IBM® Storage

# A Hybrid Cloud Cyber Security Solution using IBM Spectrum Virtualize for Public Cloud on Azure and IBM Spectrum Virtualize Safeguarded Copy

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ii A Hybrid Cloud Cyber Security Solution using IBM Spectrum Virtualize for Public Cloud on Azure and IBM



## About this document

The document describes the configuration and end-to-end architecture for configuring the logical air-gap solution for cyber resiliency using IBM® Spectrum Virtualize for Public Cloud (SV4PC) on Azure, IBM Spectrum® Virtualize Safeguarded Copy, and IBM FlashSystem®.

**Important:** The information in this document is distributed on an "as is" basis without any warranty that is either expressed or implied. Support assistance for the use of this material is limited to situations where IBM Spectrum Virtualize for Public Cloud on Azure and IBM FlashSystem are supported and entitled and where the issues are specific to a blueprint implementation.

#### **Executive summary**

In today's world, data security is of utmost importance. Data can be compromised by human error, system glitches, or malicious criminal acts.

Data breaches are among the gravest and most expensive threats to businesses today.

The traditional business continuity solutions most organizations developed and implemented use high availability (HA) and disaster recovery (DR) to protect their data. However, these solutions alone are not sufficient enough to protect against the cyberattacks.

According to the 2020 Cost of Data Breach Report, the average cost worldwide of a data breach in the preceding 12 months was \$4 million, which is an adjusted average total cost. In addition to loss of revenue, organizations that are affected by a breach run the risk of having their normal business operations disrupted, and losing valuable data, customers, and reputation within their industry.

Cyber resilience solutions are developed by organizations to continue operating with the least amount of disruption despite cyberattacks and outages. Cyber resilience expands the scope of protection, covering cybersecurity and business continuity.

A significant part of cyber resilience is the ability to recover from a logical data corruption event. Because this unrelenting tide of data breaches is driving increased interest in providing assured data integrity across hybrid cloud environments, IBM Spectrum Virtualize offers the powerful data security function of IBM Safeguarded Copy.

IBM Spectrum Virtualize for Public Cloud is a software-defined storage solution that supports many features that are included as part of IBM FlashSystem storage products that run IBM Spectrum Virtualize software. IBM Spectrum Virtualize for Public Cloud supports various cloud-based use cases, such as all-in cloud, cloud-to-cloud, and hybrid-cloud deployments.

IBM Spectrum Virtualize for Public Cloud software can be deployed in Microsoft Azure. The IBM Spectrum Virtualize for Public Cloud installation is offered through the Azure Marketplace as a Bring Your Own license (BYOL) solution.

During installation, the IBM Spectrum Virtualize for Public Cloud deployment is implemented through an Azure Managed Resource (ARM) template that gathers parameters and credentials from the user, verifies entitlement, and creates all Azure resources that are required to deploy IBM Spectrum Virtualize for Public Cloud instance in Microsoft Azure.

## Scope

This blueprint guide provides the following information:

- A solutions architecture and related solution configuration workflows, with the following essential software and hardware components:
  - IBM FlashSystem
  - IBM Spectrum Virtualize for Public Cloud on Azure
  - IBM Copy Services Manager
- Detailed technical configuration steps for building the cyber resiliency solutions

This technical report does not provide performance analysis from a user perspective or replace any official IBM manuals or documents.

### Prerequisites

This technical paper assumes that the reader is familiar with the following areas:

- Basic knowledge of IBM FlashSystem
- Azure Cloud fundamentals
- Hybrid Cloud network connectivity
- IBM Copy Services Manager

### **Blueprint roadmap**

This blueprint includes the following topics:

- The basic components of the IBM Spectrum Virtualize Safeguarded Copy are demonstrated in a single site configuration.
- The solution is expanded to illustrate an airgap configuration in which a second site is introduced and replication is configured between the sites. Then, the Safeguarded Copy is taken at the second site to provide physical isolation.
- At the end of the document the similarity of an on-premises to Azure airgap solution is discussed. The only difference is the necessity for setting up the site-to-site VPN tunnel to facilitate the IBM Spectrum Virtualize replication from on-premises to Azure.

## Getting Started: Cyber Security Solution that uses Safeguarded Copy in IBM Spectrum Virtualized for Public Cloud in Azure

This section describes the essential building blocks for creating the logical airgap, cyber resiliency solution that uses the Safeguarded Copy feature that is available in IBM FlashSystem with IBM Spectrum Virtualize.

#### **IBM FlashSystem family**

IBM FlashSystem Family is an excellent platform to simplify your hybrid multicloud storage.

The new IBM FlashSystem family, along with IBM Spectrum Virtualize for Public Cloud, simplifies storage for hybrid cloud environments. With a unified set of software, tools, and APIs, IBM FlashSystem addresses the entire range of storage needs, all from one data platform that extends enterprise functions across the storage system.

#### **IBM Spectrum Virtualize**

With IBM Spectrum Virtualize software, the IBM FlashSystem family is an industry-leading storage solution that includes technologies that complement and enhance virtual environments to achieve a simpler, more scalable, and cost-efficient IT infrastructure.

To further drive your IT transformation, IBM Spectrum Virtualize for Public Cloud offers multiple ways to create hybrid cloud solutions between on-premises private clouds and the public cloud. It enables real-time storage-based data replication and disaster recovery, and data migration between local storage and AWS, IBM Cloud®, or Microsoft Azure. This feature enables storage administration at a cloud service provider's site in the same way as on-premises, regardless of the type of storage.

For more information about IBM FlashSystem, see this web page.

IBM FlashSystem storage solutions include the following features:

- NVMe-accelerated flash arrays with control enclosures that are end-to-end NVMe-enabled, with flexibility to choose and mix between IBM FlashCore® Modules, industry standard NVMe drives and Storage-Class Memory. The systems offer industry-leading performance and scalability with support for bare-metal, virtual, and containerized environments.
- Built with IBM Spectrum Virtualize, with a full range of industry-leading data services, such as dynamic tiering, IBM FlashCopy® management, data mobility, and high-performance data encryption.
- Hybrid cloud ready, with support for private, hybrid, or public cloud deployments. The solutions come with ready-to-use, proven, validated "cloud blueprints" with support for cloud API automation and secondary data orchestration software.
- Cost-efficient, with innovative data reduction pool (DRP) technology that includes deduplication and hardware-accelerated compression technology, plus SCSI UNMAP support and all the thin provisioning, copy management, and efficiency you expect from IBM Spectrum Virtualize based storage.
- Hybrid storage enabled, with multiple expansion enclosure options that are based on 12 Gbps SAS that support solid-state drives (SSDs) and hard disk drives (HDDs).

- IBM FlashSystem®, which is ready for new generation applications that support Red Hat OpenShift, Container Storage Interface (CSI), Ansible automation, and Kubernetes, along with traditional VMWare and bare-metal environments.
- IBM Cloud Satellite<sup>™</sup>, which helps you deploy consistently across all on-premises, edge computing and public cloud environments from any cloud vendor. The result is greater developer productivity and development velocity. The IBM FlashSystem family is the perfect storage choice for IBM Cloud Satellite because of its simplicity, high performance, and low latency.
- IBM Copy Services Manager coordinates and automates Safeguarded Copy function across multiple systems
- IBM Spectrum Virtualize for Public Cloud can be deployed in a Microsoft Azure for various cloud-based uses cases, such as including all-in-cloud, cloud-to-cloud, and hybrid-cloud deployments.
- The IBM Spectrum Virtualize for Public Cloud installation is offered through Azure Marketplace as a Bring Your Own License (BYOL). During installation, the IBM Spectrum Virtualize for Public Cloud deployment template gathers deployment parameters from user, verifies your license, and creates all Azure resources that are required to deploy your IBM Spectrum Virtualize for Public Cloud instance in Microsoft Azure.

### Lab setup

Figure 1 shows the architecture that was deployed in our lab to show the IBM Safeguarded Copy setup for cyber resiliency solution for volumes in SV4PC in Azure.



Figure 1 Lab setup cybersecurity solution

In this sample configuration, IBM Spectrum Virtualize for Public Cloud in Azure is used as an all-in-cloud scenario to demonstrate the cyber resiliency solution by using the IBM Spectrum Virtualize for Public Cloud Safeguarded Copy feature.

**Note:** The terms *Site A* and *Site B* are applied for the Azure region for the purpose of this publication. In reality, Site A and Site B do not exist in Azure.

Next, we describe the steps that were used in the lab configuration to demonstrate the solution.

The single site scenario included the following steps:

- 1. Deployed IBM Spectrum Virtualize for Public Cloud (SV4PC) in Azure.
- 2. Created a Safeguarded Pool on IBM Spectrum Virtualize for Public Cloud in Azure.
- 3. Set up a volume group and added volumes to it.
- 4. Reviewed the predefined Safeguarded policies (frequency and retention of backups).
- 5. Associated a predefined policy or created a policy by using the command-line interface (CLI) and associated it with the volume group.
- 6. Installed and configured the IBM Copy Services Manager with IBM Spectrum Virtualize.

The crash consistent Safeguarded backup of production volumes in IBM Spectrum Virtualize for Public Cloud in Azure is taken automatically by IBM Copy Services Manager according to the associated policy.

- Restored (to the original volume) or recovered (to a new volume) data from immutable safeguarded backups.
- 8. Restored from a Safeguarded backup.

For the airgap scenario, we replicated the IBM Spectrum Virtualize for Public Cloud storage volume between two sites in Azure

## Single-site scenario: Deploy IBM Spectrum Virtualize for Public Cloud in Azure

For this scenario, it is assumed that IBM Spectrum Virtualize for Public Cloud (SV4PC) is deployed on Azure. For more information about deployment instructions, see this IBM Documentation web page.

Post deployment of SV4PC on Azure, virtual machines (VMs) are deployed in the lab setup. Also, we created two other hosts (Restore-VM-Hemanand, and VM-Hemanand) to assign iSCSI volumes to these hosts from SV4PC storage for the demonstration, as described next.

The following VMs that are in Azure are shown in Figure 2:

- Windows Server 2019 VM: Restore-VM-Hemanand
- SV4PC node 1: sv-Hemanand-node1-vm
- SV4PC node 2: sv-Hemanand-node2-vm
- SV4PC quorum node: sv-Hemanand-quorum
- Windows Server 2019 VM: VM-Hemanand

	,	$\mathcal P$ Search resources, services, and docs (G+/)					
Home > Virtual machines >							
Virtual machines	~	sv-Redbook-quo	orum	<b>1 ☆</b> …			
$+$ Create $\lor~~ ec{\sim}~$ Switch to classic		✓ Search (Ctrl+/)	~	🖋 Connect ▷ Start 🦿			
hemanand	_	Overview	^	Advisor (1 of 2): Managem			
Name 1		Activity log		^ Essentials			
Restore-VM-Hemanand		Access control (IAM)		Resource group <b>(change)</b>			
👤 sv-Hemanand-node1-vm		🧳 Tags		Redbook-SPVC-Azure			
sv-Hemanand-node2-vm		Diagnose and solve problems		Status Running			
롲 sv-Hemanand-quorum		Settings		Location			
VM-Hemanand		🙎 Networking		Subscription (change)			

Figure 2 Azure virtual resource in resource group

Complete the following steps:

1. Post deployment of SV4PC on Azure, log in to the SV4PC Cluster by using the Bastion Service on Azure, or log in to the SV4PC Cluster by using the Windows VM that was created in Azure with access to the SV4PC cluster.

In this demonstration, we logged in to the SV4PC Cluster by using the Windows VM.

2. Log in to the VM-hemanand host (Windows 2019 server) with RDP and open the SV4PC cluster IP URL from a web browser: https://40.10.1.28:8443/login.

3. Log in to the SV4PC cluster by using the superuser account (see Figure 3).

IBM				
Spec s	ctrum Virtualize for Public Cloud torage Management (Redbook-SPVC-Azure)			
	superuser			
	Sign In			

Figure 3 IBM Spectrum virtualized for public cloud, login

This host (VM-Hemanand) also was installed by using IBM Copy Services Manager software (the log in window is shown in Figure 4).

https://localhost:9559/CSM/WelcomePage.jsp?rea	son=invalid#TOP		
	-		
IBM	Сору	Services Ma	nager
	<b>►</b>		
	User name:	d	
	Password:		
		Log in	
the second s			

Figure 4 IBM copy service manager login window

For more information about installing IBM Copy Services Manager, see refer this IBM Documentation web page.

After IBM Copy Services Manager is installed, complete the following steps to build a Cyber security solution using IBM SV4PC on Azure and IBM Spectrum Virtualize Safeguarded Copy feature:

- 1. Create a Safeguarded Pool on IBM Spectrum Virtualize for Public Cloud in Azure.
- 2. Set up the volume group and Safeguarded policies.
- 3. Install and configure IBM Copy Services Manager.
- 4. Safeguard back up the production volume.
- 5. Restore/Recover data from immutable safeguarded copy snapshots.
- 6. Restore from Safeguarded Backup.
- Replicate the IBM Spectrum Virtualize for Public Cloud storage volume with IP replication between sites in Azure.

# Creating a Safeguarded Pool on IBM Spectrum Virtualize for Public Cloud in Azure

To configure the Safeguarded Copy function, the first step is to create to the Safeguarded backup location. The Safeguarded backup location is created as a special child pool.

A Safeguarded backup location is a child pool in each parent pool where the source volume is located. The Safeguarded backup location stores Safeguarded backup copies.

The Safeguarded Copy function supports the ability to create cyber-resilient point-in-time copies of volumes that cannot be changed or deleted through user errors, malicious actions, or ransomware attacks. The Safeguarded backup location can contain multiple versions of volume data that is backed up based on different copy intervals and retention to cover various recovery point objectives.

To create a Safeguarded backup location, complete the following steps:

**Note:** In this lab setup, we deployed the following SV4PCs in Azure Site A and Site B (see Figure 1 on page 5):

- Site A: So1-SVPC
- Site B: Rebook-SVPC-Azure
- 1. Log in to the Redbook-SVPC-Azure cluster management GUI.
- 2. In the management GUI, select **Pools**  $\rightarrow$  **Pools**.
- 3. Right-click a parent pool and select Create Child Pool.
- 4. On the Create Child Pool page, enter a name of the child pool.

If the parent pool is a standard pool, enter the amount of capacity that is dedicated to the child pool. If the parent pool is a data reduction pool, the child pool shares capacity with the parent pool, as shown in Figure 5 on page 10.

Create Child Pool	×
Create a child pool or a Safeguarded child pool for a parent storage pool. Use safeguarded child pools to store backups for a volume that protected by the Safeguarded Copy function.	is
Parent Pool	
mdiskgrp0 ~	
Parent Pool Capacity Details	
Available pool capacity: 1024 GiB	
Child Pool	
redbook_safeguarded	
Child Pool Capacity	
100 – + GiB ~	
Extent-Rounded Capacity: 100 GiB (1)	
Safeguard (1)	
Encryption	
Cancel Create	

Figure 5 Creating a child pool

- 5. Select **Safeguard** to indicate that the child pool is used as the Safeguarded backup location for immutable backup copies of source volumes
- 6. Click **Create**. Child pools that are used as Safeguarded backup locations are marked with a shield icon in the Pools page, as shown in Figure 6.

IBM Spectrum Virtualize for Public Cloud	Redbook-SPVC-Azure Pools		4	superuser Security Administrator
<	$\oplus$ Create $\checkmark$ $\coloneqq$ Actions $\checkmark$		Default	✓ Contains ✓ Filter
Dashboard	Name	State	Usable Capacity	Capacity Details
	∨ mdiskgrp0	<ul> <li>Online</li> </ul>	0 bytes / 1.00 TiB (0%)	100.00 GiB / 1.00 TiB (10%)
ഹ് <sup>മ</sup> Monitoring	<code>redbook_safeguarded</code> $igveet$	✓ Online		0 bytes / 100.00 GiB (0%)

Figure 6 Child pool created in the parent pool

In this lab setup, the redbook\_safeguarded child pool is configured in the parent mdiskgrp0.

### Setting up a volume group and Safeguarded policies

Volume groups are used to manage groups of related volumes to which a Safeguarded Copy Policy is attached.

Volume groups create a set of source volumes that can span different pools and are copied collectively to Safeguarded backup child pools with Safeguarded Copy function. Before you create a volume group, determine which source volumes you want to protect.

To create a volume group, complete the following steps:

- 1. In the management GUI, select **Volumes**  $\rightarrow$  **Volumes Groups**.
- 2. Click Create Volume Group.

On the Create Volume Group page, enter a name of the volume group. From the list of volumes, select of the volumes that you want in the volume group.

**Note:** If you select volumes in a parent pool that do not contain a child pool to use as the Safeguarded backup location, select **Navigate to Pools**. For each parent pool with source volumes, you must configure a child pool as the Safeguarded backup location.

3. Click **Create Volume Group**. In this lab setup, the volume group is created with the name redbook\_safeguarded\_policy, as shown in Figure 7.

Create Volume Group			
Select the volumes to include in the vol	ume group.		
Enter name			
redbook_safeguarded_policy			
		Default $\checkmark$ Cont	ains 🗸 Filter
Name	State	Safeguarded Backup Location Synchronized	Pool
redbook_safeguarded_sour	<ul> <li>Online (formatting)</li> </ul>	redbook_safeguarded	mdiskgrp0
redbook_safeguarded_sour	<ul> <li>Online (formatting)</li> </ul>	redbook_safeguarded	mdiskgrp0
< Showing 2 volumes   Selecting 2 volumes	nes (20.00 GiB)	No volume groups are To create a volume group, d	
Cancel Create Volume Group	<u>*</u>	Create Volume Group	

Figure 7 Creating a volume group and adding volumes

- 4. After the volume group is created, add source volumes to the volume group. In this example, the following source volumes were added to the volume group:
  - Volume 1: redbook\_safeguarded\_source0
  - Volume 2: redbook\_safeguarded\_source1

Figure 8 shows the two production volumes that were added to the redbook\_safeguarded\_policy volume group.

Crea	Create Volume Group						
Select	Select the volumes to include in the volume group.						
Enter n	ame						
red	book_safeguarded_policy						
			Default ~	Contains ~ Filter			
Nar	ne	State	Safeguarded Backup Location Synchronized	Pool			
	redbook_safeguarded_sour	<ul> <li>Online (formatting)</li> </ul>	redbook_safeguarded	mdiskgrp0			
	redbook_safeguarded_sour	<ul> <li>Online (formatting)</li> </ul>	redbook_safeguarded	mdiskgrp0			
۲				are configured. n. click Create Volume I			
Sho	wing <b>2</b> volumes   Selecting <b>2</b> volum	ies (20.00 GiB)					
Cance	Create Volume Group		Create Volume Group				

Figure 8 Volumes added to volume group

## Assigning a Safeguarded Policy

A Safeguarded policy controls the creation, retention, and expiration of Safeguarded backup copies of source volumes.

The management GUI supports displaying predefined and user-defined Safeguarded policies. Although the management GUI does *not* support creating user-defined Safeguarded policies, you can use the **mksafeguardedpolicy** command to create user-defined policies.

The predefined policies that are in the system are shown in Figure 9.

Select a Safeguarded policy to s and retention period cannot be o the command-line interface.	pecify how often copies occur and h hanged for pre-set policies, but add	ow long they are retained. The schedule ditional policies can be created through			
Safeguarded policies					
NAME	COPY INTERVAL	RETENTION			
predefinedsgpolicy0	Copy every 6 hours	Retain for 7 days			
NAME	COPY INTERVAL	RETENTION			
predefinedsgpolicy1	Copy every week	Retain for 30 days			
NAME	COPY INTERVAL	RETENTION			
predefinedsgpolicy2	Copy every month	Retain for 365 days			
Choose start schedule date	Cho	ose a time			
10/12/2021	D 1	0:00 AM ~			
Close	Assign				

Figure 9 Predefined safeguarded policies

To assign a Safeguarded backup policy to a volume group, complete the following steps:

- 1. In the management GUI, select Volumes  $\rightarrow$  Volumes Groups.
- 2. Select the volume group that you want to assign a predefined policy to and then, select Group Actions  $\rightarrow$  Assign Safeguarded policy.
- 3. Select one of the predefined Safeguarded policies (in this example. Predefinedsgpolicy1 is selected (see Figure 9).

For this policy, Safeguarded backup copies are created weekly and retained for a month.

**Note:** These predefined policies cannot be changed or deleted. If you create user-defined Safeguarded backup policies by using the **mksafeguardedpolicy** command, IDs start after the predefined policies.

The system supports a maximum of 30 Safeguarded backup policies with three predefined policies and 27 user-defined policies. If you create user-defined Safeguarded backup policies in the CLI, you can view and select these policies within the management GUI. Neither interface supports changes to predefined Safeguarded backup policies.

- 4. Select a date and time for when you want to start creating Safeguarded backups that use the policy.
- 5. Click Assign.

After the Safeguarded policy is assigned to the volume group, the status of the volume group displays as Safeguarded-scheduled, as shown in Figure 10.

Q Filter Volurie Groups	redbook_safeguarded_policy Beckup PAEcy: Copy every week, retain for 30 days Last backup time: Not available yet Croup Ac 20.00 GB Tota Croup Ac 20.00 GB Tota				
C Safeguarded-scheduled	≅ Actions • All Volumes •	C	Default v Contains v Ziller		
	Name	State	Saleguarded Backup Lo Synchronizec		
	redbook_safegaarded_source0	🖌 Online (formatting)	redbook_safeguarded		
	redbook_safeguarded_source1	🖌 Online (formatting)	redbook_saleguarded		

Figure 10 Safeguarded policy scheduled

This status indicates that the policy is assigned, but the Safeguarded backup has not started. When Safeguarded backups are stored on the Safeguarded backup location, the status of volume group displays Safeguarded. After Safeguarded copies are added to the Safeguarded location, users with Administrator role or lower cannot delete any parent pool with a Safeguarded location.

### Installing and configuring IBM Copy Services Manager

This section describes installing and configuring IBM Copy Services Manager.

IBM Copy Services Manager automates the creation of Safeguarded backup copies according to a schedule that is defined in a Safeguarded policy and the recovery and restoration operations with Safeguarded backup copies.

Ensure that the following requirements are met for IBM Copy Services Manager:

- IBM Copy Manager for IBM Spectrum Virtualize is purchased, which includes IBM Copy Services Manager version 6.3.0 or later. This license option is available through iERP/AAS, IBM Passport Advantage®, or your IBM Sales team.
- IBM Copy Services Manager version 6.3.0 or later is available for download from this IBM Support web page.

After you download IBM Copy Services Manager, complete the instructions for your installation. IBM Copy Services Manager supports several installation options on different environments. For more information, see this IBM Documentation web page.

#### Creating an Administrator user for IBM Copy Services Manager

Before you can establish the IBM FlashSystem as a connection endpoint in IBM Copy Services Manager, a user with an Administrator role must be configured on the IBM FlashSystem.

For auditing, it is recommended that you create an Administrator user to configure the Safeguarded Copy function. Users with this role are limited in how they can manage and interact with Safeguarded Copy operations. The IBM Copy Services Manager uses this role to create FlashCopy® mappings between the source volumes and the Safeguarded backup copies on the IBM® FlashSystem.

To create an administrator user on IBM SV4PC for IBM Copy Services Manager, complete the following steps:

- 1. Log in to the Redbook-SVPC-Azure cluster management GUI.
- 2. In the management GUI, select Access  $\rightarrow$  Users by Groups  $\rightarrow$  Create User.
- 3. On the Create Users page, enter the name of the user, select the Administrator group and then, select **Local**.
- 4. To connect to the management GUI by using this user, enter and confirm a password. Click **Create**.

In this example, the csm\_user user is created, which is used for IBM Copy Services Manager, as shown in Figure 11.

Create Us	ser						×
$\bigcirc$	Name						^
	csm_user						
Authentic	ation Mode						
Local	<ul> <li>Remote</li> </ul>	2					
User Group	p						
Adminis	trator 👻						
Local Cree	dentials must have a pas	sword, an SSH į	oublic i	key, or both.			
● Par	ssword requiren Minimum 8 charao Must not include p	nents cters long problematic charao	ters (e):	: control characters), or	r start o	r end with a space	
Password	١	/erify password					
•••••	•••••	•••••	••	]			
SSH Public	: Key						~
				Cancel		Create	

Figure 11 Creating an admin user for IBM Copy Services Manager

#### Creating a connection to the system in IBM Copy Services Manager

To use the Safeguarded Copy function, you must create a connection to the system in the IBM Copy Services Manager interface. Complete the following steps:

- 1. Log in to IBM Copy Services Manager at https://{*CSM\_SERVER\_IP/HOST*}:9559/CSM, where *CSM\_SERVER\_IP* is the IP address or Host name of IBM Copy Services Manager instance.
- 2. Select Storage  $\rightarrow$  Storage Systems.
- 3. On the Storage Systems page, select Add Storage Connection.
- 4. Click one of the following options based on your product:
  - FlashSystem Spectrum Virtualize
  - SAN Volume Controller
  - IBM Storwize® Family
- 5. On the Connections page, enter the following information for your system:
  - Cluster IP or Domain Name
  - Management IP address or domain name for your system
  - Username for the Administrator user for the system
  - Password that is associated with the Administrator user for the system

Click Finish.

6. On the Storage Systems page, verify that Local Status for the connection is Connected, as shown in Figure 12.

IBM Copy Services Manager	Overview	Sessions	Storage	Paths	Notifications	Console	Settings		
Storage > Storage Systems									
Storage Systems Connection	ns Easy Tier H	<b>EMS</b> eat Map Transfer							
Add Storage Connection	Select A	ction: Volun	ne Protection	l					
Storage System			Local Sta	tus	Loca	ation		🛇 Туре	Vendor
O <u>svc:cluster:redbpc</u>	K-SPVC-AZURE	(Redbook-SPVC-A	zure) 🔽 Connec	ted	Nor	ne	•	SVC	IBM
O SVC:CLUSTER:SOL-SVF	PC (Sol-SVPC)		Connec	ted	Nor	1e	•	SVC	IBM

Figure 12 Creating a connection to IBM FlashSystem in IBM Copy Service Manager

After a connection is established, IBM Copy Services Manager automatically detects volume groups with Safeguarded policies and schedules the backup copies.

IBM Copy Services Manager queries the system every 5 minutes to process Safeguarded policies. The start time that is defined in the Safeguarded backup policy must factor in the possible 5-minute delay.

When IBM Copy Services Manager detects new a Safeguarded backup policy for a volume group, it creates the session and scheduled task to create and manage the Safeguarded backup copies.

To view Safeguarded backup copies in IBM Copy Services Manager interface, select **Sessions**.

The session name is based on the name of the volume group and the storage system, In this example (see Figure 13), the redbook\_safeguarded\_policy volume group that is created on IBM SV4PC is automatically visible as a session in IBM Copy Services Manager, as shown in Figure 13.

IBM Copy Services Manager Overvie	w Sessions	Storage	Paths	Notifications	Console	Settings			
👚 Sessions									
Sessions • or severe • or warning • 1 normal Create Session Session Action	s: -								
Name	Group Name	Status	▲ State	a Type	Active Ho	st Active Site	Recovera	Progress	
safeguarded_copy_VG	Automatically Generate.	Vormal	Targ	et Available Backup	H1	Site 1	Yes	H1 <b>→</b> B1	0%
redbook_safeguarded_policy	Automatically Generate.	Inactive	Defir	ned Backup	H1	Site 1	No	N/A	

Figure 13 Safeguarded copy session automatically visible in IBM copy service manager

As part of this session, it includes two volumes, which are part of volume group (see Figure 14).



Figure 14 Volume information for the session

The IBM Copy Services Manager session details (see Figure 15) includes information about the Safeguarded policy that is set on the volumes for the backup and retention.

IBM Copy Services Manage	er Overview	Sessions	Storage	Paths	Notifications	Console	Settings
Sessions > redbook_safe	eguarded_policy						
redbook sa	feguarded	policy					
reaseen_ea	logualdoa_	poney					
Session Actions: -					00		
Status	O Inactive						
State	Defined			/			
Session Type	Safeguarded Copy			(			
Active Host	H1			(		R1	
Recoverable	No				Chu A		
Description	Automatically create session(modify)	d Safeguarded (	Сору		Site 1	5	
Copy Sets	2 (view)			N			
Group Name	Automatically Gener	ated Session		63			
Backup Schedule	Every 7 days						
Volume Group	redbook_safeguarde	ed_policy					
Backup Info Recover	Backup Info						
Total Number Backups	: 0 Total Recoverable	Backups: 0 Tota	Unrecoverable	Backups: 0			

Figure 15 Policy information for the safeguarded volume group

# Safeguarded backup of production volumes in IBM Spectrum Virtualize for Public Cloud on Azure

In this environment, the Safeguarded backup of the following production volumes is created: one volume is named redbook\_Safeguarded\_source0; second volume is named redbook\_safeguarded\_source1.

The Safeguarded backup is a crash IBM consistent FlashCopy. To create application consistency, the database must be quiesced or database is made read-only before the backup is taken.

In this example, we show the ad hoc backup that was created to demonstrate the Safeguarded backup; otherwise, the backup runs according to the schedule that is selected.

Complete the following steps:

- Log in to IBM Copy Services Manager at https://{CSM\_SERVER\_IP/HOST}:/:9559/CSM, where is the IP address or domain name of IBM Copy Services Manager instance in your network.
- 2. Select Sessions  $\rightarrow$  redbook\_safeguarded\_policy. Click Session Actions  $\rightarrow$  Commands  $\rightarrow$  Backup (see Figure 16).

IBM Copy Services Manage	er Overview	Sessions	Storage	Paths	Notifications	Console	Settings
Sessions > redbook_safe	guarded_policy						
redbook sa	feauarded	nolicy					
TCODOOK_30	leguarded_	policy					
Session Actions:							
Commands	Backup			/	i 🔤 🧕 🚽		
View/Modify	Refresh States			(	HI		
Export	Safeguarded Copy						
Remove Session	H1 No						
Description	Automatically create	d Safeguarded	Сору		Site 1	7	
Copy Sets	2 (view)						
Group Name	Automatically Gener	ated Session					
Baakun Sabadula	Even Z deve						
Volume Group	redbook_safeguarde	ed policy					
	_ •	_ ,					
Backup Info Recover	Backup Info						
Total Number Backups	0 Total Recoverable	Backups: 0 Tota	I Unrecoverable Ba	ckups: 0			

Figure 16 Ad hoc backup for the volume group

The Safeguarded backup copy is created by using IBM Copy Services Manager according to the schedule and Safeguarded policy that is assigned to volume group, as shown in Figure 17.

IBM Copy Services Manager	Overview	Sessions	Storage	Paths	Notifications	Console	Settings	
Sessions > redbook_safeguarde	d_policy							
Backup : IWNR1026I : Succes	s : (Open Console	Completed						
redbook_safeg	uarded_	policy						
Session Actions:								
Status	Normal			/	/ 🔤 🧕 👥			
State	Protected			(				
Session Type	Safeguarded	Copy		(				
Active Host	H1					R1		
Recoverable	Yes							
Description	Automaticall Copy sessio	y created Safeg n(modify)	juarded		Site 1	5		
Copy Sets	2 (view)							
Group Name	Automatical	y Generated Se	ession					
Backup Schedule	Every 7 days	5						
Last Recoverable Backup	2021-10-12	03:03:51 UTC						
Volume Group	redbook_sat	eguarded_polic	ÿ					
Backup Info Recover Backup	n Info							
Backup into Recover Backu	pinto							
Total Number Backups: 1 To	tal Recoverable B	Backups: 1 Total	l Unrecoverable Ba	ackups: 0				
Backup Time	<b>A</b>	Backup ID	Recov	erable	Copy Sets	Last F	Result	Expiration
2021-10-12 03:03:51 UTC		1634007830	Yes		2	<b>V</b> IV	/NR2800I	2021-10-13 03:03:51 UTC

Figure 17 Safeguarded backup completed per the backup policy assigned

 Log in to the Redbook-SVPC-Azure cluster management GUI and check the status of backup volumes. Click **Pools**.

The backup volumes are created in the Safeguarded backup location (also referred to as *child pool*), as shown in Figure 18.

IBM S	pectrum Virtualize for Public Cloud	Redbook-SPVC	-Azure Volumes by Pool					4		? super	user Security Adminis	trator ~
	<	Filter Po			redbook_safe	guarded 🥝					P	ool Actions $\!$
<b>^</b>		mdiskgrp(	2 Volume copies	~	2 Volume     Easy Tier     Safeguarded	copies Balanced					4% Used 96.00 GiB (96%) / 100.00 GiB Total (	Available Capacity
r T	Poolo		24.00 GiB (2%) Stored 1.00 TiB Total Usable		⊕ Create Volumes	$\equiv$ Actions $ {\mbox{ \bullet}}$	All Volumes 👻				Filter	Å
	10015	radbaak	asfeduarded		Name	State		Synchronized	UID		ŀ	lost Mappin
B		B)-	2 Volume copies	Ť	bk_1634007830_0	🗸 Onlin	e		60050	0760728A234978	0000000000	
			4.00 GiB (4%) Used		bk_1634007830_1	🔓 🗸 Onlin	e		60050	0760728A234978	000000000	
		🗊 Safeg	100.00 GIB Total Capacity uarded									

Figure 18 Immutable backup copies created

These immutable volumes in the Safeguarded location cannot be deleted, modified, or assigned to the host for read/write.

4. Check the status of source volume as Safeguarded, as shown in Figure 19.

Q Filter Volume Groups redbook_safeguarded_policy Nolumes	redbook_safeguarded_policy <a href="https://www.eek.retainfor30.deys">https://www.eek.retainfor30.deys</a> Last backup time: 10/11/2021 8:03 PM <a href="https://www.eek.retainfor30.deys">ttps://www.eek.retainfor30.deys</a> Last backup time: 10/11/2021 8:03 PM		Group Actions • 20.00 Gi8 Total Group Capacity
() Safeguarded	= Actions • All Volumes •	Defau	it V Contains V Filter
	Name	State	Safeguarded Backup Lo Synchronizec
	redbook_safeguarded_source0	<ul> <li>Online (formatting)</li> </ul>	redbook_safeguarded
	redbook_safeguarded_source1	<ul> <li>Online (formatting)</li> </ul>	redbook_safeguarded

Figure 19 Status of the volumes in volume group as Safeguarded

## Restoring and recovering data from immutable safeguarded backups

IBM Copy Services Manager provides an automated process that is used for testing that is called the Recover Backup action. The Recover Backup action creates recovered versions of Safeguarded backup copies that you can map to a host and verify that host applications run correctly.

To test Safeguarded backup copies, complete the following steps:

- Log in to https://{CSM\_SERVER\_IP/HOST}:9559/CSM, where https://{CSM\_SERVER\_IP/HOST}:9559/CSM, where CSM\_SERVER\_IP is the IP address or Host name of IBM Copy Services Manager instance.
- 2. On the Sessions Overview page, select Sessions.
- 3. On the Sessions page, select the volume group that contains Safeguarded backup copies that you want to recover.

4. Select which generation of the backup you want to recover; in this example we are restoring the latest backup, as shown in Figure 20 and Figure 21.

IBM Copy Services Manage	er Overview	Sessions	Storage	Paths	Notifications	Console	Settings	
Sessions > redbook_safe	guarded_policy							
Backup : IWNR1026I :	Success : (Open Console	e) : Completed						
redbook sa	feguarded	policy						
roubook_ou	logualaoa_	poney						
Session Actions:						1		
Commands	Backup			,				
View/Modify	Recover Backup			(				
Export	Restore Backup			(				
Remove Session	Refresh States				R	0		
Description	TerminateH1R1	Safeo	uarded		Site 1			
Peeerbaen	TerminateH1R1 Kee	o R1	daraod					
Copy Sets	2 (view)	Ly Constant Co	aalaa					
Group Name	Automatical	ly Generated Se	SSION					
Backup Schedule	Every 7 day	S						
Volume Group	redbook sa	fequarded polic	v					
	_	0 1	, ,					
Backup Info Recover	Backup Info							
Total Number Backups	1 Total Recoverable	Backups: 1 Total	Unrecoverable Bac	kups: 0				
ioun runner backups		Suchaps. 1 Total	on coordiable bac	inalpo. o				
Backup Time		Backup ID	Recover	able	Copy Sets	Last Re	esult	Expiration
2021-10-12 03:03:51 U	TC	1634007830	Yes		2		IP29001	2021-10-13 03:03:51 UTC
2021 10 12 00.00.01 0			100				1120001	2021 10 10 00.00.01 010

Figure 20 Recover backup from the latest backup

A DAY WELLING THE THEFT	Backup ID	Copy Set	L.
2021-10-12 03:03:51 UTC	1634007830	2	

Figure 21 Recovering the latest copy backup

After the recovery completes, the recovery happens on the new volume in the parent pool where the source volume are originally present (see Figure 22).

IBM Copy Services Manager	Overview Ses	sions Storage	Paths	Notifications	Console	Settings
Sessions > redbook_safeguarded	_policy					
Recover Backup : IWNR1026I : :	Success : (Open Console	e) : Completed				
redbook safegu	arded polic	cv				
_ 0		,				
Session Actions:				000	1	
Status	Normal		/	· 🗧 🧕 🧧		
State	Target Available		(			
Session Type	Safeguarded Copy		(			
Active Host	H1					
Recoverable	Yes			Site 1	/	
Description	Automatically create Copy session(modified)	ed Safeguarded fv)		5101		
Copy Sets	2 (view)	,,				
Group Name	Automatically Gene	rated Session				
Backup Schedule	Everv 7 davs					
Last Recoverable Backup	2021-10-12 03:03:5	51 UTC				
Volume Group	redbook_safeguard	ed_policy				
Backup Info Recover Backup	Info					
Decement Declars T	D-t-			D		Error
Recovered Backup Time	Backup		Volum	es Recovered		Error
2021-10-12 03:03:51 UTC	163400	7830	2			No

Figure 22 Status of the recovered volume

5. Log in to the IBM SV4PC storage (https://40.10.1.28:8443/login), and check the status of recovered volumes, as shown in Figure 23.

Filter Po	ols		mdiskgrp0 ⊘     ⊕ Create Volumes	Volumes •		
mdiskgrp0		~	Name		¥	State
r881	4 Volume copies		redbook_safeguarded_source1_211011200351	Þ		<ul> <li>Online (formatting)</li> </ul>
	44.00 GIB (4%) Stored 1.00 TiB Total Usable		redbook_safeguarded_source1			<ul> <li>Online (formatting)</li> </ul>
			redbook_safeguarded_source0_211011200351			<ul> <li>Online (formatting)</li> </ul>
redbook_	_safeguarded	~	redbook_safeguarded_source0			<ul> <li>Online (formatting)</li> </ul>
₩)a	2 Volume copies					
Ŧ	4.00 GiB (4%) Used 100.00 GiB Total Capacity					
🕕 Safeg	uarded					

Figure 23 Recovered volume information

For more information about how to log in to IBM SV4PC Cluster, see "Single-site scenario: Deploy IBM Spectrum Virtualize for Public Cloud in Azure" on page 7.

The newly recovered volumes that are shown in Figure 23 on page 23 can be mapped to the host to check for data integrity and consistency:

- redbook\_safeguarded\_source0\_211011200351
- redbook\_safeguarded\_source1\_211011200351)

#### Restoring from a Safeguarded backup copy

If your production data was compromised by a cyberattack, you can restore data to the source volumes by using a Safeguarded backup. The IBM Copy Services Manager automates and simplifies the process of testing and restoring compromised data from a Safeguarded backup copy.

Before you can restore data to the source volume with a Safeguarded backup copy, ensure that you fully test the Safeguarded backup copies that are associated with the compromised source volume by recovering to an alternative volume and validating the data on that recovery volume.

Multiple versions of Safeguarded backup copies can exist, and some versions can include malware or damaged data. The restore operation copies all source volume data with the version of the Safeguarded backup copy from which you are restoring.

To restore Safeguarded backup copies, complete the following steps:

- Log in to https://{CSM\_SERVER\_IP/HOST}:9559/CSM, https://{CSM\_SERVER\_IP/HOST}:9559/CSM, where CSM\_SERVER\_IP is the IP address or Host name of IBM Copy Services Manager instance
- 2. On the Sessions Overview page, select Sessions.
- 3. On the Sessions page, select the volume group that contains the Safeguarded backup copies that you want to restore.
- 4. Select Session Actions  $\rightarrow$  Command  $\rightarrow$  Restore Backup.
- 5. On the Restore Backup page, select the version of the Safeguarded backup copy that you want to restore. Safeguarded backup copies are displayed by their backup time from the most recent to the latest version. Restored Safeguarded backup copies replace the source volumes that is defined in volume group.
- 6. Click Yes.

## Two-site Airgap scenario: Replicating the IBM Spectrum Virtualize for Public Cloud storage volume between two sites in Azure

In this section of two-site air-gap scenario, we describe the configuration steps that were done in the lab setup. This setup was deployed IBM SV4PC on Site A and Site B in Azure, as described in the architecture (see Figure 1 on page 5).

In this demonstration, we added two volumes on IBM SV4PC in Site A and created similar size volumes on IBM SV4PC in Site B. We also replicated the volumes by using native storage-based replication (global mirror) from IBM SV4PC storage

After the volumes are replicated, we create a Safeguarded Copy of the volume at Site B and create a Safeguarded backup. After the Safeguarded backup is completed, we started a recovery of latest Safeguarded backup copy and assigned a recovered volume to the restore VM. Then, we checked the sample data that is available on the recovered volumes:

- So1-SVPC: Name of the SV4PC storage in Site A in Azure region
- Redbook-SVPC-Azure: Name of the SV4PC storage in Site B Azure region

Complete the following steps:

**Note:** Before creating the partnership, ensure that you set up the IP address and portset for remote copy. For more information, see this IBM Documentation web page.

- Set up an IP replication between two sites: So1-SVPC (Site A) and Redbook-SVPC-Azure (Site B).
- Log in to the So1-SVPC storage (Site A), select Copy-Services and then, click Remote Copy. Click Create Partnership → Two site partnership → IP. Enter the information as shown in Figure 24 on page 26. Click Create to set up the partnership.

Partner IP Address			
40.10.1.28			
Link Bandwidth (Mbps) 🛈		Background Copy Rate (9	6) (j)
1000		50	
Partner CHAP Secret		Compression Enabled	
Enter Value	٢	Off	
Portset Link 1		Portset Link 2 (Optional)	
portset1	~	portset2	~
Cancel		Create	

Figure 24 Creating partnership Sol-SVPC (Site A)

A message is displayed when the creation process completes (see Figure 25).

View more details The Lask is two complete. Creating IP partnership with 40.10.1.28 Running command: svctask mkippartnership -backgroundcopyrate 50 -clusterip 40.10.1.28 -compressed no -link1 portset1 -linkbandwidthmbits 1000 -type ipv4 Synchronizing memory cache. The task is 100% complete. Fack completed	
View more details The Lask 15 0% complete. Creating IP partnership with 40.10.1.28 Running command: svctask mkippartnership -backgroundcopyrate 50 -clusterip 40.10.1.28 -compressed no -link1 portset1 -linkbandwidthmbits 1000 -type ipv4 Synchronizing memory cache. The task is 100% complete. Fack completed	
Creating IP partnership with 40.10.1.28 Running command: svctask mkippartnership -backgroundcopyrate 50 -clusterip 40.10.1.28 -compressed no -link1 portset1 -linkbandwidthmbits 1000 -type ipv4 Synchronizing memory cache. The task is 100% complete.	U3.U1 .
Running command: svctask mkippartnership -backgroundcopyrate 50 -clusterip 40.10.1.28 -compressed no -link1 portset1 -linkbandwidthmbits 1000 -type ipv4 Synchronizing memory cache. The task is 100% complete.	03:01
svctask mkippartnership -backgroundcopyrate 50 -clusterip 40.10.1.28 -compressed no -link1 portset1 -linkbandwidthmbits 1000 -type ipv4 Synchronizing memory cache. The task is 100% complete.	03:01
Synchronizing memory cache. The task is 100% complete.	03:01
The task is 100% complete.	03:01
Task completed	03:01
lask compreted.	03:01
Class	h-

Figure 25 Partnership creation process complete (Site A)

 Log in to the Redbook-SVPC-azure storage (Site B). Select Copy-Services and then, click Remote Copy. Click Create Partnership → Two site partnership → IP. Enter the information as shown in Figure 26. Then, click Create to set up the partnership.

Create Partnership	×
Partner IP Address	
40.10.1.4	
Link Bandwidth (Mbps)	Background Copy Rate (%)
1000	50
Partner CHAP Secret	Compression Enabled
Enter Value 💿	Off
Portset Link 1	Portset Link 2 (Optional)
portset1 ~	Select a Portset 🗸 🗸
Cancel	Create

Figure 26 Creating partnership Redbook-SVPC-Azure (Site B)

A message is displayed when the creation process completes (see Figure 27).



Figure 27 Partnership creation process complete (Site B)

4. Ensure that you added iSCSI hosts and volumes to the hosts. In our lab setup, two hosts are available (VM-Hemanand and Restore-VM-Hemanand).

We added two Volumes to these hosts and replicated the volumes by using native replication from IBM SV4PC storage. After the volumes are replicated, we create a Safeguarded Copy of the volume at Site B and a Safeguarded backup.

After the Safeguarded backup is completed, we start a recovery of latest Safeguarded backup copy and assign a (recovered volumes) to the restore VM. Then, we check the sample data that is available on recovered volumes.

As described in Step 4, to add iSCSI host and volumes to the storage, Figure 28 shows the sample iSCSI connection from the Restore-VM-Hemanand where targets are added in the iSCSI configuration of the Windows hosts. In a similar way, you must add targets and a configuration to the Windows host (see Figure 28).

	ator rrope	i i i i i i i i i i i i i i i i i i i			
rgets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration
Quick C	Connect				
To disc DNS na	over and log ame of the ta	) on to a target usin arget and then click	g a basic connection, t Quick Connect.	ype the IP	address or
Target	:			Qu	uick Connect
iscove	ered targets				
					Refresh
Name				Status	
ign. 19	986-03.com.i	bm:2145.redbook-s	spvc-azure.node1	Connected	d
ign. 19	986-03.com.i	ibm:2145.redbook-s	pvc-azure.node2	Connected	d
ign. 19	986-03.com.i	ibm:2145.sol-svpc.r	node1	Connecte	d
fo con	nect using a	dvanced options, se	ect a target and then		Connect
To con dick Co	nect using a nnect. Ipletely disco	dvanced options, se	elect a target and then		Connect
To con dick Co To com hen d	nect using a onnect. Ipletely disco ick Disconne	dvanced options, se innect a target, sele ct.	elect a target and then		Connect Disconnect
To con click Co To corr then d =or tar select	nect using a onnect. upletely disco ick Disconne get properti the target ar	dvanced options, se nnect a target, sele ct. es, including configu nd click Properties.	elect a target and then ect the target and uration of sessions,		Connect Disconnect Properties
To con dick Co To con then d For tar select For co the tar	nect using an onnect. Ipletely disco ick Disconner get properti the target ar ofiguration o get and ther	dvanced options, se nnect a target, sele ct. es, including configu nd click Properties. f devices associated n click Devices.	elect a target and then ect the target and uration of sessions, d with a target, select		Connect Disconnect Properties Devices
To con click Co To con then cl For tar select For con the tar	nect using ai nnect. Ipletely disco ick Disconner ick Disconner the target ar nfiguration o 'get and ther	dvanced options, se onnect a target, sele ct. es, including configu nd dick Properties. f devices associated n dick Devices.	elect a target and then ect the target and uration of sessions, d with a target, select		Connect Disconnect Properties Devices
To con dick Co Fo con then cl For tar select For cor the tar	nect using an innect. ipletely disco ick Disconner ick Disconner inget properti the target ar nfiguration o get and ther	dvanced options, se onnect a target, sele ct. es, including configu nd dick Properties. f devices associated n dick Devices.	elect a target and then ect the target and uration of sessions, d with a target, select		Connect Disconnect Properties Devices

Figure 28 Sample iSCSI configuration from Windows host

After you set up the remote replication and added iSCSI hosts, start the replication of the volumes. Log in to the source side SV4PC; that is. Site A (Sol-SVPC). Select Copy Services → Remote Copy → Add Consistency group. Select the location of the target volumes and then, click Add (see Figure 29).

Add Consistency Group	×
Consistency groups simplify management because copy actions are applied simult group.	nt of related remote-copy relationships aneously to all relationships in the
Group name	
redbook-svpc	
Location of target volumes	
Redbook-SPVC-Azure	~
Cancel	Add
	6

Figure 29 Add Consistency Group window

Figure 30 shows the status of the configured consistency group.

Consistency			
Redbook-SPVC-Azure : Configured Add Consist New 1	y Groups (1) rency Group +	Independent Rel	ationships (0)
	⊖→ 曽 redbook-svpc <sub>Empty</sub>	PRIMARY	RELATIONSHIPS 0

Figure 30 Consistency group configured

- 6. To create a relationship, log in to the Sol-SVPC and select **Copy Services**. Select the Redbook-SVPC-Azure storage in the Remote copy tab. Click **Create Relationship** and then, Select **Global Mirror** and then, the **use consistency protection** option. Click **Next**.
- Click another system and select Redbook-SVPC-Azure. Then, click Next → Master. In the drop-down menu, select Sol-SVPC-Source1 and Auxiliary. In the drop-down menu, select Sol-SVPC-Target1. Click Add and then, select No, do not add master change volume. Click Finish.
- 8. In a similar way add, volumes to the relationship Sol-SVPC-Source0 to Sol-SVPC-Target0. Click **Next** and then, select **No, the volumes are not synchronized**. Click **Next**.
- 9. Select Yes, Start copying. Click Finish. After the relationship is created, click Close.

Before the relationship is created, ensure that the correct volumes were created on SVPC on both sites. In our lab, we set up the following volumes that were used for source and target volumes (see Figure 31 and Figure 32):

- Sol-SVPC: Sol-SVPC-Source0
- Sol-SVPC: Sol-SVPC-Source1
- Rebook-SVPC-Azure: Sol-SVPC-target0
- Rebook-SVPC-Azure: Sol-SVPC-target1

Name         State         Synchronized         Pool         UID           Safeguarded_Copy0_2110         ® Degraded         mdiskgrp0         600507607287618C780000000           Safeguarded_Copy1_2110         ® Degraded         mdiskgrp0         600507607287618C7800000000           Sol-SVPC-Source1         ® Degraded         mdiskgrp0         600507607287618C7800000000           Sol-SVPC. Source0         ® Degraded         mdiskgrp0         600507607287618C7800000000	⊕ Create Volumes	Actions • All Vol	umes •		Default ~
Safeguarded_Copy0_2110         Degraded         mdiskgrp0         60050760728761BC780000000           Safeguarded_Copy1_2110         8 Degraded         mdiskgrp0         60050760728761BC7800000000           Sol-SVPC-Source1         9 Degraded         mdiskgrp0         60050760728761BC7800000000           Sol-SVPC-Source1         9 Degraded         mdiskgrp0         60050760728761BC7800000000           Sol-SVPC. Source0         8 Degraded         mdiskgrp0         60050760728761BC7800000000	Name	State	Synchronized	Pool	UID
Safeguarded_Copy1_2110         Degraded         mdiskgrp0         60050760728761BC780000000           Sol-SVPC-Source1         Degraded         mdiskgrp0         60050760728761BC7800000000           Sol-SVPC. Source0         Degraded         mdiskgrp0         60050760728761BC7800000000	Safeguarded_Copy0_211	0, 😗 Degraded		mdiskgrp0	60050760728761BC7800000000
Sol-SVPC-Source1         Degraded         mdiskgrp0         600507607287618C780000000           Sol-SVPC. Source0         IDegraded         mdiskgrp0         600507607287618C7800000000	Safeguarded_Copy1_211	0 🤨 Degraded		mdiskgrp0	60050760728761BC7800000000
Sol-SVPC Source0 Destaded mdiskerp0 600507607287618C7800000000	Sol-SVPC-Source1	Degraded		mdiskgrp0	60050760728761BC7800000000
	Sol-SVPC_Source0	• Degraded		mdiskgrp0	60050760728761BC780000000

Figure 31 Source volume information

Create Volumes	$\equiv$ Actions $\bullet$	All Volumes 👻			Default $\checkmark$ Contains $\checkmark$
Name		State	Synchronized	Pool	UID
Sol-SVPC-Target0		<ul> <li>Online (formatting)</li> </ul>		mdiskgrp0	60050760728A23497800000000
Sol-SVPC-Target1		<ul> <li>Online (formatting)</li> </ul>		mdiskgrp0	60050760728A23497800000000

Figure 32 Volume target information

Figure 33 shows the status of relationship and the state as Inconsistent Copying.

Partnerships		Redbook	-SPVC-Azure	;		Actions •
@ Sol-SVPC	I	Configured				
Padhoak-SP//C-Amura		Consistency Grou	ups (1)		Independent Relationships (2)	
Configured		Create Relation	ionship 🗏 🗄 Actions 🔹	*	Default $\checkmark$ Contains $\checkmark$	Filter
		Name	↑ State	Master Volum	Replication Direction	Auxiliary Volume
		rcrei0	Inconsistent Copying	Sol-SVPC-Source	ı →	Sol-SVPC-Target1
		rcrei1	Inconsistent Copying	Sol-SVPC_Source	∞ <b>→</b>	Sol-SVPC-Target0

Figure 33 Relationship created for two volumes

10. To add the volume relationship to a consistency group, select **Copy Services** → **Remote Copy**. Select **Redbook-SVCP-Azure** and then, click **Independent Relationship**.

## 11.Select the Master volume and then, right-click and select **Add to Consistency Group** (see Figure 34).

Partnerships		Redbook-SPVC-Azure		Actions
@ Sol-SVPC	I	Configured		
Padhook 60% Arris		Consistency Groups (1)	Independent Relationships (2)	
Configured		$\oplus$ Create Relationship $\equiv$ Actions •	Detault ~ Contains ~ Filter	
		Name 🛧 State	Master Volume Replication Direction Auxilia	ry Volume
		rcrei0 Inconsistent Copying	Sol-SVPC-Sourcet Sol-SVP	C-Target1
		rcret1 Inconsistent Copying	Sol-SVPC_Sourced Sol-SVP	C-Target0
			Add to Consistency Group	
			Convert to 3-site	
			Change Volumes	
			Start	

Figure 34 Adding relationship volumes to consistency group

12. Check the state of the replication.

The Inconsistent Copying status changes (see Figure 35) to Consistent Synchronized after initial synchronization is achieved (see Figure 36 on page 32).

Partnerships	redbook-sy ← Back to Redbook-SP	vpc-CG <sup>vc-Azure</sup>			Actions •
Redbook-SPVC-Azure	redbook-svpc-	CG	Gr	iroup info	
Configured		_ —®→ 몸	Rej	eplication type rimary site	Sol-SVPC
	Sol-SVPC Master	Redbook-SPVC-	Azure Cyc	ycle period (1) reeze time (1)	300 s
			۵n ور	roup ID	0
	Relationships (	2)			
	⑦ Create Relationsh           Name         ↑	lip   ≔ Actions •   土	Master Volume	Default  Contains  Replication Direction	Auxiliary Volume
	rcret0	Inconsistent Copying Inconsistent Copying	Sol-SVPC-Source1 Sol-SVPC_Source0	$\underset{\longrightarrow}{\longrightarrow}$	Sol-SVPC-Target1 Sol-SVPC-Target0

Figure 35 Copy status displayed as consistent copying

Partnerships @ Sol-SVPC	1	Redbook-SPVC-Azure			Actions
Redbook-SPVC-Azure Configured	:	Consistency Groups (1) Add Consistency Group + No issues 1 ~	Independe	nt Relationships (0)	T
0		B ← ● B redbook-svpc-CG Consistent synchronized	PRIMARY Sol-SVPC	RELATIONSHIPS 2	of Global

Figure 36 Copy status displayed as consistent synchronized

13.Add the target volumes (So1-SVCP-target0 and So1-SVPC-Traget1) to the volume group by logging in to the Redbook-SVCP-Azure (Site B) storage. Select Volumes → Volume Group → Group Actions. In the drop-down menu, select Add volume. Select the two volumes: Sol-SVPC-target0 and Sol-SVPC-target1. Click Add Volumes.

Ensure that the backup policy is assigned to the volume group for the scheduled Safeguarded Copy backup of the volumes (see Figure 37).

Q Fifter Volume Groups	redbook_safeguarded_policy Backup Policy: Copy every week, retain for 3D Last backup time: Not available yet	days	Group Actions
redbook_safeguarded_policy 2 Volumes	Image: Safeguarded-scheduled     Image: Safeguarded-scheduled       Image: Safeguarded-scheduled-sche	es have pending backups	Default V Contains V Filler
	Name	State	Safeguarded Backup Lo Synchronizec
	Sol-SVPC-Target0	🖌 Online	redbook_safeguarded
	Sol-SVPC-Target1	🖌 Online	redbook_safeguarded

Figure 37 Volumes added to volume group

14.Log in to the IBM Copy Service Manager by using the csmadmin user and password. Select **Session** and you can see the newly created session in IBM Copy Services Manager. The Redbook-Safeguarded-Policy session was used in our lab setup (see Figure 38).

IBM Copy Services Manager Overview	Sessions	Storage	Р	aths Noti	fications	Console	Settings		
👚 Sessions									
Sessions									
1 normal									
Create Session Session Actions:	7								
Name	Group Name	Status	-	State	Туре	Active H	ost Active Site	Recovera	Progress
safeguarded_copy_VG	Automatically Generate	- Normal		Target Available	Backup	H1	Site 1	Yes	N/A
redbook_safeguarded_policy	Automatically Generate	Inactive		Defined	Backup	H1	Site 1	No	N/A

Figure 38 Session automatically discovered in IBM Copy Services Manager

## 15. Select Redbook-Safeguarded-Policy and then, select Session Action $\rightarrow$ Commands $\rightarrow$ Backup $\rightarrow$ Retention days (1). Click Yes. The backup is created (see Figure 39).

I	BM Copy Services Manager	Overview Sessions	Storage	Paths	Notifications	Console	Settings	
龠	Sessions > redbook_safeguarded	_policy						
	Backup : IWNR1026I : Success	: (Open Console) : Completed						
	redbook_safegu	arded_policy						
	Session Actions:					1		
	Status	Normal		/	See 19 19 19 19 19 19 19 19 19 19 19 19 19			
	State	Protected		(				
	Session Type	Safeguarded Copy		(				
	Active Host	H1			R	1)		
	Recoverable	Yes			Site 1			
	Description	Automatically created Safeg Copy session(modify)	juarded		0.001			
	Copy Sets	2 (view)						
	Group Name	Automatically Generated Se	ession					
	Backup Schedule	Every 7 days 2021-10-13 03:39:34 UTC			~	<u>ل</u>		
	Volume Group	redbook_safeguarded_polic	У					
	Backup Info Recover Backup	Info						
	Total Number Backups: 1 Tota	I Recoverable Backups: 1 Tota	I Unrecoverable Bac	<b>kups:</b> 0				
	Backup Time	<ul> <li>Backup ID</li> </ul>	Recover	able	Copy Sets	Last Resi	ult Expiration	1
	2021-10-13 03:39:34 UTC	1634096371	Yes		2	<b>WNR</b>	28001 2021-10-1	4 03:39:34 UTC

Figure 39 Safeguarded copy backup created

16.Log in to the SV4PC Storage and select **Pools**. Click the Safeguarded Pools and verify that the backup volumes were created (see Figure 40).

Filter Poo	6 Volume copies 54.00 GiB (5%) Stored 1.00 TiB Total Usable	~	redbook_safeguarded          2 Volume copies         Easy Tier: Balanced         ③ Safeguarded         ④ Create Volumes         Image: Actions -         All Volumes -	
redbook_	safeguarded 2 Volume copies 4.00 GiB (4%) Used 100.00 GiB Total Capacity arded	~	Name         ↓           bk_1634096371_1            bk_1634096371_0	State <ul> <li>Online</li> <li>Online</li> </ul>

Figure 40 Safeguarded copy backup volumes created

Similar to how you can recover the volumes, after the backup is completed, log in to IBM Copy Services Manager and select **Session Actions**  $\rightarrow$  **Commands**  $\rightarrow$  **Recover Backup**. Select **backup ID** and click **Yes**.

17. Click the Recover backup tab and check the status of the recovery, as shown in Figure 41.

IBM Copy Services Manager	Overview Sessions	Storage	Paths	Notifications	Console	Settings
Sessions > redbook_safeguarded	_policy					
Recover Backup : IWNR1026I : \$	Success : (Open Console) : Complet	ed				
redbook_safegu	arded_policy			-35		
Session Actions:  Status State Session Type Active Host Recoverable Description Copy Sets Group Name	Normal Target Available Safeguarded Copy H1 Yes Automatically created Safegu Copy session(modify) 2 (view) Automatically Generated Ses	arded		Site 1		
Backup Schedule Last Recoverable Backup Volume Group Backup Info Recover Backup	Every 7 days 2021-10-13 03:39:34 UTC redbook_safeguarded_policy					
Recovered Backup Time	<ul> <li>Backup ID</li> </ul>		Volum	es Recovered		Error
2021-10-13 03:39:34 UTC	1634096371		2			No

Figure 41 Recover backup info volume information

18.Log in to the SV4PC Storage and select **Pools**. Click **Safeguarded Pool** and check that the recover volumes were created in the pool, as shown in Figure 42.

Filter Poo	ols		mdiskgrp0 ⊘ ⊕ Create Volumes I Actions ▼ All Volumes ▼ 2 MDisks. 8 Volume copies		
mdiskgrp0	)	~	Name	↑	State
r881	8 Volume copies		Sol-SVPC-Target0		✓ Online
	64.00 GiB (6%) Stored 1.00 TiB Total Usable		Sol-SVPC-Target0_211012203934		<ul> <li>Online (formatting)</li> </ul>
			Sol-SVPC-Target1		✓ Online
redbook_	safeguarded	~	Sol-SVPC-Target1_211012203934		<ul> <li>Online (formatting)</li> </ul>
	2 Volume copies				
Color	100.00 GiB Total Capacity				
🕕 Safegu	uarded				

Figure 42 Recovered volume information

19. To map the recovered targets to the recovery host, log in to the SV4PC storage (Site B). Click **Hosts** and then, select **Volumes by hosts and Clusters**.

20. Select Host Restore-VM → Host Actions → Modify volume mapping. Click Add Volume mapping. Select the recovered volume and then, click Next. Click Map Volumes (see Figure 43).

Host Cluster Q Filter Hosts	Restore-VM I Port 2 Mapped Volumes Generic			
Restore-VM O 10.00 GiB Total Provisioned 1 Port, 2 Mapped Volumes	Mapped Volumes           ⊕ Create Volumes         ≔ Actions ▼	Port Definitions		Properties
Windows-VM 20.00 GiB Total Provisioned 1 Port, 2 Mapped Volumes	Name Sol-SVPC-Target0_211012203934	State	Synchronized	Pool mdiskgrp0
	Sol-SVPC-Target1_211012203934	<ul> <li>Online (formatting)</li> </ul>		mdiskgrp0

Figure 43 Mapped recovered target volumes to host

21.Log in to the target VM; that is, Restore-VM (Windows 2019 DC Host). Open Computer management and select **Disk management** → **Rescan Disks**. Then, select the disk and right-click and select **Online**, as shown in Figure 44.

Sector 2017 - Remote Desktop Co	nnection							
🌆 Computer Management								
File Action View Help								
🗢 🔿 🙍 🖬 🗩	<b>V</b>							
🛃 Computer Management (Local)	Volume	Layout	Туре	File System	Status	Capacity	Free Space	% Free
V System Tools	- Safeguarded_Cop	y0 (G:) Simple	Basic	NTFS	Healthy (Primary Partition)	4.98 GB	4.96 GB	99 %
> 🕑 Task Scheduler	- Safeguarded_Cop	y1 (E:) Simple	Basic	NTFS	Healthy (Primary Partition)	4.98 GB	4.81 GB	97 %
> 🛃 Event Viewer	Safeguarded_Cop	y1 (F:) Simple	Basic	NTFS	Healthy (Primary Partition)	4.98 GB	4.81 GB	97 %
> 👔 Shared Folders	System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)	500 MB	465 MB	93 %
Local Users and Groups	Temporary Storag	e (D:) Simple	Basic Basic	NIFS	Healthy (Page File, Primary Partition)	16.00 GB	14.07 GB	88 %
> N Performance	- windows (C:)	Simple	Dasic	INTES	Healthy (Boot, Crash Dump, Primary Partition)	120.51 GD	115.20 GB	91 70
Device Manager								
<ul> <li>Storage</li> <li>Windows Sonver Backup</li> </ul>								
Disk Management								
Services and Applications								
Services and Applications								
	T Disk 2							
	Basic	Safamuardad Com	1 (E.)					
	4.98 GB	4.98 GB NTFS	I (E:)					
	Online	Healthy (Primary Pa	tition)					
	O Disk 3							
	Basic							
	4.98 GB	Online						
		Drawartian						
		Properties						
	- Disk 4	Help						
	Basic	Safeguarded Copy	1 (F:)					
	4.98 GB	4.98 GB NTFS						

Figure 44 Restore VM Volume information for sample data

22.Check the status of the test folder that is available in the recovered volumes, as shown in Figure 45.



Figure 45 Sample data available on the restored volume

This demonstration showed how to create a Safeguarded Copy solution for the cloud scenario for the IBM SV4PC storage in Azure. The Safeguarded Copy function was performed on the replicated Spectrum Virtualize instance, which is airgap isolated from the instance that is running the primary workload.

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