AIX Backups with IBM Power Virtual Server

An IBM Systems Lab Services Tutorial

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Chapter 1: Solution Overview

Introduction

A key client expectation of IBM Power Virtual Server (PowerVS) is the ability to deploy a similar backup strategy to the one they use on-premise for their AIX workloads. Most clients employ a strategy of weekly or monthly full-system backups, combined with more frequent filesystem- or file-level backups.

PowerVS provides AIX clients with similar capabilities. However, **the method and interfaces in PowerVS are somewhat different** from those on-premise.

This tutorial will provide step-by-step instructions for performing full-system or file-level backups in AIX in three common scenarios.

Use Cases

Full-system Snapshot and Restore

In this case, we will provide examples of how to use the new snapshot/restore application programming interfaces (APIs) to perform full-system image backups.

Full-system and File-level Backups with IBM Spectrum Protect

Here we will demonstrate how to perform full-system and file-level saves and restores using a Spectrum Protect (formerly Tivoli Storage Manager) server and IBM Cloud Object Storage (COS).

File-level Backups from AIX to Cloud Object Storage

Lastly, we will show how to perform file-level saves and restores from an AIX VSI directly to and from COS.

Solution Components and Requirements

Components

Full-system Native Save and Restore

- *AIX Virtual Server Instance*
- *Direct Link Connect to IBM Cloud*
- *Linux Virtual Server Instance*
- *Cloud Object Storage Service*
- *IBM Spectrum Protect Server for Linux*
- *IBM Spectrum Protect Client for AIX*

File-level Save and Restore

- *AIX Virtual Server Instance*
- *Direct Link Connect to IBM Cloud*
- *Linux Virtual Server Instance*
- *Cloud Object Storage Service*
- *s3fs-fuse Storage Driver for Linux*
- *NFS Server for Linux*
- *NFS Client for AIX*
- *mksysb for AIX*

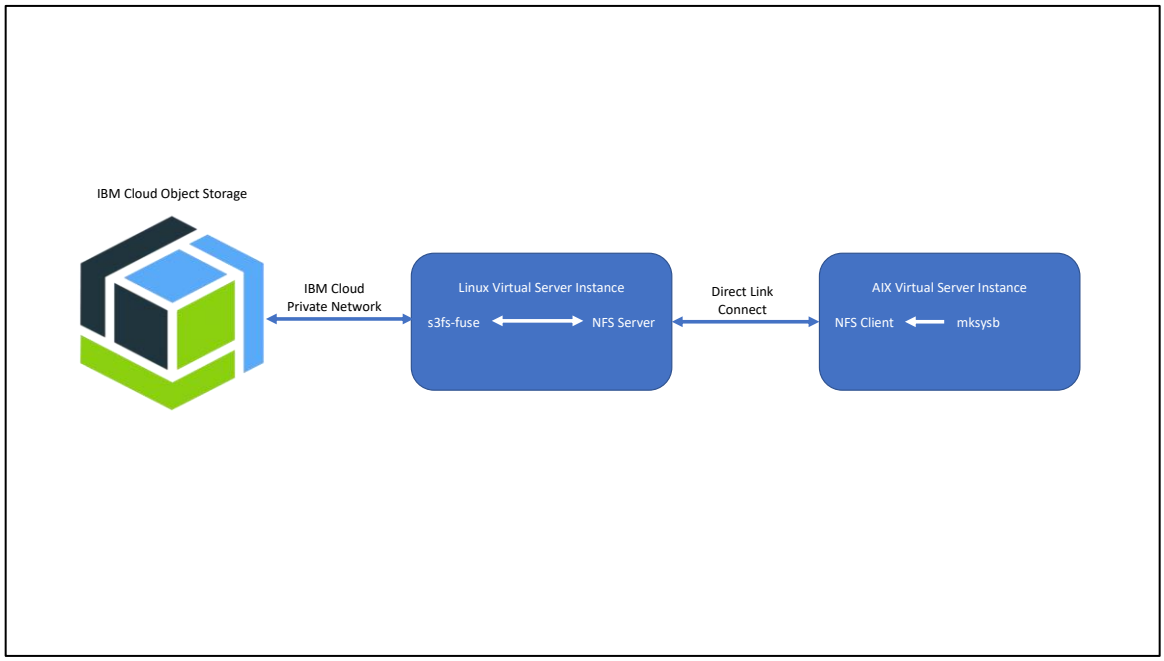
Requirements

The full-system and file-level Save and Restore Use Cases each require a Linux Virtual Server Instance in IBM cloud to facilitate private

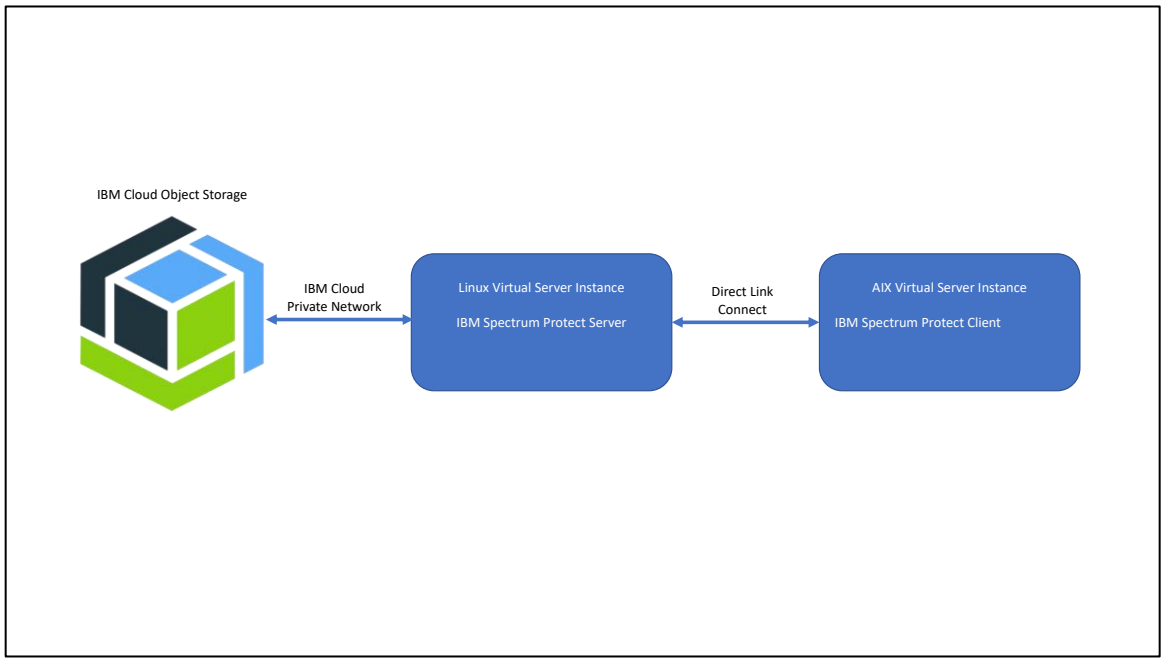
network access to Cloud Object Storage and a Direct Link Connect connection between IBM Cloud and the Power VS service.

Solution Diagrams

Full-System Native Save and Restore



File-Level Save and Restore

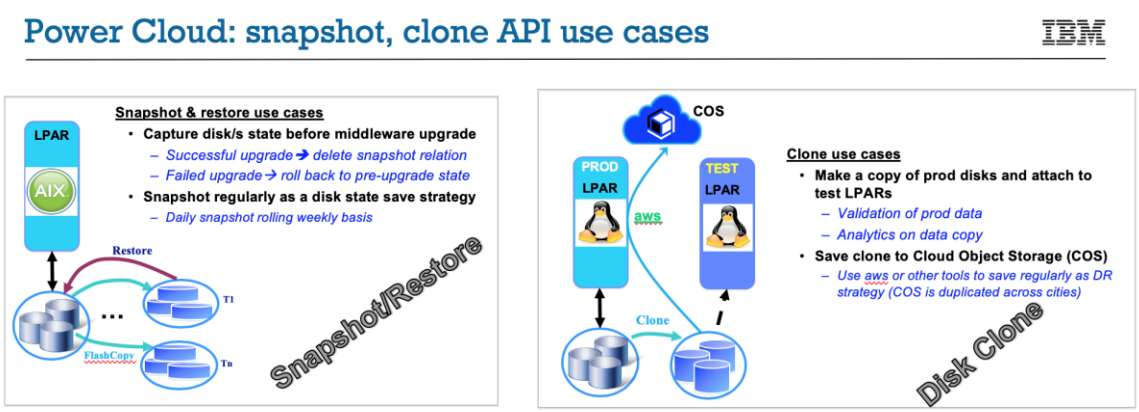


Chapter 2: Implementation

Full-system Snapshot and Restore

PowerVS recently introduced the capability to perform snapshots, restores and clones of Power Virtual Server Instances (VSIs). As of the time of this writing, the capability is available only via API.

Use Cases



Examples

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```

```
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```

General use information about IBM Cloud PowerVS API use

Following example/sample code shows how to use Cloud API. Following sample focusses on use of VM shutdown and such operations. This sample should be modified to perform any snapshot/restore such operations.

```
#!/bin/bash

### START OF VARIABLES
API_KEY="ENTER YOUR API KEY HERE"
CLOUD_CRN="ENTER YOUR CLOUD CRN"
INSTANCE_NAME="ENTER YOUR INSTANCE NAME"
## Acceptable values are stop, start ,hard-reboot, soft-reboot
OPERATION="stop"

#################
IFS=":" read -ra ADDR <<< "${CLOUD_CRN}"
CLOUD_INSTANCE_ID=${ADDR[7]}
CLOUD_URL=(${ADDR[5]}.power-iaas.cloud.ibm.com)
```

FIRST WE GET THE TOKEN FROM THE CLOUD IAM SERVICE USING THE API KEY

GET_TOKEN=$(curl -X POST -H "Content-Type: application/x-www-form-urlencoded" -H "Accept: application/json" -d "grant_type=urn%3Aibm%3Aparams%3Aoauth%3Agrant-type%3Aapikey&apikey=$API_KEY" https://iam.bluemix.net/oidc/token | jq -r '.access_token')

THIS IS THE POST CALL TO INVOKE the OPERATION
curl -X POST https://$CLOUD_URL/pcloud/v1/cloud-instances/$CLOUD_INSTANCE_ID/pvm-instances/$INSTANCENAME/action -H "CRN: $CLOUD_CRN " -H "Authorization: Bearer $GET_TOKEN" -H 'Content-Type:application/json' -d '{ "action":"'$OPERATION'" }'

sleep 30

THIS IS A GET CALL
curl -X GET https://$CLOUD_URL/pcloud/v1/cloud-instances/$CLOUD_INSTANCE_ID/pvm-instances/$INSTANCE_NAME -H "CRN: $CLOUD_CRN " -H "Authorization: Bearer $GET_TOKEN" -H 'Content-Type:application/json'

Examples of Disk/Volume Snapshot/Restore/Clone operations

Pre-Conditions:

The body of the Snapshot, Restore and Clone (PVM and Volume) API would have to be modified with user defined values.

Before running the Restore API, the PVM instance would have to be SHUTOFF.

Create a new Snapshot:

curl -X POST https://< Cloud IP >/pcloud/v1/cloud-instances/<Cloud Instance ID>/pvm-instances/<PVM Instance ID>/snapshots \

-H "authorization: <AuthToken>" \

-H "content-type: application/json" \

-H "crn: <CRN>" \

-d "{\"name\": \"VM1-SS\",\"description\": \"Snapshotfor VM1\",\"volumeIDs\": [\"VM1-7397dc00-0000035b-boot-0\",\"vm1dv1\"]}"

Expected Response:

{"snapshotID":"65ea39fd-cab6-46b3-b88c-3c28479ab019"}

Get Snapshot Details:

curl -X GET https://< Cloud IP >/pcloud/v1/cloud-instances/<Cloud Instance ID>/snapshots/<Snapshot ID>\

-H "authorization: <AuthToken>" \

-H "content-type: application/json" \

-H "crn: <CRN>"

Expected Response:

{

"action": "snapshot",

"creationDate": "2020-04-13T08:51:21.000Z",

```
    "description": "Snapshotfor VM1",
    "lastUpdateDate": "2020-04-13T08:51:54.000Z",
    "name": "VM1-SS",
    "percentComplete": 100,
    "pvmInstanceID": "7397dc00-f328-4bfb-bef2-27200ca42cb9",
    "snapshotID": "65ea39fd-cab6-46b3-b88c-3c28479ab019",
    "status": "available",
    "volumeSnapshots": {
        "398344bb-a64d-4fd5-b3cd-14ddfea6dd0e": "72f07383-ca5b-46a0-94a2-3d1e7a7faceb",
        "7a7a5b6e-1177-400a-82a4-0784957bbe75": "33f91096-f204-4ed2-8110-c497a258c29c"
    }
}
```


Restore to Snapshot:

```
curl -X POST "https://< Cloud IP >/pcloud/v1/cloud-instances/<Cloud Instance ID>/pvm-instances/<PVM Instance ID>/snapshots/<Snapshot ID>/restore?restore_fail_action=" \
-H "authorization: <AuthToken>" \
-H "content-type: application/json" \
-H "crn: <CRN>" \
-d "{\"forceRestore\":\"false\"}"
```

Expected Response:


```
{
   "action": "restore",
   "creationDate": "2020-04-13T08:51:21.000Z",
   "description": "Snapshotfor VM1",
   "lastUpdateDate": "2020-04-13T08:55:28.000Z",
   "name": "VM1-SS",
   "pvmInstanceID": "7397dc00-f328-4bfb-bef2-27200ca42cb9",
   "snapshotID": "65ea39fd-cab6-46b3-b88c-3c28479ab019",
   "status": "available",
   "volumeSnapshots": {
      "398344bb-a64d-4fd5-b3cd-14ddfea6dd0e": "72f07383-ca5b-46a0-94a2-3d1e7a7faceb",
      "7a7a5b6e-1177-400a-82a4-0784957bbe75": "33f91096-f204-4ed2-8110-c497a258c29c"
   }
}
```

Create Volume Clone:

```
curl -X POST \
  https://<Cloud IP>/pcloud/v1/cloud-instances/<Cloud Instance ID>/volumes/clone \
  -H 'authorization: <Auth Token>' \
  -H 'content-type: application/json' \
  -H 'crn: <CRN>' \
  -d '{
"displayName": "PerfClone",
"volumeIDs": ["VMT-1422dbc9-00000063-boot-0", "vmtdv1"]
}'
```

Expected Response:

```
{
   "clonedVolumes": {
      "6342e6a9-716d-4686-b644-7f089bceb332": "fd99a7ae-3e15-4f7e-af79-f5637e9a27f8",
      "8461389f-e8fb-403f-8f48-81edcc9ef46f": "16ed7611-26cc-4b93-945d-760cd6a52c58"
   }
}
```

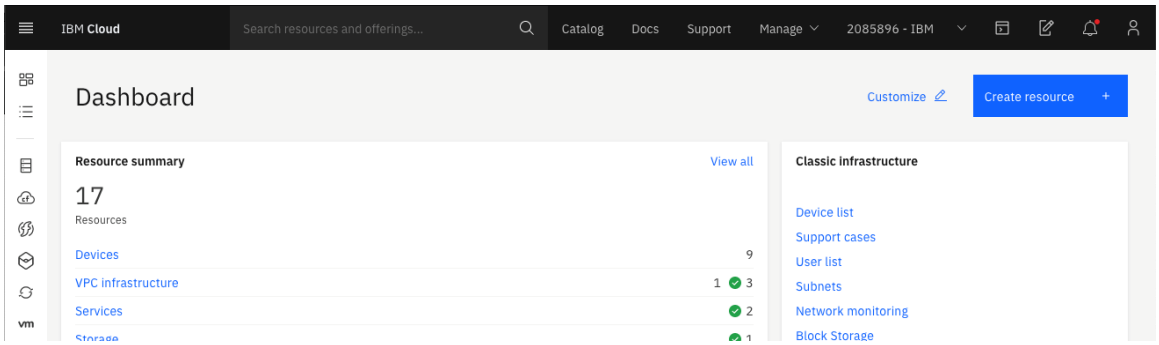
Full-system Native Save and Restore

There are several possible approaches to providing full-system save and restore functionality in the Power VS environment that offer different compromises regarding security, capacity and cost. This solution uses the mksysb capability in AIX to perform full-system backups and a Linux Virtual Server Instance (VSI) in IBM Cloud to provide a staging area for mksysb images and easy access to store those images in Cloud Object Storage.

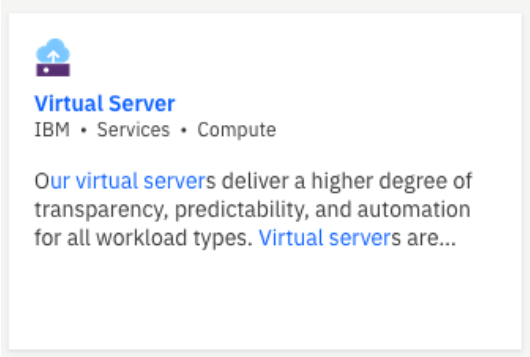
Note: Some issues were discovered using this approach for Power Virtual Serve Instances built from the default Power VS AIX images. This process works correctly for backup and restore of a VSI built from a standard fresh AIX install.

Create a Linux VSI for Staging

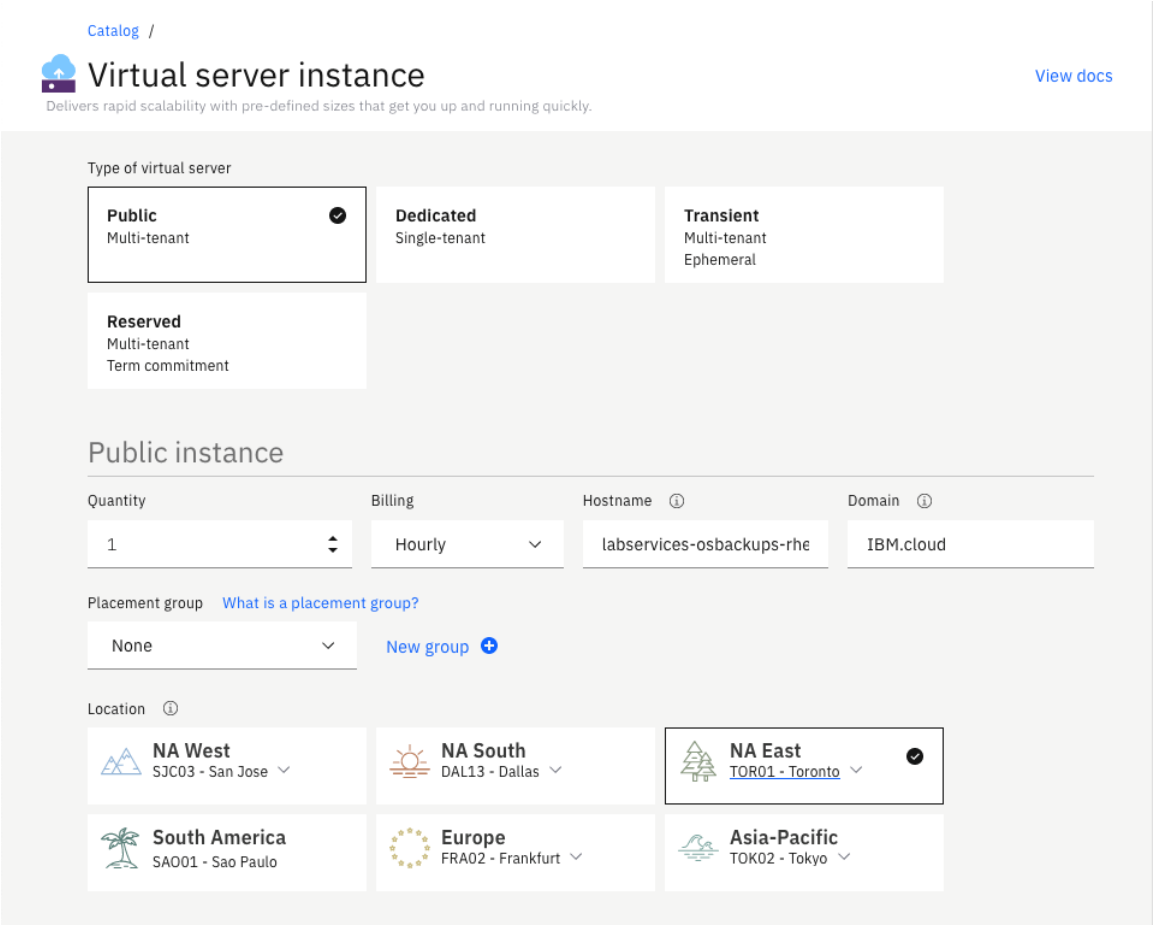
To begin, create your Linux VSI with appropriate resources. From the IBM Cloud dashboard, click the blue Create resource button in the upper right corner.



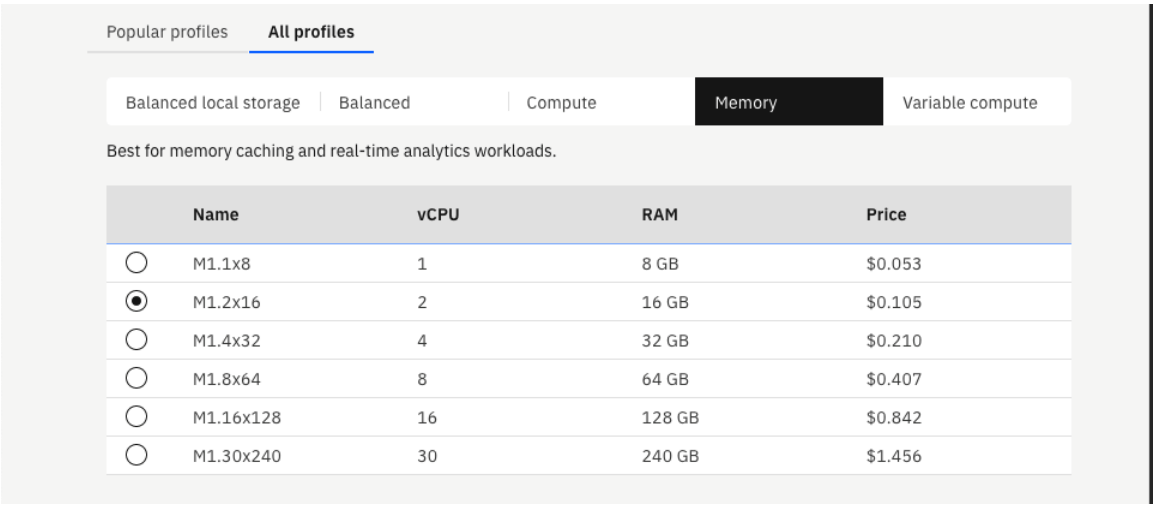
Search for and select Virtual Server.



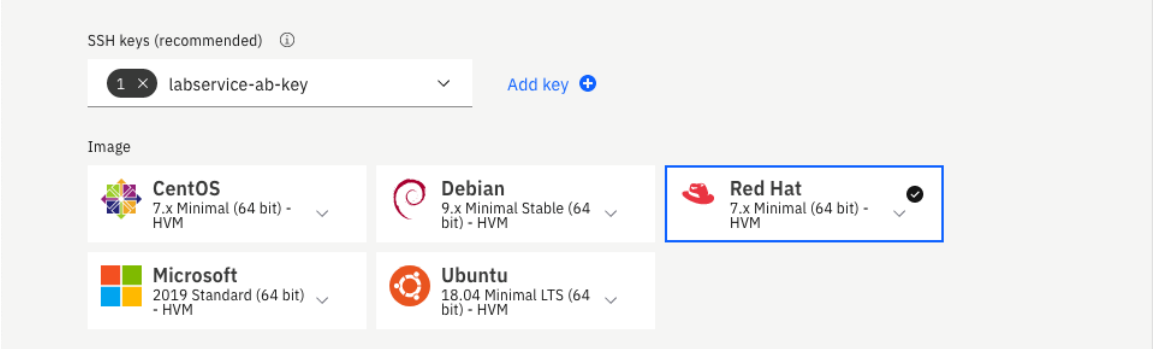
You can select the option for Public. Give your VSI a meaningful Hostname and select the same region as your Power VS environment. Then scroll down to select further options.



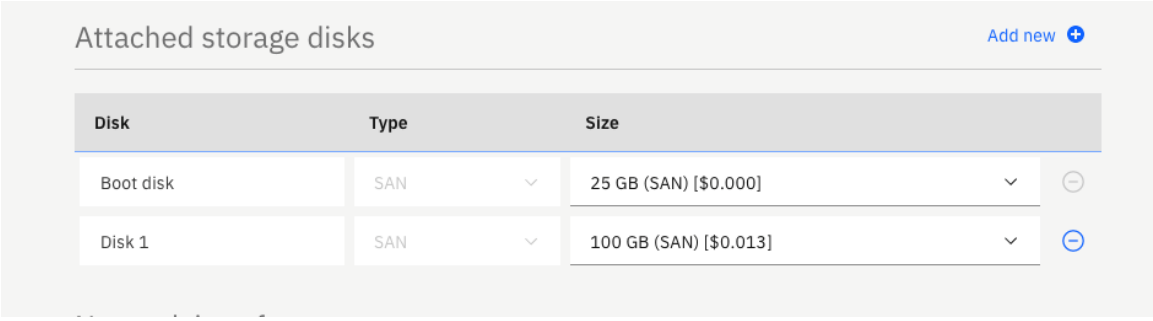
Click on All profiles and then click on the option for Memory and select the M1.2x16 profile. Depending on your actual usage, you may determine you need additional resources, but this is a good starting point.



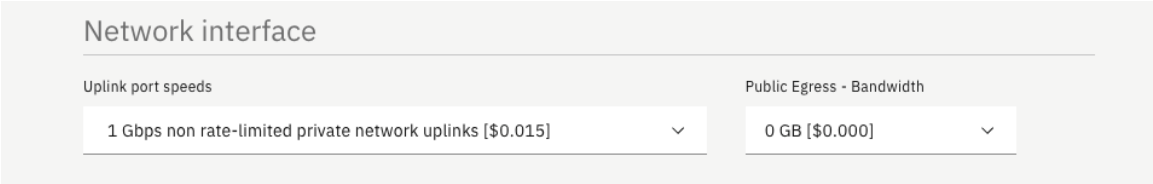
Below that, select an ssh key, if you have one configured, for more convenient console access and choose a Red Hat operating system.



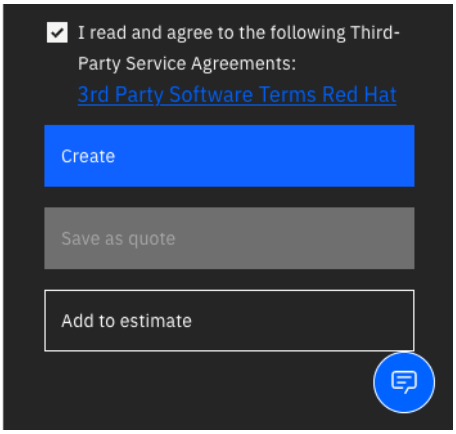
You'll need to add an additional disk to allow space to stage mksysb images. Click the Add New button to the right of Attached Storage Disks and create an addition 100 GB disk.



Finally, change the network Uplink port speeds to 1 Gbps private.

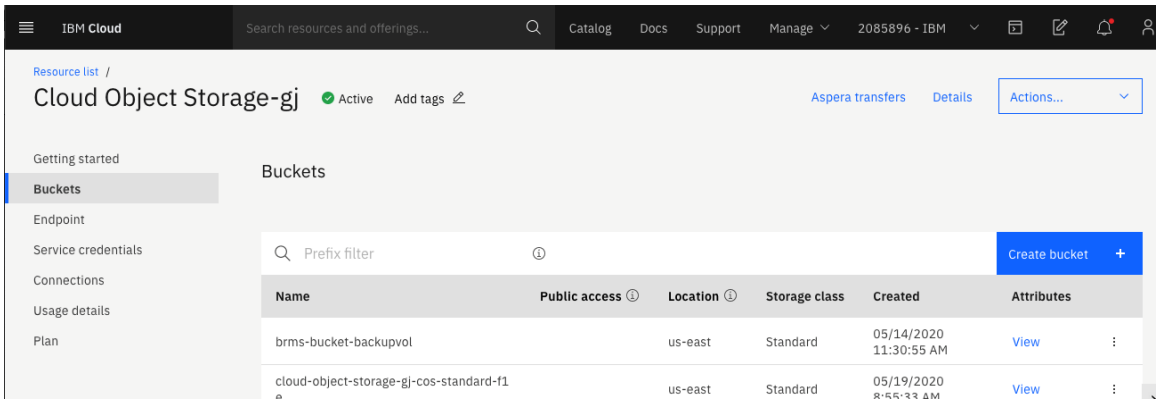


Then, in the right column, select the check box to accept the Red Hat service agreement and click the Create button. Wait a few minutes as your new VSI is provisioned.

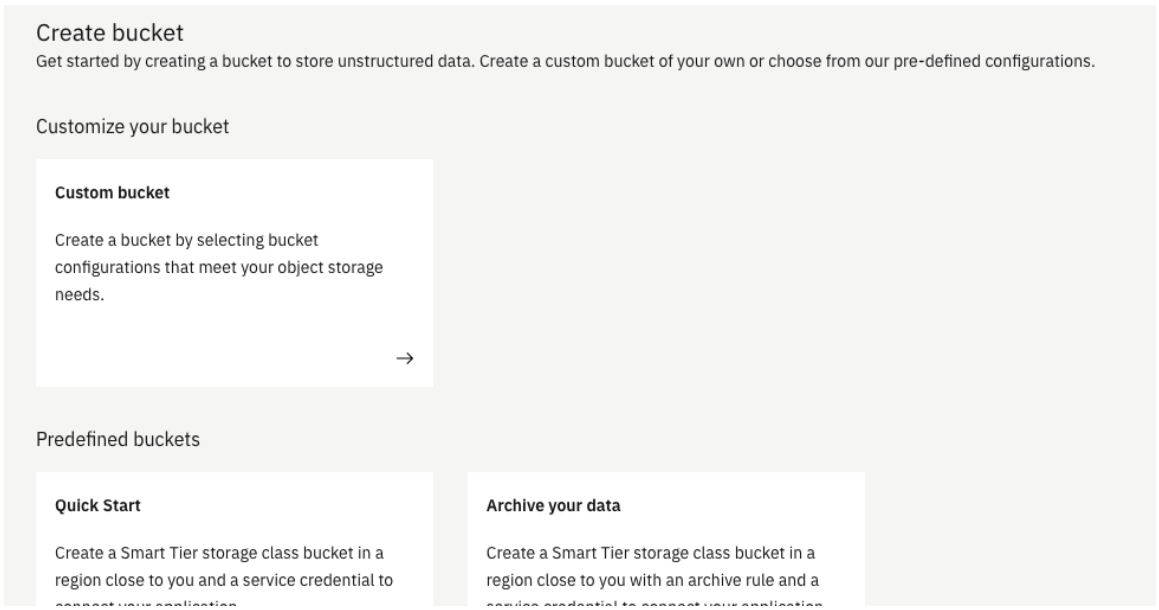


Create a Cloud Object Storage Bucket

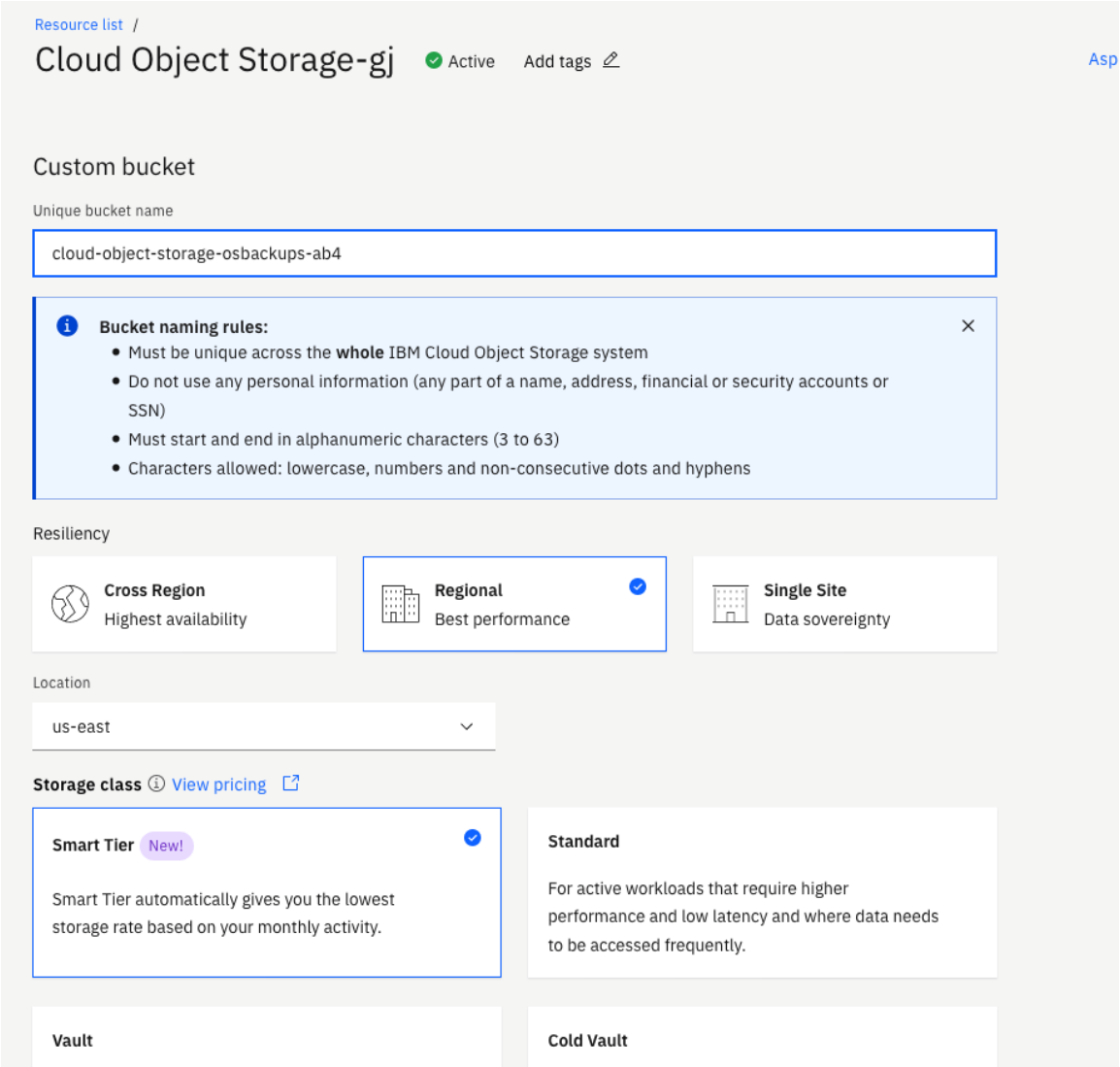
You'll need a Cloud Object Storage bucket to store your mksysb files. Navigate to the Cloud Object Storage resource in the IBM Cloud GUI. Click the blue Create Bucket button on the right side of the Buckets screen.



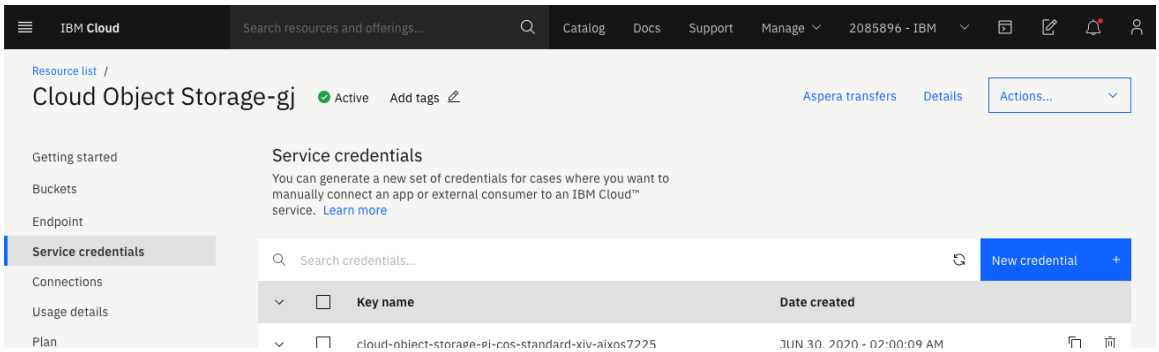
Select the option for Custom Bucket.



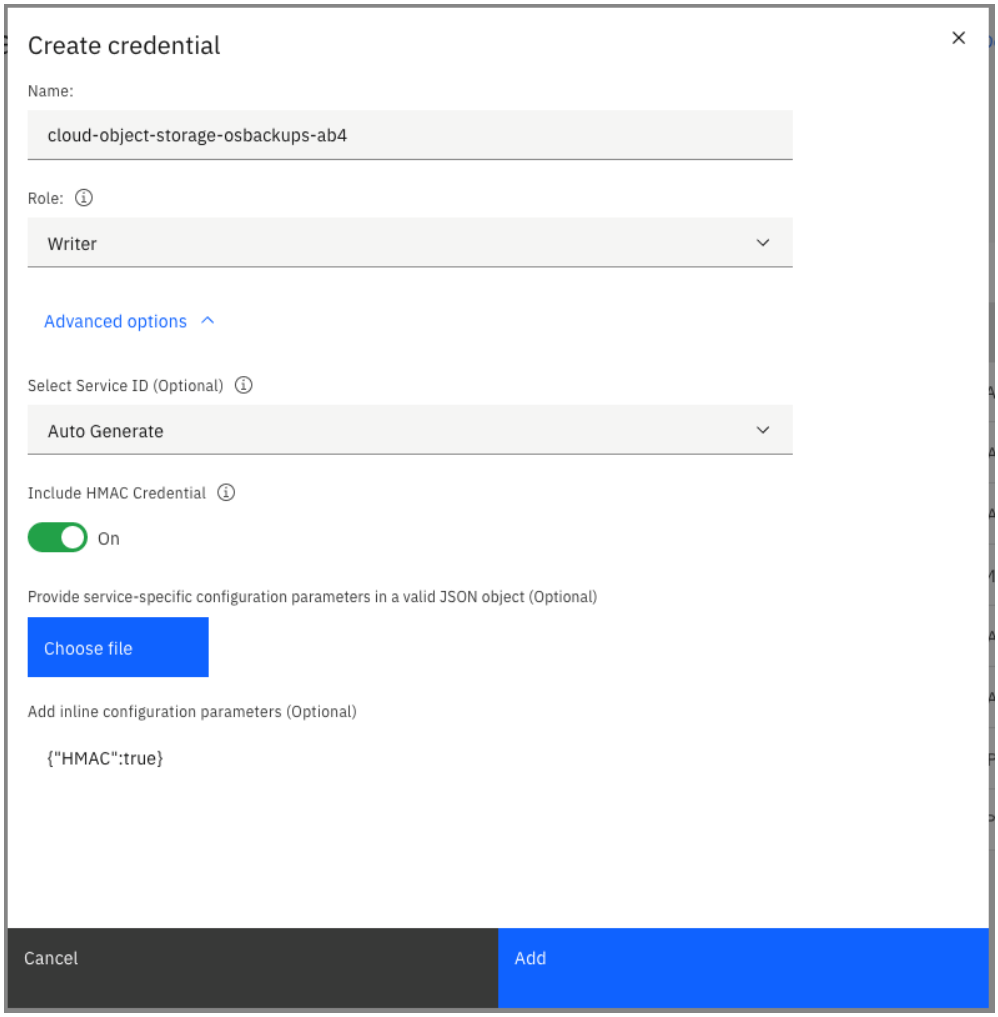
Give your bucket a meaningful name and ensure your Resiliency, Location and Storage Class options are appropriate. Then scroll to the bottom and click the Create Bucket button.



Now click the Service Credentials item in the left column to create a key to access the bucket.



Give your Service Credential a meaningful name. Then, click Advanced Options and select the option to Include HMAC credential. Then click Add.



Configure s3fs-fuse in the Linux VSI

After you've completed that configuration, log in to the Linux VSI you've created. Next you will install s3fs-fuse, which will allow you to attach your Cloud Object Storage bucket as a filesystem. First use yum to update packages in the VSI to current levels.

```
[root@labservices-osbackups-rhel-ab4 ~]# yum -y update
Loaded plugins: product-id, search-disabled-repos, subscription-manager
rhel-7-server-optional-rpms                                 | 2.0 kB  00:00:00
rhel-7-server-rpms                                          | 2.0 kB  00:00:00
rhel-7-server-supplementary-rpms                            | 2.0 kB  00:00:00
Resolving Dependencies
--> Running transaction check
---> Package NetworkManager.x86_64 1:1.18.0-5.el7_7.1 will be updated
---> Package NetworkManager.x86_64 1:1.18.4-3.el7 will be an update
---> Package NetworkManager-config-server.noarch 1:1.18.0-5.el7_7.1 will be updated
---> Package NetworkManager-config-server.noarch 1:1.18.4-3.el7 will be an update
---> Package NetworkManager-libnm.x86_64 1:1.18.0-5.el7_7.1 will be updated
---> Package NetworkManager-libnm.x86_64 1:1.18.4-3.el7 will be an update
---> Package NetworkManager-ppp.x86_64 1:1.18.0-5.el7_7.1 will be updated
---> Package NetworkManager-ppp.x86_64 1:1.18.4-3.el7 will be an update
---> Package NetworkManager-team.x86_64 1:1.18.0-5.el7_7.1 will be updated
---> Package NetworkManager-team.x86_64 1:1.18.4-3.el7 will be an update
---> Package NetworkManager-tui.x86_64 1:1.18.0-5.el7_7.1 will be updated
---> Package NetworkManager-tui.x86_64 1:1.18.4-3.el7 will be an update
---> Package acl.x86_64 0:2.2.51-14.el7 will be updated
---> Package acl.x86_64 0:2.2.51-15.el7 will be an update
---> Package avahi-autoipd.x86_64 0:0.6.31-19.el7 will be updated
---> Package avahi-autoipd.x86_64 0:0.6.31-20.el7 will be an update
---> Package avahi-libs.x86_64 0:0.6.31-19.el7 will be updated
---> Package avahi-libs.x86_64 0:0.6.31-20.el7 will be an update

... Many lines skipped ...

  sudo.x86_64 0:1.8.23-9.el7
  systemd.x86_64 0:219-73.el7_8.8
  systemd-libs.i686 0:219-73.el7_8.8
  systemd-libs.x86_64 0:219-73.el7_8.8
  systemd-sysv.x86_64 0:219-73.el7_8.8
  teamd.x86_64 0:1.29-1.el7
  tuned.noarch 0:2.11.0-8.el7
  tzdata.noarch 0:2020a-1.el7
  util-linux.x86_64 0:2.23.2-63.el7
  yum.noarch 0:3.4.3-167.el7

Complete!
[root@labservices-osbackups-rhel-ab4 ~]#
```

Then use yum to install the necessary tools to build the s3fs-fuse package.

```
[root@labservices-osbackups-rhel-ab4 ~]# yum -y install automake fuse fuse-devel gcc-
c++ git libcurl-devel libxml2-devel make openssl-devel unzip
Loaded plugins: product-id, search-disabled-repos, subscription-manager
rhel-7-server-optional-rpms                                 | 2.0 kB  00:00:00
rhel-7-server-rpms                                          | 2.0 kB  00:00:00
rhel-7-server-supplementary-rpms                            | 2.0 kB  00:00:00
Package 1:make-3.82-24.el7.x86_64 already installed and latest version
Resolving Dependencies
--> Running transaction check
---> Package automake.noarch 0:1.13.4-3.el7 will be installed
--> Processing Dependency: perl >= 5.006 for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: autoconf >= 2.65 for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: perl(warnings) for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: perl(vars) for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: perl(threads) for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: perl(strict) for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: perl(constant) for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: perl(Thread::Queue) for package: automake-1.13.4-
3.el7.noarch
--> Processing Dependency: perl(TAP::Parser) for package: automake-1.13.4-3.el7.noarch
--> Processing Dependency: perl(POSIX) for package: automake-1.13.4-3.el7.noarch

... Many lines skipped ...

  perl-macros.x86_64 4:5.16.3-295.el7
  perl-parent.noarch 1:0.225-244.el7
  perl-podlators.noarch 0:2.5.1-3.el7
  perl-threads.x86_64 0:1.87-4.el7
  perl-threads-shared.x86_64 0:1.43-6.el7
  rsync.x86_64 0:3.1.2-10.el7
  xz-devel.x86_64 0:5.2.2-1.el7
  zlib-devel.x86_64 0:1.2.7-18.el7

Complete!
[root@labservices-osbackups-rhel-ab4 ~]#
```

Now, visit https://github.com/s3fs-fuse/s3fs-fuse and download the code for s3fs-fuse as a zip. Transfer that zip to your VSI and unpack it.

```
[root@labservices-osbackups-rhel-ab8 s3fs]# unzip s3fs-fuse-master.zip
Archive:  s3fs-fuse-master.zip
e0a38adaf6cec3f413bfe0bc45869bcf33301f19
   creating: s3fs-fuse-master/
  inflating: s3fs-fuse-master/.clang-tidy
  inflating: s3fs-fuse-master/.gitattributes

... Several lines skipped ...

  inflating: s3fs-fuse-master/test/sample_ahbe.conf
  inflating: s3fs-fuse-master/test/sample_delcache.sh
  inflating: s3fs-fuse-master/test/small-integration-test.sh
  inflating: s3fs-fuse-master/test/test-utils.sh
  inflating: s3fs-fuse-master/test/ut_test.py
  inflating: s3fs-fuse-master/test/write_multiple_offsets.py
[root@labservices-osbackups-rhel-ab8 s3fs]# ls
s3fs-fuse-master  s3fs-fuse-master.zip
[root@labservices-osbackups-rhel-ab8 s3fs]#
```

Next change to the s3fs-fuse-master directory and autogen.sh, configure, make and make install to build and install s3fs-fuse.

```
[root@labservices-osbackups-rhel-ab4 ~]# cd s3fs-fuse-master/
[root@labservices-osbackups-rhel-ab4 s3fs-fuse]# ./autogen.sh
--- Make commit hash file -------
--- Finished commit hash file ---
--- Start autotools -------------
configure.ac:26: installing './config.guess'
configure.ac:26: installing './config.sub'
configure.ac:27: installing './install-sh'
configure.ac:27: installing './missing'
src/Makefile.am: installing './depcomp'
parallel-tests: installing './test-driver'
--- Finished autotools ----------
[root@labservices-osbackups-rhel-ab4 s3fs-fuse]# ./configure
checking build system type... x86_64-unknown-linux-gnu
checking host system type... x86_64-unknown-linux-gnu
checking target system type... x86_64-unknown-linux-gnu
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes

... Many lines skipped ...

checking github short commit hash... 62c8be8
checking that generated files are newer than configure... done
configure: creating ./config.status
config.status: creating Makefile
config.status: creating src/Makefile
config.status: creating test/Makefile
config.status: creating doc/Makefile
config.status: creating config.h
config.status: executing depfiles commands
[root@labservices-osbackups-rhel-ab4 s3fs-fuse]# make
make  all-recursive
make[1]: Entering directory `/root/s3fs-fuse'
Making all in src
make[2]: Entering directory `/root/s3fs-fuse/src'
g++ -DHAVE_CONFIG_H -I. -I..  -D_FILE_OFFSET_BITS=64 -I/usr/include/fuse -
I/usr/include/libxml2      -g -O2 -Wall -D_FILE_OFFSET_BITS=64 -D_FORTIFY_SOURCE=2 -MT

... Many lines skipped ...

make[2]: Entering directory `/root/s3fs-fuse'
make[2]: Leaving directory `/root/s3fs-fuse'
make[1]: Leaving directory `/root/s3fs-fuse'
[root@labservices-osbackups-rhel-ab4 s3fs-fuse]# make install
Making install in src
make[1]: Entering directory `/root/s3fs-fuse/src'
make[2]: Entering directory `/root/s3fs-fuse/src'
 /usr/bin/mkdir -p '/usr/local/bin'

... Several lines skipped ...

make[2]: Nothing to be done for `install-exec-am'.
make[2]: Nothing to be done for `install-data-am'.
make[2]: Leaving directory `/root/s3fs-fuse'
make[1]: Leaving directory `/root/s3fs-fuse'
[root@labservices-osbackups-rhel-ab4 s3fs-fuse]#
```

Now you need to configure access to your bucket. In the Cloud Object Storage section of the IBM Cloud console, locate the Service Credential you created earlier.

Create a file /etc/passwd-s3fs containing your access_key_id and secret_access_key separated by a colon.

```
9eec0f82e7dd4a72a6fa19f0bd67d657:c22701d0d39517b860699ba0d8cab1ec23a7a04d71ed1d05
~
~
```

Set the permissions on that file.

```
[root@labservices-osbackups-rhel-ab4 ~]# chmod 600 /etc/passwd-s3fs
[root@labservices-osbackups-rhel-ab4 ~]#
```

Now create a mount point to attach your bucket and use the s3fs command to attach the storage. You'll need the name of the bucket and the url of the private Cloud Object Storage endpoint for the appropriate region. Use df to confirm the mount succeeded.

```
[root@labservices-osbackups-rhel-ab4 ~]# mkdir /cosbucket
[root@labservices-osbackups-rhel-ab4 ~]# s3fs cloud-object-storage-osbackups-ab4
/cosbucket -o passwd_file=/etc/passwd-s3fs -o url=https://s3.private.us-east.cloud-
object-storage.appdomain.cloud -o use_path_request_style -o dbglevel=info -o
allow_other
[root@labservices-osbackups-rhel-ab4 ~]# df -h | grep s3fs
s3fs            256T     0  256T   0% /cosbucket
[root@labservices-osbackups-rhel-ab4 ~]#
```

Create and Export Staging File System

Next, you'll need to format and mount your staging disk. You can use fdisk to determine the name of the intended disk. Look for the disk that is around 100 GB, in this case /dev/xvcd.

```
[root@labservices-osbackups-rhel-ab8 ~]# fdisk -l

Disk /dev/xvda: 26.8 GB, 26843545600 bytes, 52428800 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x0000cece

    Device Boot      Start         End      Blocks   Id  System
/dev/xvda1   *        2048     2099199     1048576   83  Linux
/dev/xvda2         2099200    52428799    25164800   83  Linux

Disk /dev/xvdc: 107.4 GB, 107374182400 bytes, 209715200 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/xvdb: 2147 MB, 2147483648 bytes, 4194304 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x00025cdb

    Device Boot      Start         End      Blocks   Id  System
/dev/xvdb1              63     4192964     2096451   82  Linux swap / Solaris
[root@labservices-osbackups-rhel-ab8 ~]#
```

Format that disk using mkfs.xfs.

```
[root@labservices-osbackups-rhel-ab8 ~]# mkfs.xfs /dev/xvdc
meta-data=/dev/xvdc              isize=512    agcount=4, agsize=6553600 blks
         =                       sectsz=512   attr=2, projid32bit=1
         =                       crc=1        finobt=0, sparse=0
data     =                       bsize=4096   blocks=26214400, imaxpct=25
         =                       sunit=0      swidth=0 blks
naming   =version 2              bsize=4096   ascii-ci=0 ftype=1
log      =internal log           bsize=4096   blocks=12800, version=2
         =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime =none                   extsz=4096   blocks=0, rtextents=0
[root@labservices-osbackups-rhel-ab8 ~]#
```

Create a mount point to attach the new disk.

```
[root@labservices-osbackups-rhel-ab8 ~]# mkdir /stage
```

Then edit /etc/fstab and add a line to mount that disk on the mount point.

```
#
# /etc/fstab
# Created by anaconda on Thu Oct  3 14:41:18 2019
#
# Accessible filesystems, by reference, are maintained under '/dev/disk'
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info
#
UUID=b894c135-27a1-4f7c-8cb1-8b3a69a05491 /                       ext3
defaults,noatime        1 1
UUID=1205ee90-24ba-4bed-af8d-7f9bf36008ed /boot                   ext3
defaults,noatime        1 2
LABEL=SWAP-xvdb1 swap swap    defaults        0 0

# Filesystem for mksysb staging
/dev/xvdc    /tsm     xfs    defaults    1 2
```

Use mount -a to mount the new file system and df -h to check that it is available.

```
[root@labservices-osbackups-rhel-ab8 ~]# mount -a
[root@labservices-osbackups-rhel-ab8 ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
devtmpfs        7.8G     0  7.8G   0% /dev
tmpfs           7.8G     0  7.8G   0% /dev/shm
tmpfs           7.8G   17M  7.8G   1% /run
tmpfs           7.8G     0  7.8G   0% /sys/fs/cgroup
/dev/xvda2       24G  3.5G   19G  16% /
/dev/xvda1      976M  155M  770M  17% /boot
tmpfs           1.6G     0  1.6G   0% /run/user/0
s3fs            256T     0  256T   0% /cosbucket
/dev/xvdc       100G   33M  100G   1% /stage
[root@labservices-osbackups-rhel-ab8 ~]#
```

Next, you can configure nfs to share your staging file system with your AIX VSIs. Begin by using yum to install the nfs utilities.

```
[root@labservices-osbackups-rhel-ab4 ~]# yum install nfs-utils
Loaded plugins: product-id, search-disabled-repos, subscription-manager
rhel-7-server-optional-rpms                                 | 2.0 kB  00:00:00
rhel-7-server-rpms                                          | 2.0 kB  00:00:00
rhel-7-server-supplementary-rpms                            | 2.0 kB  00:00:00
Resolving Dependencies
--> Running transaction check
---> Package nfs-utils.x86_64 1:1.3.0-0.66.el7 will be installed
--> Processing Dependency: libtirpc >= 0.2.4-0.7 for package: 1:nfs-utils-1.3.0-
0.66.el7.x86_64
--> Processing Dependency: gssproxy >= 0.7.0-3 for package: 1:nfs-utils-1.3.0-
0.66.el7.x86_64

... Many lines skipped ...

Installed:
  nfs-utils.x86_64 1:1.3.0-0.66.el7

Dependency Installed:
  gssproxy.x86_64 0:0.7.0-28.el7              keyutils.x86_64 0:1.5.8-3.el7
  libbasicobjects.x86_64 0:0.1.1-32.el7       libcollection.x86_64 0:0.7.0-32.el7
  libevent.x86_64 0:2.0.21-4.el7              libini_config.x86_64 0:1.3.1-32.el7
  libnfsidmap.x86_64 0:0.25-19.el7            libpath_utils.x86_64 0:0.2.1-32.el7
  libref_array.x86_64 0:0.1.5-32.el7          libtirpc.x86_64 0:0.2.4-0.16.el7
  libverto-libevent.x86_64 0:0.2.5-4.el7      quota.x86_64 1:4.01-19.el7
  quota-nls.noarch 1:4.01-19.el7              rpcbind.x86_64 0:0.2.0-49.el7
  tcp_wrappers.x86_64 0:7.6-77.el7

Complete!
[root@labservices-osbackups-rhel-ab4 ~]#
```

Then edit /etc/exports to share the filesystem where your Cloud Object Storage bucket is mounted. Ensure you specify the correct subnet information for your PowerVS environment.

```
/stage 192.168.50.0/24(rw,no_root_squash,insecure)
~
~
```

Now start the nfs-server service.

```
[root@labservices-osbackups-rhel-ab4 ~]# systemctl start nfs-server
[root@labservices-osbackups-rhel-ab4 ~]#
```

Mount the Staging File System and Back Up AIX

Open a terminal connection to an AIX that you plan to back up. Create a convenient mount point for the remote storage and then mount the exported file system from your NFS server.

```
# mkdir /stage
# mount 10.72.253.136:/stage /stage
#
```

Now you can take a mksysb backup of your AIX VSI. Enter smit mksysb to begin. Enter a meaningful filename in the mount you made earlier in the Backup Device or File field. Ensure Expand /tmp if needed is set to yes. Then press Enter to begin the backup.

```
                Back Up This System to Tape/File or UDFS capable media

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
    WARNING:  Execution of the mksysb command will
              result in the loss of all material
              previously stored on the selected
              output medium. This command backs
              up only rootvg volume group.

* Backup DEVICE or FILE                              [/stage/aix72backup1.mksysb] +/
  Create MAP files?                                   no                            +
  Create backup using snapshots?                      no                            +
  EXCLUDE files?                                      no                            +
  Exclude WPAR file systems?                          no                            +
  Location of File System Exclusion List             []                              /
  List files as they are backed up?                   no                            +
  Verify readability if tape device?                  no                            +
  Generate new /image.data file?                      yes                           +
  EXPAND /tmp if needed?                              yes                           +
  Disable software packing of backup?                 no                            +
  Backup extended attributes?                         yes                           +
  Number of BLOCKS to write in a single output       []                              #
     (Leave blank to use a system default)
  Location of existing mksysb image                  []                              /
  File system to use for temporary work space        []                              /
     (If blank, /tmp will be used.)
  Backup encrypted files?                             yes                           +
  Back up DMAPI filesystem files?                     yes                           +
  Build new alt_disk_install boot_image?              no                            +




F1=Help              F2=Refresh           F3=Cancel            F4=List
F5=Reset             F6=Command           F7=Edit              F8=Image
F9=Shell             F10=Exit             Enter=Do
```

Once your backup completes, you can exit smit.

```
                                COMMAND STATUS

Command: OK            stdout: yes           stderr: no

Before command completion, additional instructions may appear below.


Creating information file (/image.data) for rootvg.

Creating list of files to back up

Backing up 56586 files.............................
4542 of 56586 files backed up (8%).............................
5139 of 56586 files backed up (9%).............................
5861 of 56586 files backed up (10%)............................

56586 of 56586 files backed up (100%)
0512-038 mksysb: Backup Completed Successfully.









F1=Help              F2=Refresh           F3=Cancel            F6=Command
F8=Image             F9=Shell             F10=Exit             /=Find
n=Find Next
```

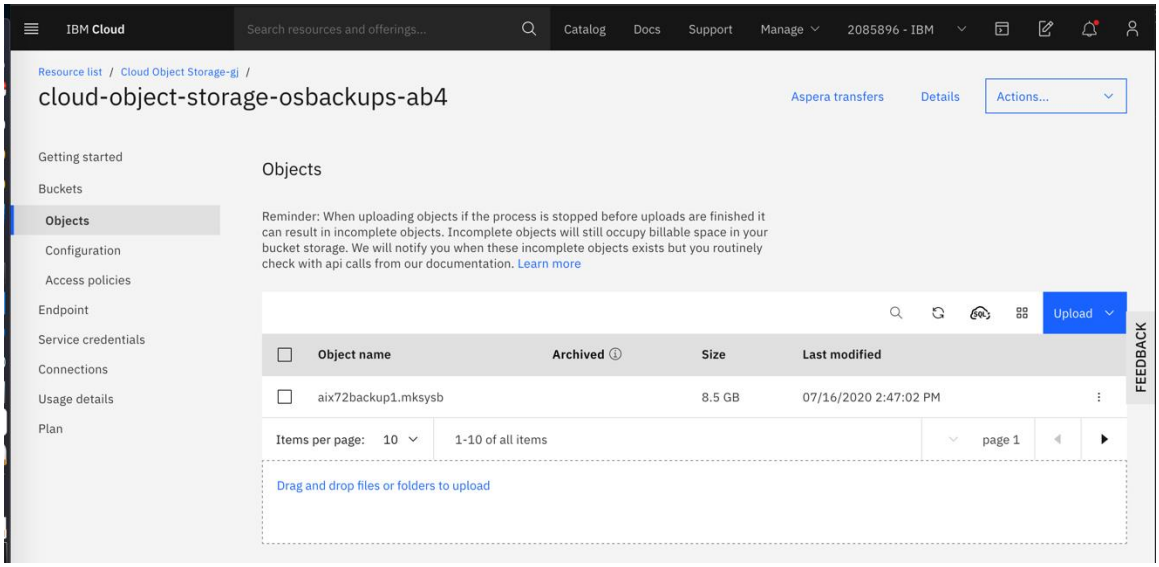
Now return to your Linux VSI. You should find your mksysb in the staging directory that you made.

```
[root@labservices-osbackups-rhel-ab8 ~]# ls -l /stage
total 8882152
-rw-r--r--. 1 root root 9095321600 Jul 16 14:32 aix72backup1.mksysb
[root@labservices-osbackups-rhel-ab8 ~]#
```

To put it in your Cloud Object Storage bucket, simply copy it to the directory where your bucket is attached.

```
[root@labservices-osbackups-rhel-ab8 ~]# ls -l /stage
total 8882152
-rw-r--r--. 1 root root 9095321600 Jul 16 14:32 aix72backup1.mksysb
[root@labservices-osbackups-rhel-ab8 ~]#
```

You can check the Cloud Object Storage GUI to confirm the file is in the bucket.



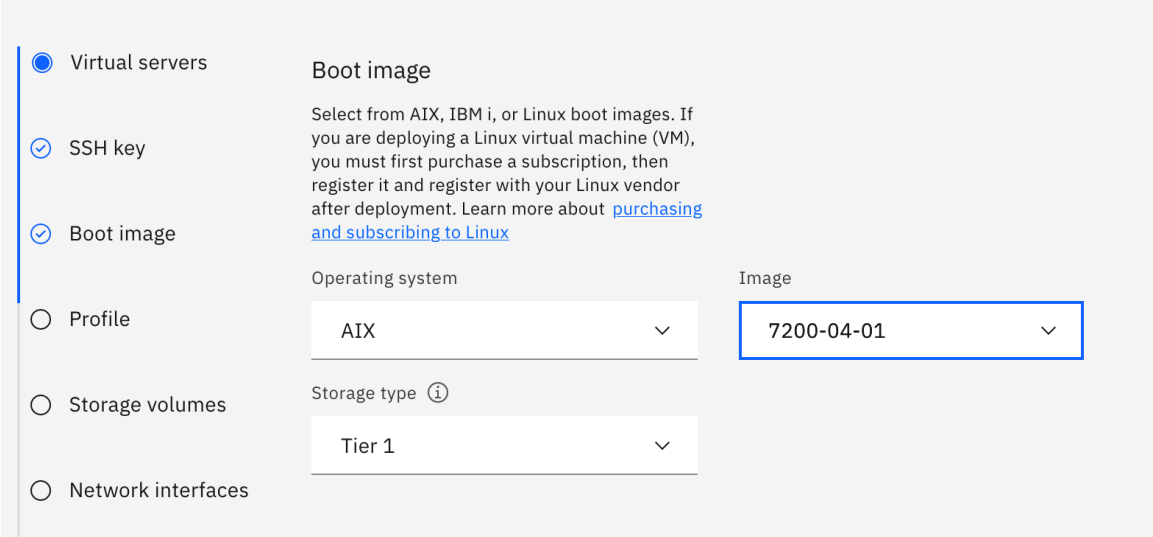
Remove the file from the staging filesystem to free up space for additional backups.

Restore the mksysb Backup to a New VSI

To restore a mksysb backup into a new Power VSI, first connect to your Linux staging VSI. List the available images in your Cloud Object Storage bucket and copy the desired image to the staging filesystem.

```
[root@labservices-osbackups-rhel-ab8 ~]# ls -l /cosbucket/
total 8882151
-rw-r--r--. 1 root root 9095321600 Jul 16 14:43 aix72backup1.mksysb
[root@labservices-osbackups-rhel-ab8 ~]# cp /cosbucket/aix72backup1.mksysb /stage/
[root@labservices-osbackups-rhel-ab8 ~]#
```

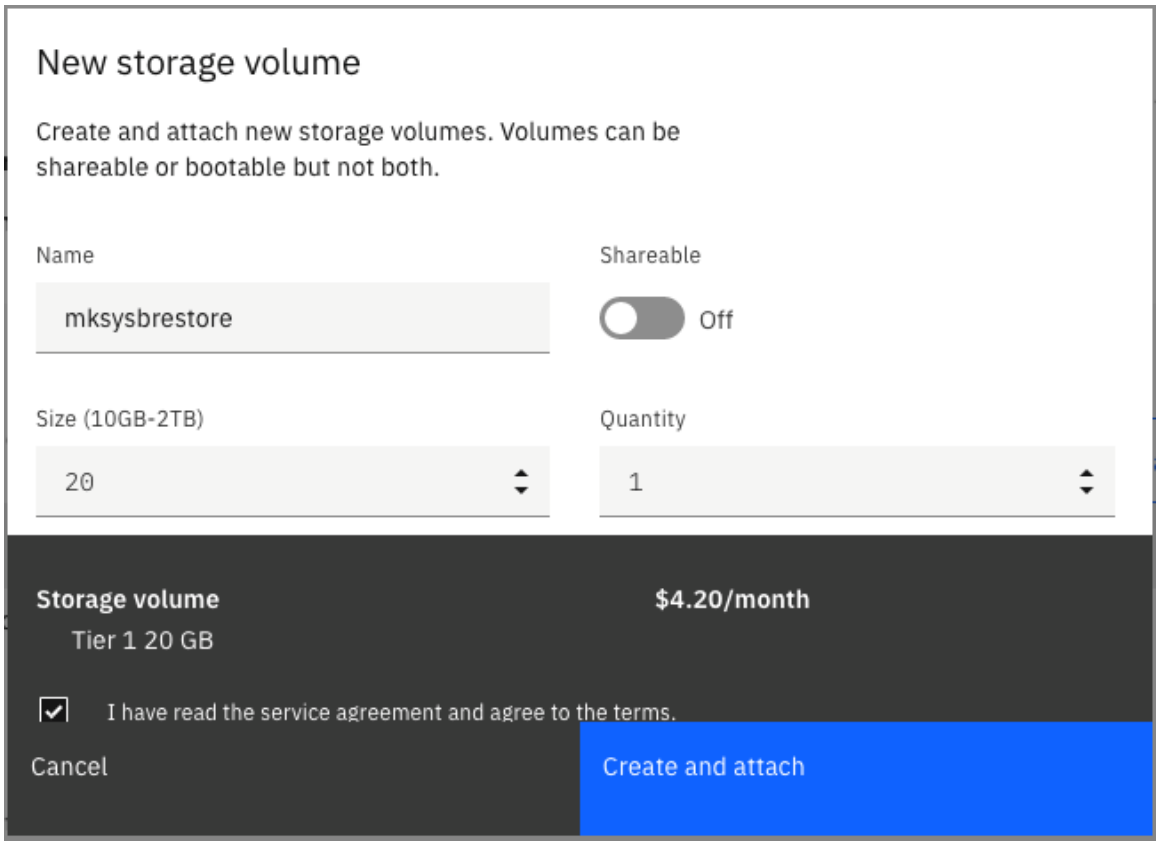
Now create a new Power VSI which will be the target for your mksysb restore. Choose one of the standard AIX boot images. This image will be used as a helper to perform the mksysb restore.



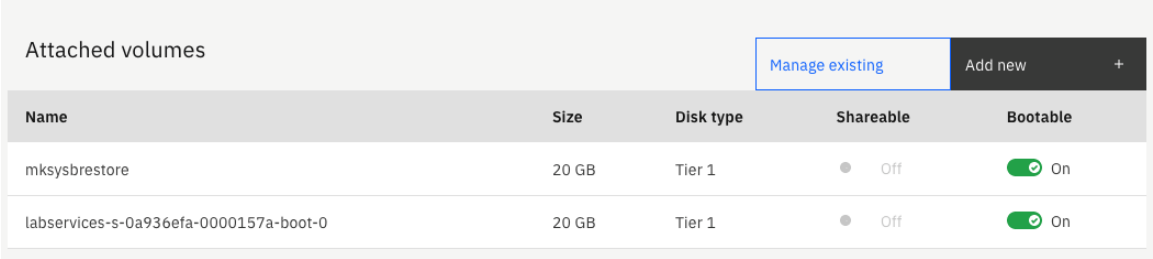
Once your new VSI is provisioned log in to it, create a mount point and mount the staging filesystem from your Linux VSI, which contains the mksysb that you will restore. Use ls to confirm the mksysb is available.

```
# mkdir /stage
# mount 10.72.253.136:/stage /stage
# ls -l /stage/aix72backup1.mksysb
-rw-r--r--    1 root     system   9095321600 Jul 16 14:32 /stage/aix72backup1.mksysb
#
```

Then return to the IBM Cloud GUI and add a new storage volume to your AIX VSI to use as a target for the mksysb restore.



Once the volume is attached, make sure the Bootable parameter is set to On. You may have to refresh your browser several times to see the status change.



Then run cfgmgr and use lspv to confirm the new disk is available.

```
# cfgmgr
# lspv
hdisk0          00f6db0af58e9775                    rootvg          active
hdisk1          none                                None
#
```

Next use the alt_disk_mksysb command to restore your mksysb on to the new disk.

```
# alt_disk_mksysb -c /dev/vty0 -d hdisk1 -m /stage/aix72backup1.mksysb
Restoring /image.data from mksysb image.
Checking disk sizes.
Creating cloned rootvg volume group and associated logical volumes.
Creating logical volume alt_hd5.
Creating logical volume alt_hd6.
Creating logical volume alt_hd8.
Creating logical volume alt_hd4.
Creating logical volume alt_hd2.
Creating logical volume alt_hd9var.
Creating logical volume alt_hd3.
Creating logical volume alt_hd1.
Creating logical volume alt_hd10opt.
Creating logical volume alt_hd11admin.
Creating logical volume alt_lg_dumplv.
Creating logical volume alt_livedump.
Creating logical volume alt_repo00.
Creating /alt_inst/ file system.
Creating /alt_inst/admin file system.
Creating /alt_inst/home file system.
Creating /alt_inst/opt file system.
Creating /alt_inst/tmp file system.
Creating /alt_inst/usr file system.
Creating /alt_inst/usr/sys/inst.images file system.
Creating /alt_inst/var file system.
Creating /alt_inst/var/adm/ras/livedump file system.
Restoring mksysb image to alternate disk(s).
Linking to 64bit kernel.
Changing logical volume names in volume group descriptor area.
Fixing LV control blocks...
forced unmount of /alt_inst/var/adm/ras/livedump
forced unmount of /alt_inst/var/adm/ras/livedump
forced unmount of /alt_inst/var
forced unmount of /alt_inst/var
forced unmount of /alt_inst/usr/sys/inst.images
forced unmount of /alt_inst/usr/sys/inst.images
forced unmount of /alt_inst/usr
forced unmount of /alt_inst/usr
forced unmount of /alt_inst/tmp
forced unmount of /alt_inst/tmp
forced unmount of /alt_inst/opt
forced unmount of /alt_inst/opt
forced unmount of /alt_inst/home
forced unmount of /alt_inst/home
forced unmount of /alt_inst/admin
forced unmount of /alt_inst/admin
forced unmount of /alt_inst
forced unmount of /alt_inst
Fixing file system superblocks...
Bootlist is set to the boot disk: hdisk0 blv=hd5
#
```

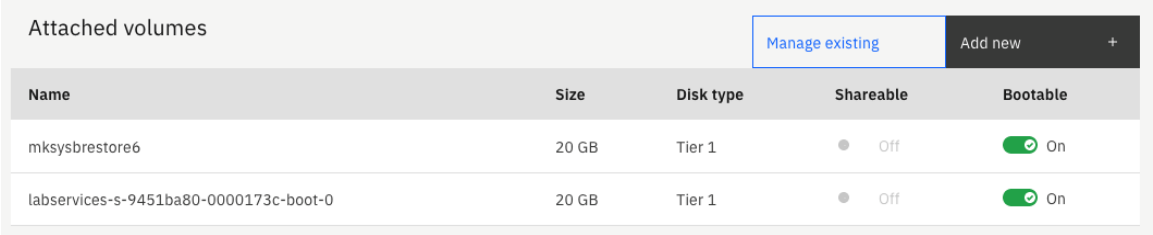
The bootlist is automatically modified to boot from the newly restored disk. Just reboot the VSI to begin using your restored image. This first boot may take some extra time while AIX is reconfigured to run in the new VSI.

Clean Up After a mksysb Restore

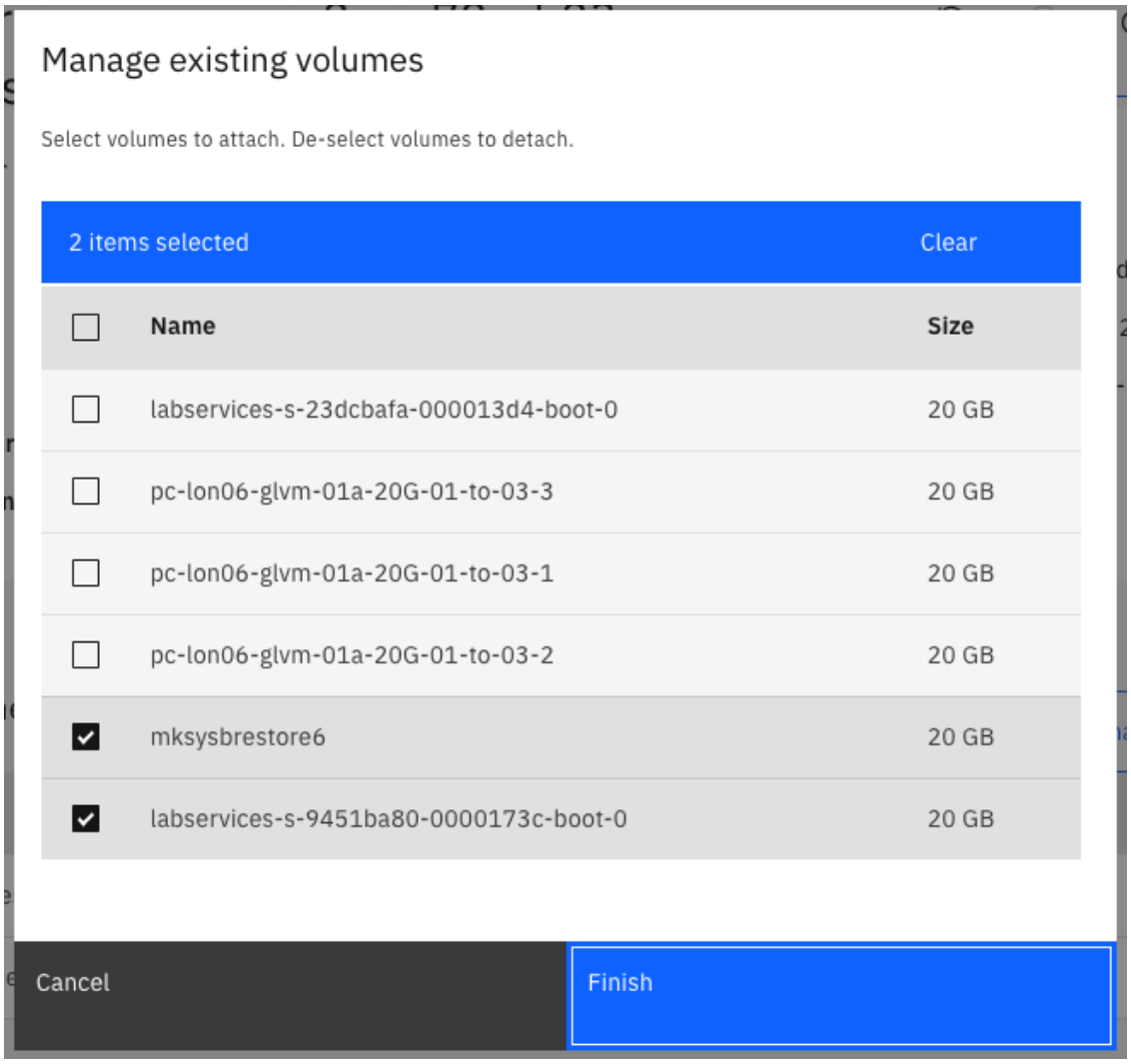
Once your new AIX VSI is running and you can log in, you can remove the original boot volume from the configuration. First use exportvg to remove the old rootvg then use rmdev to remove the original rootvg disk.

```
# lspv
hdisk0          00f6db0af58e9775                    old_rootvg
hdisk1          00c8d1607c6bb0be                    rootvg          active
# exportvg old_rootvg
# rmdev -Rdl hdisk0
hdisk0 deleted
#
```

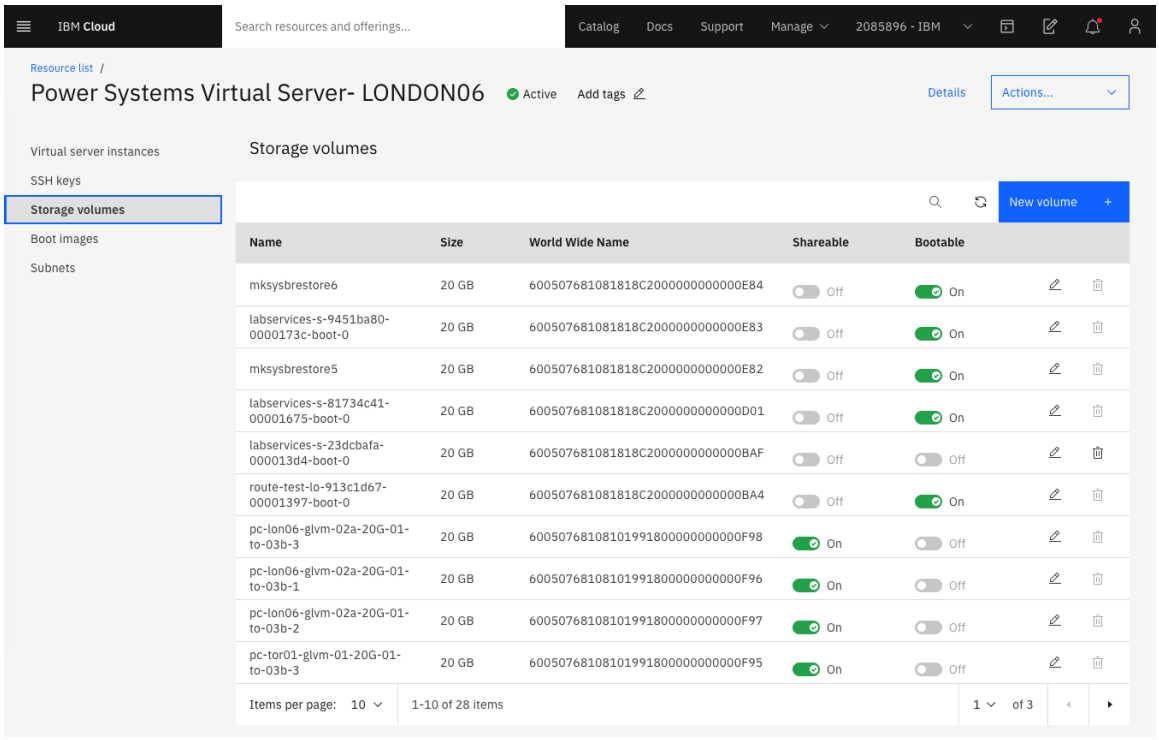
Then find the Attached Volumes section in your IBM Cloud GUI for your VSI. Click the Manage Existing button.



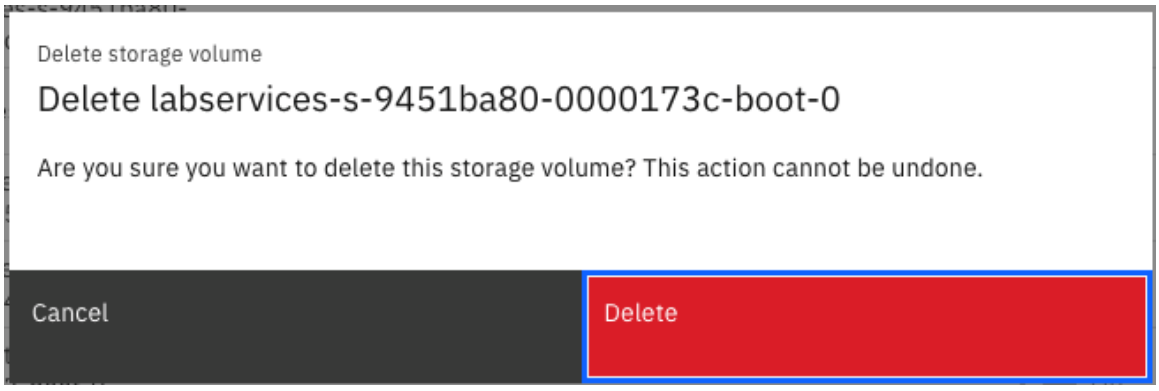
Then deselect the original boot volume, leaving your mksysb restore volume selected, and click Finish.



Finally, navigate to Storage Volumes in the left column. Locate your original boot volume and click the trash can icon on the right side of the listing to delete the volume.



Click the Delete button on the pop-up message to confirm.

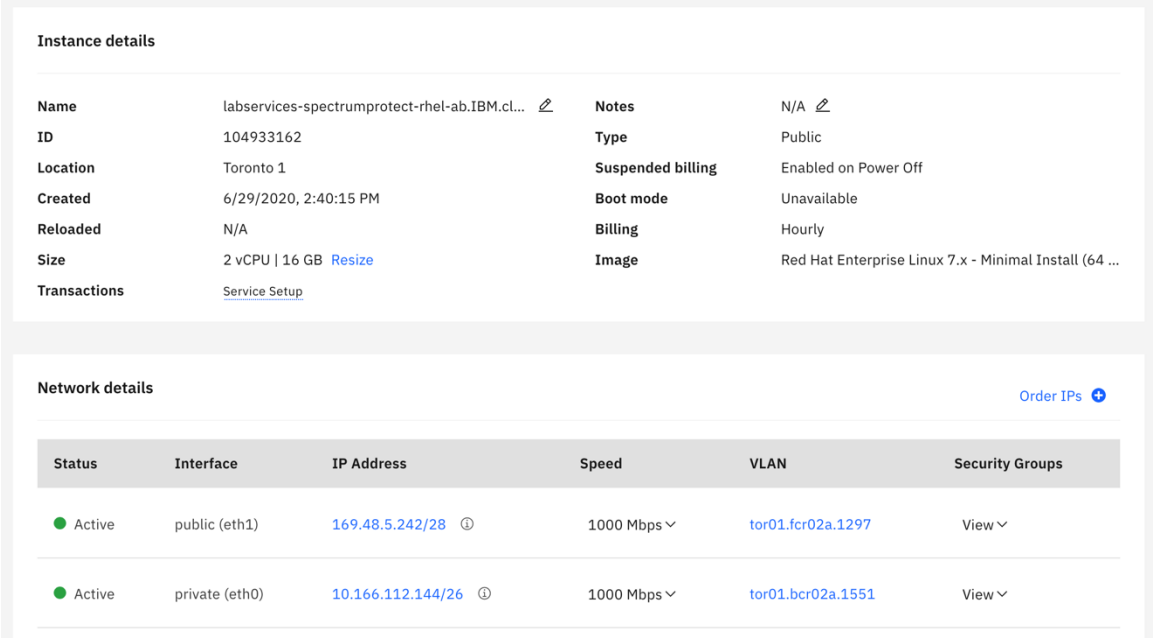


File-level Save and Restore

To facilitate file save and restore operations, you will use IBM Spectrum Protect on an x86 Linux VSI located in the Classic Infrastructure area of IBM Cloud. This VSI can be accessed from the Power VS environment using the Direct Link Connect and can access Cloud Object Storage using an internal endpoint.

Create a Linux VSI and Install IBM Spectrum Protect

Create a VSI with adequate resources to install and use IBM Spectrum Spectrum Protect. 16 GB of RAM is the minimum for standard operations. In addition to the 25 GB boot disk, a 100 GB disk is used for the Spectrum Protect database.



Once the VSI has been provisioned, upload the IBM Spectrum Protect installer into a convenient directory. Make it executable and then execute it to unpack it.

```
[root@labservices-spectrumprotect-rhel-ab SP]# chmod a+x
SP_8.1.9_LIN86_SERSTG_AGT_ML.bin
[root@labservices-spectrumprotect-rhel-ab SP]# ./SP_8.1.9_LIN86_SERSTG_AGT_ML.bin
UnZipSFX 6.00 of 20 April 2009, by Info-ZIP (http://www.info-zip.org).
   creating: im64/
   creating: im64/Offerings/
   creating: im64/configuration/
   creating: im64/configuration/org.eclipse.update/
   creating: im64/documentation/
   creating: im64/documentation/de/
   creating: im64/documentation/en/
   creating: im64/documentation/es/

... Many lines skipped ...

  inflating: input/uninstall_response_sample.xml
  inflating: input/update_response_sample.xml
  inflating: im32/post-install.xml
  inflating: im64/post-install.xml
  inflating: README.htm
[root@labservices-spectrumprotect-rhel-ab SP]#
```

Before the IBM Spectrum Protect install can begin, libaio and ksh packages need to be installed. Use yum to perform that installation.

```
[root@labservices-spectrumprotect-rhel-ab SP]# yum install libaio ksh
Loaded plugins: product-id, search-disabled-repos, subscription-manager
rhel-7-server-optional-rpms                                 | 2.0 kB  00:00:00
rhel-7-server-rpms                                          | 2.0 kB  00:00:00
rhel-7-server-supplementary-rpms                            | 2.0 kB  00:00:00
Resolving Dependencies
--> Running transaction check
---> Package ksh.x86_64 0:20120801-142.el7 will be installed
---> Package libaio.x86_64 0:0.3.109-13.el7 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package       Arch          Version                  Repository              Size
================================================================================
Installing:
 ksh           x86_64        20120801-142.el7         rhel-7-server-rpms      884 k
 libaio        x86_64        0.3.109-13.el7           rhel-7-server-rpms       24 k

Transaction Summary
================================================================================
Install  2 Packages

Total download size: 909 k
Installed size: 3.2 M
Is this ok [y/d/N]: y
Downloading packages:
(1/2): ksh-20120801-142.el7.x86_64.rpm                      | 884 kB  00:00:00
(2/2): libaio-0.3.109-13.el7.x86_64.rpm                     |  24 kB  00:00:00
--------------------------------------------------------------------------------
Total                                              2.5 MB/s | 909 kB  00:00
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : ksh-20120801-142.el7.x86_64                                  1/2
  Installing : libaio-0.3.109-13.el7.x86_64                                 2/2
Loaded plugins: product-id, subscription-manager
  Verifying  : libaio-0.3.109-13.el7.x86_64                                 1/2
  Verifying  : ksh-20120801-142.el7.x86_64                                  2/2

Installed:
  ksh.x86_64 0:20120801-142.el7             libaio.x86_64 0:0.3.109-13.el7

Complete!
[root@labservices-spectrumprotect-rhel-ab SP]#
```

Now you can run the installer. You can generally accept the default options and you'll need to agree to a number of licenses.

```
[root@labservices-spectrumprotect-rhel-ab SP]# ./install.sh -c
Preprocessing the input.
Loading repositories...
Preparing and resolving the selected packages...
Preparing and resolving the selected packages...
Preparing and resolving the selected packages...
Preparing and resolving the selected packages...
Preparing and resolving the selected packages...
Preparing and resolving the selected packages...
Preparing and resolving the selected packages...


=====> IBM Installation Manager> Install

Select packages to install:
     1. [X] IBM® Installation Manager 1.9.0
     2. [X] IBM Spectrum Protect server 8.1.9.20191011_1255
     3. [X] IBM Spectrum Protect languages 8.1.9.20191011_1251
     4. [X] IBM Spectrum Protect license 8.1.9.20191011_1250
     5. [X] IBM Spectrum Protect storage agent 8.1.9.20191011_1250
     6. [X] IBM Spectrum Protect device driver  8.1.9.20191011_1252
     7. [X] IBM Spectrum Protect Operations Center 8.1.9000.20191004_1254

     O. Check for Other Versions, Fixes, and Extensions

     N. Next,      C. Cancel
-----> [N]
Validating package prerequisites...
...


=====> IBM Installation Manager> Install> Licenses

Read the following license agreements carefully.
View a license agreement by entering the number:
     1. IBM Installation Manager - License Agreement

Options:
     A. [ ] I accept the terms in the license agreement
     D. [ ] I do not accept the terms in the license agreement

     B. Back,      C. Cancel
-----> [C] A


=====> IBM Installation Manager> Install> Licenses

Read the following license agreements carefully.
View a license agreement by entering the number:
     1. IBM Installation Manager - License Agreement

Options:
     A. [X] I accept the terms in the license agreement
     D. [ ] I do not accept the terms in the license agreement

     B. Back,      N. Next,      C. Cancel
-----> [N]
```

```
=====> IBM Installation Manager> Install> Licenses> Shared Directory

Installation Manager installation location:
        /opt/IBM/InstallationManager/eclipse

Shared Resources Directory:
        /opt/IBM/IBMIMShared

Options:
     L. Change Installation Manager Installation Location
     M. Change Shared Resources Directory

     B. Back,      N. Next,      C. Cancel
-----> [N]
Finding compatible package groups...


=====> IBM Installation Manager> Install> Licenses> Shared Directory> Location

New package group:
     1. [X] IBM Spectrum Protect

Selected group id: "IBM Spectrum Protect"
Selected location: "/opt/tivoli/tsm"
Selected architecture: 64-bit

Options:
     M. Change Location

     B. Back,      N. Next,      C. Cancel
-----> [N]


=====> IBM Installation Manager> Install> Licenses> Shared Directory>
  Location> Features

IBM® Installation Manager

IBM Spectrum Protect server

IBM Spectrum Protect languages
     1. [ ] Spanish
     2. [ ] Portuguese
     3. [ ] German
     4. [ ] French
     5. [ ] Italian
     6. [ ] Russian
     7. [ ] Japanese
     8. [ ] Korean
     9. [ ] Traditional Chinese
    10. [ ] Simplified Chinese

IBM Spectrum Protect license

IBM Spectrum Protect storage agent

IBM Spectrum Protect device driver
```

```
IBM Spectrum Protect Operations Center
    11. [X] Operations Center


     B. Back,      N. Next,      C. Cancel
-----> [N]

=====> IBM Installation Manager> Install> Licenses> Shared Directory>
  Location> Features> Custom panels


---- Configuration for IBM Spectrum Protect Operations Center 8.1.9000.20191004_1254


Specify the secure communication settings - Secure (https) port
-----> [11090]

Specify the secure communication settings - SP800-131a Compliance Mode:

   0. Off
   1. Transition
   2. Strict

-----> [2]

---- Create password


         Password length:
         - Minimum: 6 characters
         - Maximum: 64 characters

         The password must contain at least:
         - One uppercase letter (A - Z)
         - One lowercase letter (a - z)
         - One digit (0 - 9)
         - Two non-alphanumeric characters: ~ # $ % ^ @ * _ - + =  | ( ) { } [ ] : ; <
> , . ? /

Create password
----->

Confirm password
----->

---- Configuration for IBM Spectrum Protect server 8.1.9.20191011_1255


Select the product that you purchased:
     1. IBM Spectrum Protect
     2. IBM Spectrum Protect Extended Edition
     3. IBM Spectrum Protect for Data Retention

-----> 1
```

```
Read the following license agreements carefully.
View a license agreement by entering the number:
     1. IBM Spectrum Protect - Software License Agreement
     2. IBM Spectrum Protect - Non-IBM Terms
Options:
     A. [ ] I accept the terms in the license agreements.
     D. [ ] I do not accept the terms in the license agreements.

-----> A
Read the following license agreements carefully.
View a license agreement by entering the number:
     1. IBM Spectrum Protect - Software License Agreement
     2. IBM Spectrum Protect - Non-IBM Terms
Options:
     A. [X] I accept the terms in the license agreements.
     D. [ ] I do not accept the terms in the license agreements.


---- Configuration for IBM Spectrum Protect storage agent 8.1.9.20191011_1250


Read the following license agreements carefully.
View a license agreement by entering the number:
     1. IBM Spectrum Protect for Storage Area Networks - Software License Agreement
     2. IBM Spectrum Protect for Storage Area Networks - Non-IBM Terms
Options:
     A. [ ] I accept the terms in the license agreements.
     D. [ ] I do not accept the terms in the license agreements.

-----> A
Read the following license agreements carefully.
View a license agreement by entering the number:
     1. IBM Spectrum Protect for Storage Area Networks - Software License Agreement
     2. IBM Spectrum Protect for Storage Area Networks - Non-IBM Terms
Options:
     A. [X] I accept the terms in the license agreements.
     D. [ ] I do not accept the terms in the license agreements.



     B. Back,      N. Next,      C. Cancel
-----> [N]

=====> IBM Installation Manager> Install> Licenses> Shared Directory>
  Location> Features> Custom panels> Summary

Target Location:
  Package Group Name         :  IBM Installation Manager
  Installation Directory     :  /opt/IBM/InstallationManager/eclipse
  Package Group Name         :  IBM Spectrum Protect
  Installation Directory     :  /opt/tivoli/tsm
  Shared Resources Directory :  /opt/IBM/IBMIMShared

Translations:
        English
```

```
Packages to be installed:
        IBM® Installation Manager 1.9.0
        IBM Spectrum Protect server 8.1.9.20191011_1255
        IBM Spectrum Protect languages 8.1.9.20191011_1251
        IBM Spectrum Protect license 8.1.9.20191011_1250
        IBM Spectrum Protect storage agent 8.1.9.20191011_1250
        IBM Spectrum Protect device driver  8.1.9.20191011_1252
        IBM Spectrum Protect Operations Center 8.1.9000.20191004_1254

Options:
     G. Generate an Installation Response File

     B. Back,      I. Install,      C. Cancel
-----> [I]
                 25%                50%                75%                100%
------------------|------------------|------------------|------------------|
..................................................................................

=====> IBM Installation Manager> Install> Licenses> Shared Directory>
  Location> Features> Custom panels> Summary> Completion

The install completed successfully.

INFORMATION: Multiple informations are generated.

     V. View Message Details

Options:
     F. Finish
-----> [F]
[root@labservices-spectrumprotect-rhel-ab SP]#
```

Configure Linux for IBM Spectrum Protect

Once the installation is complete, configure Linux to prepare for Spectrum Protect start up. First, you'll need to create a user account and group to own the IBM Spectrum Protect instance.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# groupadd tsmsrvrs -g 1111
[root@labservices-spectrumprotect-rhel-ab2 ~]# useradd -d /home/tsminst1 -u 2222 -g
1111 -s /bin/bash tsminst1
[root@labservices-spectrumprotect-rhel-ab2 ~]# passwd tsminst1
Changing password for user tsminst1.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[root@labservices-spectrumprotect-rhel-ab2 ~]#
```

Now you'll need to format and mount your database disk and create some directories for the database. You can use fdisk to determine the name of the intended disk. Look for the disk that is around 100 GB, in this case /dev/xvcd.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# fdisk -l

Disk /dev/xvdb: 2147 MB, 2147483648 bytes, 4194304 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x00025cdb

    Device Boot      Start         End      Blocks   Id  System
/dev/xvdb1              63     4192964     2096451   82  Linux swap / Solaris

Disk /dev/xvdc: 107.4 GB, 107374182400 bytes, 209715200 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes


Disk /dev/xvda: 26.8 GB, 26843545600 bytes, 52428800 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x0000cece

    Device Boot      Start         End      Blocks   Id  System
/dev/xvda1   *        2048     2099199     1048576   83  Linux
/dev/xvda2         2099200    52428799    25164800   83  Linux
[root@labservices-spectrumprotect-rhel-ab2 ~]#
```

Format that disk using mkfs.xfs.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# mkfs.xfs /dev/xvdc
meta-data=/dev/xvdc              isize=512    agcount=4, agsize=6553600 blks
         =                       sectsz=512   attr=2, projid32bit=1
         =                       crc=1        finobt=0, sparse=0
data     =                       bsize=4096   blocks=26214400, imaxpct=25
         =                       sunit=0      swidth=0 blks
naming   =version 2              bsize=4096   ascii-ci=0 ftype=1
log      =internal log           bsize=4096   blocks=12800, version=2
         =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime =none                   extsz=4096   blocks=0, rtextents=0
```

Create a mount point to attach the new disk.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# mkdir /tsm
```

Then edit /etc/fstab and add a line to mount that disk on the mount point.

```
#
# /etc/fstab
# Created by anaconda on Thu Oct  3 14:41:18 2019
#
# Accessible filesystems, by reference, are maintained under '/dev/disk'
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info
#
UUID=b894c135-27a1-4f7c-8cb1-8b3a69a05491 /                       ext3
defaults,noatime        1 1
UUID=1205ee90-24ba-4bed-af8d-7f9bf36008ed /boot                   ext3
defaults,noatime        1 2
LABEL=SWAP-xvdb1 swap swap    defaults        0 0

# Filesystem for Spectrum Protect Database
/dev/xvdc    /tsm     xfs    defaults    1 2
```

Use mount -a to mount the new file system and df -h to check that it is available.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# mount -a
[root@labservices-spectrumprotect-rhel-ab2 ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
devtmpfs        7.8G     0  7.8G   0% /dev
tmpfs           7.8G     0  7.8G   0% /dev/shm
tmpfs           7.8G  8.6M  7.8G   1% /run
tmpfs           7.8G     0  7.8G   0% /sys/fs/cgroup
/dev/xvda2       24G   11G   13G  46% /
/dev/xvda1      976M  129M  797M  14% /boot
tmpfs           1.6G     0  1.6G   0% /run/user/0
/dev/xvdc       100G   33M  100G   1% /tsm
[root@labservices-spectrumprotect-rhel-ab2 ~]#
```

Change the ownership of the new file system to the ID that owns the server instance.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# chown tsminst1:tsmsrvrs /tsm
```

Now use su to change to the instance owner account and create the necessary directories inside the file system.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# su - tsminst1
Last login: Wed Jul  1 14:35:17 CDT 2020 from localhost.localdomain on pts/1
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ mkdir /tsm/tsminst1
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ mkdir /tsm/tsmdb001
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ mkdir /tsm/tsmlog
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ mkdir /tsm/tsmarchlog
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ mkdir /tsm/dbback
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ mkdir /tsm/cosbuckettmp
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$
```

Configure IBM Spectrum Protect Server

The next set of steps configure the server instance. Return to the root user account and use db2icrt to create the db2 instance.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# /opt/tivoli/tsm/db2/instance/db2icrt -a
server -u tsminst1 tsminst1
DBI1446I  The db2icrt command is running.


DB2 installation is being initialized.

 Total number of tasks to be performed: 4
Total estimated time for all tasks to be performed: 309 second(s)

Task #1 start
Description: Setting default global profile registry variables
Estimated time 1 second(s)
Task #1 end

Task #2 start
Description: Initializing instance list
Estimated time 5 second(s)
Task #2 end

Task #3 start
Description: Configuring DB2 instances
Estimated time 300 second(s)
Task #3 end

Task #4 start
Description: Updating global profile registry
Estimated time 3 second(s)
Task #4 end

The execution completed successfully.

For more information see the DB2 installation log at "/tmp/db2icrt.log.31888".
DBI1070I  Program db2icrt completed successfully.


[root@labservices-spectrumprotect-rhel-ab2 ~]#
```

Then use su to change to the instance user account and proceed with setting the instance directory.

```
[root@labservices-spectrumprotect-rhel-ab2 ~]# su - tsminst1
Last login: Wed Jul  1 15:38:29 CDT 2020 on pts/0
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ db2 update dbm cfg using dftdbpath
/tsm/tsminst1/
DB20000I  The UPDATE DATABASE MANAGER CONFIGURATION command completed
successfully.
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$
```

Now edit /home/tsminst1/sqllib/userprofile to add the appropriate library path. This file will be empty initially. Just add the following line.

```
export
LD_LIBRARY_PATH=/opt/tivoli/tsm/server/bin/dbbkapi:/usr/local/ibm/gsk8_64/lib64:/opt/i
bm/lib:/opt/ibm/lib64:$LD_LIBRARY_PATH
```

Next, copy the sample server options file to the instance directory. Ensure you rename it dsmserv.opt. For this example, the default options configuration is sufficient.

```
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ cp
/opt/tivoli/tsm/server/bin/dsmserv.opt.smp /tsm/tsminst1/dsmserv.opt
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$
```

After that, you will initialize the database. Change to the instance directory and use the dsmserv command to format the database specifying the directories you created earlier. Be patient. This process takes about 10 minutes to complete.

```
[tsminst1@labservices-spectrumprotect-rhel-ab2 ~]$ cd /tsm/
[tsminst1@labservices-spectrumprotect-rhel-ab2 tsm]$ dsmserv format
dbdir=/tsm/tsmdb001/ activelogsize=32768 activelogdirectory=/tsm/tsmlog/
archlogdirectory=/tsm/tsmarchlog/
ANR7800I DSMSERV generated at 11:33:37 on Oct 11 2019.

IBM Spectrum Protect for Linux/x86_64
Version 8, Release 1, Level 9.000

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ANR7801I Subsystem process ID is 10024.
ANR0905W Options file /tsm/dsmserv.opt not found.
ANR7814I Using instance directory /tsm.
ANR3339I Default Label in key data base is TSM Server SelfSigned SHA Key.
ANR4726I The ICC support module has been loaded.
ANR0152I Database manager successfully started.
ANR2976I Offline DB backup for database TSMDB1 started.
ANR2974I Offline DB backup for database TSMDB1 completed successfully.
ANR0992I Server's database formatting complete.
ANR0369I Stopping the database manager because of a server shutdown.
[tsminst1@labservices-spectrumprotect-rhel-ab2 tsm]$
```

Once the format is complete. Start up db2 with db2start. You can safely ignore the warning message.

```
[tsminst1@labservices-spectrumprotect-rhel-ab2 tsm]$ db2start
07/02/2020 10:16:47     0   0   SQL5043N  Support for one or more communications
protocols specified in the DB2COMM environment variable failed to start successfully.
However, core database manager functionality started successfully.
SQL1063N  DB2START processing was successful.
[tsminst1@labservices-spectrumprotect-rhel-ab2 tsm]$
```

Now, you can use a macro to create an administrative user. Edit a new file called setup.mac and add the following lines.

```
register admin adminadmin adminadmin1
grant auth adminadmin classes=system
```

Then, run the macro to add the user adminadmin with the password set to adminadmin1.

```
[tsminst1@labservices-spectrumprotect-rhel-ab2 tsm]$ dsmserv runfile setup.mac
ANR7800I DSMSERV generated at 11:33:37 on Oct 11 2019.

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Version 8, Release 1, Level 9.000

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ANR7801I Subsystem process ID is 16715.
ANR0900I Processing options file /tsm/dsmserv.opt.
ANR7814I Using instance directory /tsm.
ANR3339I Default Label in key data base is TSM Server SelfSigned SHA Key.
ANR4726I The ICC support module has been loaded.
ANR0990I Server restart-recovery in progress.
ANR0152I Database manager successfully started.
ANR1628I The database manager is using port 51500 for server connections.
ANR2277W The server master encryption key was not found. A new master encryption key
will be created.
ANR1636W The server machine GUID changed: old value (), new value (e8.d7.a5.58.d0.bb-
.ea.11.aa.67.06.4f.e6.e3.5c.bc).
ANR2100I Activity log process has started.
ANR4726I The NAS-NDMP support module has been loaded.
ANR1794W IBM Spectrum Protect SAN discovery is disabled by options.
ANR2200I Storage pool BACKUPPOOL defined (device class DISK).
ANR2200I Storage pool ARCHIVEPOOL defined (device class DISK).
ANR2200I Storage pool SPACEMGPOOL defined (device class DISK).
ANR2560I Schedule manager started.
ANR0993I Server initialization complete.
ANR0916I IBM Spectrum Protect distributed by International Business Machines is now
ready for use.
ANR2068I Administrator ADMINADMIN registered.
ANR2076I System privilege granted to administrator ADMINADMIN.
ANR1912I Stopping the activity log because of a server shutdown.
ANR0369I Stopping the database manager because of a server shutdown.
[tsminst1@labservices-spectrumprotect-rhel-ab2 tsm]$
```

After that, you'll need to prepare the database manager for database backup. Edit /home/tsminst1/sqllib/userprofile and add the following lines.

```
DSMI_CONFIG=/tsm/tsminst1/tsmdbmgr.opt
DSMI_DIR=/tsm/tsminst1/dbbkapi
DSMI_LOG=/tsm/tsminst1/
export DSMI_CONFIG DSMI_DIR DSMI_LOG
```

Logout and log back in to pick up the environment changes. Then, create a new file /tsm/tsminst1/tsmdbmgr.opt and enter the following line.

```
SERVERNAME TSMDBMGR_TSMINST1
```

Next, log in as the root user. Create a new file /opt/tivoli/tsm/server/bin/dbbkapi/dsm.sys and add the following lines.

```
servername TSMDBMGR_TSMINST1
commmethod tcpip
tcpserveraddr localhost
tcpport 1500
errorlogname /tsminst1/tsmdbmgr.log
nodename $$_TSMDBMGR_$$
```

Additional DB2 or Spectrum Protect configuration may be desirable, but this minimum configuration is sufficient for this example.

IBM Spectrum Protect should now be able to start. Login as the tsminst1 user and change to the /tsminst1/tsm directory. Then use the dsmserv command to start it up.

```
[tsminst1@labservices-spectrumprotect-rhel-ab2 tsm]$ dsmserv
ANR7800I DSMSERV generated at 11:33:37 on Oct 11 2019.

IBM Spectrum Protect for Linux/x86_64
Version 8, Release 1, Level 9.000

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ANR7801I Subsystem process ID is 18872.
ANR0900I Processing options file /tsm/dsmserv.opt.
ANR7814I Using instance directory /tsm.
ANR3339I Default Label in key data base is TSM Server SelfSigned SHA Key.
ANR4726I The ICC support module has been loaded.
ANR0990I Server restart-recovery in progress.
ANR0152I Database manager successfully started.
ANR1628I The database manager is using port 51500 for server connections.
ANR1635I The server machine GUID, e8.d7.a5.58.d0.bb.ea.11.aa.67.06.4f.e6.e3.5c.bc,
has initialized.
ANR2100I Activity log process has started.
ANR4726I The NAS-NDMP support module has been loaded.
ANR1794W IBM Spectrum Protect SAN discovery is disabled by options.
ANR2803I License manager started.
ANR0984I Process 1 for AUDIT LICENSE started in the BACKGROUND at 11:05:18 AM.
ANR2820I Automatic license audit started as process 1.
ANR8598I Outbound SSL Services were loaded.
ANR8230I TCP/IP Version 6 driver ready for connection with clients on port 1500.
ANR8200I TCP/IP Version 4 driver ready for connection with clients on port 1500.
ANR2560I Schedule manager started.
ANR2825I License audit process 1 completed successfully - 0 nodes audited.
ANR0985I Process 1 for AUDIT LICENSE running in the BACKGROUND completed with
completion state SUCCESS at 11:05:19 AM.
ANR0984I Process 2 for EXPIRE INVENTORY (Automatic) started in the BACKGROUND at
11:05:28 AM.
ANR0811I Inventory client file expiration started as process 2.
ANR0167I Inventory file expiration process 2 processed for 0 minutes.
ANR0812I Inventory file expiration process 2 is completed: processed 0 nodes,
examined 0 objects, retained 0 objects, deleted 0 backup objects, 0 archive objects,
0 database backup volumes, and 0 recovery plan files. 0 objects were retried 0 errors
were detected, and 0 objects were skipped.
ANR0985I Process 2 for EXPIRE INVENTORY (Automatic) running in the BACKGROUND
completed with completion state SUCCESS at 11:05:28 AM.
ANR0281I Servermon successfully started during initialization, using process 18903.
IBM Spectrum Protect:SERVER1>
ANR0993I Server initialization complete.
ANR0916I IBM Spectrum Protect distributed by International Business Machines is now
ready for use.
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: QUERY PROCESS
ANR0944E QUERY PROCESS: No active processes found.
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW LOCKS ONLYW=Y
```

```
ANR2017I Administrator SERVER_CONSOLE issued command: INSTRUMENTATION END
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2841W Server is NOT IN COMPLIANCE with license terms.
ANR1434W No files have been identified for automatically storing device configuration
information.
ANR4502W No files have been defined for automatically storing sequential volume
history information.
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW DBCONN
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW DEDUPTHREAD
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW BANNER
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW RESQ
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TXNT LOCKD=N
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2034E QUERY MOUNT: No match found using this criteria.
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2034E QUERY SESSION: No match found using this criteria.
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW SESS F=D
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW THREADS
ANR2017I Administrator SERVER_CONSOLE issued command: SHOW TIME

IBM Spectrum Protect Server for Linux/x86_64 - Version 8, Release 1, Level 9.000

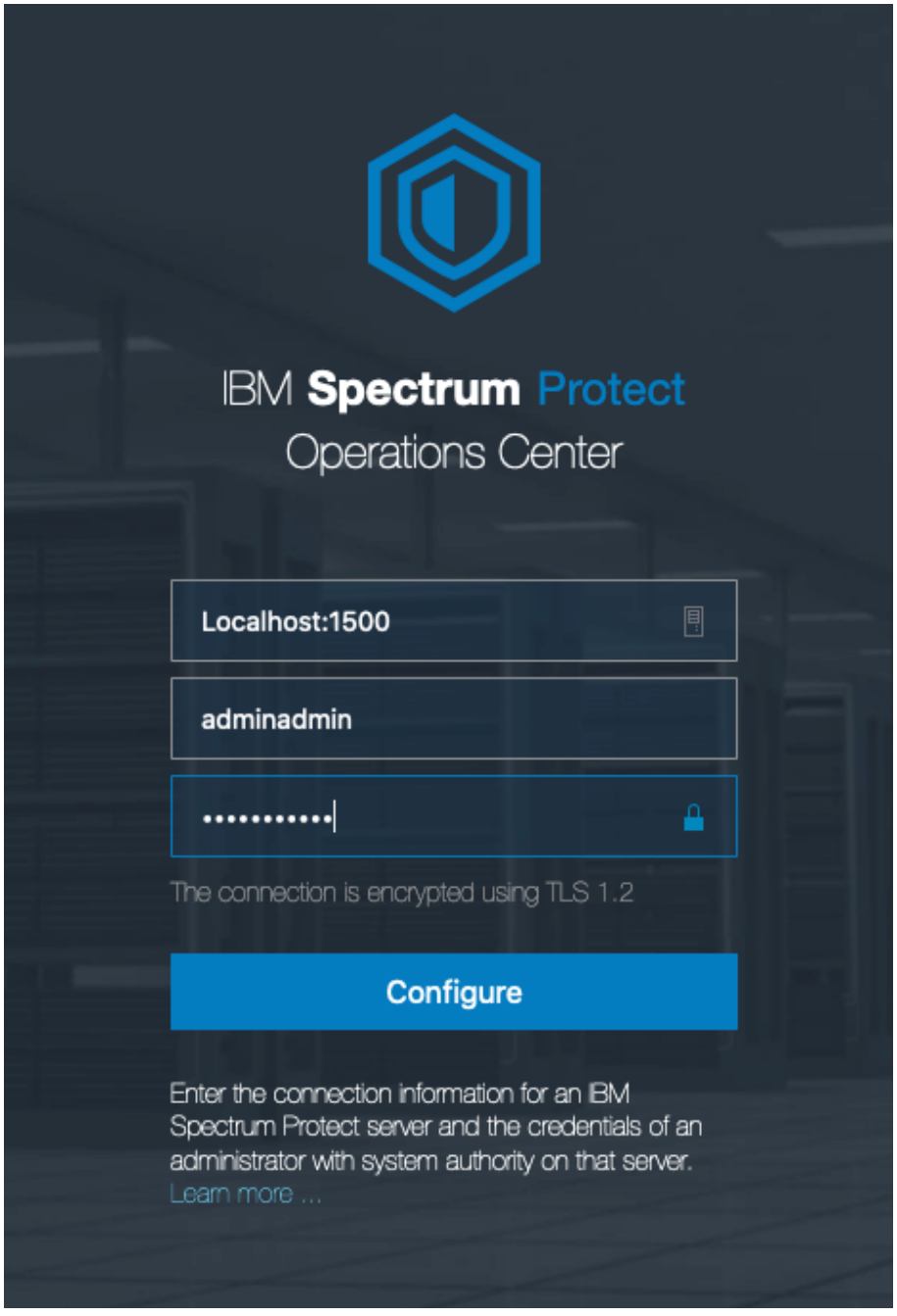
IBM Spectrum Protect:SERVER1>
```

Finally, define a device class for database backup and set dbrecovery to use that device.

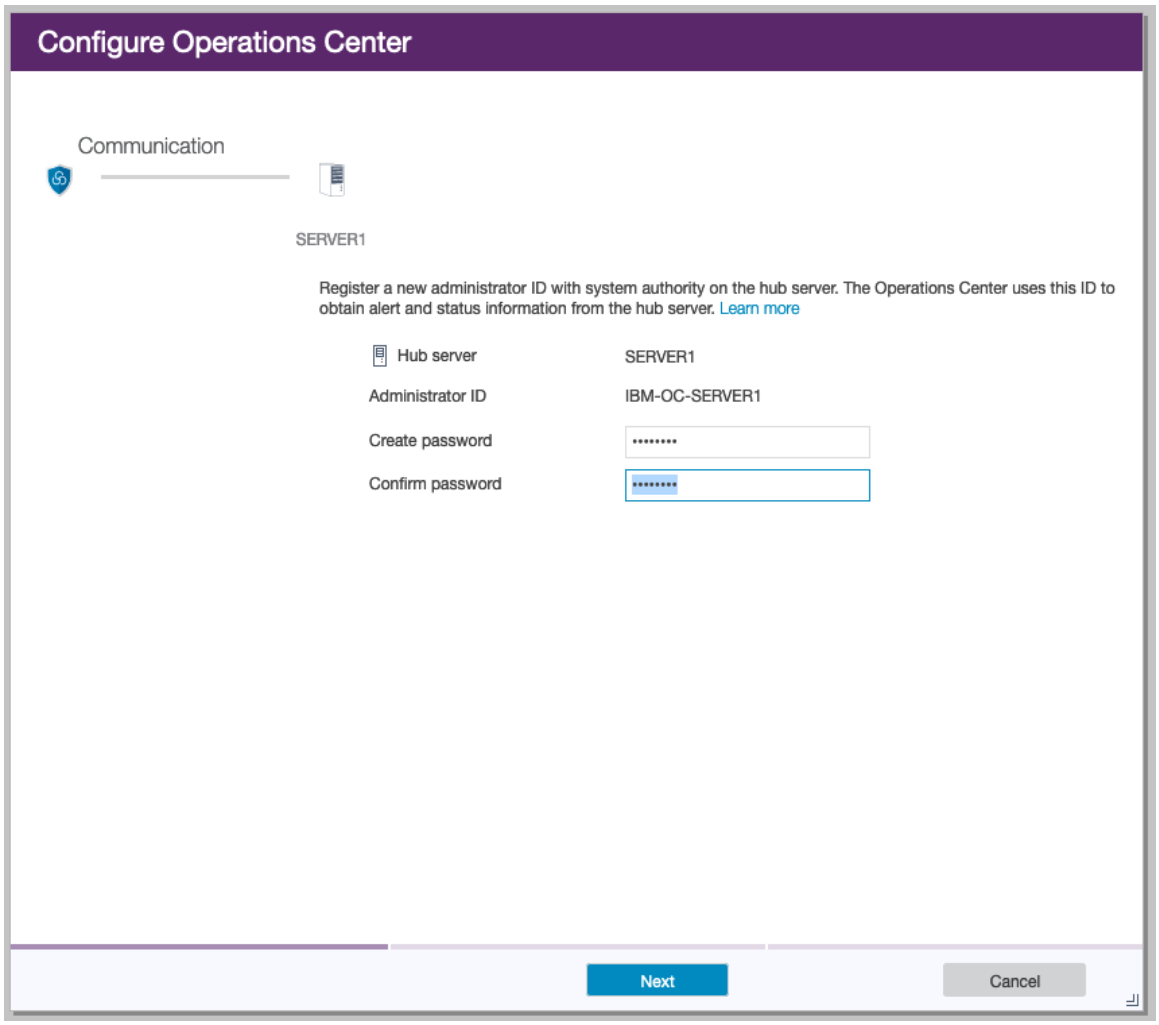
```
IBM Spectrum Protect Server for Linux/x86_64 - Version 8, Release 1, Level 9.000

IBM Spectrum Protect:SERVER1>
define devclass dbback devtype=file directory=/tsm/dbback
ANR2017I Administrator SERVER_CONSOLE issued command: DEFINE DEVCLASS dbback
devtype=file directory=/tsm/dbback
ANR2203I Device class DBBACK defined.
ANR1434W No files have been identified for automatically storing device configuration
information.
IBM Spectrum Protect:SERVER1>
set dbrecovery dbback protectkeys=yes password=Passw0rd
ANR2017I Administrator SERVER_CONSOLE issued command: SET DBRECOVERY dbback
protectkeys=yes password=?***?
ANR2782I SET DBRECOVERY completed successfully and device class for automatic DB
backup is set to DBBACK.
IBM Spectrum Protect:SERVER1>
```

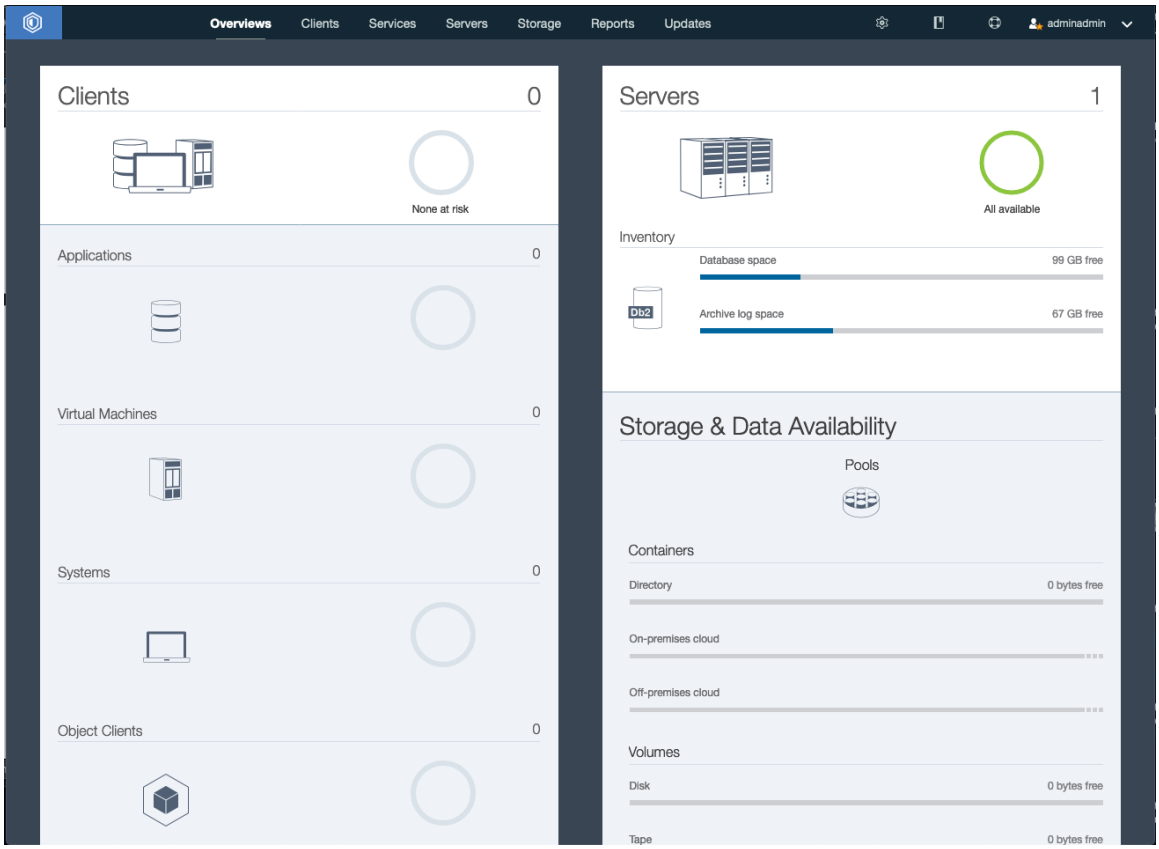
You can now log in to and configure the IBM Spectrum Protect Operations Center. Enter https://<ip of your VSI>:11090/oc/ in a web browser. This will take you to the Operations Center login screen. Login with the adminadmin user that you created earlier.



You will then set a new password for the new Operations Center administrator ID.

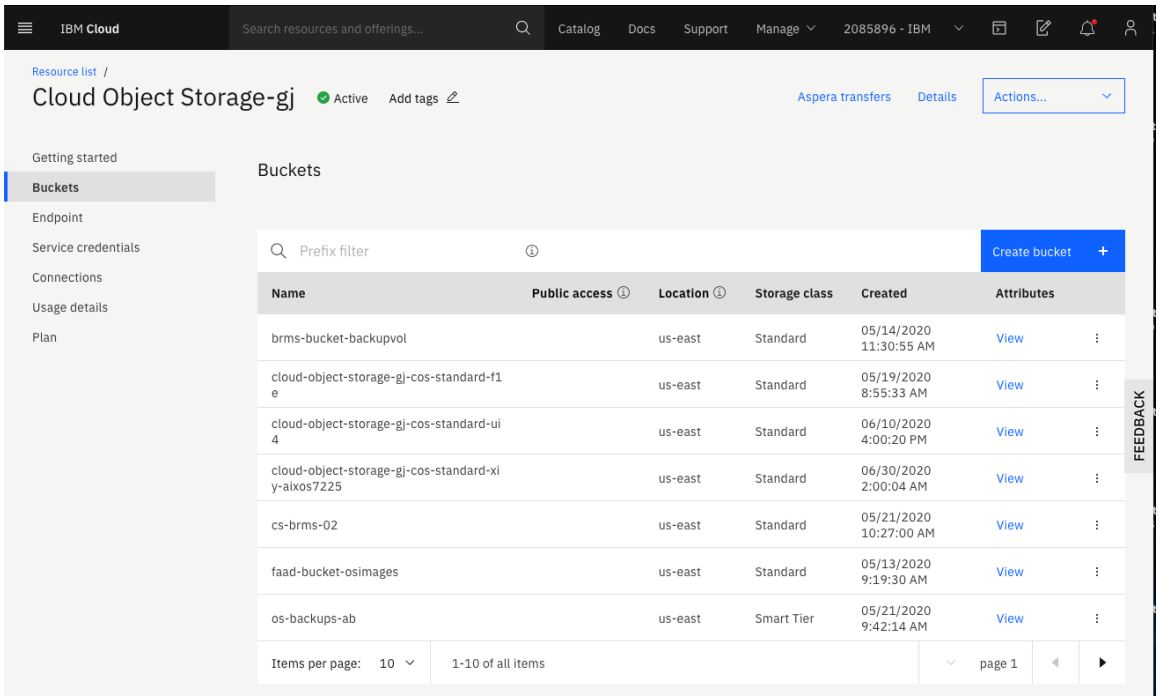


Make any adjustments you desire in the configuration wizard and then click Configure and then Close when configuration is complete. After configuration, you will reach the Overview screen.

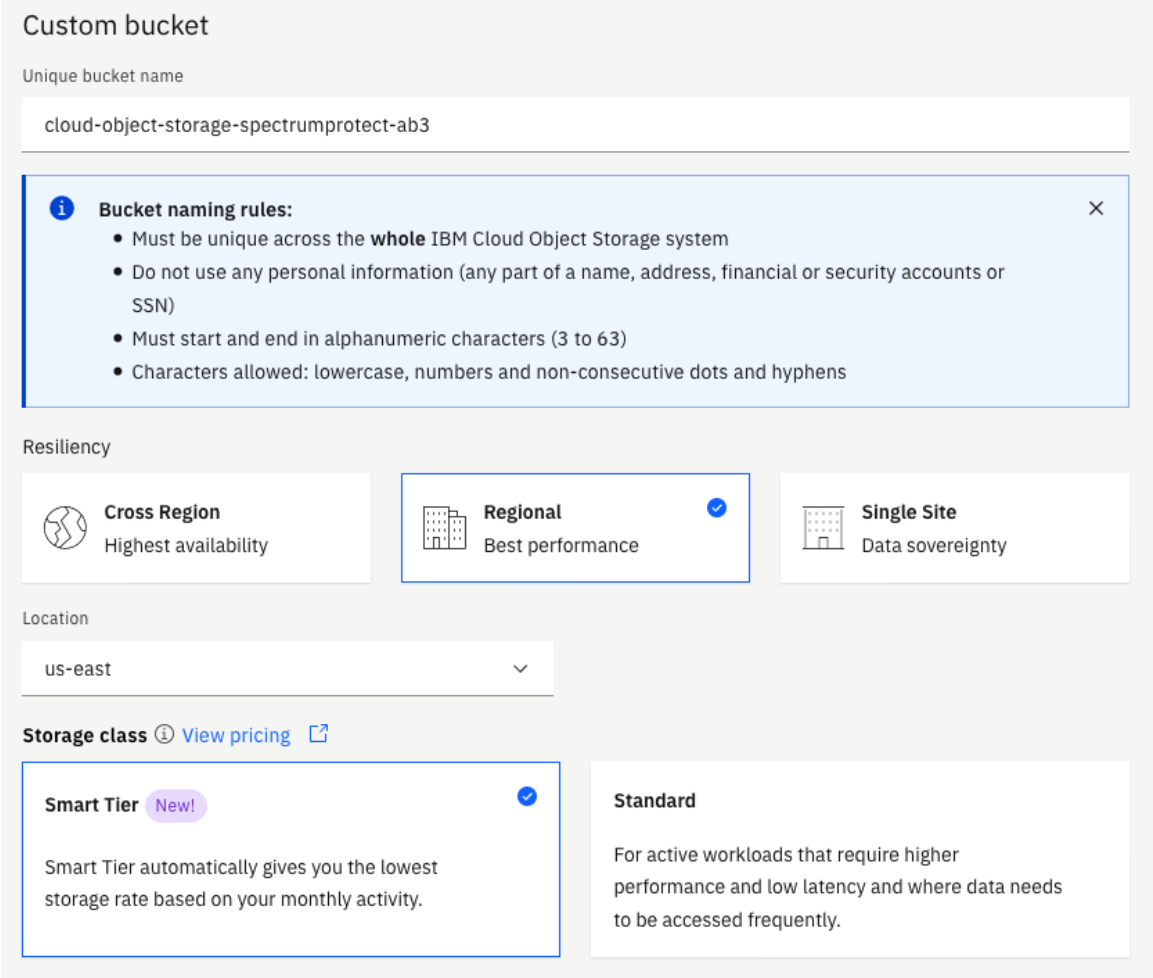


Prepare Cloud Object Storage Configuration

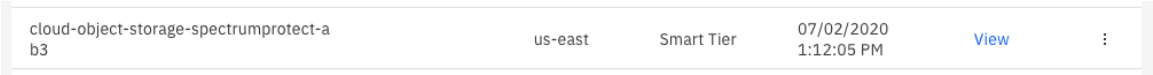
Before you can add Cloud Object Storage as a storage pool for IBM Spectrum Protect, you'll need to create a Bucket and a Service Credential. To create a bucket, navigate to your Cloud Object Storage resource in the IBM Cloud console. Then click the blue Create bucket button.



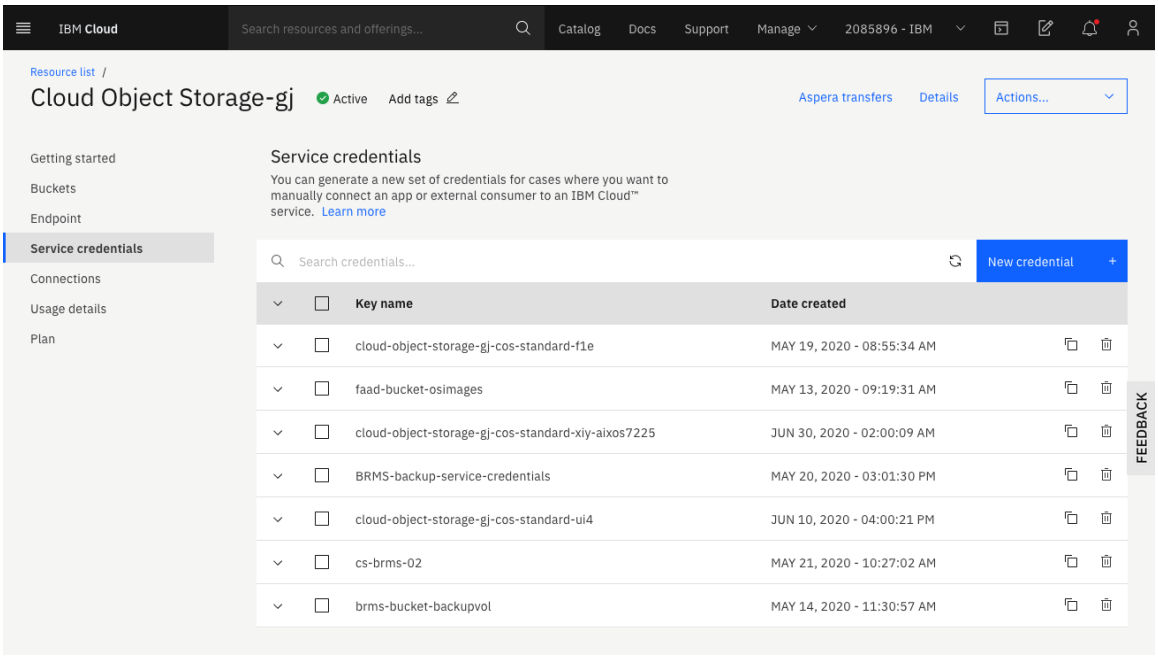
Choose the option for Custom Bucket. Then give the bucket a meaningful name. Ensure that the appropriate Location and Storage Class options are selected. Then scroll to the bottom and click the Create Bucket button.



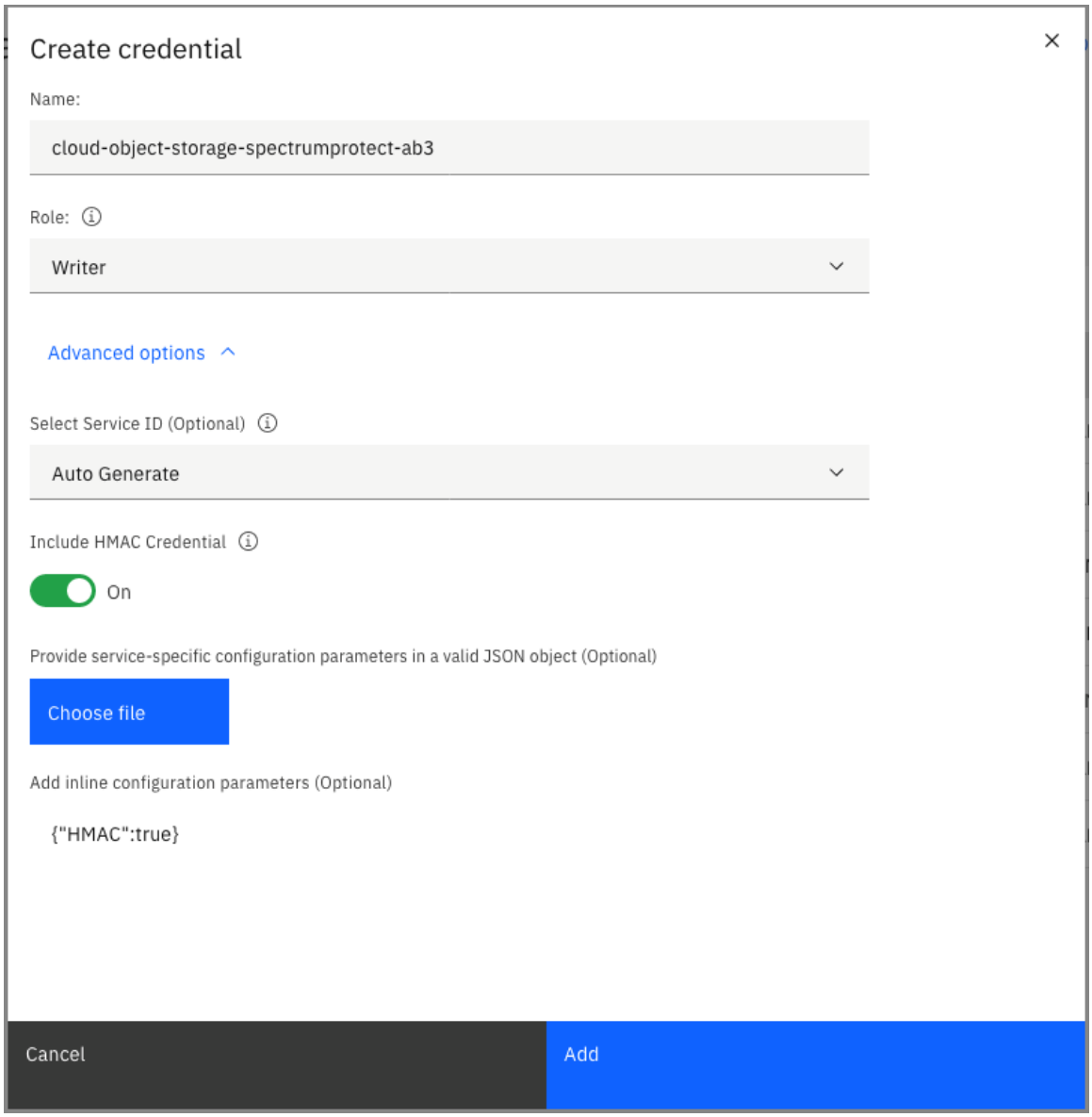
Your new bucket should appear on the list of buckets in the Cloud Object Storage resource.



Then, navigate to Service Credentials screen and click the New Credential button.



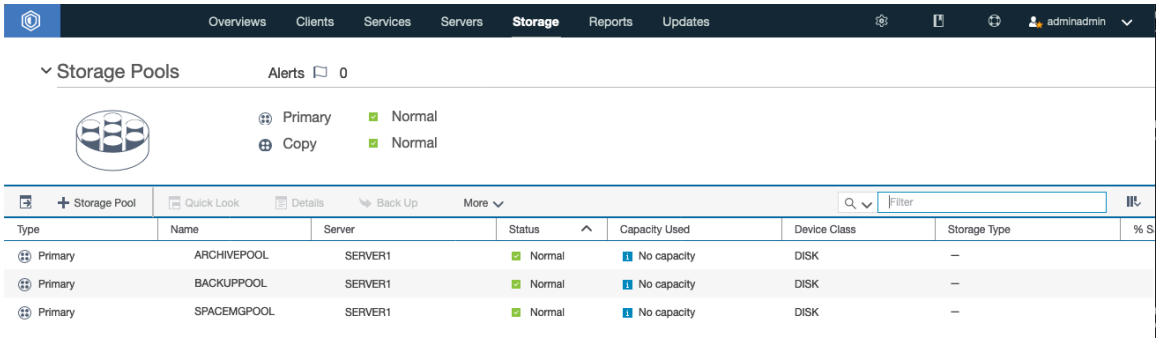
Give the new credential a meaningful name. Also, click Advanced Options and select the Include HMAC Credential option. Then click Add.



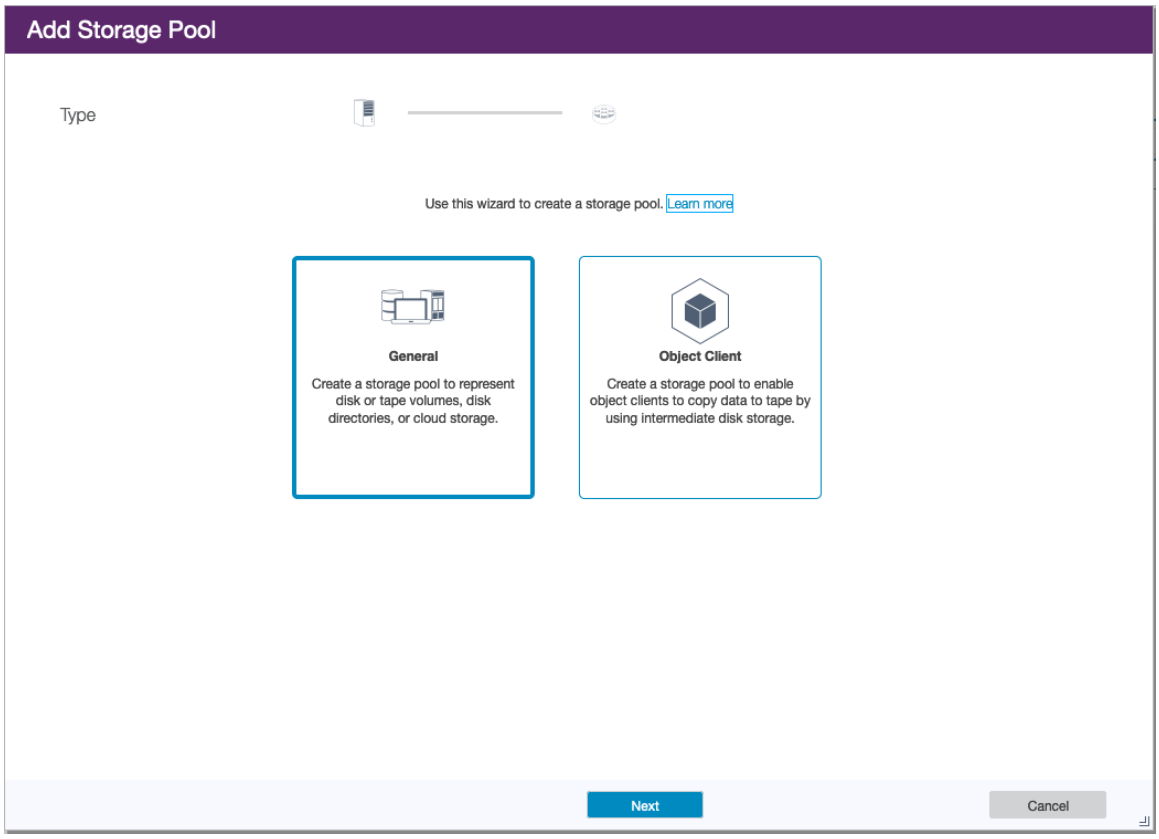
Now your new credential should be visible in the list of credentials. Click the down arrow to the left of its name to view the contents of the credential.

Connect Spectrum Protect to Cloud Object Storage

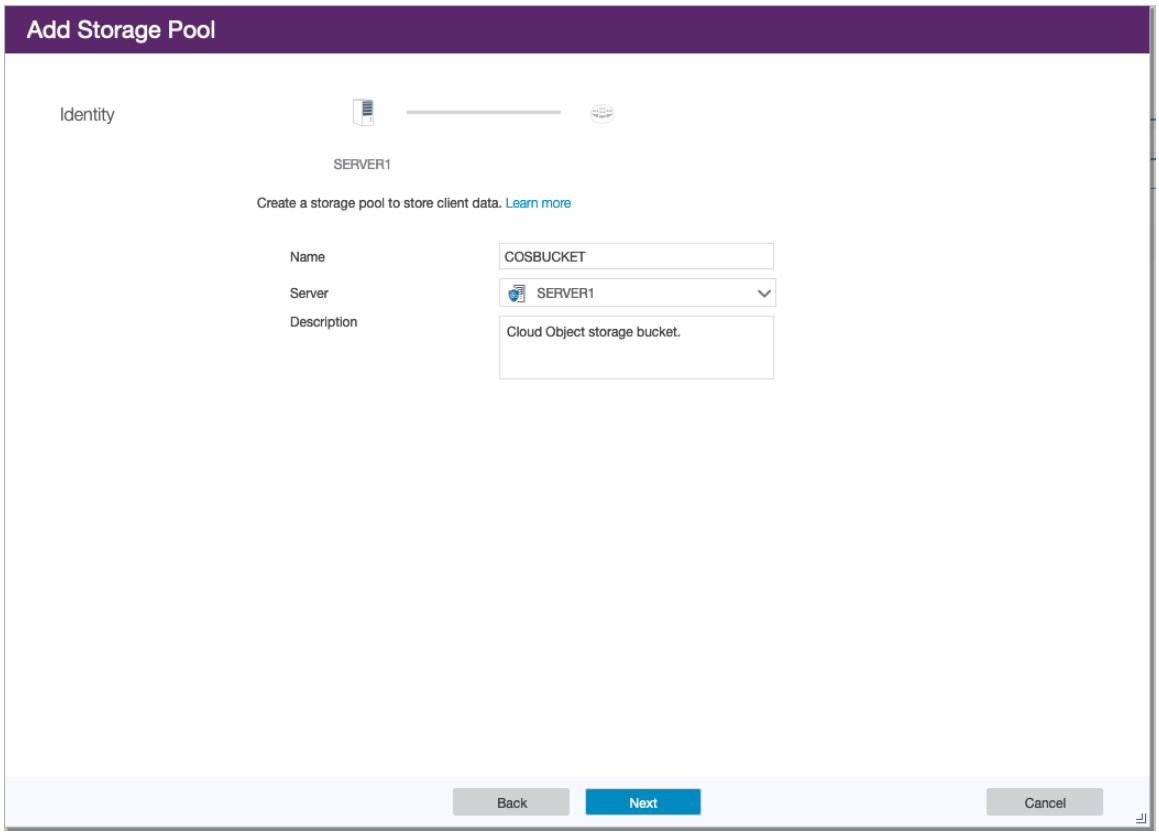
Now you can add the IBM Cloud Object Storage bucket as a storage pool. Return to the Spectrum Protect Operations center, click on Storage in the menu bar and select Storage Pools. This will take you to the Storage Pools screen.



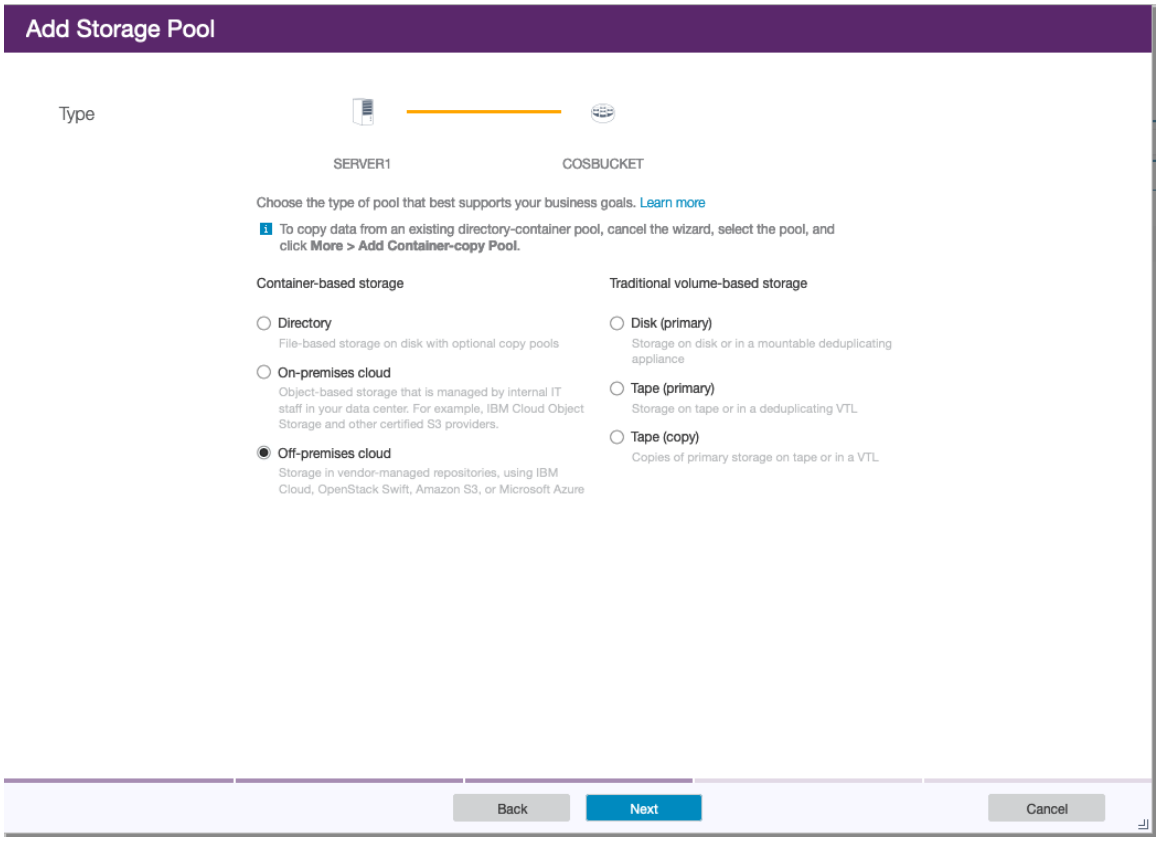
Click the + Storage Pool button to begin to add the new storage pool. Select the General option and click Next.



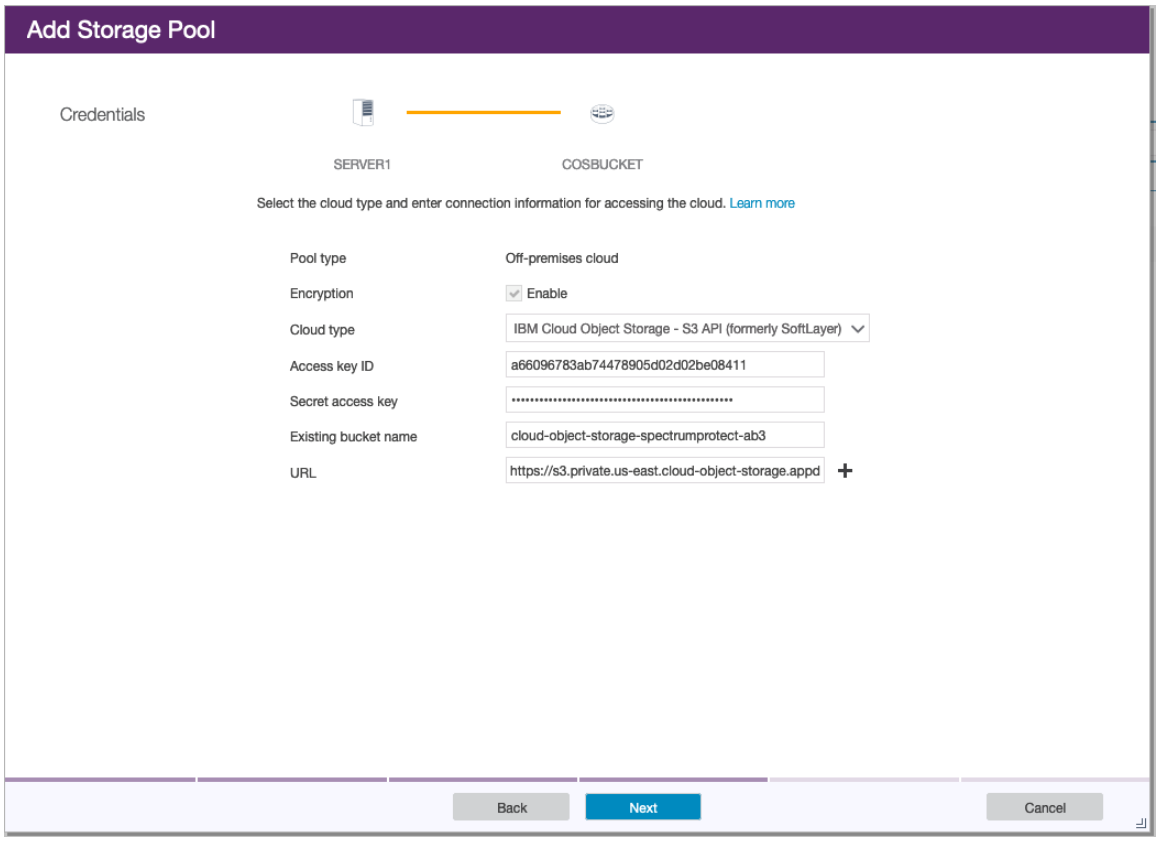
Give the new pool a meaningful name and description and then click Next.



Select the option for Off-premises Cloud and then click Next.



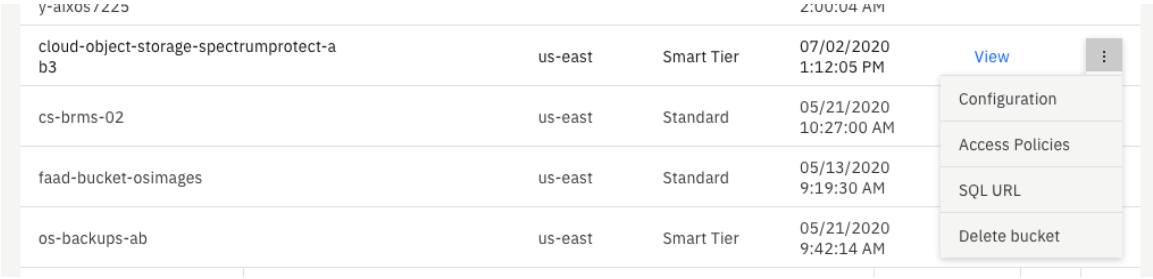
Select IBM Cloud Object Storage – S3 API as the Cloud Type. Then you'll need to gather and paste in the Access Key ID, Secret Access Key, Existing Bucket Name, and URL from the IBM Cloud Console.



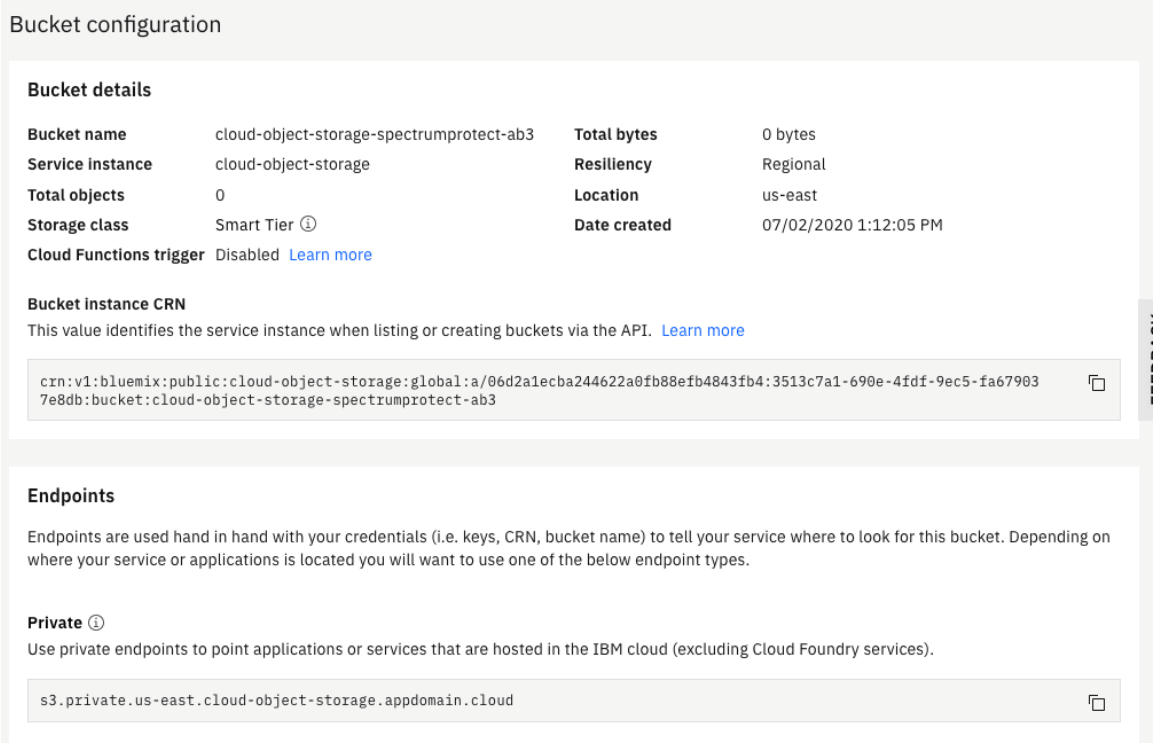
The Access Key ID and Secret Access Key are found in the Service Credential that you created.

```
"cos_hmac_keys": {
  "access_key_id": "a66096783ab74478905d02d02be08411",
  "secret_access_key": "cd64278cc5d88ce216d46d5908f25c232a378f77469aa02e"
},
```

And the Existing Bucket Name and URL can be found by looking at the Configuration of your bucket. To look at the configuration click on the three dots icon to the right of the bucket name and choose Configuration.

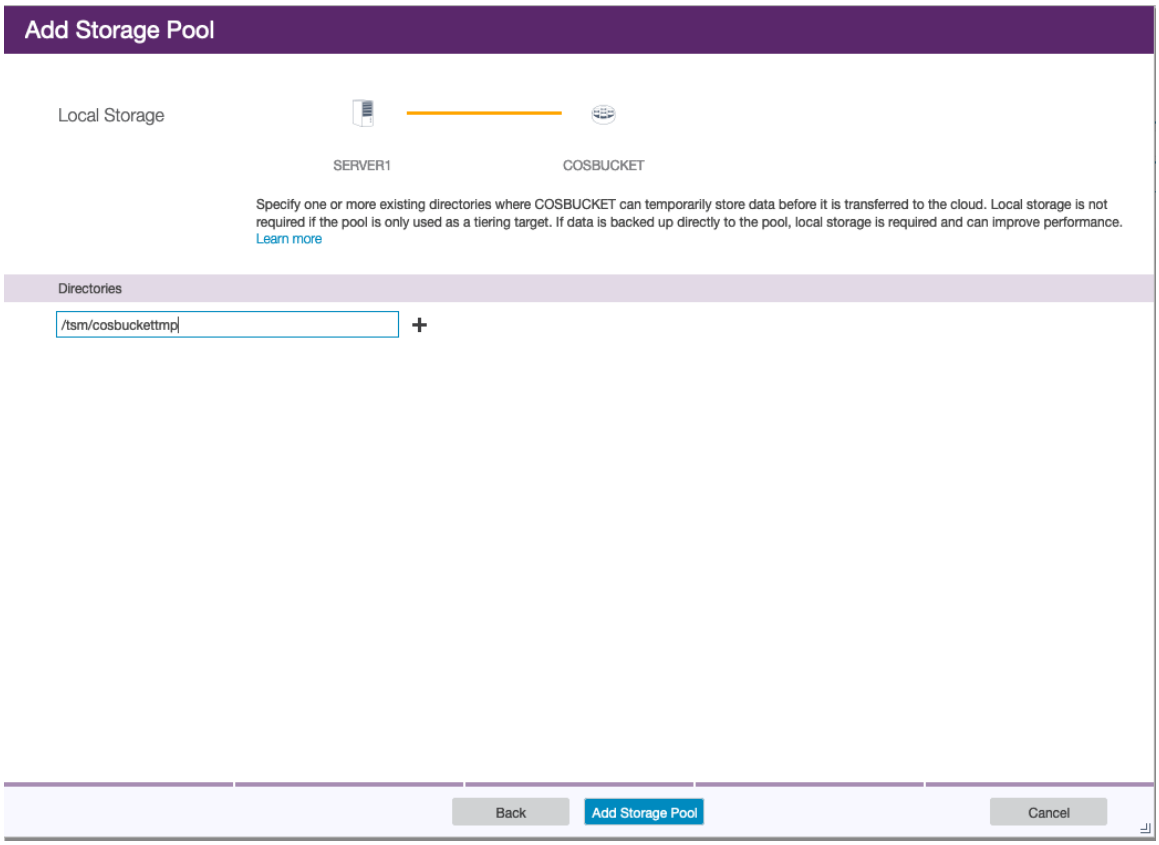


The Existing Bucket Name is just the name of the bucket. The URL is the Private Endpoint listed below.

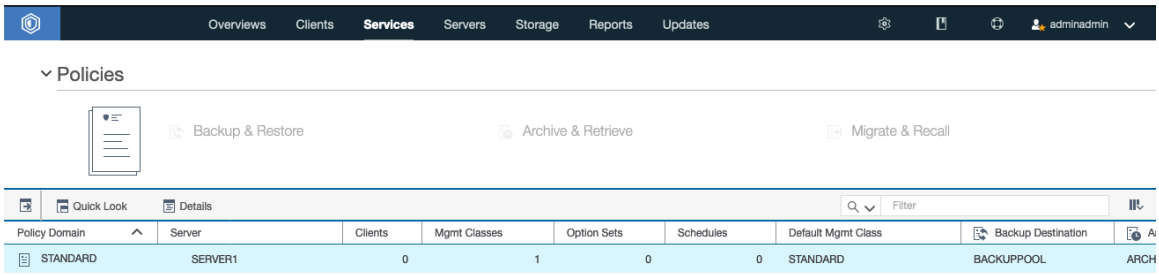


Click Next after the parameters are entered.

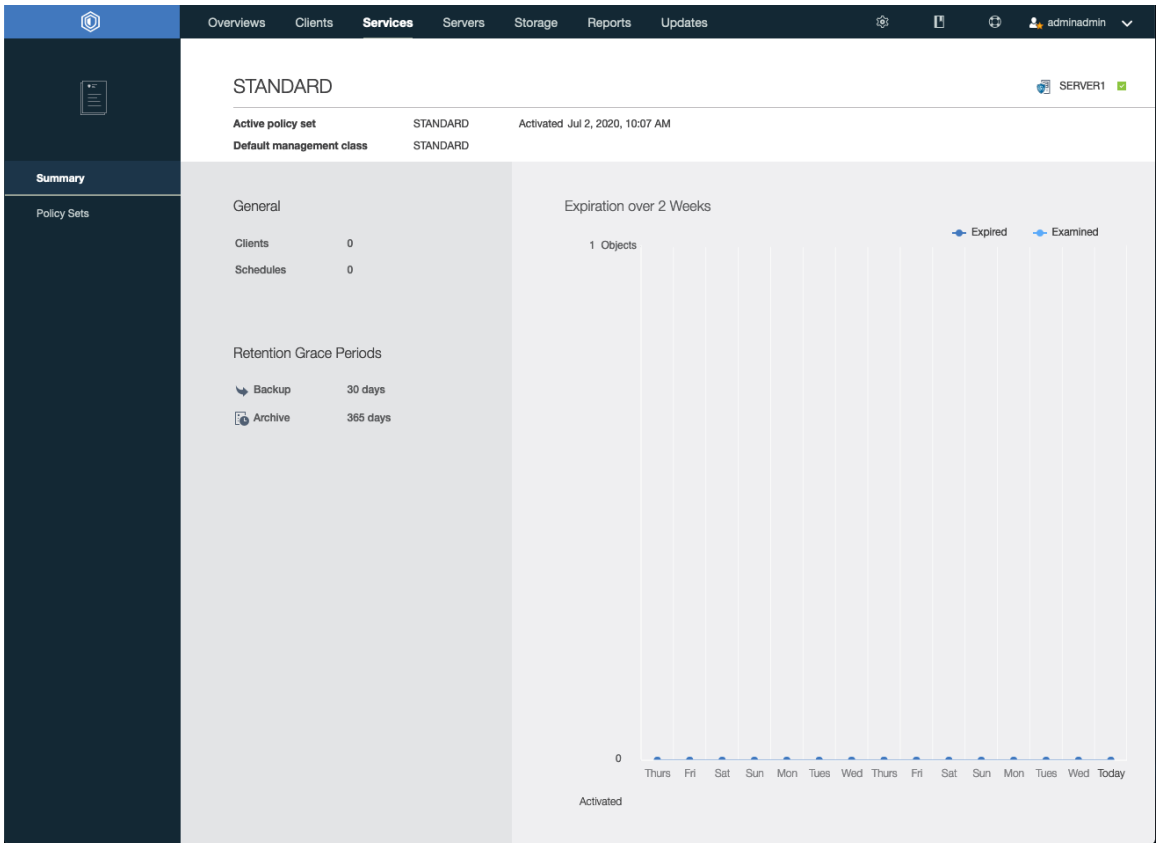
Now specify a temporary staging directory for data to be uploaded to Cloud Object Storage, and then click Add Storage Pool.



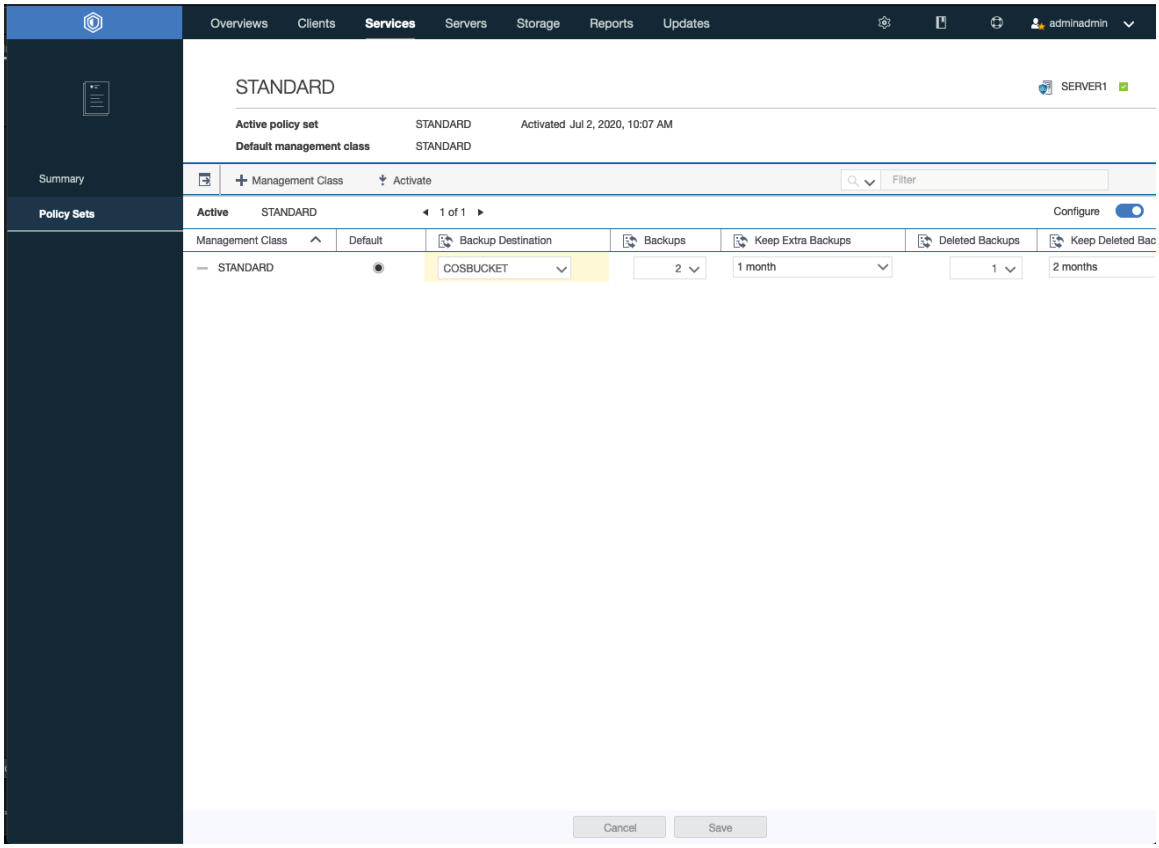
Once the storage pool is created, you can click the Close & View Policies button to be taken to the Policies screen, or you can navigate to the Policies screen from the Services menu.



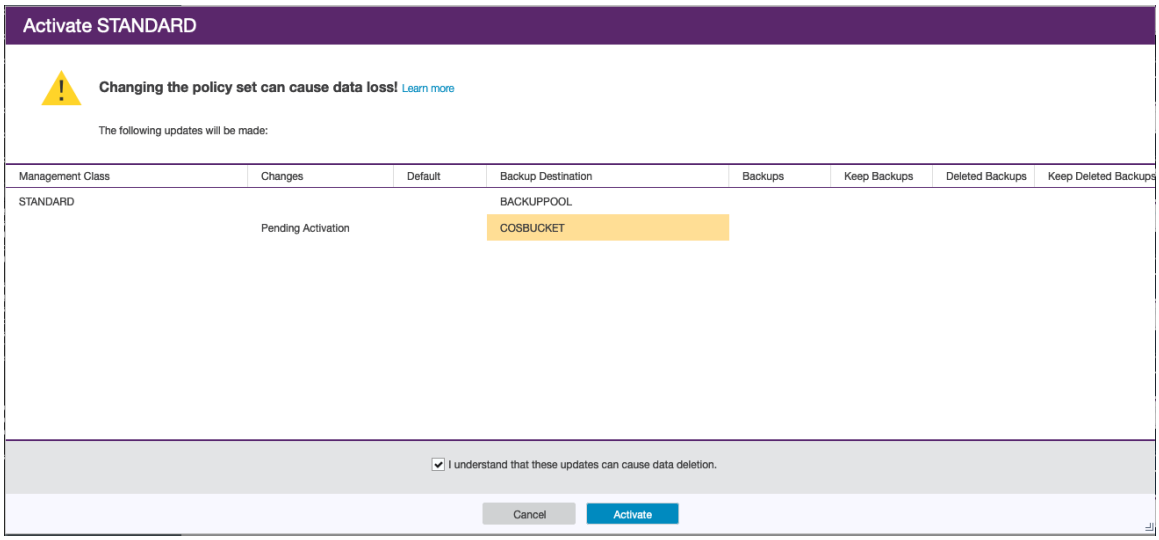
Double click STANDARD to view the summar for the Standard policy.



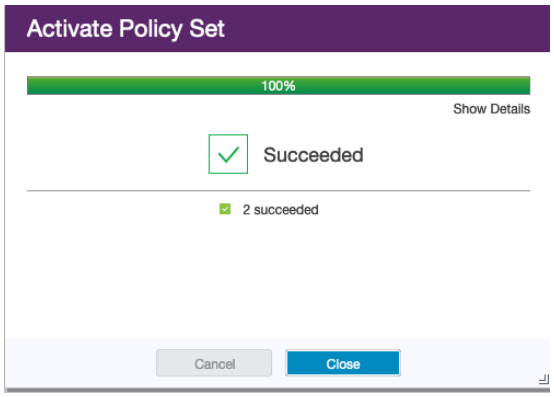
To change the target Backup Destination for the Standard Policy Set, click Policy Sets in the left column. Then click the Configure toggle on the right side of the GUI. Finally, choose the Cloud Object Storage bucket on the pulldown menu under Backup Destination.



Then click Activate in the middle button bar. This will open a warning that the change may cause data loss. Select the check box to confirm the change and click Activate again.



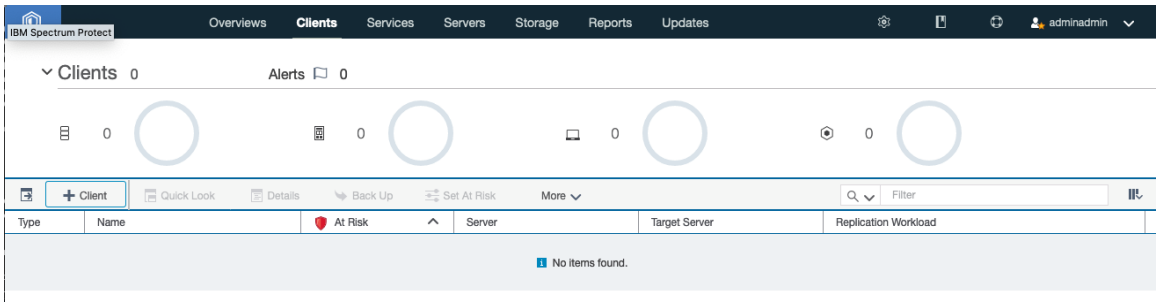
You will receive a confirmation message for the change.



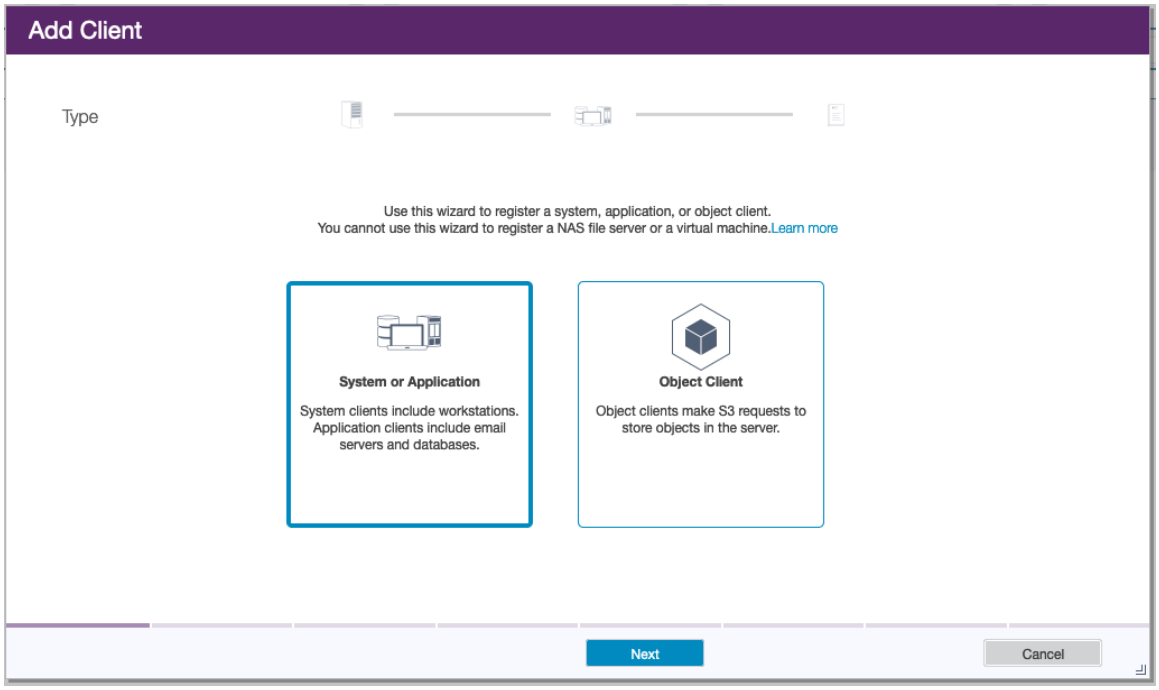
If needed make sure to also click Save at the bottom of the Policy Set screen.

Configure Spectrum Protect Server to Back Up an AIX Client

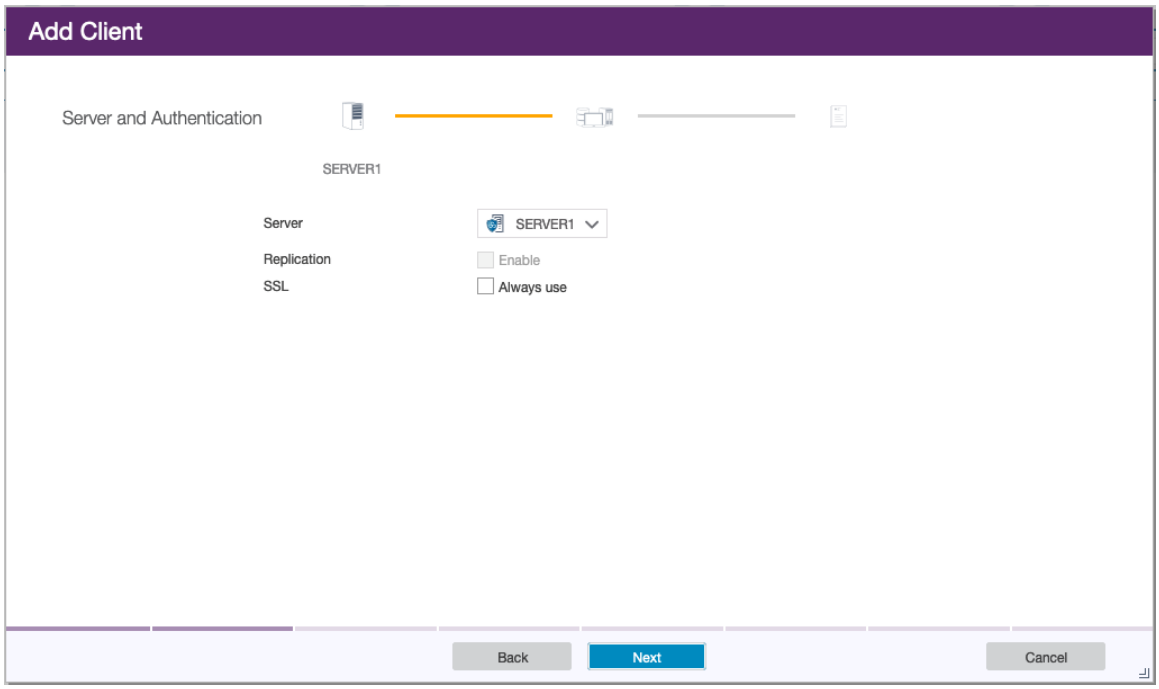
Now you can proceed to set up a client definition. Choose Clients from the Clients menu in the top bar. Then click the + Client button.



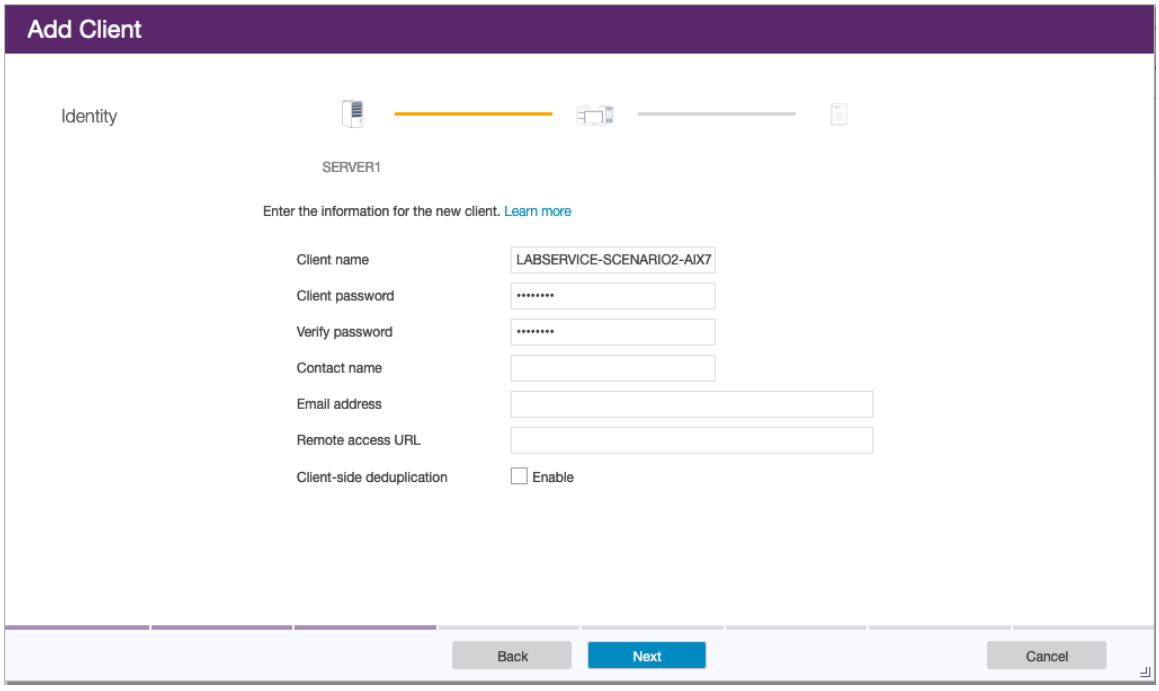
Select the option for System or Application and then click Next.



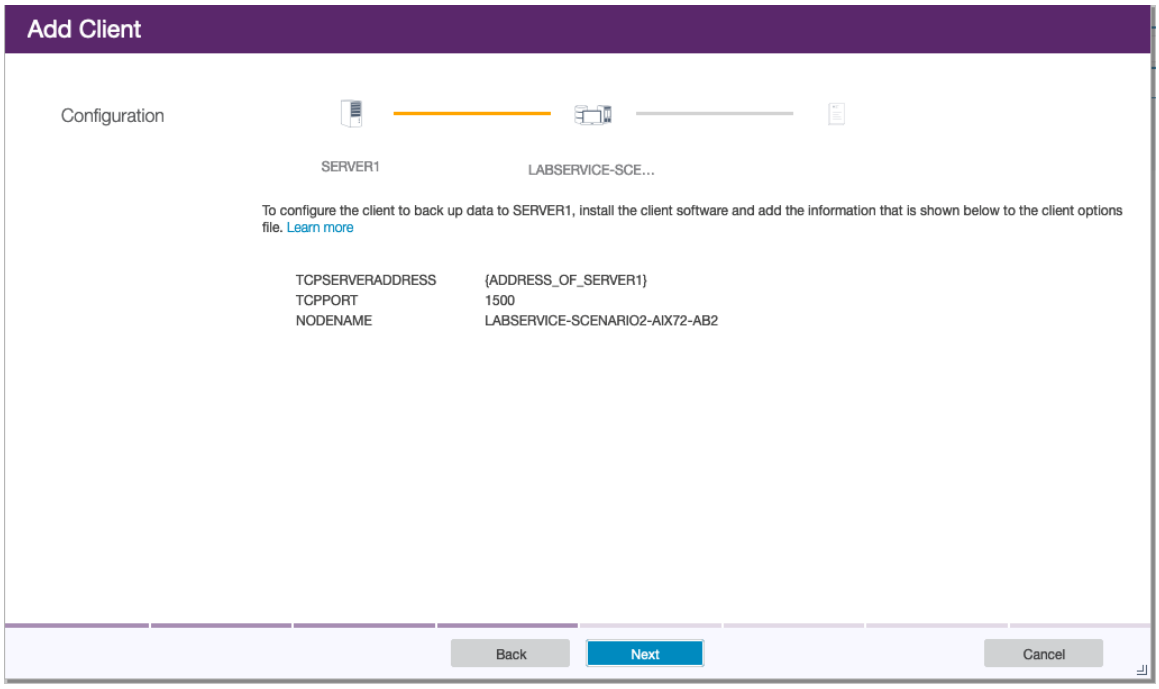
Select Next on the following screen to indicate that you will use the current Spectrum Protect server.



Then fill in the client name, in this case the host name of the client, and choose a password for the client to use to connect. Then click Next.

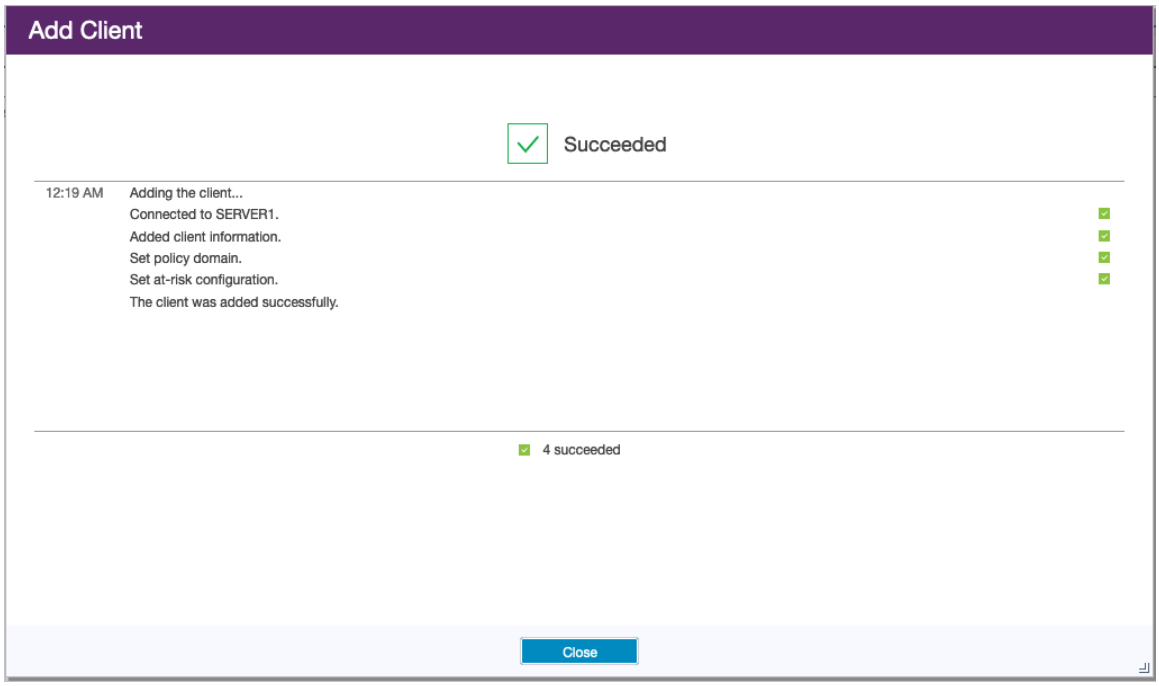


Take note of the information provided on the next screen. You will put it into the options file when you set up the client VSI. Then click Next.



Click Next to accept the default Policy Domain for you client and Next again on the next few screens to take other default configuration choices. You can refer to the IBM Spectrum Protect documentation for more complex configuration options.

Once all the configuration screens are complete the client will be added.



Configure IBM Spectrum Protect Client in AIX

Now, you'll need to copy the IBM Spectrum Protect Client software to your AIX VSI in the Power VS environment. Since direct network access to the AIX environment may be limited, you can upload the software to a location within your Linux VSI and then use scp to copy it to your AIX VSI. Ensure you have enough space in the target filesystem.

```
# chfs -a size=2G /tmp
Filesystem size changed to 4194304
# mkdir /tmp/sp
# scp root@10.166.112.159:~/SP_CLIENT* /tmp/sp/
The authenticity of host '10.166.112.159 (10.166.112.159)' can't be established.
ECDSA key fingerprint is SHA256:14azUGCC1vXr1uXVEBLvsgX1Tu2VIpevk0pvpU7AKmQ.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.166.112.159' (ECDSA) to the list of known hosts.
root@10.166.112.159's password:
SP_CLIENT_8.1.9_AIX_ML.tar.gz                       100%  635MB  59.2MB/s   00:10
#
```

Change to the directory containing the client software and unpack it.

```
# cd /tmp/sp
# gunzip SP*
# tar xvf SP*
x TSMCLI_AIX
x TSMCLI_AIX/usr
x TSMCLI_AIX/usr/sys
x TSMCLI_AIX/usr/sys/inst.images
x TSMCLI_AIX/usr/sys/inst.images/.toc, 34692 bytes, 68 tape blocks
x TSMCLI_AIX/usr/sys/inst.images/GSKit8.gskcrypt64.ppc.rte, 4539392 bytes, 8866 tape
blocks
x TSMCLI_AIX/usr/sys/inst.images/GSKit8.gskssl64.ppc.rte, 38441984 bytes, 75082 tape
blocks
x TSMCLI_AIX/usr/sys/inst.images/README.htm, 22335 bytes, 44 tape blocks
x TSMCLI_AIX/usr/sys/inst.images/README_api.htm, 21360 bytes, 42 tape blocks
x TSMCLI_AIX/usr/sys/inst.images/tivoli.tsm.client.api.64bit, 184666624 bytes, 360677
tape blocks
x TSMCLI_AIX/usr/sys/inst.images/tivoli.tsm.client.ba.64bit, 238700032 bytes, 466211
tape blocks
x TSMCLI_AIX/usr/sys/inst.images/tivoli.tsm.client.jbb.64bit, 1138176 bytes, 2223 tape
blocks
x TSMCLI_AIX/usr/sys/inst.images/tivoli.tsm.client.webgui, 446763520 bytes, 872585
tape blocks
x TSMCLI_AIX/usr/sys/inst.images/tivoli.tsm.filepath_aix, 2611200 bytes, 5100 tape
blocks
x TSMCLI_AIX/usr/sys/inst.images/update.txt, 401 bytes, 1 tape blocks
#
```

Then change to the directory where the installable files were unpacked.

```
# cd TSMCLI_AIX/usr/sys/inst.images
#
```

Run smit install and choose the option to Install and Update Software.

```
                        Software Installation and Maintenance

Move cursor to desired item and press Enter.

  Install and Update Software
  List Software and Related Information
  Software Maintenance and Utilities
  Software Service Management
  Relocatable Software Installation and Maintenance
  Network Installation Management
  EZ NIM (Easy NIM Tool)
  System Workload Partition Software Maintenance
  System Backup Manager
  Alternate Disk Installation
  EFIX Management
  Thin Server Maintenance

F1=Help              F2=Refresh           F3=Cancel            F8=Image
F9=Shell             F10=Exit             Enter=Do
```

Then choose the option to Install Software.

```
                             Install and Update Software

Move cursor to desired item and press Enter.

  Install Software
  Update Installed Software to Latest Level (Update All)
  Update Installed Software to Latest Level (Live Update)
  Install Software Bundle
  Update Software by Fix (APAR)
  Install and Update from ALL Available Software

F1=Help              F2=Refresh           F3=Cancel            F8=Image
F9=Shell             F10=Exit             Enter=Do
```

Enter . to indicate the current directory as the Input device / directory and then hit Enter to proceed.

```
                                  Install Software

Type or select a value for the entry field.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
* INPUT device / directory for software              [.]                          +

F1=Help              F2=Refresh           F3=Cancel            F4=List
F5=Reset             F6=Command           F7=Edit              F8=Image
F9=Shell             F10=Exit             Enter=Do
```

On the next screen change the option for Accept new license agreements to yes and hit Enter to proceed. Press Enter again to confirm.

```
                                  Install Software

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]                                                   [Entry Fields]
* INPUT device / directory for software               .
* SOFTWARE to install                                [_all_latest]                +
  PREVIEW only? (install operation will NOT occur)    no                          +
  COMMIT software updates?                            yes                         +
  SAVE replaced files?                                no                          +
  AUTOMATICALLY install requisite software?           yes                         +
  EXTEND file systems if space needed?                yes                         +
  OVERWRITE same or newer versions?                   no                          +
  VERIFY install and check file sizes?                no                          +
  Include corresponding LANGUAGE filesets?            yes                         +
  DETAILED output?                                    no                          +
  Process multiple volumes?                           yes                         +
  ACCEPT new license agreements?                      yes                         +
  PREVIEW new LICENSE agreements?                     no                          +

  INVOKE live update?                                 no                          +
[MORE...8]

F1=Help              F2=Refresh           F3=Cancel            F4=List
F5=Reset             F6=Command           F7=Edit              F8=Image
F9=Shell             F10=Exit             Enter=Do
```

Eventually the installation will complete. You can then hit F10 or esc+0 to exit from smit.

```
                                  COMMAND STATUS

Command: OK            stdout: yes           stderr: no

Before command completion, additional instructions may appear below.

[TOP]
geninstall -I "a -cgNQqwXY -J"  -Z   -d . -f File 2>&1

File:
    I:GSKit8.gskcrypt64.ppc.rte    8.0.55.9
    I:GSKit8.gskssl64.ppc.rte      8.0.55.9
    I:tivoli.tsm.client.api.64bit  8.1.9.0
    I:tivoli.tsm.client.ba.64bit.base 8.1.9.0
    I:tivoli.tsm.client.ba.64bit.common 8.1.9.0
    I:tivoli.tsm.client.ba.64bit.web 8.1.9.0
    I:tivoli.tsm.client.ba.64bit.hdw 8.1.9.0
    I:tivoli.tsm.client.ba.64bit.image 8.1.9.0
    I:tivoli.tsm.client.ba.64bit.nas 8.1.9.0
    I:tivoli.tsm.client.jbb.64bit  8.1.9.0
    I:tivoli.tsm.client.webgui     8.1.9.0
    I:tivoli.tsm.filepath.rte      2.2.0.58
[MORE...260]

F1=Help              F2=Refresh            F3=Cancel            F6=Command
F8=Image             F9=Shell              F10=Exit             /=Find
n=Find Next
```

Now change directory to /usr/tivoli/tsm/client/ba/bin64/ and edit a new file called dsm.sys.

```
# cd /usr/tivoli/tsm/client/ba/bin64
# vi dsm.sys
#
```

Put your server and connection information in that file.

```
Servername               labservices-spectrumprotect-rhel-ab2.IBM.cloud
   COMMMethod                TCPip
   TCPPort                   1500
   TCPServeraddress          10.166.112.159
```

Finally, it’s time to connect the client to the server. Use dsmc to start the client. Ensure the Node Name and Password match what was used during the Client Configuration process in Spectrum Protect.

```
# dsmc
ANS0990W Options file '/usr/tivoli/tsm/client/ba/bin64/dsm.opt' could not be found.
Default option values will be used.
IBM Spectrum Protect
Command Line Backup-Archive Client Interface
  Client Version 8, Release 1, Level 9.0
  Client date/time: 07/10/20   10:58:44
(c) Copyright by IBM Corporation and other(s) 1990, 2019. All Rights Reserved.

Node Name: LABSERVICE-SCENARIO2-AIX72-AB2
Please enter your user id <LABSERVICE-SCENARIO2-AIX72-AB2>:

Please enter password for user id "LABSERVICE-SCENARIO2-AIX72-AB2":

Session established with server SERVER1: Linux/x86_64
  Server Version 8, Release 1, Level 9.000
  Server date/time: 07/10/20   10:50:32  Last access: 07/10/20   00:19:10

Protect>
```

Back Up an AIX Client and Validate the Back Up

Enter the command incremental to take a full backup of your client.

```
Protect> incremental

Incremental backup of volume '/'

Incremental backup of volume '/usr'

Incremental backup of volume '/var'

Incremental backup of volume '/home'

Incremental backup of volume '/admin'

Incremental backup of volume '/opt'

Incremental backup of volume '/var/adm/ras/livedump'

Incremental backup of volume '/usr/sys/inst.images'
Normal File-->          201,153 /usr/sys/inst.images/RPMS/linux/XML-LibXML-1.58-
1.i386.rpm [Sent]

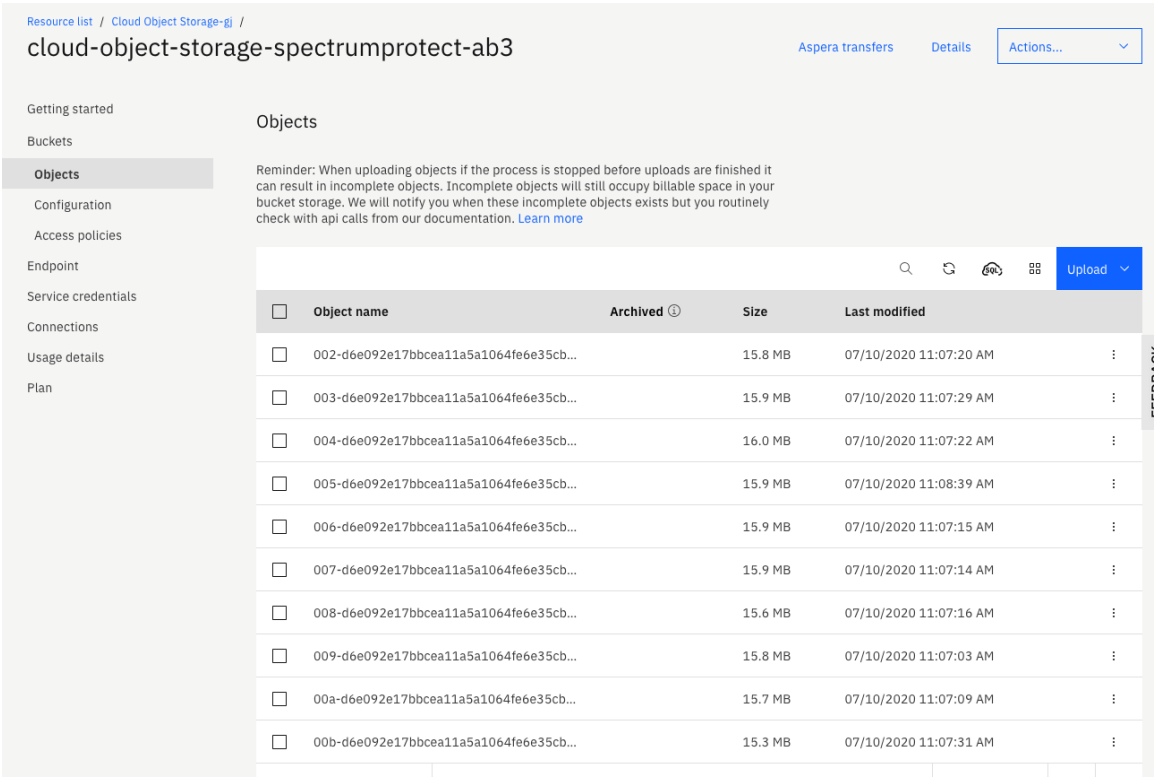

... Many lines skipped ...


Normal File-->            2,191 /opt/triton/system-start [Sent]
Normal File-->            2,215 /opt/triton/system-stop [Sent]
Normal File-->            4,697 /opt/triton/vg-start [Sent]
Normal File-->            4,485 /opt/triton/vg-stop [Sent]
Successful incremental backup of '/opt'

Directory-->                256 /var/adm/ras/livedump/ [Sent]
Directory-->                256 /var/adm/ras/livedump/lost+found [Sent]
Successful incremental backup of '/var/adm/ras/livedump'


Total number of objects inspected:       62,118
Total number of objects backed up:       62,075
Total number of objects updated:              0
Total number of objects rebound:              0
Total number of objects deleted:              0
Total number of objects expired:              0
Total number of objects failed:               0
Total number of objects encrypted:            0
Total number of objects grew:                 0
Total number of retries:                    841
Total number of bytes inspected:          10.81 GB
Total number of bytes transferred:        10.83 GB
Data transfer time:                      315.36 sec
Network data transfer rate:           35,998.57 KB/sec
Aggregate data transfer rate:         27,633.44 KB/sec
Objects compressed by:                        0%
Total data reduction ratio:                0.00%
Elapsed processing time:                00:06:50
Protect>
```

You will be able to see the objects that Spectrum Protect uses to store the backup in your Cloud Object Storage bucket.



You can validate file backup and restore by creating a new sample file, taking a backup, deleting the file and then restoring it. Start by using dd to create a convenient example file. This one is 10 MB.

```
# dd if=/dev/zero of=/testfile bs=1m count=10
10+0 records in
10+0 records out
# ls -l /testfile
-rw-r--r--    1 root     system     10485760 Jul 10 14:27 /testfile
#
```

Now perform and incremental backup. This will capture your example file and any other files that have changed since your previous backup.

```
# dsmc incremental
ANS0990W Options file '/usr/tivoli/tsm/client/ba/bin64/dsm.opt' could not be found.
Default option values will be used.
IBM Spectrum Protect
Command Line Backup-Archive Client Interface
  Client Version 8, Release 1, Level 9.0
  Client date/time: 07/10/20   14:27:47
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Node Name: LABSERVICE-SCENARIO2-AIX72-AB2
Please enter your user id <LABSERVICE-SCENARIO2-AIX72-AB2>:

Please enter password for user id "LABSERVICE-SCENARIO2-AIX72-AB2":

Session established with server SERVER1: Linux/x86_64
  Server Version 8, Release 1, Level 9.000
  Server date/time: 07/10/20   14:19:13  Last access: 07/10/20   14:01:06


Incremental backup of volume '/'

Incremental backup of volume '/usr'

Incremental backup of volume '/var'

... several lines skipped ...

Normal File-->        10,485,760 /testfile [Sent]

... several lines skipped ...

Total number of bytes inspected:          10.81 GB
Total number of bytes transferred:        23.43 MB
Data transfer time:                       39.22 sec
Network data transfer rate:              611.93 KB/sec
Aggregate data transfer rate:            443.32 KB/sec
Objects compressed by:                        0%
Total data reduction ratio:               99.79%
Elapsed processing time:                00:00:54
#
```

Then delete your example file and confirm that it is gone.

```
# ls -l /testfile
-rw-r--r--    1 root     system     10485760 Jul 10 14:27 /testfile
# rm /testfile
# ls -l /testfile
/testfile not found
#
```

Finally, restore your example file and confirm that it has been recovered.

```
# dsmc restore /testfile
ANS0990W Options file '/usr/tivoli/tsm/client/ba/bin64/dsm.opt' could not be found.
Default option values will be used.
IBM Spectrum Protect
Command Line Backup-Archive Client Interface
  Client Version 8, Release 1, Level 9.0
  Client date/time: 07/10/20   14:30:04
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Node Name: LABSERVICE-SCENARIO2-AIX72-AB2
Please enter your user id <LABSERVICE-SCENARIO2-AIX72-AB2>:

Please enter password for user id "LABSERVICE-SCENARIO2-AIX72-AB2":

Session established with server SERVER1: Linux/x86_64
  Server Version 8, Release 1, Level 9.000
  Server date/time: 07/10/20   14:21:30  Last access: 07/10/20   14:19:21

Restore function invoked.

Restoring      10,485,760 /testfile [Done]

Restore processing finished.

Total number of objects restored:             1
Total number of objects failed:               0
Total number of bytes transferred:        10.00 MB
Data transfer time:                       13.63 sec
Network data transfer rate:              751.26 KB/sec
Aggregate data transfer rate:            631.47 KB/sec
Elapsed processing time:                00:00:16
# ls -l /testfile
-rw-r--r--    1 root     system     10485760 Jul 10 14:27 /testfile
#
```

Chapter 3: Troubleshooting

Chapter 4: Additional Resources