for more than 30 days, CloudSnap would automatically store it in S3 IA, which is considerably cheaper.

Protecting Oracle Databases

The Oracle Recovery Manager (RMAN) utility is built into the Oracle database software to automate the backup, restore, and recovery of an Oracle database. It was introduced in Oracle 8 and Oracle adds new features with every new release. Unique features include block-level corruption detection and repair, plus tight integration with Oracle Enterprise Manager.

RMAN has typically played a central role in an organization's Oracle database protection strategy because it offers a rich set of capabilities, it's platform agnostic, and it is designed, recommended, and supported by Oracle.

However, a gradual is shift happening. Because of their exceptional capabilities, FlashArray snapshots are playing an increasingly important role in the Oracle database protection and recovery strategies of Pure Storage customers. Some organizations base their entire Oracle database protection strategy—including mission-critical databases—on FlashArray snapshots. The primary reasons they cite for using Purity Snapshots as the backbone of their data-protection strategy include the following:

- Easier and faster to take a snapshot-based backup
- Quicker point-in-time recovery using FlashArray Snapshots and archive log files
- Savings in storage due to space efficiency of FlashArray snapshots
- Lower CPU utilization on the database host due to not having to run RMAN
- Possible reduction in Oracle license cost due to lower CPU utilization
- Purity ActiveCluster™ removes the FlashArray as the single point of failure.

In addition, the stability of Oracle code is a factor. Because database corruption events are very rare, you can do periodic snapshot validation and database corruption checks by hydrating the database backup on a different server and running database-validation commands.

This is not by any means a suggestion against using Oracle RMAN. However, not all snapshots are the same and Purity Snapshot technology is enabling solutions and strategies that are "outside the box." You should do your own cost and risk assessment. Decide on a data-protection strategy that takes into account your business requirements and the pros and cons of each solution.

How CloudSnap Changes the Story

It is well known that snapshots are not the same as backups. That's true whether they are stored on the same FlashArray or another FlashArray in the same failure domain. This white paper shows how CloudSnap changes that.

FlashArray has had the capability to asynchronously replicate snapshots to a remote FlashArray for many years. This enabled you to store snapshots externally from the source array and provides a simple, flexible, and efficient low-RPO solution for data protection and disaster recovery (DR). However, this approach required you to have a second FlashArray at the remote site. Moreover, it didn't have the agility and economics of the cloud. That has changed with CloudSnap.

Environment

Component	Type
Database	Oracle Enterprise Edition 18c
Host OS	Linux
Cloud Target	AWS S3
On-premises storage	FlashArray//X 90R2

Setting up Purity CloudSnap

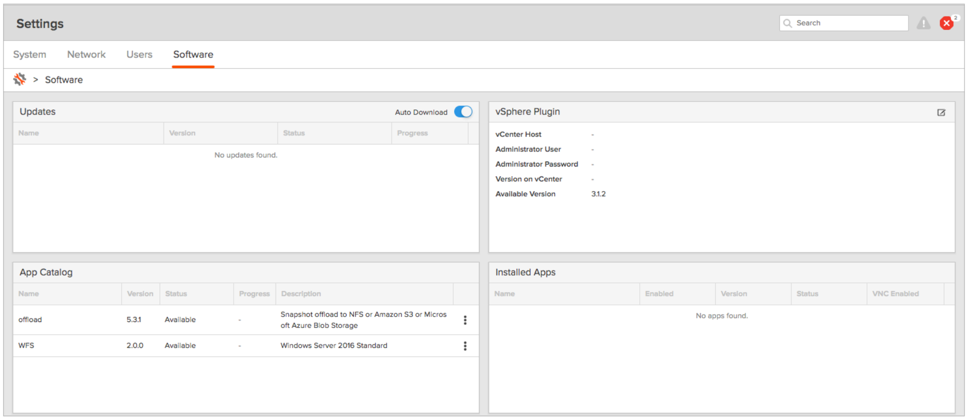
First, verify the following pre-requisites:

- Make sure Purity version is at least 5.2.
- Make sure you have credentials for an AWS account that can create an S3 bucket

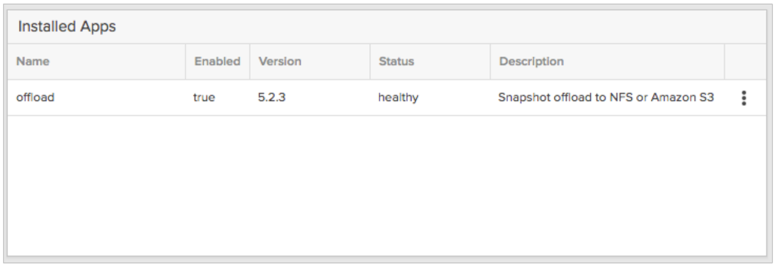
Here are the high-level steps that you need to perform:

1. Install the offload app
2. Configure network connectivity for the offload app
3. Set up a S3 bucket
4. Add the S3 bucket as new Offload Target

Step 1. Install the Offload App



Once install is complete, it will show up under **Installed Apps** as shown below.



Installed Apps

Name	Enabled	Version	Status	Description
offload	true	5.2.3	healthy	Snapshot offload to NFS or Amazon S3

Step 2. Configure Network Connectivity for the Offload App

Create a virtual interface (vif) for the Offload app and select a physical interface on the FlashArray to connect to the vif. (Make sure that the physical interface has network connectivity to the offload target.) If a "replbond" interface exists on the FlashArray, connect the vif for the Offload app to the replbond interface.

```
pureuser@sn1-x70-f05-27> purenetwork create vif @offload.data0 --subinterfacelist replbond
```

Otherwise, if replbond has not been created, connect the vif for the Offload app directly to a replication port on the FlashArray.

```
pureuser@sn1-x70-f05-27> purenetwork create vif @offload.data0 --subinterfacelist
ct0.eth3,ct1.eth3
```

Next, assign an IP to the virtual interface:

```
pureuser@sn1-x70-f05-27> purenetwork setattr --address 10.21.228.16 --netmask 255.255.255.0 --
gateway 10.21.228.1 @offload.data0
```

Now, enable the interface:

```
pureuser@sn1-x70-f05-27> purenetwork enable @offload.data0
```

Finally, restart the Offload App:

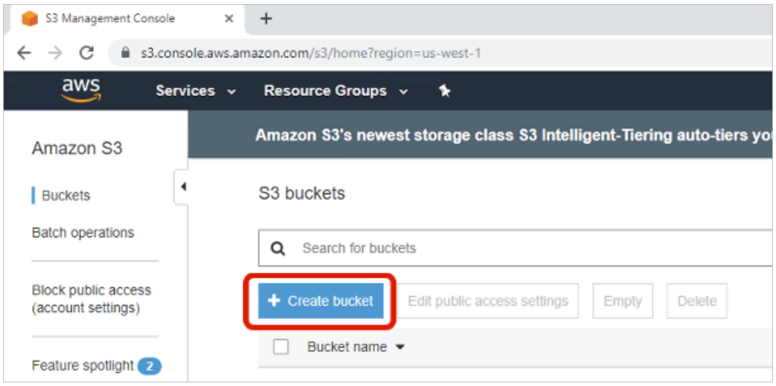
```
pureuser@sn1-x70-f05-27> pureapp disable offload
pureuser@sn1-x70-f05-27> pureapp enable offload
```

Use the list command to make sure that the status of the Offload app is healthy.

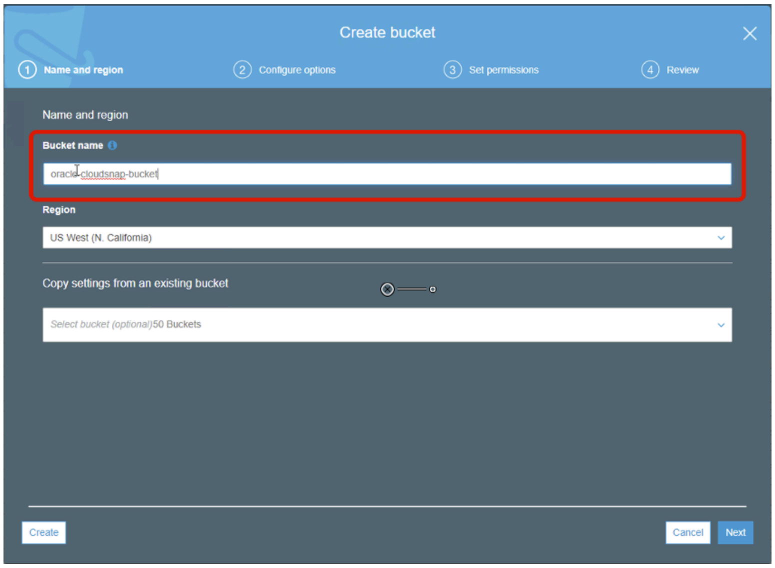
```
pureuser@sn1-x70-f05-27> pureapp list
Name     Enabled  Version  Status   Description                          Details
offload  True     5.3.0    healthy  Snapshot offload to NFS or Amazon S3  -
```

Step 3. Set Up an S3 Bucket

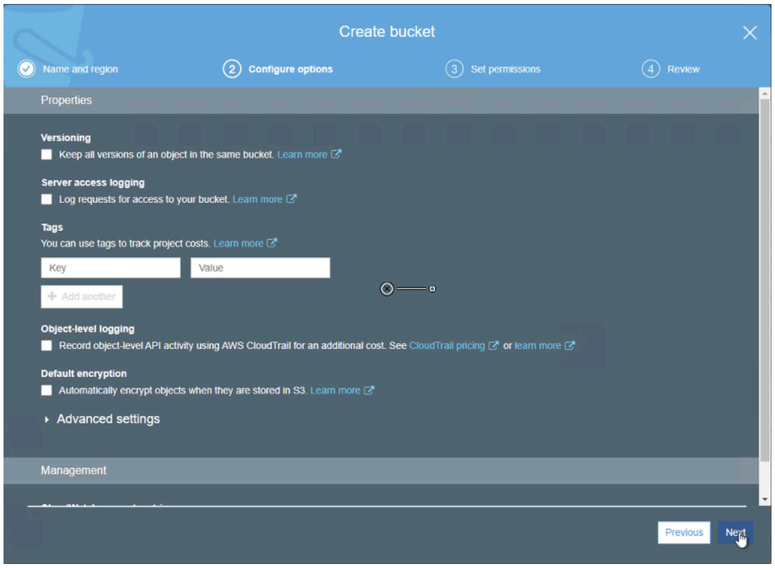
Login to AWS and navigate to the S3 service page. Click on the Create Bucket button.



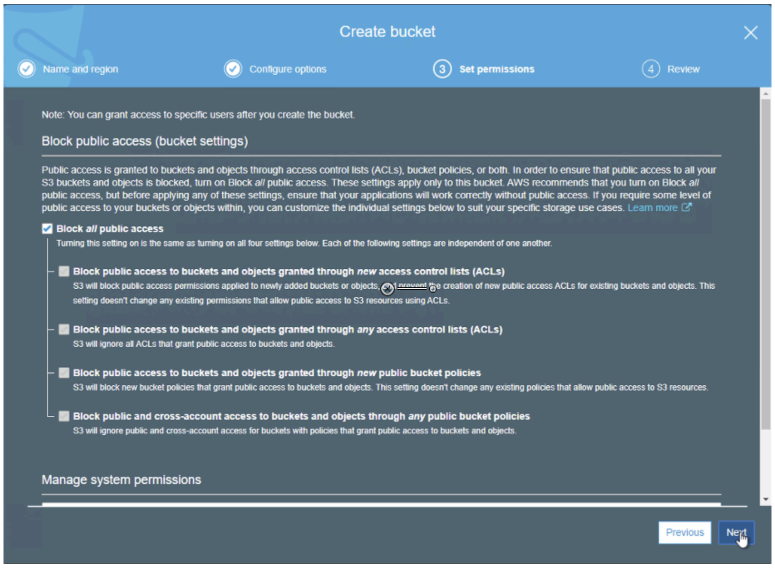
The **Create Bucket** dialog will pop up. Provide a name for the bucket.



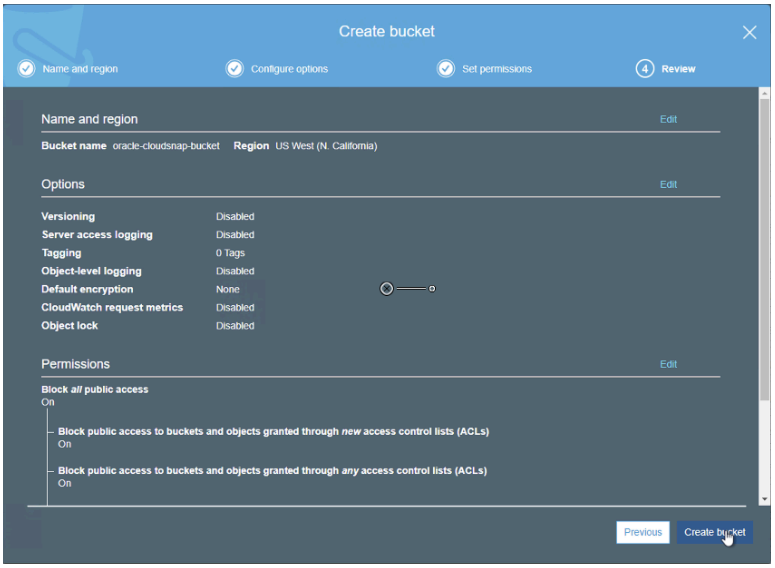
On the **Configure Options** screen, the defaults are good, so move to the next screen.



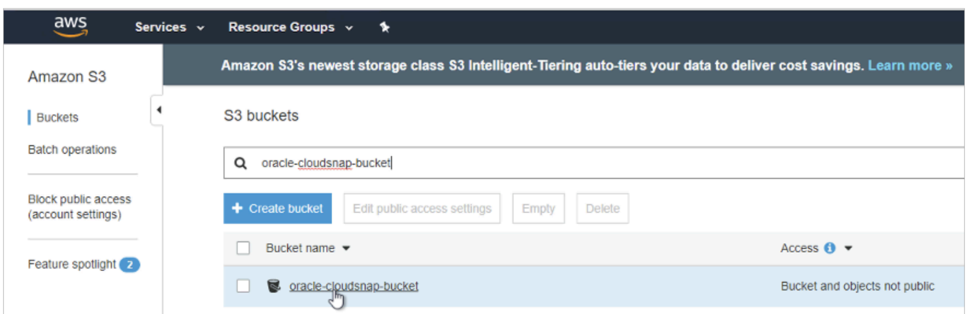
Make sure the **Block all public access** checkbox is checked.



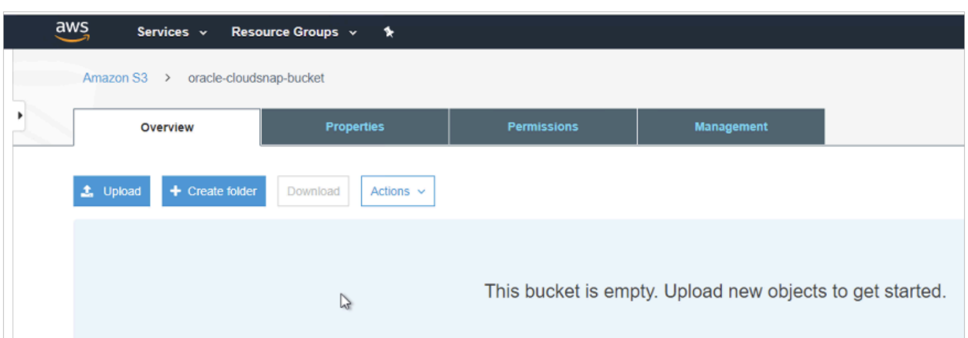
Review the selected options and click on **Create Bucket**.



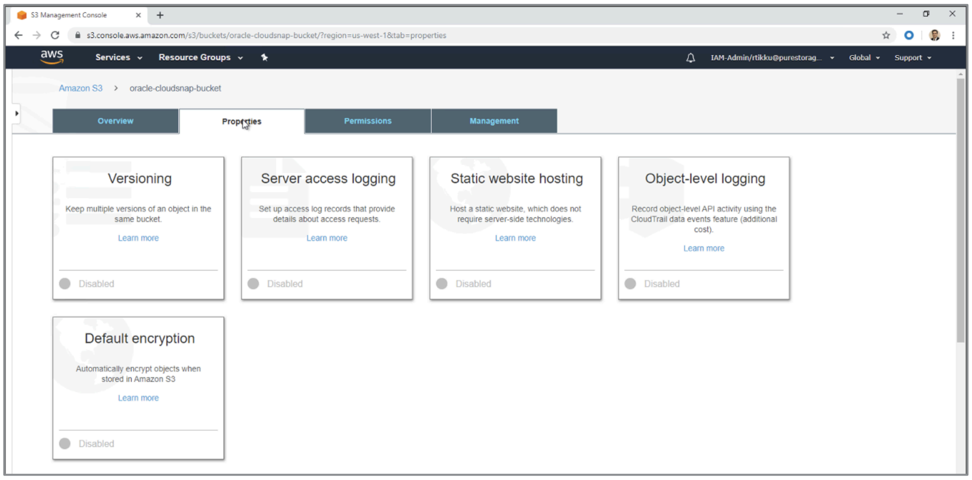
The bucket gets created. Click on it to go to the Bucket details page.



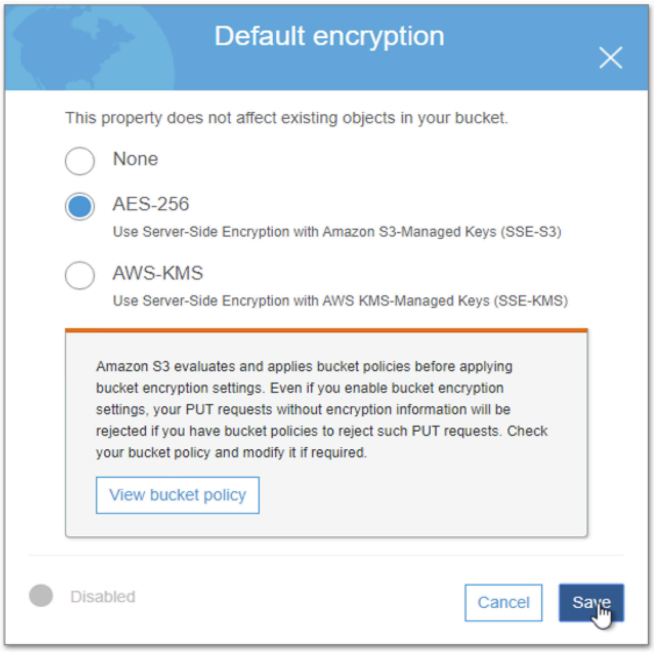
Click on the **Properties** tab.



Click on the Default Encryption tile.

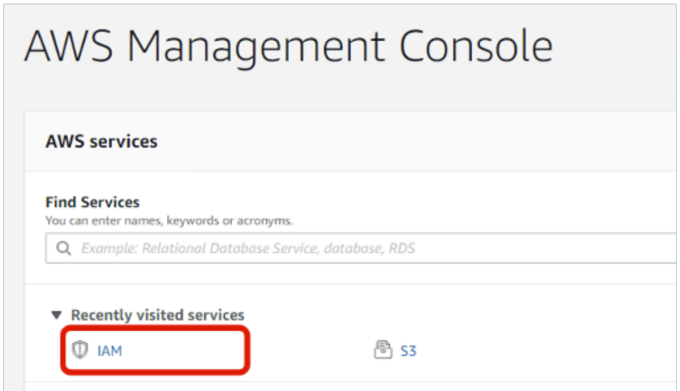


Once expanded, select the AES-256 radio button and hit Save.

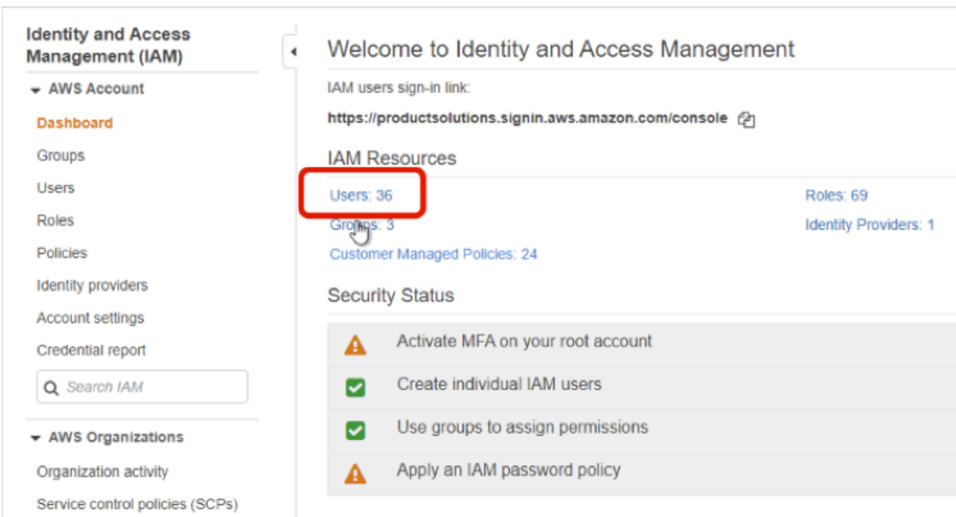


No changes are needed on the remaining tabs. The bucket is ready to use. Now we need to create a User.

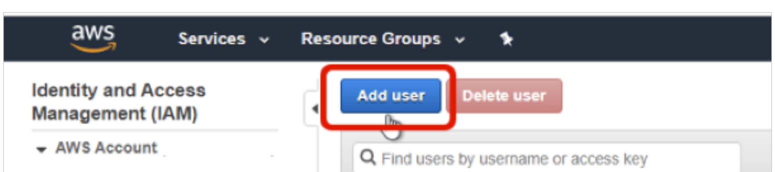
Go to the AWS Services home page and click on the **IAM** service.



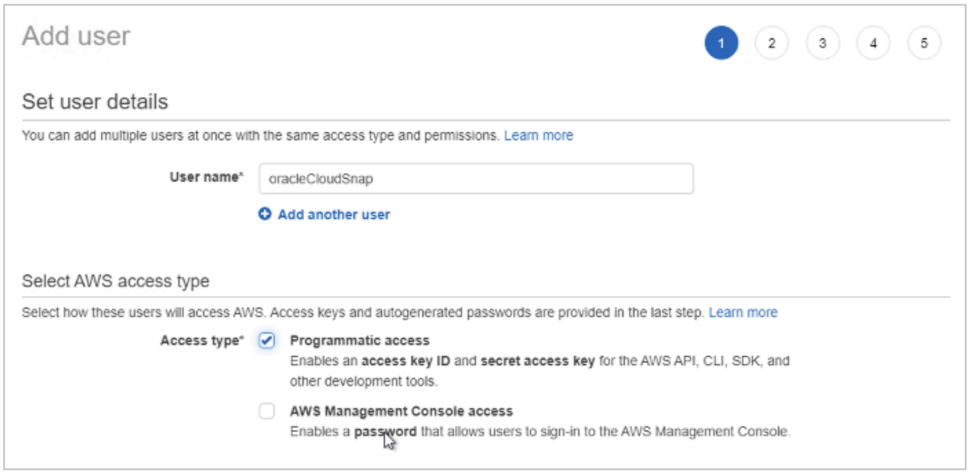
Then click on **Users.**



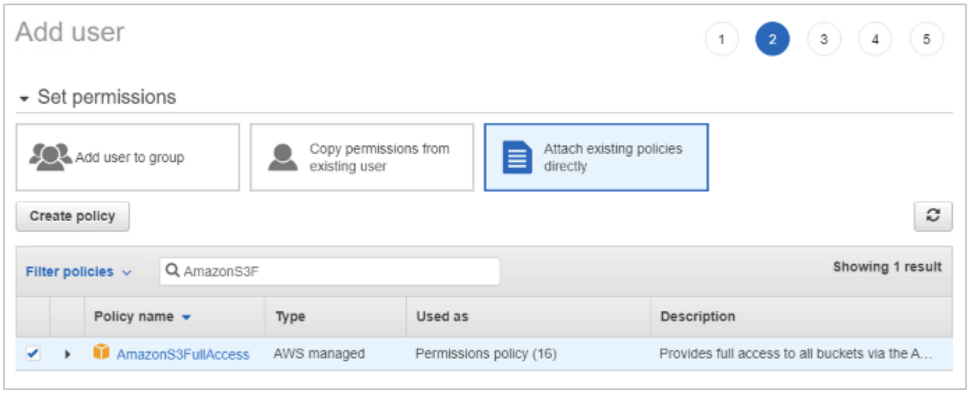
Click on the **Add User** button.



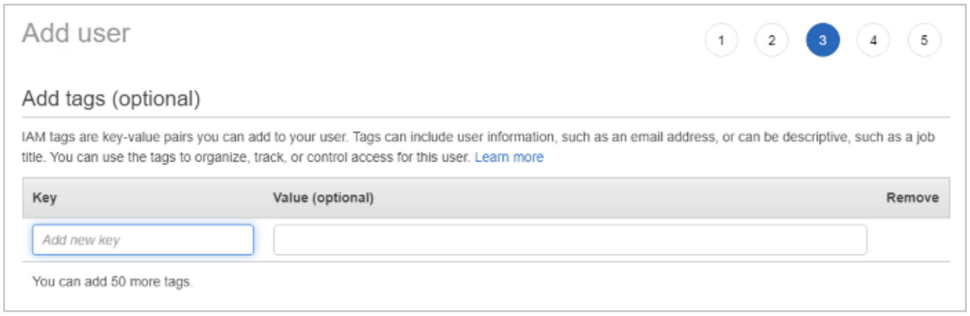
Provide a user name and select the **Programmatic access** checkbox.



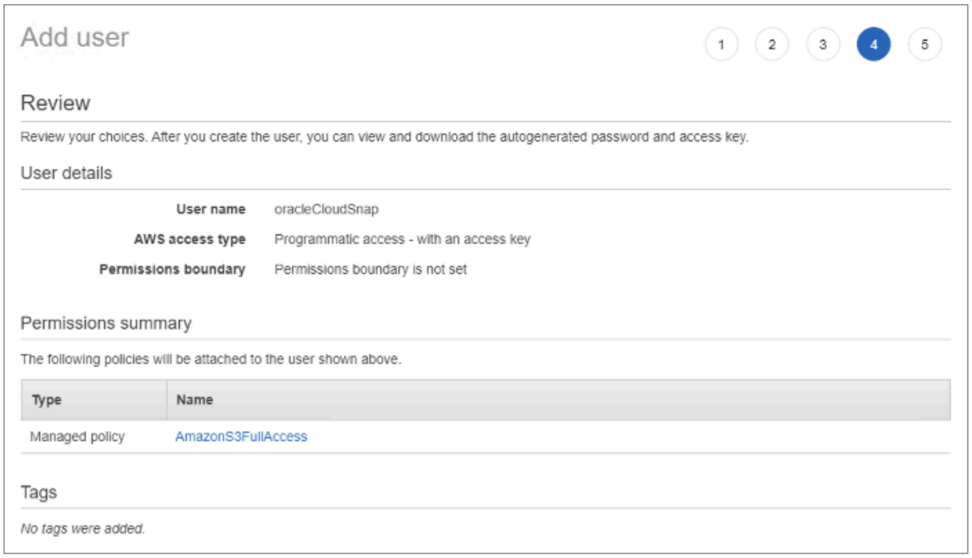
Select Attach AmazonS3FullAccess policy to the user.



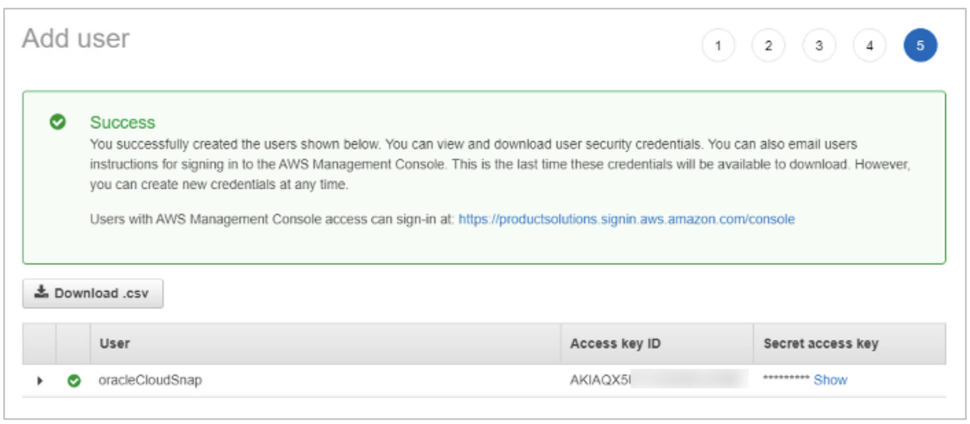
Add Tags if desired.



Review inputs provided before selecting **Create User**.

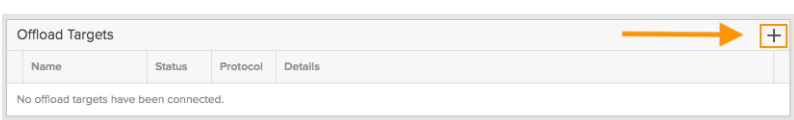


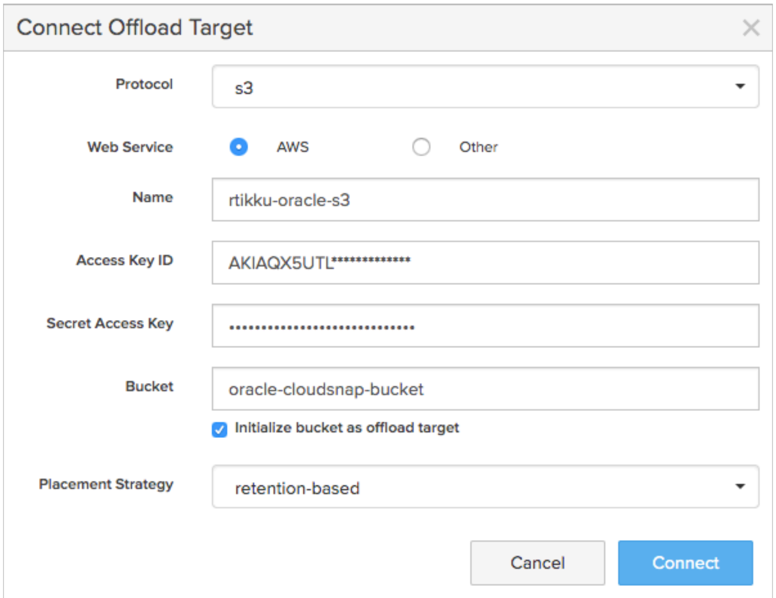
Finally, the user is created. The confirmation screen provides the Access Key ID and Secret access key. There is also a link to download this information as a csv file.

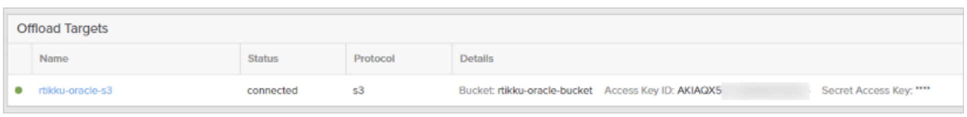


Be sure to either click on the Download .csv file or copy the Access key ID and the Secret access key at this point. Once this screen is closed, there is no way to get the security credentials for the IAM user. Save the security credentials and use them when connecting FlashArray to the S3 bucket.

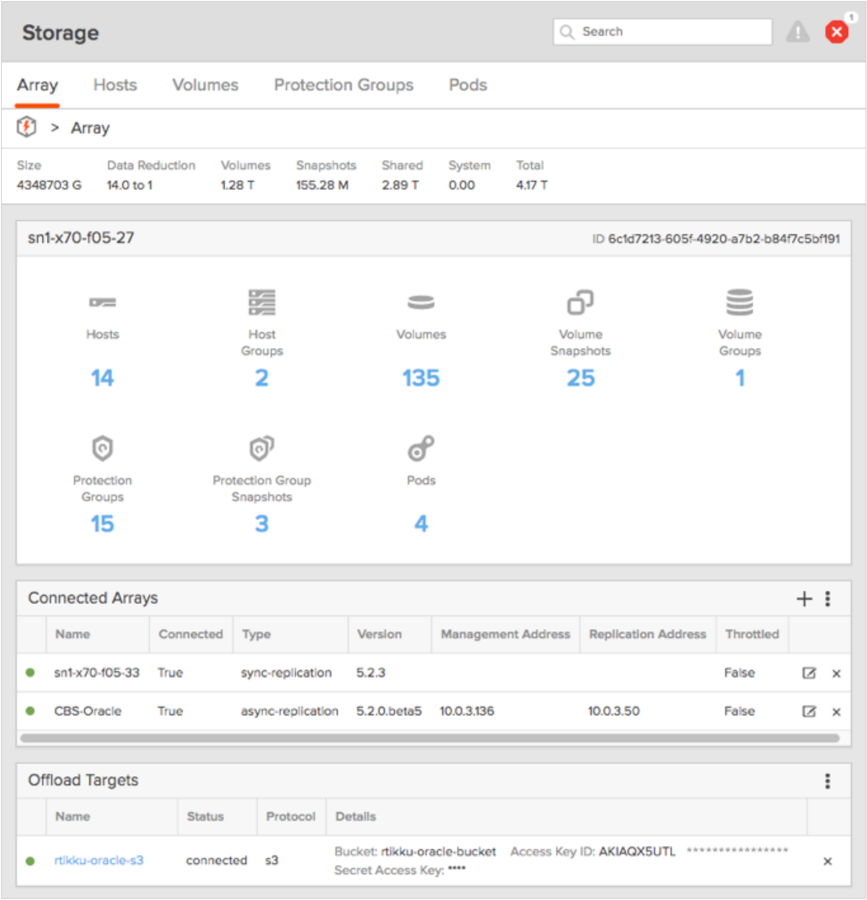
Step 4. Add the S3 Bucket as New Offload Target







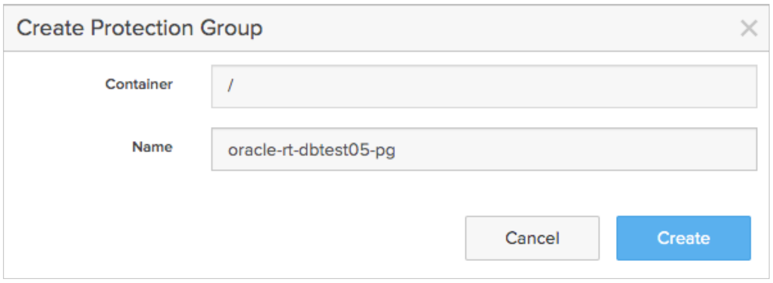
With this, setting up of CloudSnap is complete on FlashArray sn1-x70-f05-27.



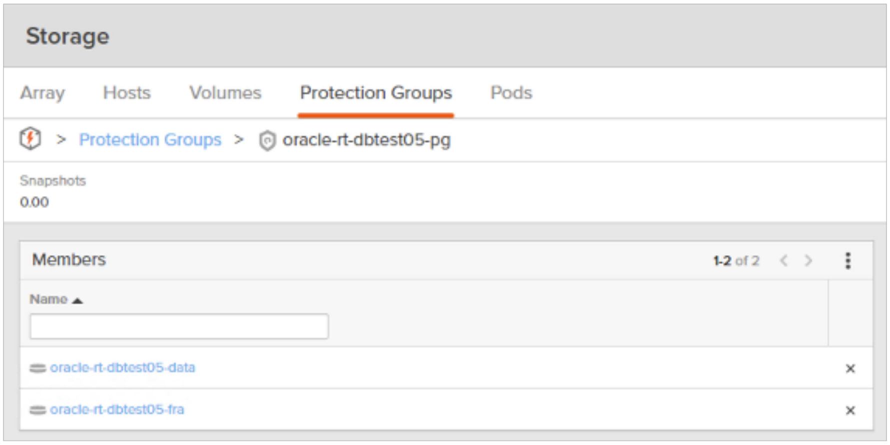
Offloading an Oracle Database to S3

Identify which volumes the Oracle database is sitting on. If it hasn't already been done, create a Protection Group and that contains these volumes.

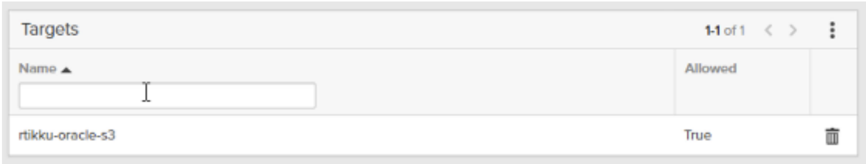
To create a Protection Group, click on the Protection Groups tab on the Storage page and click on the **plus sign** on the table titled Protection Groups. In the popup dialog, enter the name of the Protection Group and click on **Create**.



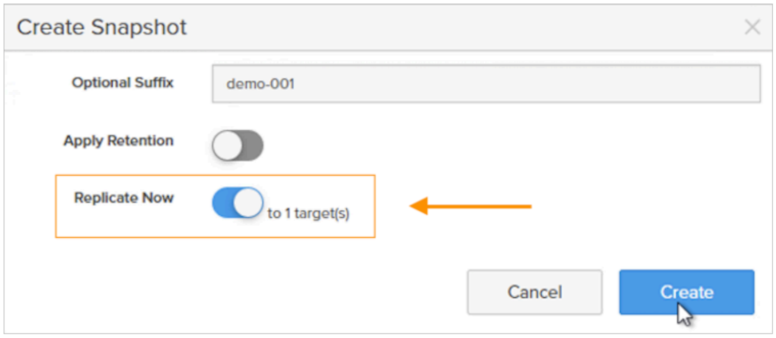
Once created, drill down on this Protection Group to see the Members. Make sure that the Members table lists all the volumes of the database being protected.



Add the S3 offload target created in the previous step to this Protection Group.



Next, create a snapshot of this Protection Group. You can provide an optional suffix to make it easier to identify this Protection Group Snapshot. It is very important to select the **Replicate Now** option, otherwise the snapshot will not be replicated to the target.



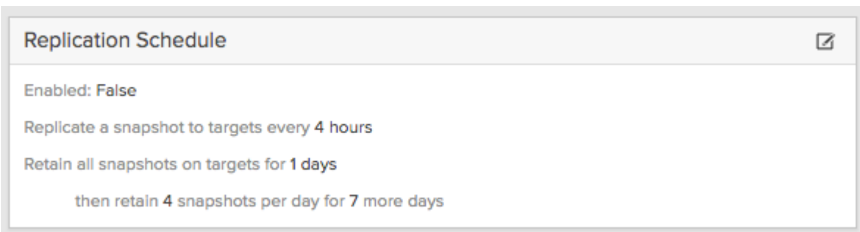
Important note: The snapshot taken above is a crash-consistent snapshot. You can use it to restore or clone the Oracle database to the point in time when the snapshot was taken. If the database is in Archive Log mode, and has the ability to do a point-in-time recovery, then you should put the source database in Hot Backup mode **before** creating the snapshot. Do this by executing the following command on the source database: “ALTER DATABASE BEGIN BACKUP”

After the snapshot is created (typically in a matter of seconds), you need to take the database needs out of Hot Backup mode. Do this by executing the following command on the source database: “ALTER DATABASE END BACKUP”

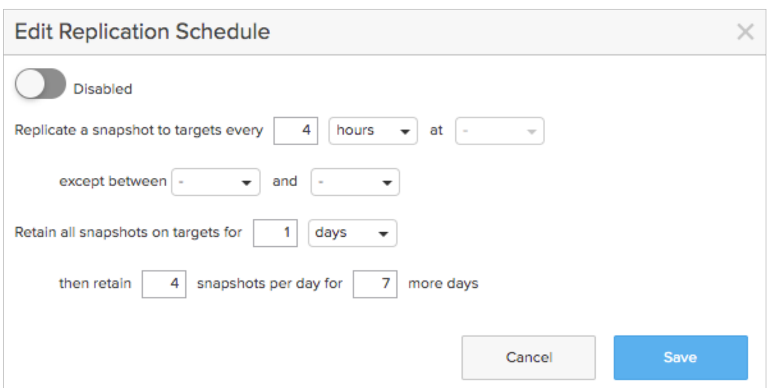
The snapshot taken above was an ad-hoc or on-demand snapshot. When using CloudSnap as part of a larger data-protection strategy, you would schedule snapshot offloading to the cloud.

If a crash-consistent snapshot is all you need, you can schedule snapshot replication to offload target using the GUI itself using the steps given below. However, if you want the ability to use the snapshots for point-in-time recovery, then you need to put the database in Hot Backup mode before taking the snapshot, and take it off Hot backup mode after the snapshot is taken. This is not possible using the GUI method and has to be orchestrated via scripts using the command line or the REST interface.

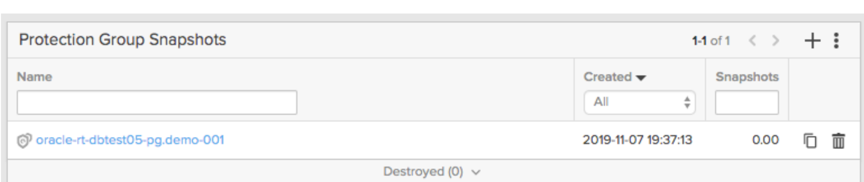
Go to Storage > Protection Group and select the protection group to bring up the following screen. Click on the edit icon on the right of Replication Schedule.



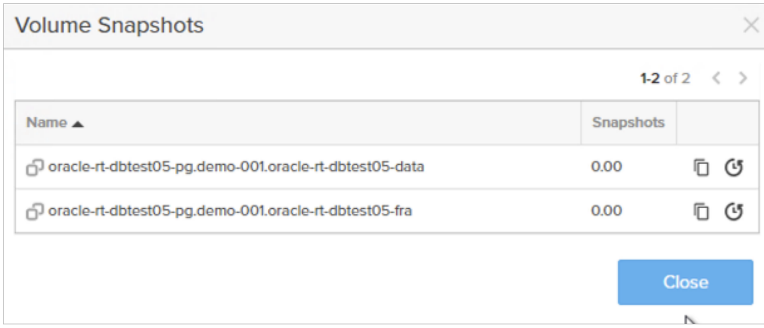
The following dialog will appear.



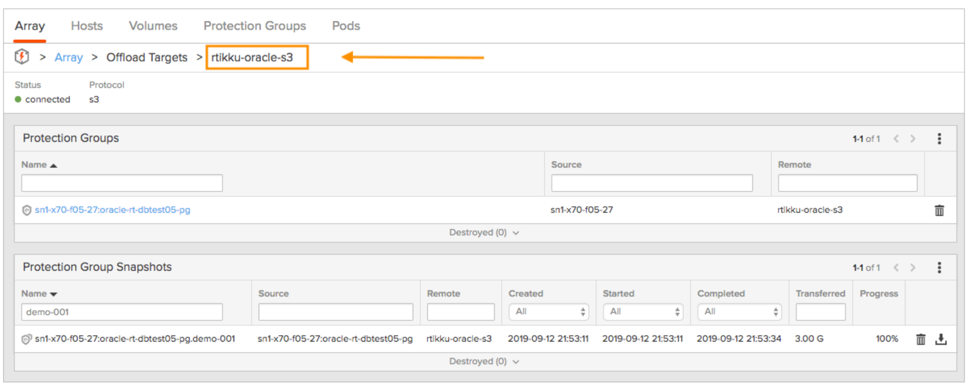
Select the desired replication schedule as well as how long would you like to retain the snapshots on the targets. The Protection Group Snapshots table will now show an entry for the snapshot taken.



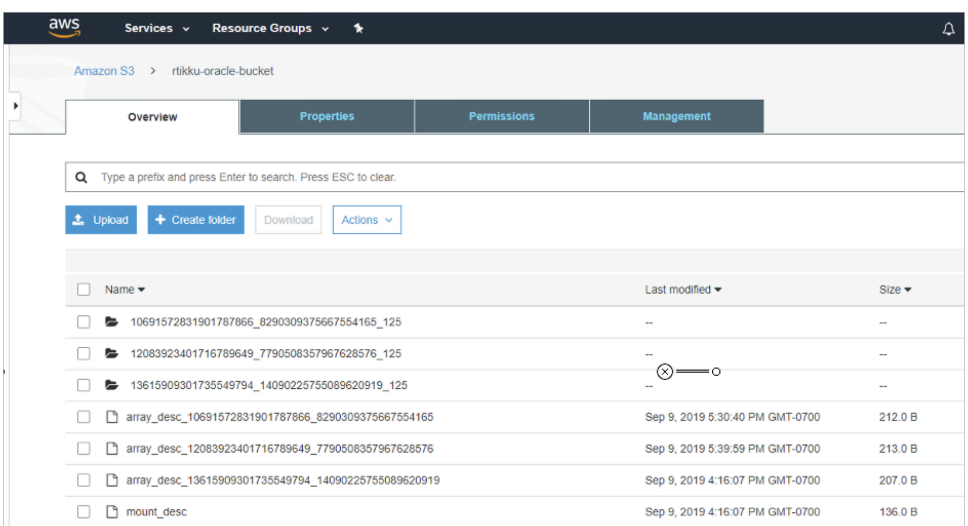
Click on the Protection Group Snapshot to verify that it contains all the volumes for the database.



In the Array tab of the Storage page, click on the S3 bucket hyperlink to verify that the Protection Group has been offloaded to the target. Pay attention to the Progress column: It should show 100%. Also, the **Transferred** column shows the amount of data that was actually transferred, and you can use the **Started** and **Completed** columns to find out the time taken for the transfer.



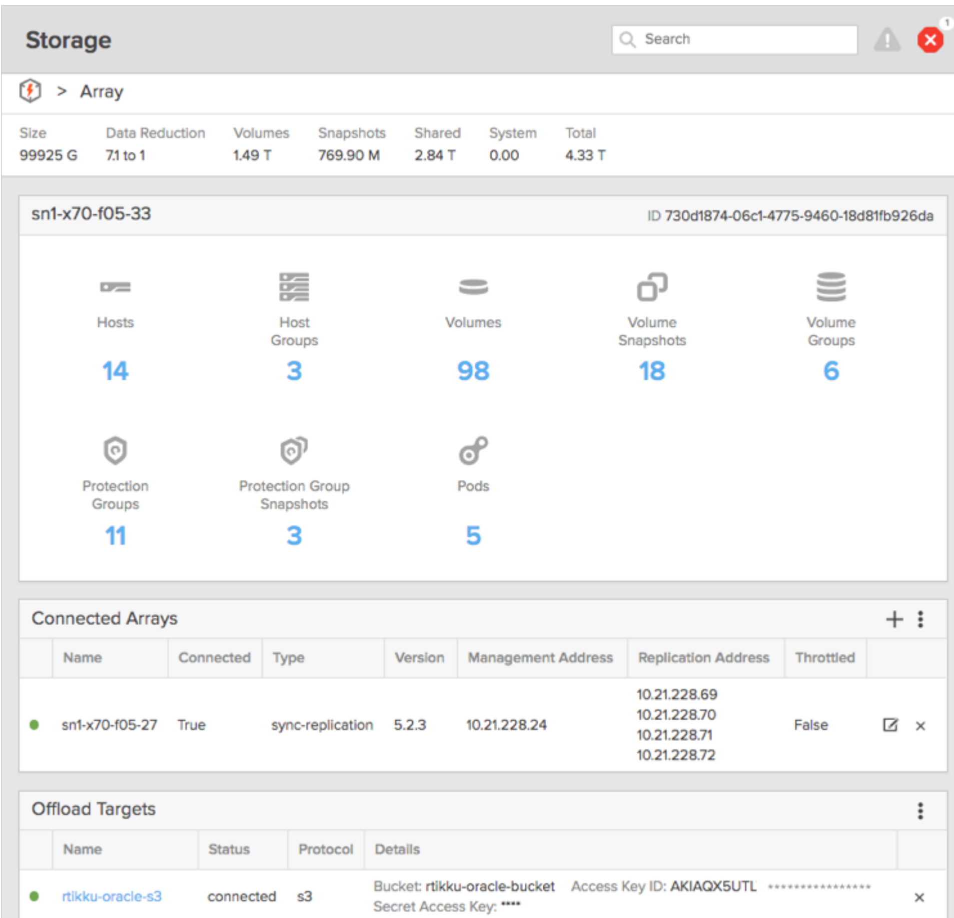
The AWS S3 details page shows objects that were created in the S3 bucket. However, the data is in an encrypted and proprietary format and can only be restored using the Purity offload interface.



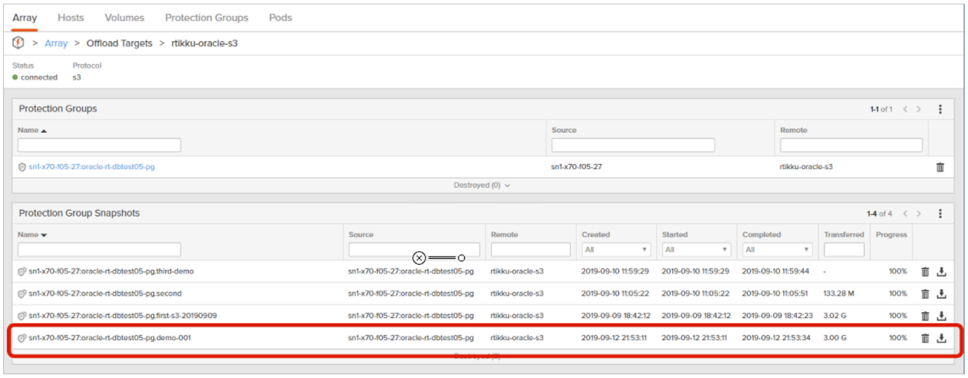
Restoring an Oracle Database from S3

In the previous section, we offloaded protection group **oracle-rt-dbtest05-pg** for an Oracle database **dbtest05** using FlashArray **sn1-x70-f05-27** for storage to an AWS S3 bucket **rtikku-oracle-s3**. Let's now look at the steps to restore the database. You can restore the database back to the same array, to another FlashArray, or to Cloud Block Store.

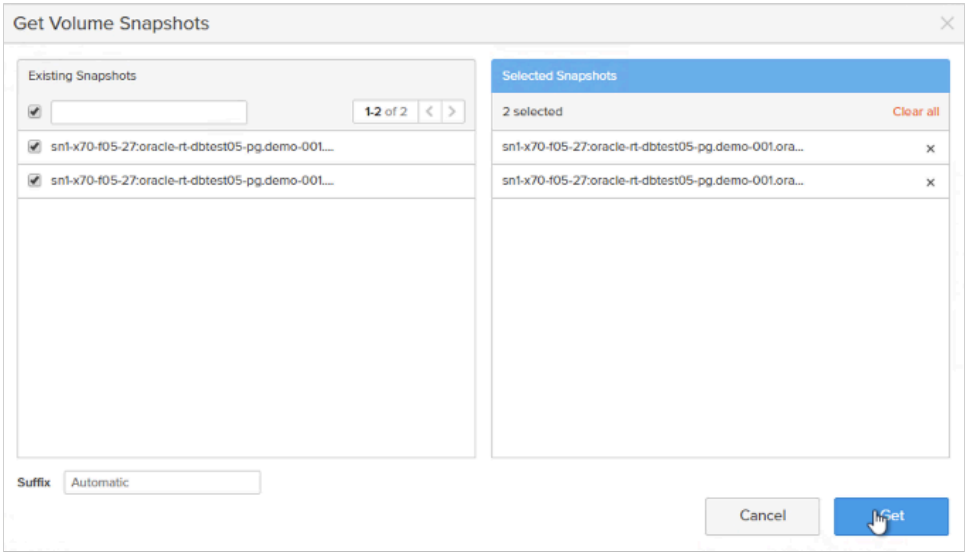
The following scenario shows how to restore a snapshot from the S3 target to a different FlashArray **sn1-x70-f05-33**. The first step is to install and configure the Offload app as detailed earlier. After the Offload app is installed, you need to add the previously created S3 bucket (that contains the CloudSnap snapshot) as an **Offload Target**.



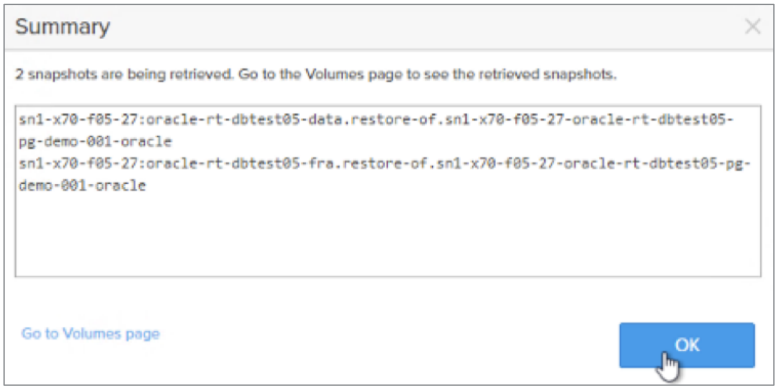
After you've added the S3 Offload Target, click on it to see the Protection Group snapshot backups it contains.



Find the Protection Group snapshot that you need to restore. Click on the **Download** icon in the last column on the right. The following dialog will appear and lists the volumes available in the Protection Group snapshot. Select the database volumes and click on the **Get** button.

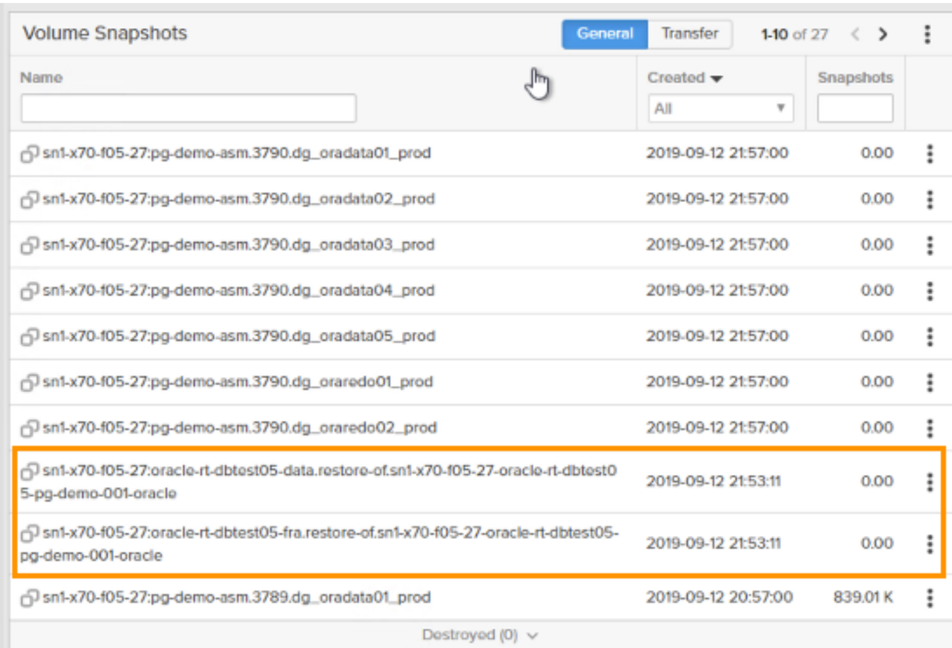


Another popup window will appear with confirmation that the volume snapshots have been restored.

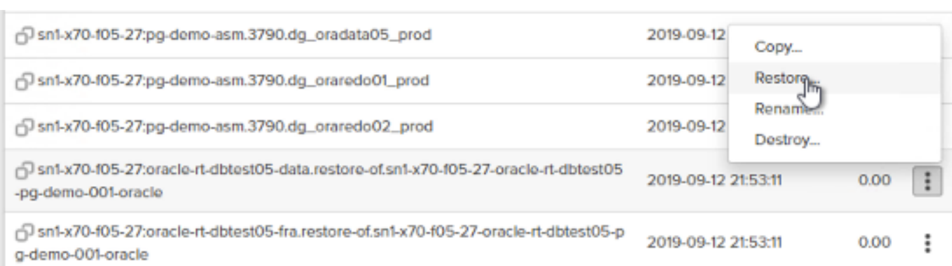


Please note that these are *volume snapshots,* not *volumes*. You need to go to the Volumes tab, and create volumes from the volume snapshots.

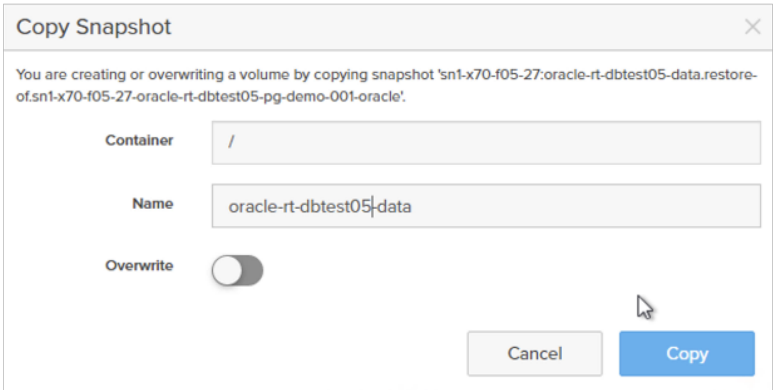
Click on the **Go to Volumes page** link on the lower left corner of the above popup or go to **Storage > Volumes**. Locate the volume snapshots that were restored from the S3 CloudSnap backup. Click on the three vertical dots icon on the right for each volume that you need to restore.



Select **Restore** from the popup menu.



This brings up the familiar Copy Snapshot dialog. Provide a new name for the restored volume or use the original name. If the volume already exists, you must select the overwrite option.



Once you've copied all the volumes belonging to the Oracle Database from the snapshot, the database is ready to be opened after you've performed instance or media recovery.

Conclusion

CloudSnap enables flexible and efficient off-premises data protection/disaster recovery use cases. Purity Snapshots are playing an increasingly larger role in our customer's Oracle database protection and recovery strategy, and with CloudSnap, these snapshots can be stored on low cost cloud storage for longer term retention.

The Oracle database snapshot backup can not only be restored on any on-premises FlashArray, they can also be restored to a virtual FlashArray in the cloud, known officially as the Cloud Block Store.

Additional Resources

- Learn about Effortless Cloud Data Protection with CloudSnap.
- Download the CloudSnap / Snap to NFS Installation and Configuration Guide.
- Explore Purity CloudSnap Setup and Best Practices.

Product Information

- Purity CloudSnap
- Pure Cloud Block Store

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