



# Configuring ZFS Storage for Cloud Snapshot Backups to OCI Object Store



## Configuration Best Practices

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## INTRODUCTION

The Oracle ZFS Storage Appliance provides the ability to migrate data to Oracle Cloud Infrastructure (OCI) object storage either locally on premise or to OCI object storage.

Object storage is the primary method of storing large amounts of data in the cloud. With a flat namespace, it scales better than file system storage and supports extended metadata attributes that allow comprehensive search operations. Billions of objects can be stored when needed.

## Cloud Snapshot Backups

The cloud snapshot backup feature of the Oracle ZFS Storage Appliance allows you to back up full and incremental snapshots from a local Oracle ZFS Storage Appliance to an object store target on another ZFS Storage Appliance as well as to cloud targets associated with an Oracle Cloud Infrastructure account. You can decide which snapshots are backed up to another appliance or to an actual cloud target.

## OCI-Compatible Object Store On-Premise

The Oracle ZFS Storage Appliance also provides an OCI-compatible object storage that enables you to send cloud snapshots to local object storage on another ZFS Storage Appliance.

- Consistent OCI object store experience for OCI application testing and local storage
- Can apply ZFS data services and replication when storing cloud snapshots as objects on-premise
- Cloud snapshot backups are stored as objects in OCI cloud object storage and cannot be spun up or accessed over NFS or SMB

## Use Cases

- Provides low-cost storage for snapshot backups
  - Snapshot backups can be scheduled through workflow
  - Provides recovery by restoring snapshots and rolling back
  - Provides recovery from accidental overwrite or malware like ransomware
- Provides archive storage for long-term data, such as business compliance requirements
- Provides tertiary backup storage on-premise
  - Cloud snapshots scheduled and stored in on-premise object storage
  - Not intended as complete DR solution
  - Snapshot of RMAN image copy supports database recovery

## Advantages

Review the following advantages for storing or migrating data in a hybrid cloud environment with the ZFS Storage Appliance:

- Provides native cloud integration with OCI object storage
- Cloud snapshot backups are fully supported in the ZFS Appliance BUI, CLI, and REST interfaces and integrated with Analytics, alerts, logs, and authorization roles
- File system snapshots can be backed up to another on-premise ZFS Appliance or directly to OCI object storage
- Snapshot backups can be encrypted and compressed and if required, replicated to worldwide on-premise data centers

## OVERVIEW

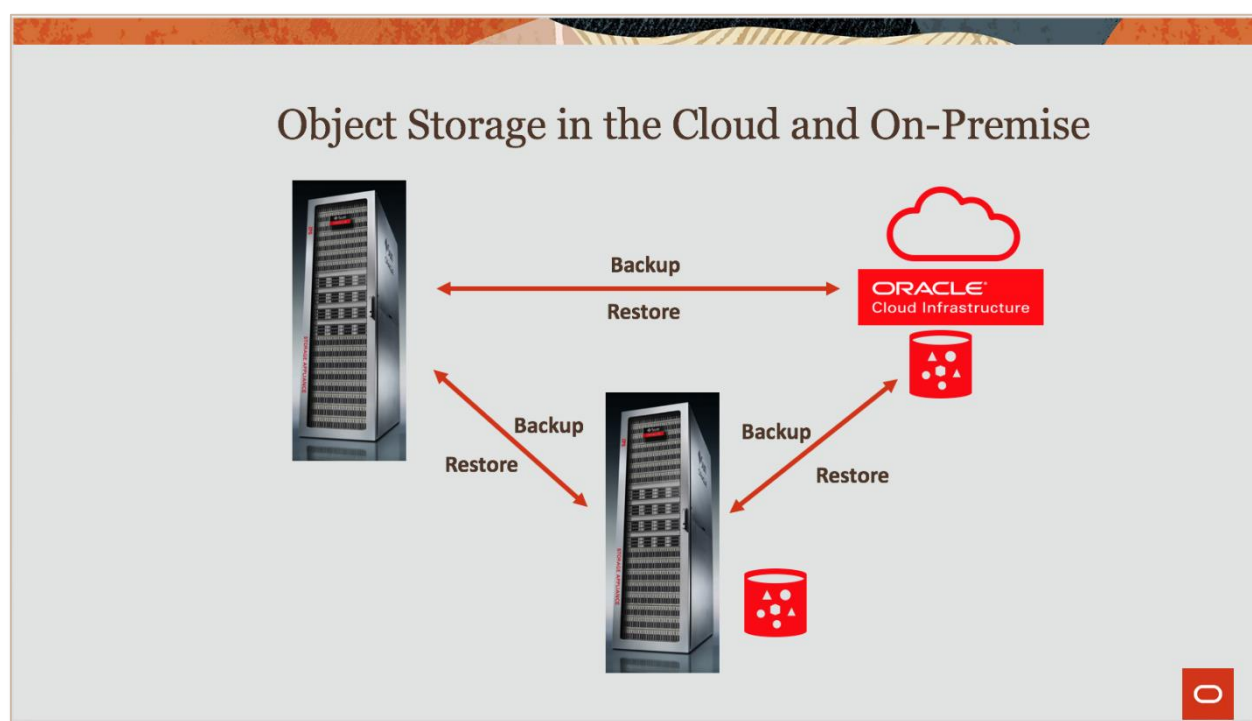
This document describes the following step-by-step instructions:

- Configuring a ZFSSA node as a cloud snapshot backup source system
- Configuring a second ZFSSA node as an OCI target to receive a ZFS snapshot from the source ZFSSA node. Steps for storing on premise data encrypted and compressed are also provided.
- Deduplication on the ZFSSA target node can be enabled if the system supports deduplication. However, deduplication is generally recommended for full backups and you must consider the impact to critical workloads. If the primary workload of the ZFSSA target node is an object storage repository and performance is not a critical factor, you might consider enabling deduplication if it is supported.
- Configuring an OCI cloud target for archiving cloud snapshot backups
- Sending a ZFS cloud snapshot backup to OCI-compatible object storage

The source ZFS Storage node is defined as the host for data in the form of filesystems and LUNs from which a snapshot can be generated and subsequently pushed to the target:

- Target ZFS Storage node is defined as the recipient of snapshots sent from the source ZFS Storage node
- Source ZFS Storage node can send snapshots to OCI object storage (cloud)
- Source ZFSSA node sees the target ZFSSA node as an OCI bucket

The following is a context diagram of the environment.



The ZFS Appliance on the left takes on the role of the source from which shares and LUNs can be exposed to clients. The source can initiate a snapshot and then send that snapshot to the target ZFS Appliance, which is another node<sup>1</sup> over a defined network.

<sup>1</sup> This node may be a member of the ZFSSA cluster or could be a completed different ZFSSA.

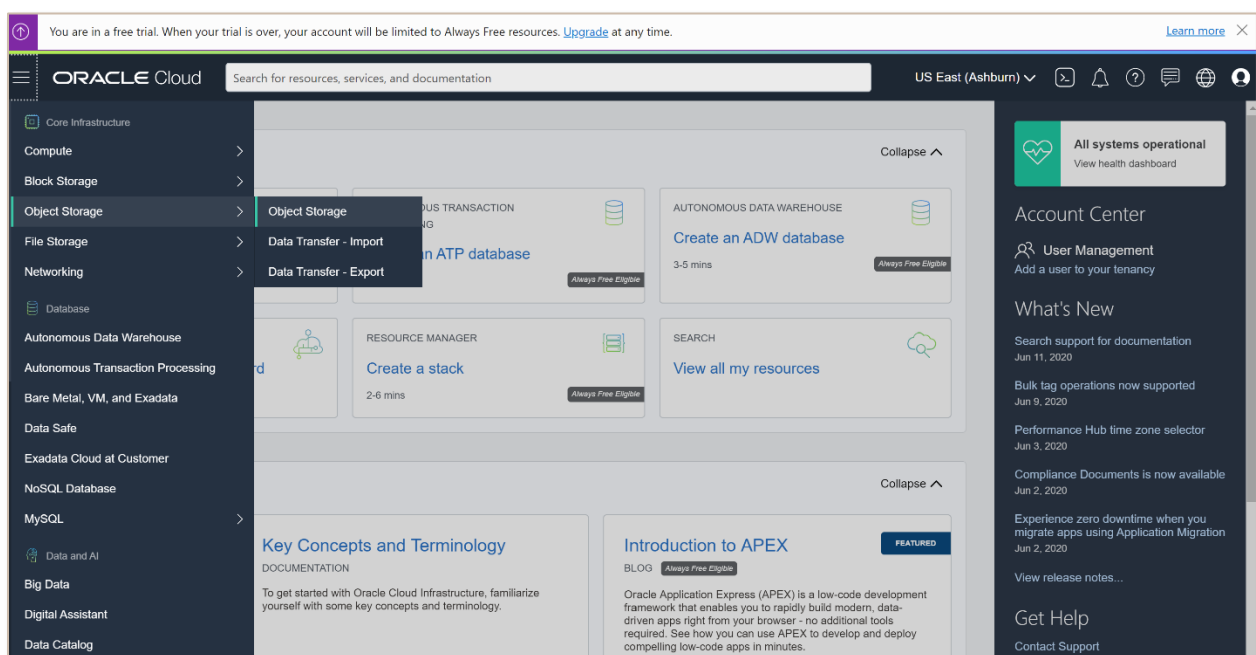
## ORACLE CLOUD INFRASTRUCTURE (OCI) OBJECT STORAGE

OCI provides a low-cost solution for data archival that integrates with on-premise ZFS Storage Appliance. OCI object storage provides both standard and archive tiers. When stored in either storage tier, data is encrypted automatically and cannot be disabled. Multiple cloud regions are available and data can be migrated between geographic regions.

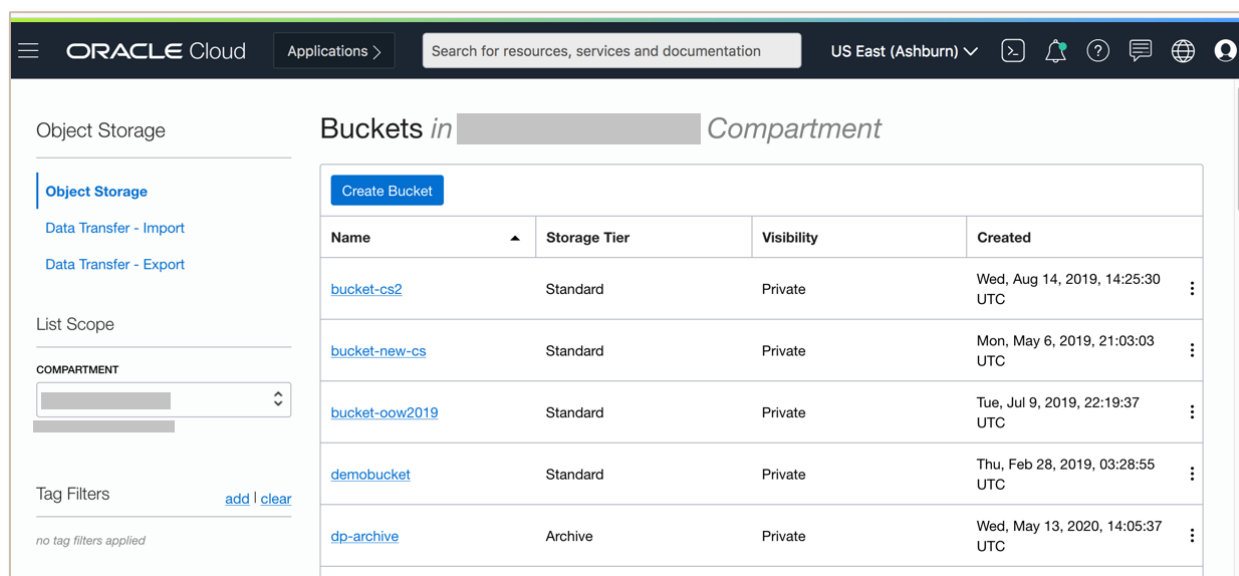
Sign up for a free 30-day cloud trial to start an on-premise data migration to OCI object storage:

<https://www.oracle.com/cloud/free/>

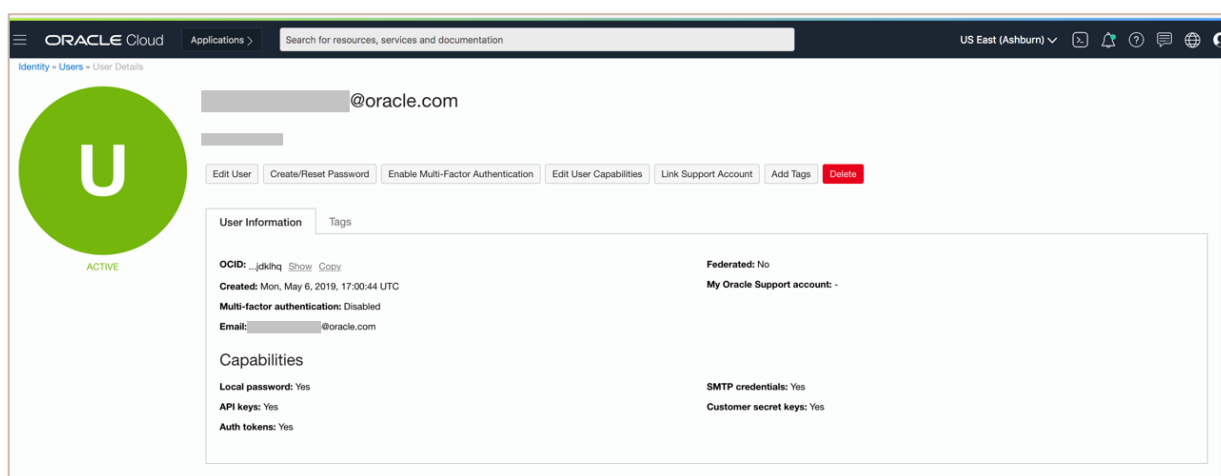
OCI provides the following management interfaces into all cloud components, including Object Storage. Select Object Storage from left panel under Oracle Cloud.



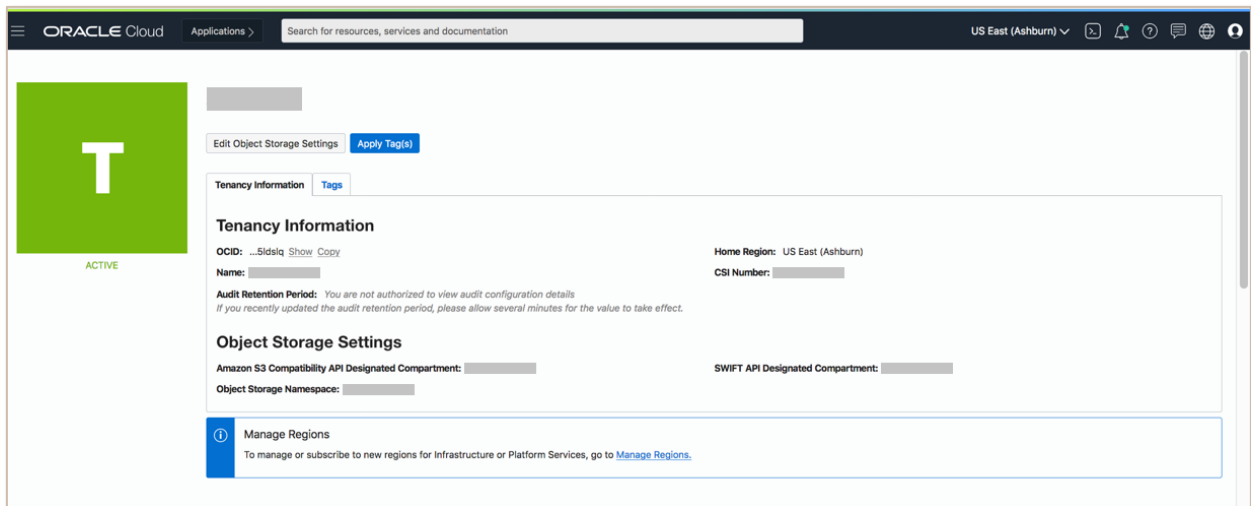
The OCI Object Storage interface provides a management view of your object storage tenancy and current compartment. Cloud storage buckets are created to store your data and can be reviewed accordingly. More options are available to provide cloud bucket details.



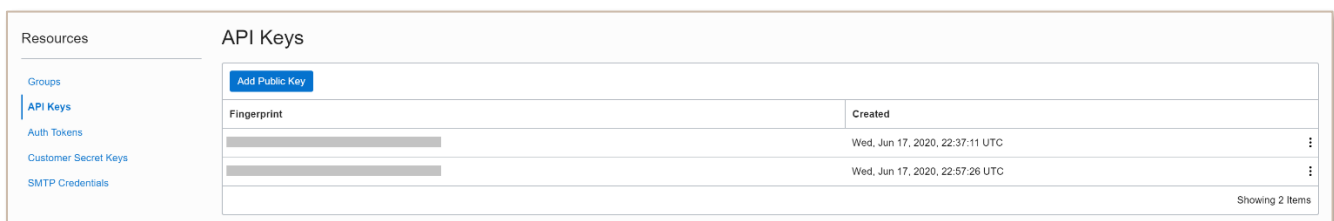
OCI Object Storage User profile screen includes user certificates that are created when the account is created. The OCID of the user is required when the cloud bucket target is created on the ZFS Storage Appliance.



Each OCI tenant is assigned one unique and uneditable Object Storage namespace that spans all compartments within a region. This is the OCI Tenancy screen that identifies the tenancy ID that was created when you create your OCI account. The tenancy OCID is required when the cloud bucket target is created on the on-premise ZFS Storage Appliance.



The public key (oci\_api\_key\_public.pem) generated during OCI CLI installation needs to be uploaded in the OCI Object Storage User profile screen to grant the user access for CLI management. The fingerprint generated by the public key is required to modify and view objects on the ZFS Storage Appliance.



## Summary Steps for OCI Cloud Object Storage Free Trial

- » Review the summary steps below to set up your free OCI cloud storage trial. For information about OCI command line setup, see [Part I: CLI Installation and Certificate Creation](#).
- » Setup cloud account
- » Sign into your account after it is activated
- » Note the limitations of the object storage trial at the top of the screen
- » Review user profile and tenancy information
- » Select Object Storage from left menu under Oracle Cloud
- » Select the (root) storage compartment that is created automatically in your tenancy
- » Create a bucket with auto-generated name or give it a new name, if you prefer
  - » Select standard tier
  - » Oracle encryptions key
- » From your local system, download and install OCI command line interface
  - » From user profile screen, copy the certificates
  - » Set up .oci config file
- » Display the empty bucket with the OCI command line
- » Do a test file migration with the OCI command line



## GENERAL OVERVIEW

A summary of the configuration steps are as follows:

» **Part I: CLI installation and Certification Creation**

- » Install CLI
- » Create certificates
- » Generate fingerprint for the certificate
- » Create configuration file

» **Part II: ZFS Storage Appliance (both) – OCI Account Creation**

- » Create OCI account on both target and source

» **Part III: Local System and ZFS Storage Appliance (target) – OCI Target Creation**

- » Create encrypted project and share with compression enabled for the target destination
- » Create the target and bucket
- » List the bucket

» **Part IV: ZFS Storage Appliance (source) – OCI Cloud Service and Target Configuration**

- » Enable cloud service
- » Configure HTTP service
- » Create OCI-compatible target

» **Part V: ZFS Storage Appliance (both source and target) – Cloud Snapshot Backup and Restore**

- » Create a snapshot
- » Backup snapshot to on-premise ZFS Storage
- » Display the bucket content
- » Create second snapshot and send incremental backup to on-premise ZFS Storage

» **Part VI: Monitor Cloud Snapshot Backups and Object Store Bucket**

» **Part VII: Cloud Snapshot Backups Roles and Authorizations**

» **Part VIII: Automation and Customization Tips**

- » OCI command line simplification
- » Workflow installation and automation

Review the following components that are described in this document:

Component Description	Shortened Name	Purpose
Local system or laptop	local	Required to install and use the oci command line.
ZFS Storage Appliance #1	source appliance	ZFS Storage Appliance that is the source of the cloud snapshot backup
ZFS Storage Appliance #2	target appliance	ZFS Storage appliance that provides the OCI-compatible object storage target that is the destination of the cloud snapshot backups

## PART I: CLI INSTALLATION AND CERTIFICATE CREATION

The detailed configuration steps are covered in subsequent numbered list items of this document.

### 1. On the local system, install the CLI.

Specific configuration steps and visibility into the OCI-compatible object store must be completed with the OCI command interface that are installed on a local system like a server or laptop.

The oci command line interface is installed on a local system, running at least python version 3.5+. The local system can be either Linux, Windows, or Mac. The CLI can be downloaded manually or using an installer script. Depending on your network configuration, you might need to set the following parameter to successfully download this interface: "export https\_proxy=https://www-proxy.us.oracle.com:80"

Once the environment variable has been defined as required, select one of the installation methods below.

#### a) Install CLI with installer script method.

```
local# bash -c "$(curl -L https://raw.githubusercontent.com/oracle/oci-cli/master/scripts/install/install.sh)"
```

#### b) Install CLI with manual method.

The manual process will use curl to download the install script after which, the installer is run with the options noted.

```
local# curl -L -O https://raw.githubusercontent.com/oracle/oci-cli/master/scripts/install/install.sh
local# ./install.sh --accept-all-defaults
```

### 2. On the local system, create public and private keys (oci\_api\_key.pem and oci\_api\_key\_public.pem).

- If you have a free cloud trial account set up and you want to create an OCI cloud target on a ZFS Storage Appliance, you would use the certificates that are accessible from the user profile section of your cloud account.
- If you are creating an OCI-compatible object store target on a ZFS Storage Appliance, you will need to create the certificates as described below.

Recall that PEM is a X.509 certificate (whose structure is defined using ASN.1), encoded using the ASN.1 DER (distinguished encoding rules), then run through Base64 encoding and stuck between plain-text anchor lines (BEGIN CERTIFICATE and END CERTIFICATE). The example below is in the context of the root account. Note that any account may be used although the default location of the bin, lib, and other support directories are relative to the account creating the certificates.

- To generate the private and public keys, see this link:  
<https://docs.cloud.oracle.com/iaas/Content/API/Concepts/apisigningkey.htm#How>
- General info can be found [here](#).

#### Steps:

- Change to the /root directory.
  - local# **cd /root**
- Create the .oci directory.
  - local# **mkdir .oci**
- Generate the private key with or without passphrase.
  - local# **openssl genrsa -out /root/.oci/oci\_api\_key.pem -aes128 2048**
  - local# **openssl genrsa -out /root/.oci/oci\_api\_key.pem 2048**
- Reduce permissions on the private key.
  - local# **chmod go-rwx /root/.oci/oci\_api\_key.pem**
- Generate the public key.

- `local# openssl rsa -pubout -in /root/.oci/oci_api_key.pem -out /root/.oci/oci_api_key_public.pem`

**3. On the local system, generate a fingerprint of the private key.**

```
local# openssl rsa -pubout -outform DER -in /root/.oci/oci_api_key.pem | openssl md5 -c
```

Enter pass phrase for /root/.oci/oci\_api\_key.pem:

writing RSA key

(stdin)= your-fingerprint

**4. On the local system, create the configuration file that will be used to create the target and will also be referenced in oci commands to monitor cloud snapshot backup information stored in the target.**

**5. Using the information from the above steps, create .oci/config file similar to the following:**

```
[DEFAULT]
user=user-OCID
fingerprint=your-fingerprint
key_file=/root/.oci/oci_api_key.pem
tenancy=tenancy-OCID
region=us-ashburn-1
```

For information on customizing the config file so that using the oci command line can be simplified, see [Part VIII: Automation and Customization Tips](#).

## PART II: ZFS STORAGE APPLIANCE (BOTH) – OCI ACCOUNT CREATION

- 1. On the source appliance, create the oci-user account with the basic admin role.**
  - Go to Configuration→Users to create your oci-user account with selected “basic” role.
- 2. On the target appliance, create the oci-user account with the basic admin role.**
  - Go to Configuration→Users to create your oci-user account with selected “basic” role.

The screenshot shows the 'Edit Local User' configuration page for a user named 'oci-user'. The page is part of a larger application with tabs for Configuration, Maintenance, Shares, Status, and Analytics. Under the Configuration tab, there are sub-tabs for STORAGE, NETWORK, SAN, CLUSTER, USERS, PREFERENCES, SETTINGS, and ALERTS. The 'USERS' sub-tab is active, and the page title is 'Edit Local User "oci-user"'. There are 'CANCEL' and 'APPLY' buttons at the top right.

**Properties**  
This is a locally-defined appliance administrator.

Username: oci-user  
Full Name: oci-user  
Password: (set)  
Confirm: (set)  
Require session annotation: ☐  
Kiosk user: ☐  
Kiosk screen: https://status/dashboard  
SMB enabled user: ☐  
User ID: [redacted]

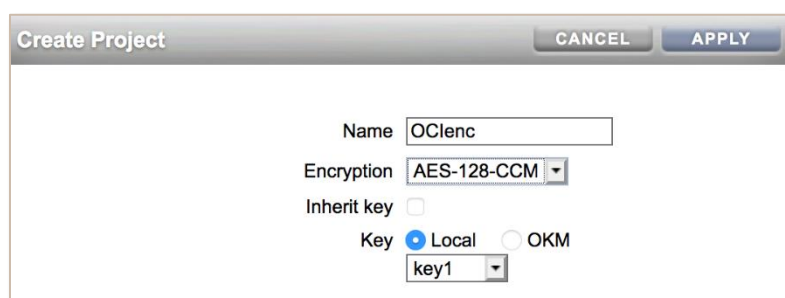
**Roles** Exceptions  
Total: 5

NAME	DESCRIPTION
<input type="checkbox"/> OEMrole	read / write account for OEM
<input type="checkbox"/> OEMtest	Restricted read / write account for OEM
<input checked="" type="checkbox"/> basic	Basic administration
<input type="checkbox"/> ikorole	iko demo
<input type="checkbox"/> oracle_agent	Role for limiting access to Oracle Enterprise Manager Access

## PART III: LOCAL SYSTEM AND ZFS STORAGE APPLIANCE (TARGET) – OCI TARGET CREATION

1. On the target appliance, create an encrypted project for the share that will become the OCI-compatible object storage target.

The default encryption algorithm is AES-128-CCM. This provides strong encryption with good performance.

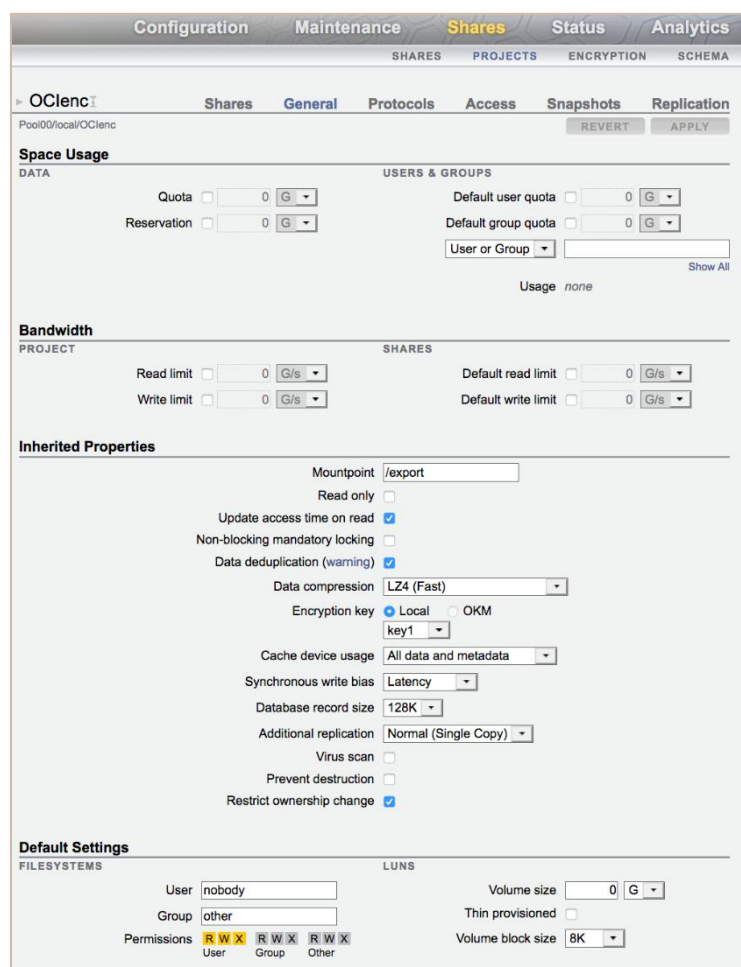


The 'Create Project' dialog box shows the following configuration:

- Name: OClenc
- Encryption: AES-128-CCM
- Inherit key: ☐
- Key: ☒ Local, ☐ OKM
- Key dropdown: key1

2. On the target appliance, modify the default project “General” settings so that the share will be both encrypted and compressed. In general, deduplication is only recommended for full backups.

- Select Data deduplication (optional)
- Select Data compression: LZ4 (optional but recommended)



The 'Shares' configuration window for project 'OClenc' shows the following settings:

- Space Usage:** Quota 0 G, Reservation 0 G.
- Bandwidth:** Read limit 0 G/s, Write limit 0 G/s.
- Inherited Properties:** Mountpoint /export, Read only ☐, Update access time on read ☒, Non-blocking mandatory locking ☐, Data deduplication (warning) ☒, Data compression LZ4 (Fast), Encryption key Local, key1, Cache device usage All data and metadata, Synchronous write bias Latency, Database record size 128K, Additional replication Normal (Single Copy), Virus scan ☐, Prevent destruction ☐, Restrict ownership change ☒.
- Default Settings:** User nobody, Group other, Permissions RWX RWX RWX, Volume size 0 G, Thin provisioned ☐, Volume block size 8K.

3. On the target appliance, create the share that will become OCI-compatible object storage target. For example, oci-elocal.

- a) From the OCI-enc project screen, select + Filesystems to create the share.
  - i. Name the object storage target (i.e. oci-elocal)
  - ii. Select user access (i.e. oci-user)

Project: OClenc

Name: oci-elocal

Data migration source: None

User: oci-user

Group: other

Permissions: ☒ R W X User ☐ R W X Group ☐ R W X Other ☐ Use Windows default permissions

Inherit mountpoint: ☒

Mountpoint:

Reject non UTF-8: ☒

Case sensitivity: Mixed

Normalization: None

Encryption: AES-128-CCM

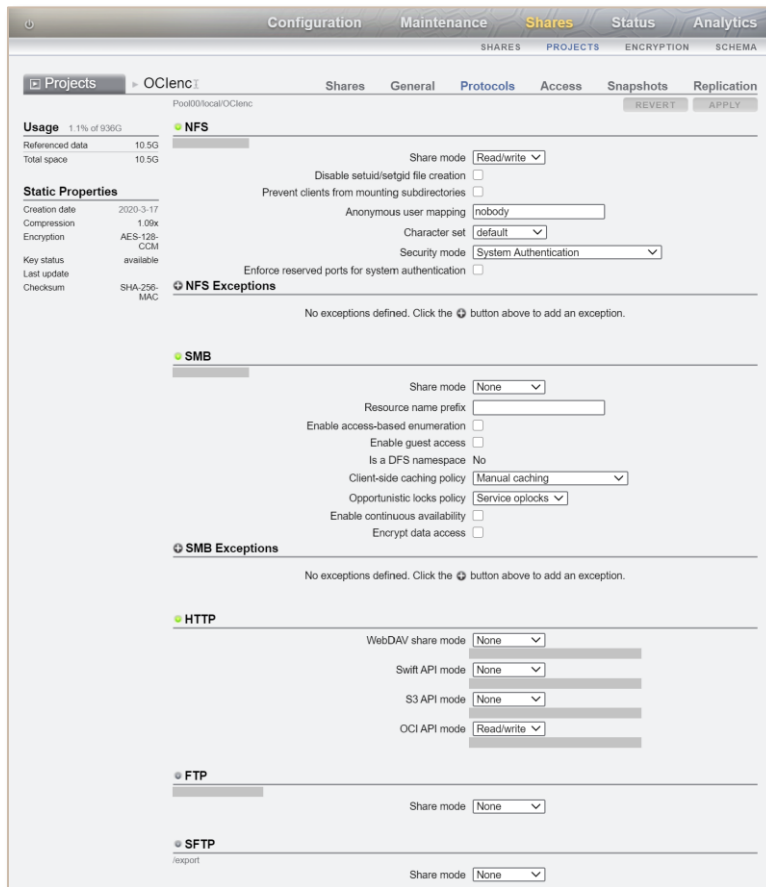
Inherit key: ☒

Key: ☒ Local ☐ OKM

key1

4. On the target appliance, modify the default project “Protocols” settings to enable the share’s OCI API mode.

- Select OCI API mode: Read/write



## 5. Create the actual bucket for either the target system or for an OCI cloud target.

- On the local system, use syntax similar to the following for the target system:

```
local# oci os bucket create --endpoint "http://ZFSSA-name-or-IP/oci" -ns
"export/oci-elocal" --config-file /root/.oci/config --name bucket --compartment-id
export/oci-elocal
```

- On the local system, use syntax similar to the following to create an OCI cloud target:

```
local# oci os bucket create --endpoint "https://objectstorage.us-ashburn-
1.oraclecloud.com" -ns "my-ns" --config-file /root/.oci/config --name cloudbucket --
compartment-id export/oci-elocal
```

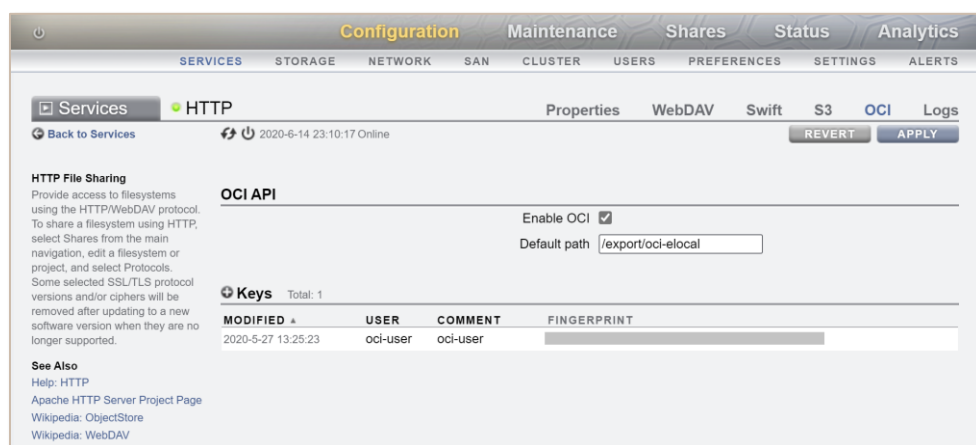
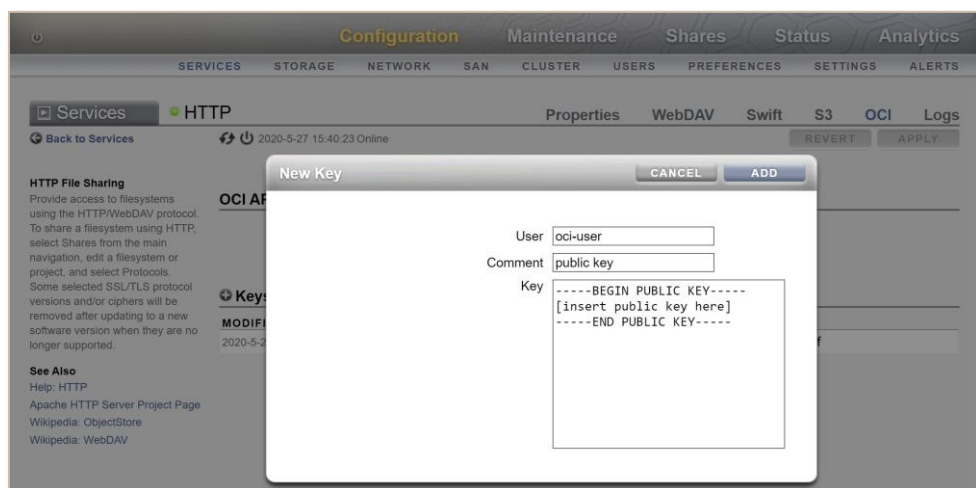
For information about creating the config file, see [Part VIII: Automation and Customization Tips](#).

## 6. On the local system, list the bucket to confirm the bucket creation.

```
local# oci os object list -ns export/oci-elocal -bn bucket --endpoint http://ZFSSA-
name-or-IP/oci
```

## 7. On the target appliance, configure the HTTP service.

- Select Configuration→Services→HTTP.
- Select the OCI tab.
- Select Enable OCI.
- Add default target/bucket location: /export/oci-elocal
- Add your public key.



## 8. On the source appliance, create the OCI-compatible object storage target.

Provide information similar to the following:

- Name: *oci-elocal*
- Location: *http://ZFSSA-name-or-IP/oci*
- Bucket: *bucket*
- User: *user-OCID*
- Tenancy: *tenancy-OCID*
- Private Key: *private key generated in Part I*

Add Cloud Target
CANCEL
ADD

Name
oci-elocal

Location
http:// /oci

Use data bucket
☐ Check this box if your data and metadata are in different buckets. Data can be saved either in a standard or archive bucket.

Bucket
bucket

Data Bucket

User

Tenancy

Private Key
-----BEGIN PRIVATE KEY-----  
[Insert private key here]  
-----END PRIVATE KEY-----

Use web proxy
☐ If your system communicates to the web through a proxy, check this box and enter the configuration information below.

Host : port
:

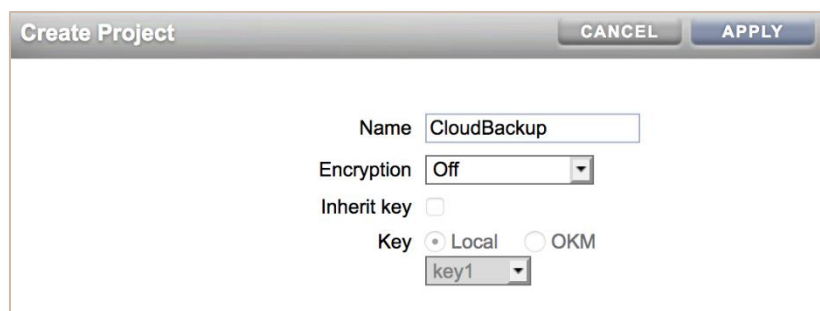
Username

Password

## PART IV: ZFS STORAGE APPLIANCE (SOURCE) – OCI CLOUD SERVICE AND TARGET CONFIGURATION

1. On the source appliance, create the project for the shares that will be used for the cloud snapshot backups. Use the initial project settings. For example:

- a) Project name=CloudBackup
- b) Accept the other project defaults on the Create Project screen.



The screenshot shows a 'Create Project' dialog box. The title bar includes the text 'Create Project' and two buttons: 'CANCEL' and 'APPLY'. The main content area contains the following configuration options:

- Name:** A text input field containing 'CloudBackup'.
- Encryption:** A dropdown menu set to 'Off'.
- Inherit key:** An unchecked checkbox.
- Key:** Two radio buttons, 'Local' (which is selected) and 'OKM'.
- Key Selection:** A dropdown menu below the radio buttons, currently showing 'key1'.

2. On the source appliance, configure the project with the following settings. For example:

- a) Select the General tab.
- b) Consider setting data compression=lz4 to reduce the size of data to be archived.
- c) Select the Protocols tab.



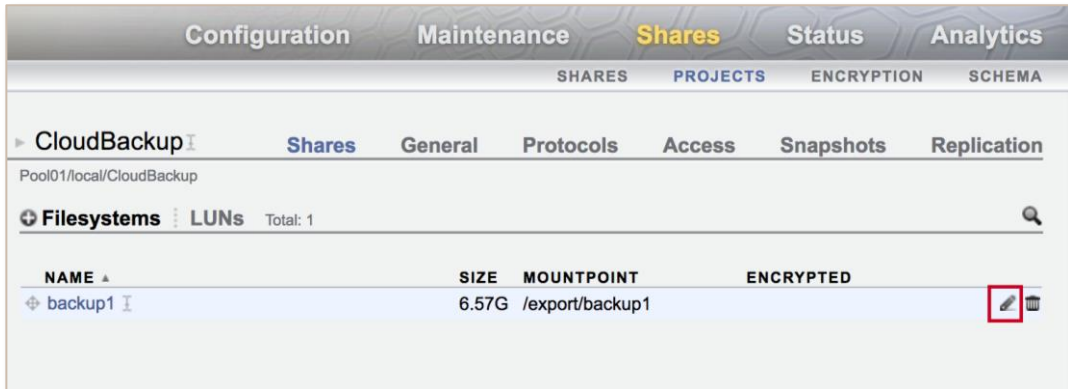
- d) In the NFS section, select Share mode: Read/write. This step enables the ability to mount and write data in the share if needed. For example, modifying data to send full and incremental snapshot backups.

3. On the source appliance, create a share in the CloudBackup project. For example, “backup1”.

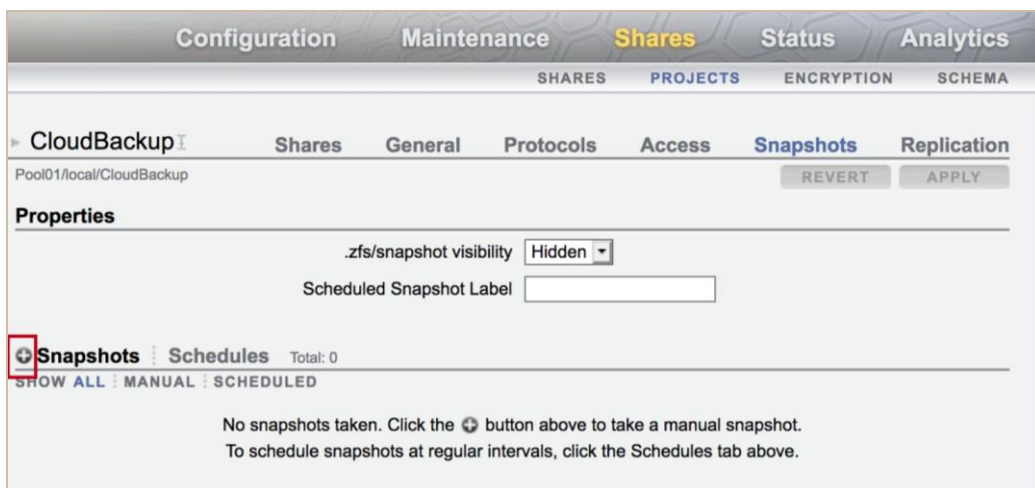
## PART V: CLOUD SNAPSHOT BACKUP AND RESTORE

### 1. On the source appliance, create a snapshot.

- If the share is empty, write data in the share.
- Select share from which to create a snapshot and select the pencil icon.



- Select the Shares→Snapshots tab and click the plus (+) icon to create a new snapshot. From the CloudBackup Shares screen, select the pencil icon. Then, select the Snapshots tab.

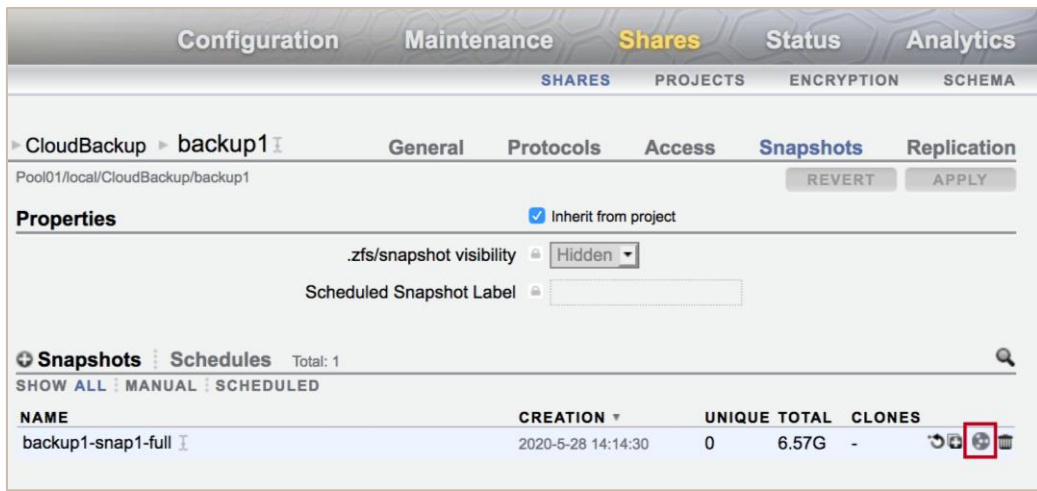


- Add a snapshot name and create the snapshot.

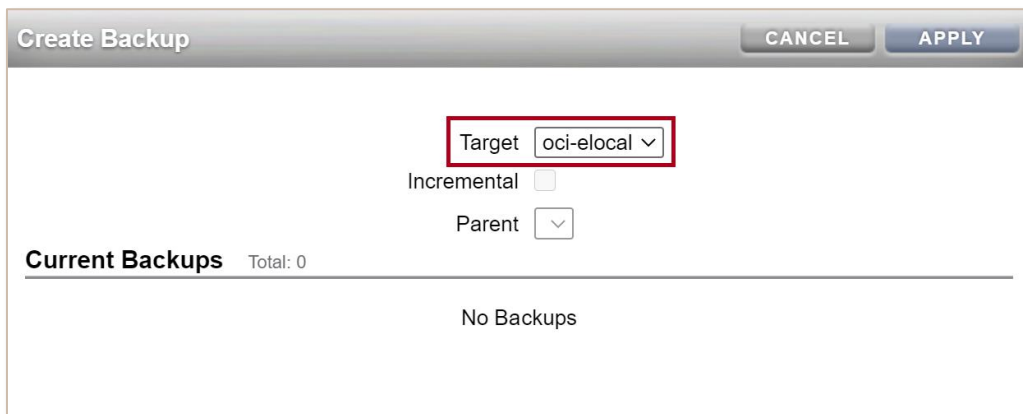


### 2. On the source appliance, backup the snapshot to the OCI-compatible object storage on the target appliance.

- Select the Snapshot tab of the share.
- Select the snapshot to back up by hovering to the right of the share and selecting the “Backup snapshot to cloud” icon.



- c) Select the cloud target to back up to and apply provided settings.

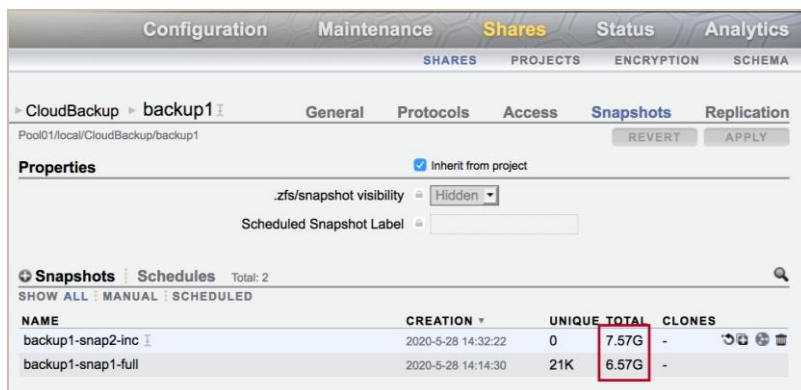


### 3. Backup the incremental snapshot to the OCI-compatible object storage on the target appliance.

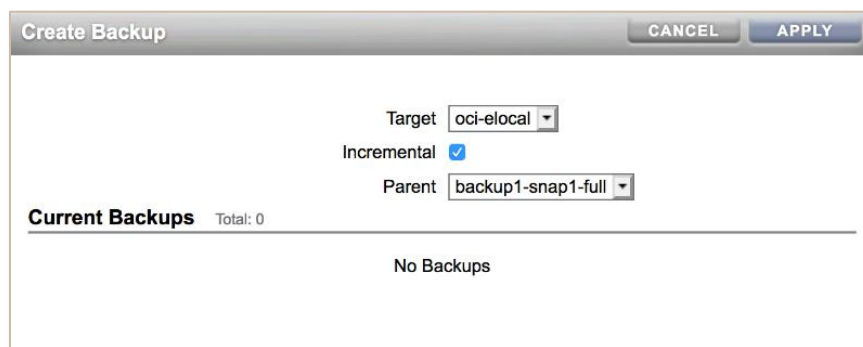
- a) Assuming the file system/share data is modified, create a new snapshot of selected.



- b) Note the difference in snapshot sizes.



- c) Select “Incremental” checkbox and assign its respective parent to only backup new data.



**Create Backup** [CANCEL] [APPLY]

Target: oci-elocal

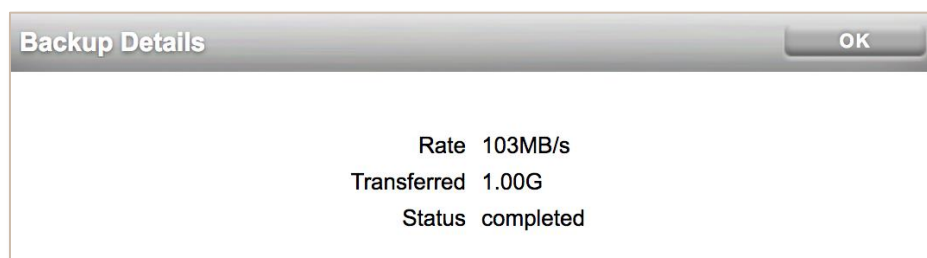
Incremental: ☒

Parent: backup1-snap1-full

**Current Backups** Total: 0

No Backups

4. Note that size of incremental snapshot backup transferred is only 1GB in size because only incremental changes are transferred.



**Backup Details** [OK]

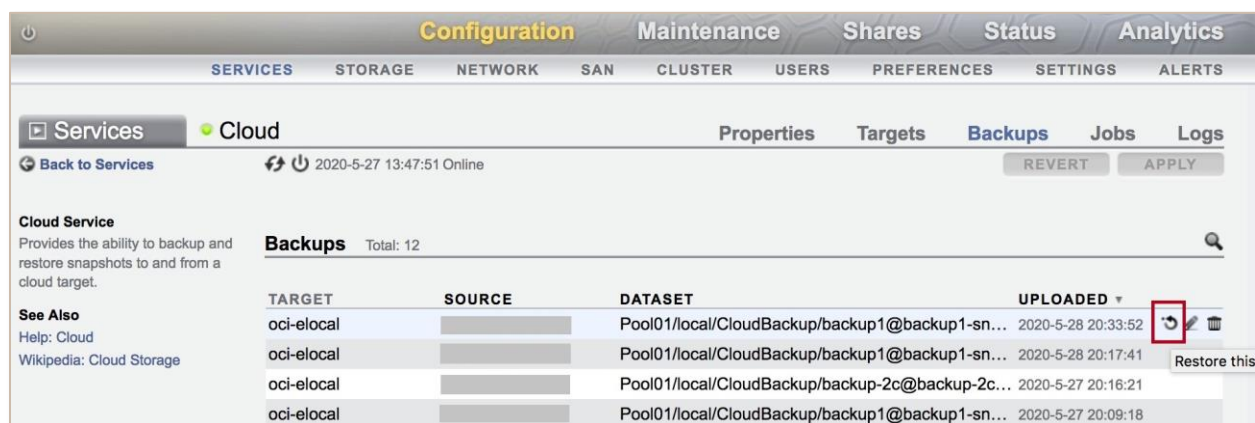
Rate 103MB/s

Transferred 1.00G

Status completed

5. Restore full and incremental cloud snapshot backup.

- a) Go to Configuration→Services→Cloud→Backups, select backup and click “restore” icon.



**Configuration** Maintenance Shares Status Analytics

SERVICES STORAGE NETWORK SAN CLUSTER USERS PREFERENCES SETTINGS ALERTS

**Services** Cloud Properties Targets Backups Jobs Logs

Back to Services 2020-5-27 13:47:51 Online [REVERT] [APPLY]

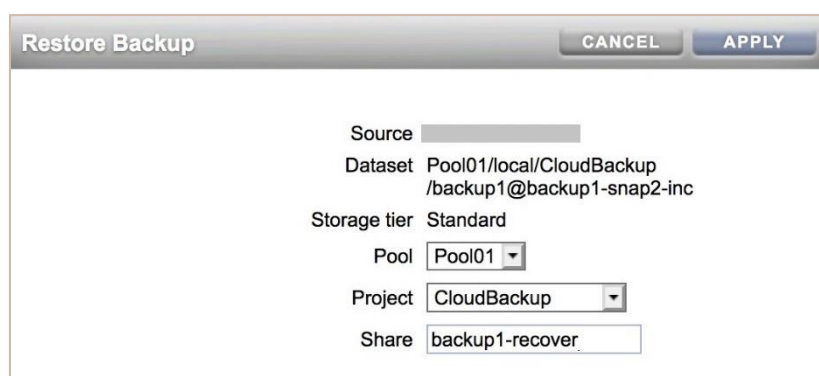
**Cloud Service**  
Provides the ability to backup and restore snapshots to and from a cloud target.

**See Also**  
Help: Cloud  
Wikipedia: Cloud Storage

**Backups** Total: 12

TARGET	SOURCE	DATASET	UPLOADED	
oci-elocal		Pool01/local/CloudBackup/backup1@backup1-sn...	2020-5-28 20:33:52	[Restore this]
oci-elocal		Pool01/local/CloudBackup/backup1@backup1-sn...	2020-5-28 20:17:41	
oci-elocal		Pool01/local/CloudBackup/backup-2c@backup-2c...	2020-5-27 20:16:21	
oci-elocal		Pool01/local/CloudBackup/backup1@backup1-sn...	2020-5-27 20:09:18	

- b) Provide a new share name to restore the cloud snapshot backup.



**Restore Backup** [CANCEL] [APPLY]

Source:

Dataset: Pool01/local/CloudBackup/backup1@backup1-snap2-inc

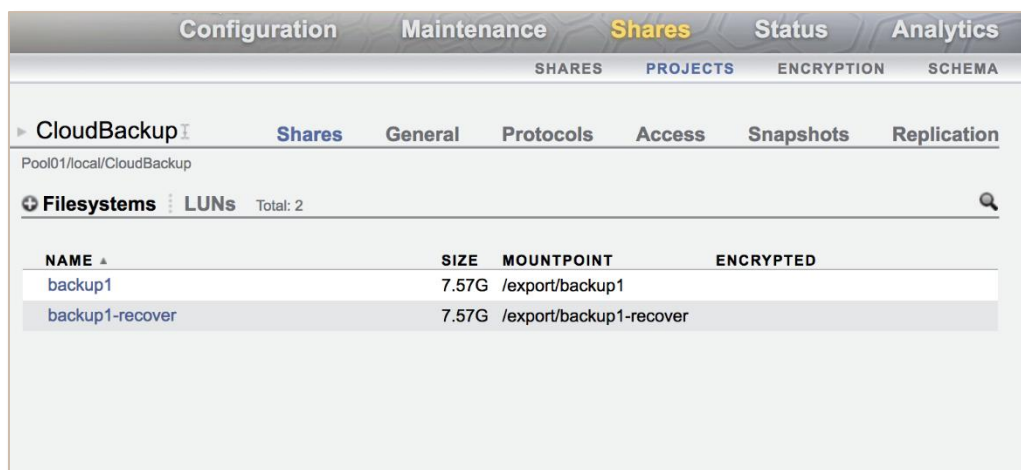
Storage tier: Standard

Pool: Pool01

Project: CloudBackup

Share: backup1-recover

- Go to Shares→CloudBackup. Confirm the cloud snapshot backup is restored.



## PART VI: MONITOR CLOUD SNAPSHOT BACKUPS AND OBJECT STORE BUCKET

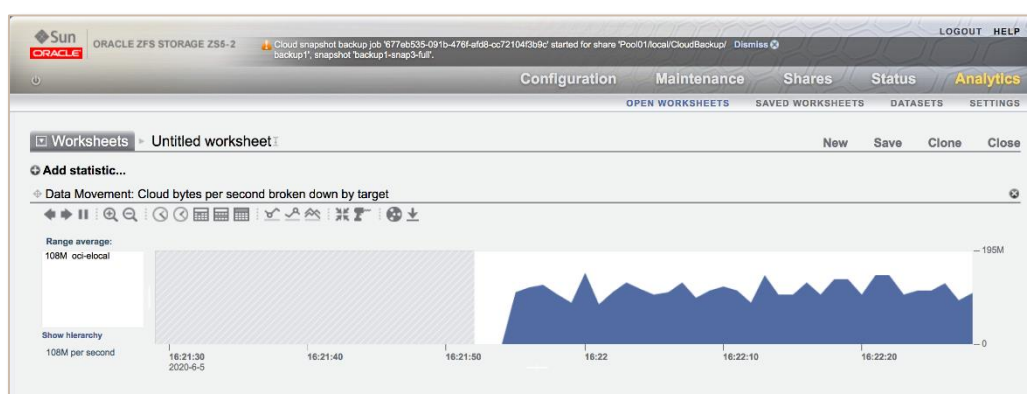
### 1. Monitor cloud backup job with Analytics.

You can monitor cloud snapshot transfers with ZFS Storage Appliance Analytics.

Cloud snapshot backup throughput performance between on-premise ZFS Storage Appliances will depend on network speed and connectivity.

Backup throughput to OCI cloud object storage from on-premise storage will also depend upon connectivity. Our testing suggests approximately 100GB/hour. OCI's FastConnect feature provides a dedicated, private connection between your data center and OCI. FastConnect provides higher-bandwidth options, and a more reliable and consistent networking experience compared to internet-based connections.

- Go to Analytics and select + sign next to Add statistics. Select Cloud bytes or Cloud requests. For example:



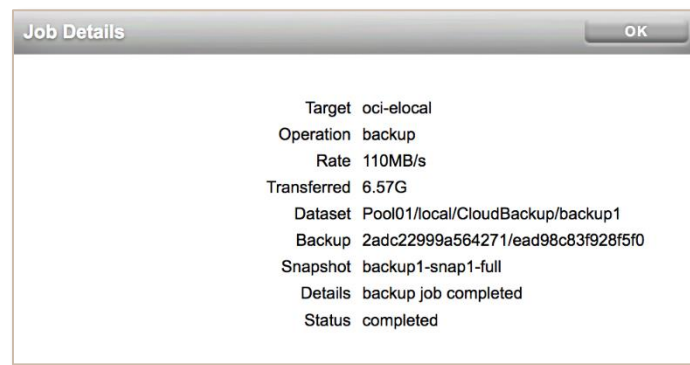
### 2. Monitor cloud backup job details and alert information.

Information about the current cloud snapshot backup job is detailed at the top of the BUI when then the job is in progress. Backup job details can also be displayed from Configuration→Services→Cloud→Backups or Configuration→ Services→Cloud→Jobs, which includes most recent backup jobs.

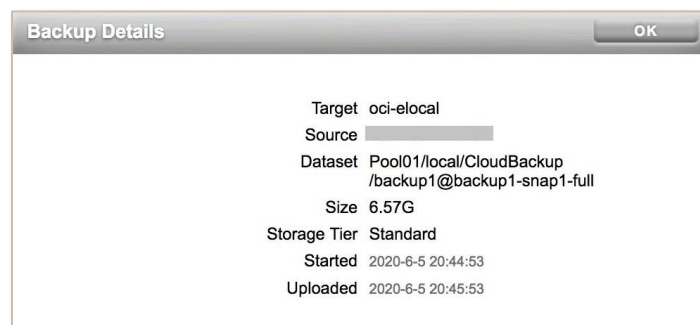
Backup job details can also be reviewed in the alert logs in Maintenance→Logs.

- On the source appliance, review details of last cloud snapshot backup job details in Configuration→ Services→Cloud→Jobs. Click the edit icon. For example:

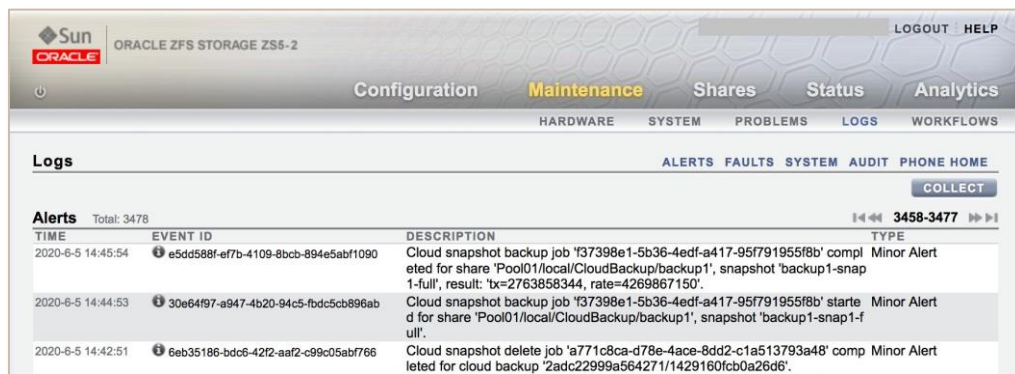




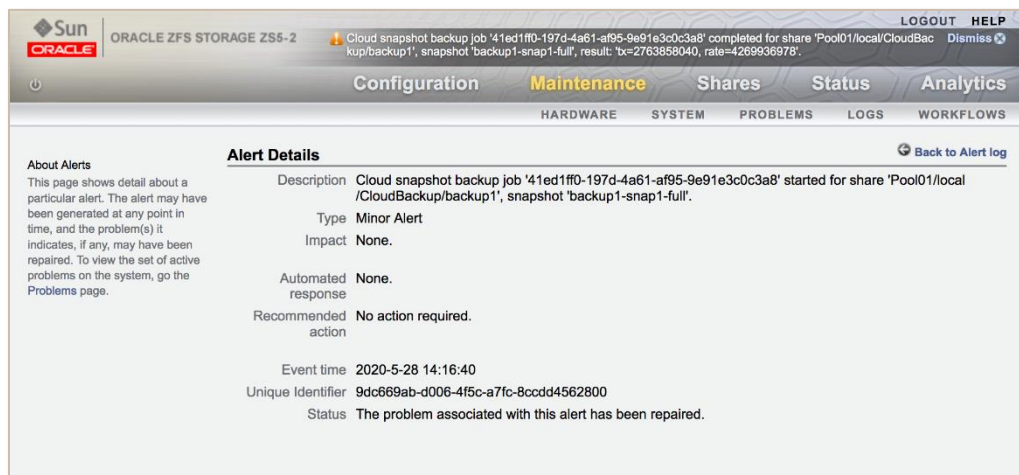
- b) On the source appliance, review details of recent cloud snapshot backups in Configuration→Services→Cloud→Backups. Click the edit icon. For example:



- c) On the source appliance, review previous cloud snapshot backup entries in Maintenance→Logs. For example:



- d) On the source appliance, select a cloud snapshot backup alert and click on the “show alert details” icon. For example:



### 3. Display OCI-compatible object storage bucket details.

The OCI-compatible object storage on an on-premise ZFS Storage Appliance does not include a management interface so visibility into the object storage bucket is through the oci command line interface.

Consider creating a config file so that oci command line syntax described below can be simplified. For more information, see [Part VIII: Automation and Customization Tips](#).

a) On the local system, list the `oci-elocal` bucket contents. For example:

```
local# oci os object list --endpoint http://ZFSSA-name-or-IP/oci -ns /export/oci-elocal --bucket-name bucket --limit 1000000 --output table --query 'data[*].{"Name":"name","Size":"size","Time created":"time-created"}'
```

Name	Size	Time created
zfs/target	63	2020-05-27T17:25:25+00:00
zfs/backups/18860d44a05efb7f/01d9aa3b984d8e7b/000000001	14852	2020-06-10T17:43:03+00:00
zfs/log/6378714b-faac-4fbf-afb2-a42a7dd969d7/000000001	106	2020-06-09T22:14:01+00:00
zfs/target	63	2020-05-27T17:25:25+00:00
zfs/log/7c6ccc16-9d6e-e254-cfc2-dd846a84b11a/00000227	109	2020-06-12T17:18:03+00:00
zfs/manifests/18860d44a05efb7f/01d9aa3b984d8e7b	788	2020-06-10T17:43:03+00:00
zfs/source/6378714b-faac-4fbf-afb2-a42a7dd969d7	204	2020-06-12T17:18:09+00:00
zfs/source/7c6ccc16-9d6e-e254-cfc2-dd846a84b11a	205	2020-06-12T17:18:03+00:00

b) On the local system, listing the bucket contents of a cloud target can also be done with the same command. For example:

```
local# oci os object list --endpoint "https://objectstorage.us-ashburn-1.oraclecloud.com" --ns "my-ns" --name cloudbucket --limit 1000000 --output table --query 'data[*].{"Name":"name","Size":"size","Time created":"time-created"}'
```

Name	Size	Time created
zfs/backups/2adc22999a564271/0d201319e7fdc6fc/000000001	4503588	2020-04-21T13:17:50.718000+00:00
zfs/backups/561f4abb58364785/e9add2fe76fa9a80/000000001	1075000608	2020-03-05T21:47:09.644000+00:00
zfs/backups/tar/300ec53b6405417f/f2c84bb0df547515/000000001	188	2020-06-02T14:32:32.371000+00:00
zfs/backups/tar/850338bd9d405668/41479dc3eb190073/000000001	187	2020-03-24T21:02:55.192000+00:00
zfs/backups/zfs/300ec53b6405417f/f2c84bb0df547515/000000001	13128	2020-06-02T14:32:24.151000+00:00
zfs/backups/zfs/850338bd9d405668/41479dc3eb190073/000000001	13256	2020-03-24T21:02:48.717000+00:00
zfs/backups/zfs/850338bd9d405668/c06f0305b9d3db20-41479dc3eb190073/000000001	3756	2020-03-24T21:03:16.441000+00:00
zfs/dependencies/zfs/850338bd9d405668/41479dc3eb190073-c06f0305b9d3db20	0	2020-03-24T21:03:16.596000+00:00
zfs/log/4c654cce-6cc1-4108-b3c9-f35b16e8a928/000000001	107	2020-03-16T15:56:52.112000+00:00

When a cloud snapshot backup is created, a unique ID string is generated that can be used to restore the snapshot. The above output is described as follows:

Component	Description
Name	zfs/backups – Identifies the snapshot backup ID zfs/dependences – identifies any incremental backup denoted with a /, which means that this backup cannot be removed unless the incremental backup snapshot is removed zfs/log – Identifies log data of the snapshot backup zfs/target – identifies the cloud snapshot target zfs/source – identifies the source name of the backup
Size	Cloud snapshot backup size in bytes
Time created	Identifies the date/time that the backup was created

## PART VII: CLOUD SNAPSHOT BACKUPS ROLES AND AUTHORIZATION

The ZFS Storage Appliance provides a pre-configured authorization (Cloud targets) so that you can determine who can add, remove, and restore cloud snapshot backups.

1. Go to Configuration→Users and select + sign next to Roles.

The screenshot shows the ZFS Storage Appliance web interface. The top navigation bar includes tabs for Configuration, Maintenance, Shares, Status, and Analytics. Below this, a secondary navigation bar lists various system areas: SERVICES, STORAGE, NETWORK, SAN, CLUSTER, USERS (highlighted), PREFERENCES, SETTINGS, and ALERTS. The main content area is divided into two panels. The left panel, titled 'Users' with a search icon and 'Total: 10', displays a table of users. The right panel, titled 'Roles' with a search icon and 'Total: 5', displays a table of roles.

NAME ▲	USERNAME	UID	TYPE
Kyle Ohme	sizing	2000000006	Local
Oracle Agent	oracle_agent	2000000003	Local
Student 2	student2	1001	Local
Student 4	student4	1002	Local
Super-User	root	0	Local
oci-user	oci-user	2000000005	Local
oem_agent	oem_agent	2000000004	Local
student1-1	student1	2000000000	Local
student3	student3	2000000002	Local
workshop-admin	workshop-admin	2000000007	Local

NAME ▲	DESCRIPTION
OEMrole	read / write account for OEM
OEMtest	Restricted read / write account for OEM
basic	Basic administration
ikorole	iko demo
oracle_agent	Role for limiting access to Oracle Enterprise ...

2. Identify user name and description.
3. Restrict cloud target name, if necessary.
4. Select Cloud Targets from the Scope pulldown menu.



5. Select the backup, delete, or restore authorization.

**Add Role** [CANCEL] [ADD]

**Properties**

Name

Description

**Authorizations** [ADD]

Scope: Cloud targets

Cloud target name: \*

Selected: 0 / Total: 3

<input type="checkbox"/>	backup	Backup snapshot data to cloud
<input type="checkbox"/>	delete	Delete cloud snapshots
<input type="checkbox"/>	restore	Restore cloud snapshots to local shares

**EXAMPLE: Cloud Snapshots Admin and Cloud Snapshots Operator permissions**

A Cloud Snapshots Admin could have the ability to backup, delete, and restore backups from a cloud target.

Selected: 3 / Total: 3

<input checked="" type="checkbox"/>	backup	Backup snapshot data to cloud
<input checked="" type="checkbox"/>	delete	Delete cloud snapshots
<input checked="" type="checkbox"/>	restore	Restore cloud snapshots to local shares

A Cloud Snapshots Operator could have the ability to backup and restore backups from a cloud target. This means the role does not have permission to delete backups.

Selected: 2 / Total: 3

<input checked="" type="checkbox"/>	backup	Backup snapshot data to cloud
<input type="checkbox"/>	delete	Delete cloud snapshots
<input checked="" type="checkbox"/>	restore	Restore cloud snapshots to local shares

6. Create or modify an existing user and assign the proper role to allow cloud snapshot permissions.

Add User
CANCEL ADD

### Properties

This is a locally-defined appliance administrator.

Type
Local

Username
BackupOperator

User ID
☒ auto
☐

Full Name
Backup Operator

Password
.....

Confirm
.....

Require session annotation
☐

Kiosk user
☐

Kiosk screen
<https://osc-zs5-2-n2-02:215/#status/dashboard>

SMB enabled user
☐

### Roles : Exceptions

Total: 7 1-6

NAME	DESCRIPTION
<input type="checkbox"/> CloudSnapsAdmin	Can backup, delete, and restore backups
<input checked="" type="checkbox"/> CloudSnapsOperator	Can backup and restore backups
<input type="checkbox"/> OEMrole	read / write account for OEM
<input type="checkbox"/> OEMtest	Restricted read / write account for OEM
<input type="checkbox"/> basic	Basic administration
<input type="checkbox"/> ikorole	iko demo

If a Cloud Snapshots Operator attempts to delete a backup, the system will prevent the request given the user does not have authorization to perform the action.

OK

You are not authorized to perform this action. If you wish to proceed, contact an administrator to obtain the proper credentials.

## PART VIII: AUTOMATION AND CUSTOMIZATION TIPS

### OCI Command Line Simplification

Because the OCI command line is used to create the target bucket and also monitor OCI object stores, you might consider setting up profiles to simplify the OCI command line execution.

Profiles can be used to facilitate command input when working with a specific target. Instead of using `-endpoint`, `-namespace`, `--compartment-id`, etc. to access a target, these configurations can be saved into a profile such that they can be called upon from a save file (for example, `--profile zfssa`).

The profile's settings are defined under its title (for example, `[zfssa]`). The `.oci/config` file can contain configuration such as: `user`, `fingerprint`, `key_file`, `tenancy`, and `region`. Similarly, the `.oci/oci_cli_rc` file (create file, if needed) can contain: `compartment_id`, `os.namespace`, and `endpoint`.

- a) Create a profile in the config file by adding configurations like the following:

```
[zfssa]
user=user-OCID
fingerprint=your-fingerprint
key_file=selected-key-file-location
tenancy=tenancy-OCID
region=your-region
```

- b) Create a profile in the `oci_cli_rc` file by adding configurations like the following:

```
[zfssa]
compartment_id=target-compartment-id
os.namespace=target-namespace
endpoint=https://ZFSSA-name-or-IP/oci
```

- c) Use profiles to simplify any `oci` command. For example, these two commands are the same (given setup above):

- `local# oci os bucket create -endpoint "http://ZFSSA-name-or-IP/oci" --ns "target-namespace" -name bucket`
- `local# oci os bucket create --profile zfssa -name bucket`

### Workflow Installation and Automation

A workflow can be used to automate processes in the ZFS Storage Appliance. Through a script, a workflow can take in parameters to perform a scheduled or one-time execution of an action through the browser interface or CLI.

Creating workflows can assist you in managing cloud snapshot backups in OCI object storage. For example, you can leverage a workflow for scheduling cloud snapshot backups or for creating and scheduling a project-level cloud snapshot backup, and even to set a retention time for backups stored in OCI object storage.

Workflow documentation can be found at: [https://docs.oracle.com/cd/E91275\\_01/html/E91291/gokxv.html#scrolltoc](https://docs.oracle.com/cd/E91275_01/html/E91291/gokxv.html#scrolltoc).

#### 1. On the source appliance, review workflow installation and execution from the BUI.

- a) Go to Maintenance→Workflows and select + sign next to Workflows.

Configuration	Maintenance	Shares	Status	Analytics
HARDWARE	SYSTEM	PROBLEMS	LOGS	WORKFLOWS
<div> <div>+</div> <div>Workflows</div> <div>Total: 7</div> </div>				
NAME ▲	DESCRIPTION	VERSION		
Cloud Backup	Backup automatic snapshots to an OCI target	1.0.0		
Cloud Backup (Test)	Backup automatic snapshots to an OCI target	1.0.0		
Cloud Snaps Project Backup	Backs up a project snapshot.	1.0.0		
Cloud Snaps Retention	Scheduled workflow that deletes old cloud snapshots.	1.0.1		

- b) On the local system, select the workflow (.akwf) file to be used and upload it.  
c) Press the “Execute Workflow” button to run workflow script.

Configuration	Maintenance	Shares	Status	Analytics
HARDWARE	SYSTEM	PROBLEMS	LOGS	WORKFLOWS
<div> <div>+</div> <div>Workflows</div> <div>Total: 7</div> </div>				
NAME ▲	DESCRIPTION	VERSION		
Cloud Backup	Backup automatic snapshots to an OCI target	1.0.0	<div> <div></div> <div></div> <div></div> </div>	
Cloud Backup (Test)	Backup automatic snapshots to an OCI target	1.0.0		
Cloud Snaps Project Backup	Backs up a project snapshot.	1.0.0		
Cloud Snaps Retention	Scheduled workflow that deletes old cloud snapshots.	1.0.1		

## 2. On the source appliance, review the workflow CLI access and management.

Some workflows must be managed through the CLI, such as a scheduled workflow.

- a) Access workflows from the CLI using the following command: `> maintenance workflows ls`

Workflows:						
WORKFLOW	NAME	OWNER	SETID	ORIGIN	VERSION	
workflow-000	Hello world	root	false	<local>	undefined	
workflow-001	New share	root	false	<local>	undefined	
workflow-002	Cloud Backup (Test)	root	true	Oracle	1.0.0	
workflow-003	Cloud Backup	root	true	Oracle	1.0.0	
workflow-004	Cloud Snaps Project Backup	root	false	Oracle	1.0.0	
workflow-005	Cloud Snaps Retention (Testing in Progress)	root	true	Oracle		
workflow-006	Cloud Snaps Retention	root	true	Oracle	1.0.1	

- b) Select the desired workflow. For example, `> select workflow-002` and `ls` to display any available actions and properties.

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