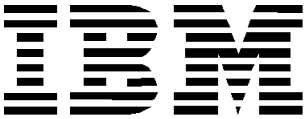
IBM® Storage

IBM FlashSystem for VMware vSphere with Tanzu Basic Edition

An IBM Validated Solution Guide

IBM Storage Team



Contents

Overview

The focus of this Blueprint is to demonstrate how IBM FlashSystem® with IBM Spectrum® Virtualize can be used as a preferred back-end persistent storage for VMware Tanzu-based deployments.

This document describes the use of IBM® FlashSystem storage volumes as virtual volumes (vVols) that are made available to provision persistent volumes for a VMware Tanzu deployment.

All models of IBM FlashSystem family are supported by this document, including:

- FlashSystem 9100 and 9200
- FlashSystem 7200
- FlashSystem 5000
- IBM SAN Volume Controller
- All storage that is running IBM Spectrum Virtualize software

By using IBM Spectrum Connect VASA provider with IBM Spectrum Virtualize, the vVols are used to create a data store under vCenter. Post provisioning of VMware Tanzu Kubernetes grid service (TKGS), the vVols data store is used to provision the persistent volumes for future applications that are deployed on the worker nodes.

Executive summary

Container adoption is growing rapidly as enterprises increasingly create and deploy containerized applications into production environments. Most companies are building and containerizing new applications to support their evolving business challenges, which gives them the agility that is needed to address dynamic market needs.

Another key area for container growth concerns developing container native applications. These applications provide developers with the ability to spin up environments for application development with persistent self-service storage capabilities that support fast, flexible application delivery.

VMware Tanzu allows businesses to run Kubernetes in vSphere and manage Kubernetes across multiple clouds, whether its public or private, while allowing customers to automate the delivery of containerized workloads.

According to VMware, VMware Tanzu Basic simplifies the operation of Kubernetes on-premises by placing cloud native constructs at the virtualization administrator's fingertips as part of vSphere 7. It delivers an open source-aligned Kubernetes distribution, which is packaged for the enterprise and delivered as part of your infrastructure to support application modernization.

Whether the use case is operations or development, providing persistent storage that reliable, available, secure, and Enterprise-class is a key requirement for customers. As customers scale containerized applications in Tanzu beyond dev/test or departmental use, IBM’s award-winning FlashSystem storage solutions deliver the enterprise data resources and storage to containers. Therefore, mission-critical infrastructure is now possible, delivering shared-storage operational efficiency, price-performance leadership, and security.

IBM integrated, qualified, and documented a step-by-step approach for IBM FlashSystem with VMware Tanzu environments, which reduces risk and speeds deployment time of the end-to-end solution.

Scope

The focus of this Blueprint is to use IBM FlashSystem storage as vVols volumes for TKGS-based container application deployments.

This document does not discuss installing VMWare Tanzu or IBM Spectrum Connect. The document focuses on how to use a vVol data store that is provisioned by using IBM Spectrum Connect VASA provider to a host TKGS cluster. This document also discusses how to provision a persistent volume by using a StorageClass entity in TKGS clusters during deployment of MySQL database image.

For more information about installing and configuring IBM Spectrum Connect, see this IBM Docs web page.

For more information about configuring vVols with IBM Spectrum Virtualize, see *Quick-start Guide to Configuring VMware Virtual Volumes for Systems Powered by IBM Spectrum Virtualize*, REDP-5321.

For more information about installing Tanzu with vSphere, see *vSphere with Tanzu Configuration and Management*.

Introduction

VMware Tanzu is the suite of products and solutions that allows customers to build, run, and manage Kubernetes-controlled, container-based applications. VMWare Tanzu is available in three editions: Basic, Standard, and Advanced, all of which support running Kubernetes in vSphere. By using Tanzu Kubernetes Grid Service, informally known as TKGS, you can create and operate Tanzu Kubernetes clusters natively in vSphere with Tanzu.

This environment provides an end-to-end integrated platform that consists of vSphere, virtual machines, a TKGS cluster node template, and vSAN storage, which are tightly integrated with VMware vSphere platform.

The cluster nodes are created from the VMware Photon operating system. With the current release of TKGS, cluster provisioning by using Photon operating system images does not support external storage connectivity by using Fibre Channel, iSCSI, or NFS. However, vVols data stores are supported by the VMware Tanzu architecture, which allows users to connect enterprise-class storage products, such as IBM FlashSystem storage, to their Tanzu environment.

IBM FlashSystem storage that is powered by IBM's award-winning IBM Spectrum Virtualize software supported vVols' functions since it was introduced by VMware. IBM's Spectrum Connect product seamlessly integrates with VMware's vStorage APIs for storage awareness (VASA) provider.

The IBM Spectrum Connects VASA plug-in is registered in VMware vCenter as storage provider. It communicates to a wide range of IBM storage systems that are available within the customer environment to provision required storage.

In this Blueprint, we demonstrate how IBM FlashSystem can be used to provision persistent storage to Tanzu Kubernetes clusters running natively in vSphere with Tanzu by way of the vVols functions.

Prerequisites

This document does not describe the process to installation or configure IBM Spectrum Connect, IBM Spectrum Connect VASA provider, or VMware Tanzu Basic Edition.

For more information about various resources and a compatibility matrix about installing these components, see “More information” on page 13.

The document assumes that the following components are installed and configured per best practices:

- Tanzu Basic Edition with vSphere
- IBM Spectrum Connect: The configuration includes, but is not limited to:
  - vCenter registration
  - vVol storage service creation
  - Addition of a Storage system to Spectrum Connect
  - vVol services are attached to storage pool
  - vCenter interface is registered in Spectrum Connect
- vVol functions are enabled on the IBM Storage. Although we focus on IBM FlashSystem FS9100 storage product in this document, any of the IBM FlashSystem storage products that use IBM Spectrum Virtualize software can be used in this environment. This also includes IBM Storage Volume Controller, IBM SAN Volume Controller, and IBM Spectrum Virtualize for Public Cloud.
- IBM Spectrum Connect VASA storage provider is registered in vCenter that is managing TKGS and the storage provider can detect FS9100 storage system.

Lab setup

The lab setup that was used in this validation process is shown in Figure 1.

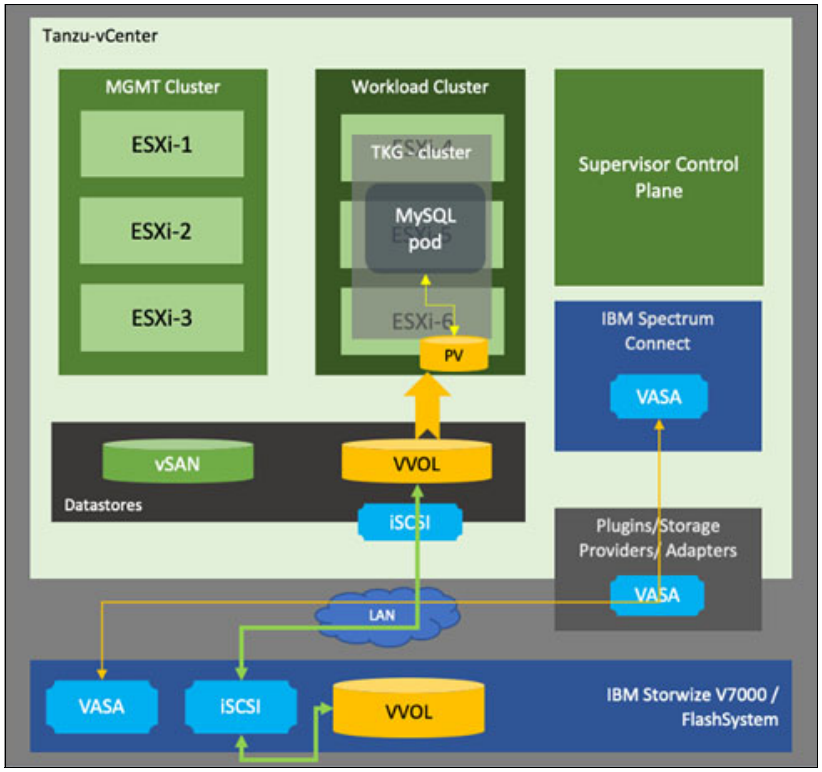


Figure 1 Lab setup

As shown in Figure 1, the lab setup is orchestrated by vCenter, which is available with VMware Tanzu Basic Edition. The IBM Spectrum Connect VASA storage provider plug-in is registered with vCenter and can detect the FS9100 storage system.

The vVol data store is backed by FS9100 storage internally and uses iSCSI protocol to map the storage volume to ESXi hosts. This data store was mounted on all ESXi hosts from the workload domain.

Post availability of the data store, storage policies were assigned to the data store, followed by the creation of the namespace entity and eventually a TKGS cluster. With the defaults chosen after a four-node TKGS cluster was provisioned, a persistent storage volume was provisioned from the storage class that points to vVol data store. This volume was used by the containerized IBM MySQL application deployment to store the database data.

Configuring VM Storage Policy

Complete the following steps to configure VM Storage Policy. After the VM Storage Policy is created, it is assigned to a namespace:

1. Log on to vSphere client (see Figure 2).

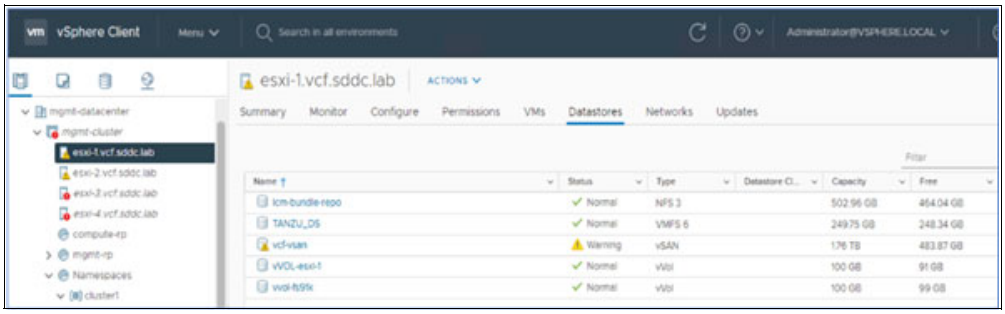


Figure 2 vSphere client view

2. Click **vSphere Client** in the upper left of the window and choose **VM Storage Policies** to assign the policies to the data store, as shown in Figure 3.

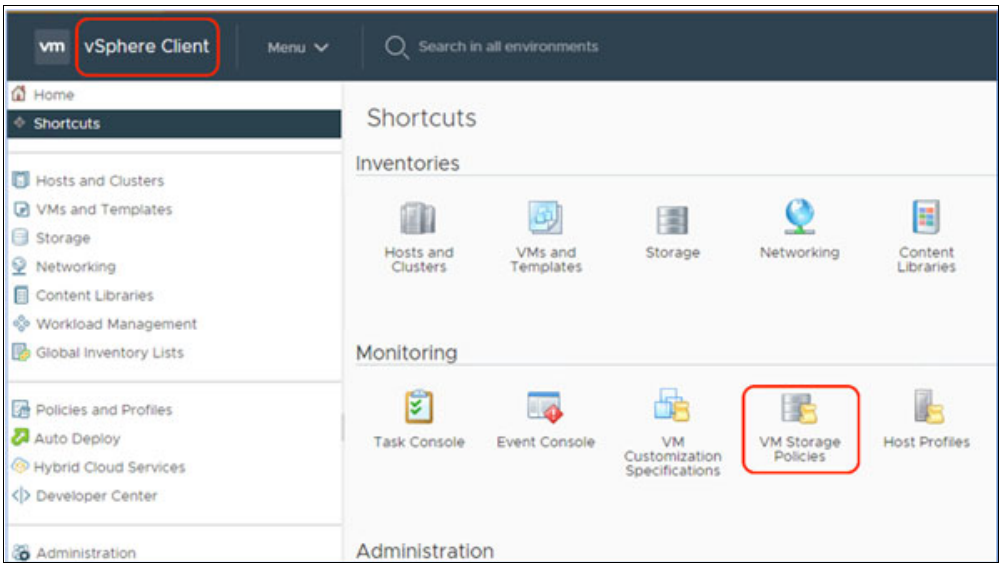


Figure 3 vSphere menu option to assign VM Storage policies

3. Click **CREATE** in the VM Storage Policies window, as shown in Figure 4.

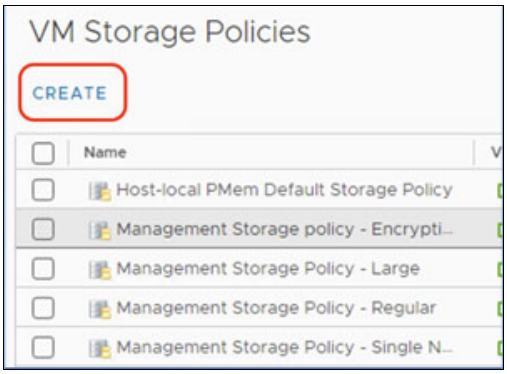


Figure 4 VM Storage Policies

4. In the Create VM Storage Policy wizard, choose the correct vCenter server and enter a relevant name and description. In the example that is shown in Figure 5, `VVOL-FS9100` was chosen as name of the VM Storage Policy to indicate a vVol type of data store from IBM FS9100 storage system.

Figure 5 Name and description

5. Enable the data store-specific rules by selecting **Enable rules for com.ibm.storageprofile.policy storage**, as shown in Figure 6.

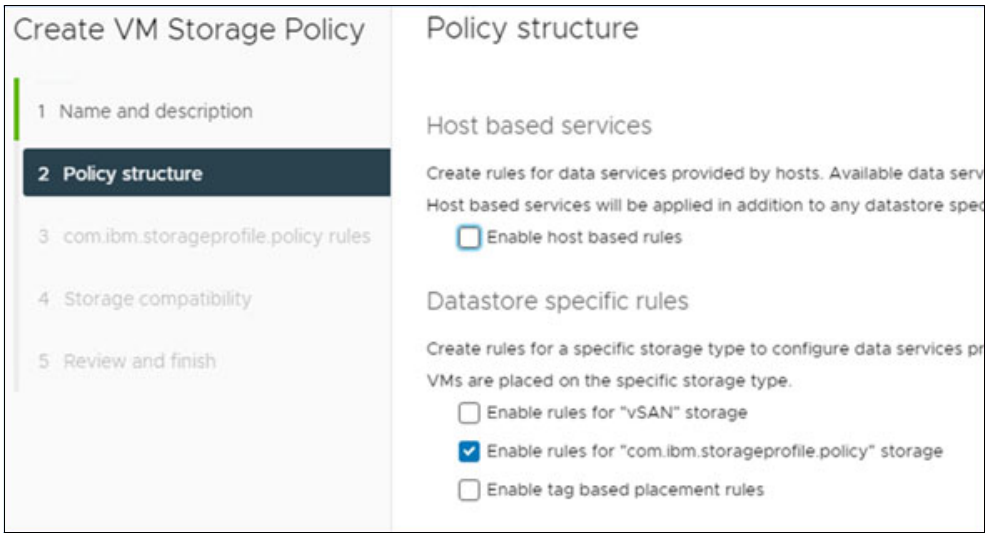


Figure 6 Policy structure

6. Choose the specific rule set that is displayed in the next window for the Storage Profile policy that was selected in Step 5, as shown in Figure 7.

Figure 7 Policy rules

During this step, the storage that is compatible with the selected policy rules is displayed, as shown in Figure 8.

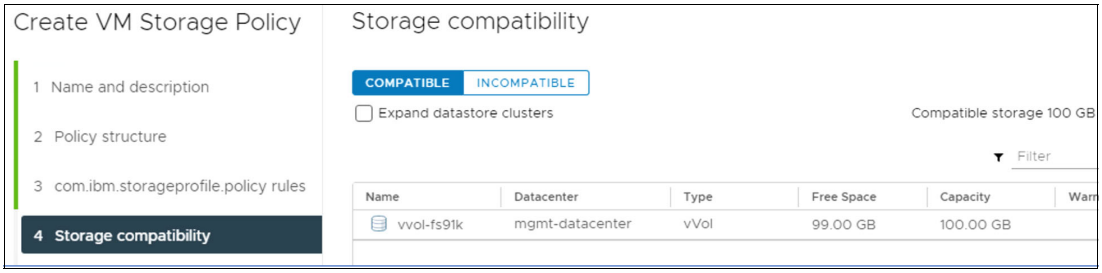


Figure 8 Storage compatibility

7. Complete the wizard by reviewing the newly created VM Storage Policy summary, as shown in Figure 9.

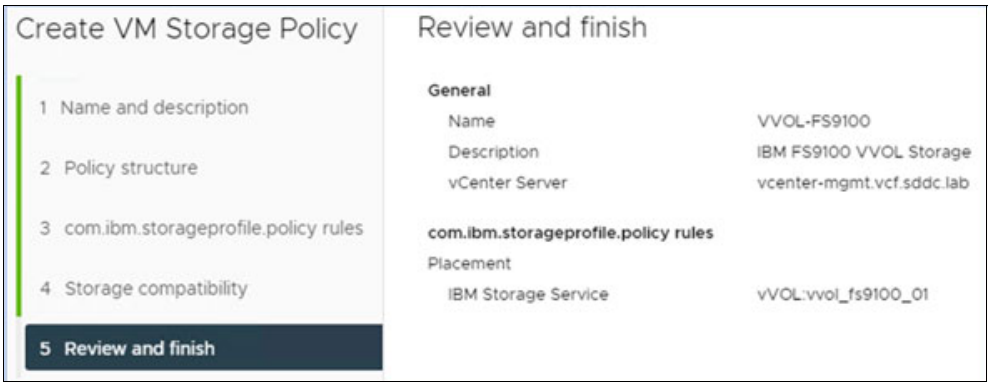


Figure 9 Review

The VM Storage Policy creation process is now complete.

Assigning VM Storage Policy to a namespace

After the required VM Storage Policy is created, it is assigned to a specific namespace, as shown Figure 10. In this case, the name of the namespace was created as `cluster1`.

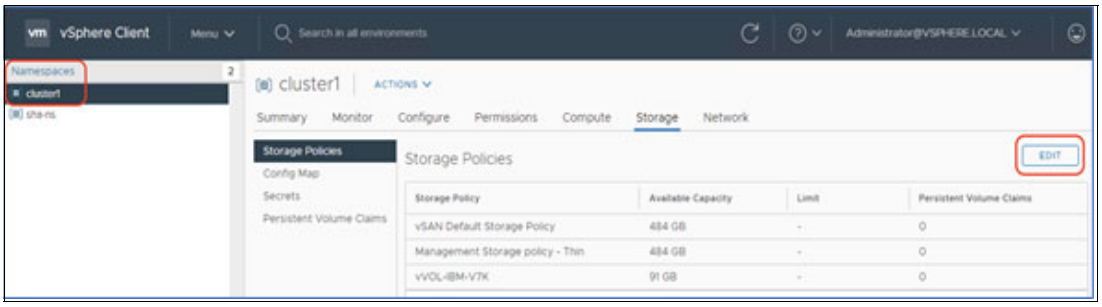


Figure 10 Assigning Storage Policy to a cluster

A namespace can have more than one Storage Policy, as shown in Figure 11.

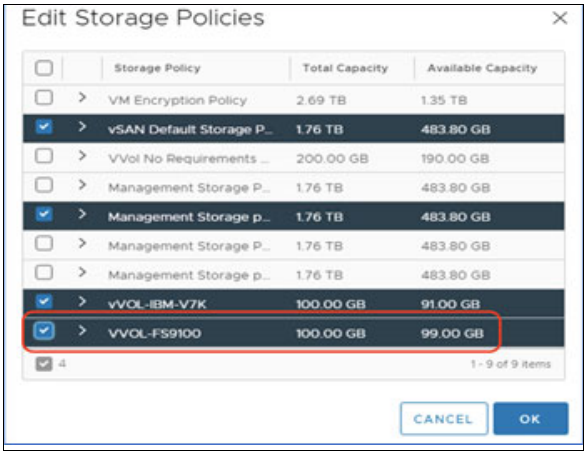


Figure 11 Choosing the suitable VM Storage Policy

By following these steps, the vVol volumes are now available for use by the TKGS cluster workload.

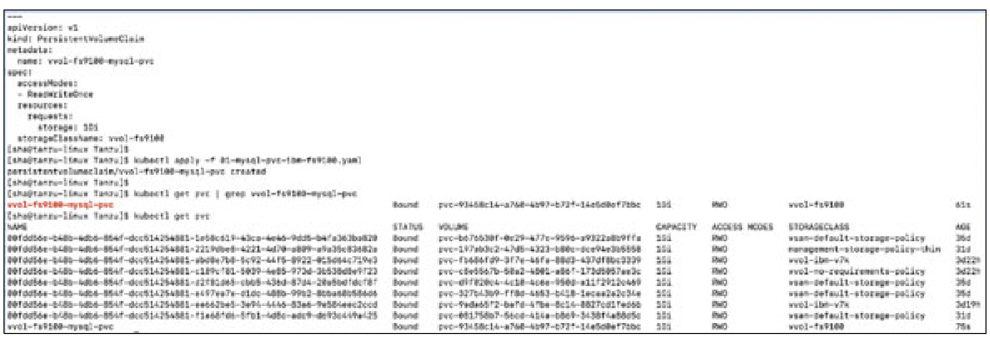
StorageClass object and Persistent Volume Claim

The Storage Policy that is assigned to the namespace is now shown as a StorageClass object under the Kubernetes cluster, as shown in Figure 12.

```
[sha@tanzu-linux ~]$ cat bin/tanzu-cluster1-login
kubectl-vsphere login --server 10.0.0.63 -u "administrator@vsphere.local" --insecure-skip-tls-verify --tanzu-kubernetes-clus
ter-name tkg-cluster-1 --tanzu-kubernetes-cluster-namespace cluster1
[sha@tanzu-linux ~]$ . bin/tanzu-cluster1-login

Password:
Logged in successfully.

You have access to the following contexts:
   10.0.0.63
   cluster1
   cluster2
   tkg-cluster-1

If the context you wish to use is not in this list, you may need to try
logging in again later, or contact your cluster administrator.

To change context, use `kubectl config use-context <workload name>`
[sha@tanzu-linux ~]$ kubectl config use-context cluster1
Switched to context "cluster1".
[sha@tanzu-linux ~]$ kubectl get sc
NAME                            PROVISIONER              RECLAIMPOLICY   VOLUMEBINDINGMODE   ALLOWVOLUMEEXPANSION   AGE
management-storage-policy-thin  csi.vsphere.vmware.com   Delete          Immediate           true                   31d
vsan-default-storage-policy     csi.vsphere.vmware.com   Delete          Immediate           true                   51d
vvol-fs9100                     csi.vsphere.vmware.com   Delete          Immediate           true                   5m56s
vvol-ibm-v7k                    csi.vsphere.vmware.com   Delete          Immediate           true                   3d23h
vvol-no-requirements-policy     csi.vsphere.vmware.com   Delete          Immediate           true                   3d21h
```

Figure 12 Storage Policy that is seen as Kubernetes StorageClass

The example PersistentVolumeClaim that is shown in Figure 13, uses the `vvol-fs9100` StorageClass to create a PersistentVolume on IBM FlashSystem. The persistent storage that is provided by `vvol-fs9100-mysql-pvc` also is used by the IBM MySQL application deployment to host the database.



```
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: vvol-fs9100-mysql-pvc
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: vvol-fs9100
```

Figure 13 PersistentVolumeClaim and IBM MySQL application deployment

Summary

This Blueprint described the use of IBM FlashSystems as persistent storage for VMWare Tanzu Kubernetes Grid Service deployment by using IBM FlashSystem VMware vVols integration through IBM Spectrum Connect's VASA provider.

The IBM FlashSystem family is a portfolio of hybrid cloud-enabled storage systems. Each system is easily deployed and quickly scaled to help optimize storage configurations, streamline issue resolution, and lower storage costs through IBM's award winning Spectrum Virtualize software.

IBM SAN Volume Controller, with IBM Spectrum Virtualize software, offers powerful technology that enables efficient, cost-effective SDS solutions for containers and hybrid multicloud environments.

It also provides comprehensive data services and storage virtualization capabilities, including advanced replication, high-performance, thin provisioning, encryption, compression, deduplication, and IBM Easy Tier®. These advanced functions improve administrator productivity and boost storage usage while also enhancing and extending the value of existing storage investments.

In addition to the support for VMware Tanzu Basic Edition that is described in this publication, these offerings support Red Hat OpenShift and Kubernetes container environments that accelerate deployment of persistent volumes with the IBM block storage CSI driver, which is certified by Red Hat and IBM.

More information

For more information, see the following resources:

- Configuring Virtual Volumes on IBM FlashSystem:

  http://www.ibm.com/docs/en/flashsystem-9x00/8.4.0?topic=c-configuring-virtual-volumes

- IBM Spectrum Connect:

  http://www.ibm.com/docs/en/spectrum-connect/3.8.0

- IBM Spectrum Connect compatibility matrix:

  http://www.ibm.com/docs/en/spectrum-connect?topic=vmware-compatibility-matrix

- VMware Tanzu:

  http://www.tanzu.vmware.com/tanzu

- VMware Tanzu Kubernetes Grid:

  http://www.docs.vmware.com/en/VMware-Tanzu-Kubernetes-Grid/index.html

- vSphere with Tanzu configuration and management:

  http://www.docs.vmware.com/en/VMware-vSphere/7.0/vmware-vsphere-with-tanzu/GUID-152BE7D2-E227-4DAA-B527-557B564D9718.html

Author

This Blueprint guide was produced by an author working at IBM Redbooks, Poughkeepsie Center.

Shashank Shingornikar is a Storage Solutions Architect with IBM Systems, Pune, India. He writes extensively and presents at various conferences worldwide about IBM Storage-based solutions and other areas, such as Oracle, MSSQL, and MySQL databases; OpenShift Container platform; and Cyber Resiliency. Before joining IBM Systems 11 years ago, Shashank worked in The Netherlands as and Application Specialist on various database solutions.

Thanks to the following people for their contributions to this project:

Sandeep R Patil
Vincent Hsu
Michelle Tidwell
Carlos F Fuente
Hemanth Kantak
Douglas O'flaherty
Bill Martinson

Notices

This information was developed for products and services offered in the US. This material might be available from IBM in other languages. However, you may be required to own a copy of the product or product version in that language in order to access it.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, MD-NC119, Armonk, NY 10504-1785, US

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product and use of those websites is at your own risk.

IBM may use or distribute any of the information you provide in any way it believes appropriate without incurring any obligation to you.

The performance data and client examples cited are presented for illustrative purposes only. Actual performance results may vary depending on specific configurations and operating conditions.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to actual people or business enterprises is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. The sample programs are provided "AS IS", without warranty of any kind. IBM shall not be liable for any damages arising out of your use of the sample programs.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at “Copyright and trademark information” at http://www.ibm.com/legal/copytrade.shtml

The following terms are trademarks or registered trademarks of International Business Machines Corporation, and might also be trademarks or registered trademarks in other countries.

Redbooks (logo)  ®	IBM®	IBM Spectrum®
Easy Tier®	IBM FlashSystem®	Redbooks®

OpenShift, Red Hat, are trademarks or registered trademarks of Red Hat, Inc. or its subsidiaries in the United States and other countries.

VMware, VMware vSphere, and the VMware logo are registered trademarks or trademarks of VMware, Inc. or its subsidiaries in the United States and/or other jurisdictions.

Other company, product, or service names may be trademarks or service marks of others.

Terms and conditions for product documentation

Permissions for the use of these publications are granted subject to the following terms and conditions.

Applicability

These terms and conditions are in addition to any terms of use for the IBM website.

Commercial use

You may reproduce, distribute and display these publications solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of these publications, or reproduce, distribute or display these publications or any portion thereof outside your enterprise, without the express consent of IBM.

Rights

Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the publications or any information, data, software or other intellectual property contained therein.

IBM reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the publications is detrimental to its interest or, as determined by IBM, the above instructions are not being properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations.

IBM MAKES NO GUARANTEE ABOUT THE CONTENT OF THESE PUBLICATIONS. THE PUBLICATIONS ARE PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.

Privacy policy considerations

IBM Software products, including software as a service solutions, ("Software Offerings") may use cookies or other technologies to collect product usage information, to help improve the end user experience, to tailor interactions with the end user, or for other purposes. In many cases no personally identifiable information is collected by the Software Offerings. Some of our Software Offerings can help enable you to collect personally identifiable information. If this Software Offering uses cookies to collect personally identifiable information, specific information about this offering's use of cookies is set forth below.

This Software Offering does not use cookies or other technologies to collect personally identifiable information.

If the configurations deployed for this Software Offering provide you as customer the ability to collect personally identifiable information from end users via cookies and other technologies, you should seek your own legal advice about any laws applicable to such data collection, including any requirements for notice and consent.

For more information about the use of various technologies, including cookies, for these purposes, see IBM's Privacy Policy at http://www.ibm.com/privacy and IBM's Online Privacy Statement at http://www.ibm.com/privacy/details in the section entitled "Cookies, Web Beacons and Other Technologies," and the "IBM Software Products and Software-as-a-Service Privacy Statement" at http://www.ibm.com/software/info/product-privacy.

June 2021

Please recycle

ISBN 0738459798

REDP-5648-00