Virtual Desktop Infrastructure Solution with VMware and IBM FlashSystem 9100

Version 1 Release 1

Contents

About this document

This information is intended to facilitate virtual desktop infrastructure (VDI) deployment using VMware Horizon 7 running on VMware vSphere 6.5 and IBM® FlashSystem® 9100. This document provides information about deployment and configuration of virtual desktops and Remote Desktop Server Host (RDSH) sessions using View Composer linked-clone and instant-clone methods in a private cloud environment, providing management simplicity and easy-to-scale virtual desktop deployment. This solution is 100 percent virtualized on Cisco UCS B200 M4 blade servers, booting VMware vSphere 6.5 via Fibre Channel SAN from the IBM FlashSystem 9100 storage array. VMware Horizon remote desktop server-hosted sessions and Microsoft Windows 10 virtual desktops were provisioned on the IBM FlashSystem 9100 storage array.

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Executive summary

Overview

Challenge

With restrictions on budget and resources, organizations are looking at technologies that offer flexibility and ease of management. In this world of multi-cloud deployments, users need secure access to their data from any device and anywhere. Typical VDI deployments have thousands of virtual desktops that use the same master image. This results in a large amount of duplicated data.

Solution

IBM FlashSystem 9100 with data reduction technology effectively reduces dollar-per-virtual-desktop costs and provides the low latency and high-performing architecture required for a typical VDI environment. VMware Horizon provides an industry-leading desktop virtualization solution that enables end users to securely access their data from any device and from anywhere. It offers a centrally managed, simplified desktop virtualization solution to end users by reducing management overhead.

In today's multi-cloud architectures, the need to access data from any location and from any device is becoming a requirement. For enterprises, it is challenging to satisfy mobile users' requests securely and without affecting the user experience. With restrictions on resources and budgets, organizations are looking at technologies that offer scalable architectures without additional management overhead.

VDIs are popular among organizations because virtual desktops can help save time and money, provide greater defense against catastrophic failures, improve update speeds and provide an easy way to customize desktops for certain users or groups of users.

VMware Horizon offers an industry-leading desktop virtualization solution that helps simplify IT management and increase security and control for end users, while helping to decrease costs, by centrally delivering desktop services. By delivering secure access to user data and applications from any device and from anywhere, VMware Horizon provides mobility and flexibility.

For VDI environments, storage cost remains a primary consideration; data reduction, which enables storing more data in the same amount of physical storage capacity, is a key cost-reduction tool.

The IBM FlashSystem 9100 all-flash array with Non-Volatile Memory Express (NVMe) drives supports a comprehensive range of data reduction and efficiency capabilities including compression, deduplication, thin provisioning, compaction, SCSI UNMAP, and space-efficient snapshots. VDI deployments benefit from the IBM FlashSystem 9100 storage system's scalability, ease of use, agility, elasticity and rapid deployment capabilities, as well as its greater control, increased performance, predictable costs, tighter security and flexible management options in comparison to traditional infrastructure.

Typically, organizations adopting VDIs deploy thousands of virtual machines (VMs). Failure in a VDI deployment could therefore leave thousands of users unable to perform their business functions. IBM Spectrum Protect™ Plus is a data protection and availability solution for virtual environments that can be deployed in minutes that can protect your virtual environment within an hour. It simplifies data protection, whether data is stored in physical, virtual, software-defined or cloud environments.

Scope

This Blueprint provides:

- A solution architecture and related configuration workflows with the following essential hardware and software components:
    - IBM FlashSystem 9100
    - VMware vCenter 6.5
    - VMware ESXi 6.5
    - VMware Horizon 7
    - IBM Spectrum Protect Plus
- Detailed technical configuration steps for building VMware Horizon VDI on IBM FlashSystem 9100

This technical report does not:

- Provide performance analysis from a user perspective
- Claim support for a particular number of virtual desktops
- Replace any official manuals and documents issued by IBM
- Explain installation and configuration of VMware vSphere

Prerequisites

This Blueprint assumes the following prerequisites:

- Basic knowledge of IBM FlashSystem 9100
- Basic knowledge of VMware vSphere version 6.5 or later
- Basic knowledge of VMware Horizon 7 or later
- Basic knowledge of IBM Spectrum Protect Plus
- Basic knowledge of IP networking

Getting started: Essential VMware VDI with IBM FlashSystem 9100 building blocks

This section describes in detail an essential VMware VDI solution with IBM FlashSystem 9100.

IBM FlashSystem 9100

The new IBM FlashSystem 9100 combines the performance of flash and the NVMe protocol with the reliability and innovation of IBM FlashCore® technology and the rich feature set of IBM Spectrum Virtualize™ software in a powerful new storage platform for your data-driven multi-cloud enterprise.

The NVMe-optimized all-flash IBM FlashSystem 9100 arrays are offered in two basic models: IBM FlashSystem 9110 and IBM FlashSystem 9150. The compact, 2U enclosures feature dual array controllers, dual power supplies, redundant cooling, and full hot-swap capabilities. Both models have two Intel Skylake CPUs per array controller, with the IBM FlashSystem 9110 offering eight cores per CPU, while the 9150 model comes with 14 cores per CPU for higher throughput and performance. In just two rack units of space, IBM FlashSystem 9100 systems can provide the performance and efficiency of more than a terabyte of memory and, with the 9150 model's eight rack units of space, up to 3 petabytes of effective storage—all moving at NVMe speeds to tackle even the most demanding real-time analytics or artificial intelligence (AI) applications and workloads.

IBM FlashSystem 9100 also provides the software-defined, modern data protection and multi-cloud capabilities of several members of the IBM Spectrum Storage™ family. Chief among these is IBM Spectrum Virtualize, the system foundation that provides a broad set of enterprise-class data services—such as dynamic tiering, replication, IBM FlashCopy® management, data mobility, transparent cloud tiering, and high-performance data-at-rest encryption, among many others. The arrays also leverage innovative new data reduction pools that incorporate deduplication and hardware-accelerated compression technology, plus SCSI UNMAP support and all the thin provisioning and data efficiency features you'd expect from IBM Spectrum Virtualize-based storage to potentially reduce your capital expenditures and operating expenses. Additionally, the IBM FlashSystem 9100 solution with virtualization capabilities can be used to virtualize more than 440 IBM and non-IBM heterogeneous storage systems.

To further drive your IT transformation, IBM Spectrum Virtualize for Public Cloud offers multiple ways to create hybrid cloud solutions uniting public-cloud storage with on-premises private clouds based on IBM FlashSystem 9100. It enables real-time storage-based data replication and disaster recovery, as well as data migration between local storage and IBM Cloud™.

IBM FlashSystem 9100 at a glance		
Models	IBM FlashSystem 9110, model AF7	IBM FlashSystem 9150, model AF8
System size	Single 2U enclosure	Clustered 4-way x 2U enclosures
Flash type	IBM-enhanced 3D TLC	
Supported drives	2.5-inch NVMe IBM FlashCore modules (FCMs) 4.8 TB, 9.6 TB and 19.2 TB compressing FCMs 2.5-inch NVMe flash drives 1.92 TB, 3.84 TB, 7.68 TB and 15.36 TB	
Maximum NVMe flash capacity	461 TB raw 379 TB usable, DRAID6 758 TB effective (2:1 reduction)	1.8 PB raw 1.5 PB usable, DRAID6 3.0 PB effective (2:1 reduction)

IBM FlashSystem 9100 at a glance (contd.)		
Maximum external storage capacity	External virtualization: Up to 32 PB usable capacity	
Drives, canisters, fans and power supplies	Fully redundant, hot-swappable	
Management software	IBM Spectrum Virtualize software	
Advanced features	Deduplication and compression FlashCopy Remote mirroring External virtualization IBM Easy Tier® Data migration	
Encryption	Data-at-rest AES-XTS 256	
NVMe-oF hardware ready connectivity	Up to: 24 ports 16 GB Fibre Channel 8 ports 10 GBe iSCSI 12 ports 25 GBe iWARP or RoCE	Up to: 96 ports 16 GB Fibre Channel 16 ports 10 GBe iSCSI 48 ports 25 GBe iWARP or RoCE
SAS Expansion enclosures	Model AFF 2U 24 drive Model A9F 5U 92 drive 2.5-inch flash drives supported: 1.92 TB, 3.2 TB, 3.84 TB, 7.68 TB and 15.36 TB	
Controller CPU	Model AF7 - Four 8-core Model AF8 - Four 14-core	16 8-core 16 14-core
Cache	128 GB standard, up to 1536 GB	512 GB standard up to 6144 GB
Dimensions	Control enclosures Width: 48.3 cm (19.0 in) Depth: 85.0 cm (33.5 in) Height: 8.8 cm (3.5 in)	
Weight	Control enclosure: Drive-ready (without drive modules installed): 38.5 kg (84.7 lb) Fully configured (24 drive FCMs installed): 46.6 kg (102.5 lb)	

Table 1: IBM FlashSystem 9100 storage configurations

VMware infrastructure

VMware ESXi is a hypervisor that runs directly on the system hardware. It provides the necessary functions to host multiple guest operating systems, such as Microsoft Windows or Linux, on the physical server.

VMware vCenter Server

VMware vCenter is the management software suite that is used to manage the VMs within an ESXi host. When you allocate resources such as memory, storage, networking or processors to a VM, a vCenter server manages the way these resources are allocated and maintained. vCenter can manage a single ESXi host or a cluster of hosts. vCenter includes several features for the mobility of VMs between ESXi hosts and storage. These features can add to the availability of the VMs in a cluster.

VMware Horizon 7

VMware Horizon desktop virtualization solutions are built on a unified architecture, so they are simple to manage and flexible enough to meet the needs of all your organization's users. They provide an end-to-end solution delivering Windows virtual desktops to users on a wide variety of endpoint devices. Virtual desktops are dynamically assembled on demand, providing users with personalized desktops each time they log on.

With VMware Horizon 7, Windows applications can be deployed to users in nearly any location, regardless of the device type and available network bandwidth, enabling a mobile workforce for improved productivity. Horizon 7 also enables IT administrators to effectively control application and desktop provisioning while securing data assets and lowering capital and operating expenses.

Horizon 7 supports dedicated and stateless desktop provisioning. It allows manual as well as automated pools for full VMs or instant clones for dedicated and stateless desktop provisioning. Virtual desktops can be provisioned in the following ways:

Full clones
A full clone is an independent copy of a VM that shares nothing with the parent VM after the cloning operation. Ongoing operation of a full clone is entirely separate from the parent VM.

View Composer linked clones
View Composer linked clones share the same base image of a parent VM and use less storage space than full-clone VMs.

Instant clones
Similar to View Composer linked clones, instant clones share a virtual disk of a parent VM and therefore consume less storage space than full-clone VMs. In addition, instant clones share the memory of a parent VM.

Instant clones offer significant benefits for the administrators; they do not need to be refreshed, recomposed or rebalanced. When a user logs out of the desktop, that desktop always gets deleted and recreated as a fresh image from the latest patch before the next login. This process creates a staggered approach to patching, thus eliminating “boot storms,” reducing storage IOPS, and imposing a smaller load on the vCenter Server.

This Blueprint describes the deployment of automated View Composer linked clones and instant clones.

Horizon with VMware hypervisor features the following main components:

Component	Description
Horizon Connection Server	This is the core component of Horizon. It is the point of contact for client devices that are requesting virtual desktops. It authenticates users and directs the virtual desktop requests to the appropriate VM or desktop. Users can define View desktop pools, applications, and permissions in Horizon Connection Server administrator console.
Replica Server	Additional connection servers are called as replicas. Replica servers provide redundancy and load balancing, thus providing greater availability.
View Composer Server	Starting with Horizon 7, when linked clones are used for desktop deployment, View Composer Server is required.
Security server	The security server is placed in the DMZ, allowing external users to securely access Horizon on the internal network from the Internet.
View Administrator	View Administrator configures Connection Server, provisions virtual desktops and manages user authentication using the web-based Horizon interface.
View Client	View Client is software that is installed on client devices such as tablets and laptops to act as an agent to communicate with the virtual desktops.
vCenter Server	vCenter is the management software suite that is used to manage the VMs within an ESXi host.
VMware ESXi	VMware ESXi is a bare-metal hypervisor for the compute servers. It is installed directly on a physical server. With direct access to and control of underlying resources, it can effectively partition hardware to increase consolidation ratios and make efficient use of hardware resources.
Shared storage	Shared storage is used to host virtual desktops. Depending on the provisioning model used, different data is stored for VM images in shared storage.

Table 2: VMware Horizon components

VDI with IBM FlashSystem 9100 solution architecture

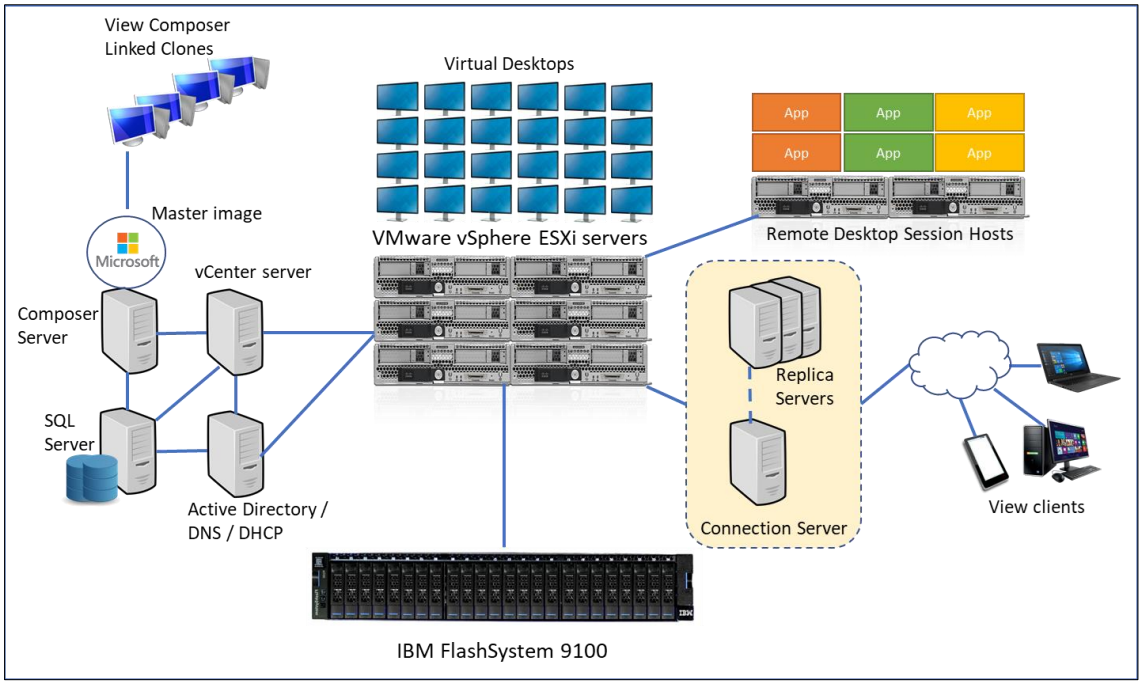

Figure 1: VMware Horizon VDI with IBM FlashSystem 9100: Architectural overview

In this lab solution validation, VMware Horizon has been set up in a private cloud environment. This solution architecture demonstrates the deployment of an RDSH farm and virtual desktops deployed using both instant-clone and linked-clone methods.

In this solution validation, IBM FlashSystem 9100 is connected to multiple ESXi servers. These ESXi servers are used to configure Horizon infrastructure components such as Horizon Connection Server and View Composer Server. This deployment uses a dedicated vCenter Server 6.5 instance installed and configured on a Microsoft Windows 2012 R2 server. Microsoft SQL Server 2014 is configured to host the vCenter Server database, View Composer database and Horizon event database. Existing Microsoft Active Directory, DNS and DHCP servers are used for virtual desktop configuration and deployment.

IBM FlashSystem has 24 NVMe drives configured in a single pool in a distributed RAID 6 (DRAID 6) configuration. To save storage space, volumes with data deduplication enabled are configured to host VMware Horizon infrastructure components and virtual desktops.

Software and hardware used

This Blueprint documents a deployment of 1,000 virtual desktops featuring the following software products:

- IBM FlashSystem 9100 with IBM Spectrum Virtualize version 8.2
- VMware vSphere ESXi 6.5.0 server
- VMware Horizon, release 7.4
- Microsoft Windows Server 2012 R2, 64-bit VM operating system
- Microsoft Windows 10, 64-bit VM operating system
- Microsoft SQL Server 2014

For the environment used in this Blueprint, the following servers were used:

Model	No. of servers	Logical processors	Memory(GB)	Operating system
Cisco Systems UCSB-B200-M4, Processor: Intel Xeon CPU E5-2697 v4 @ 2.30GHz	10	72 each	256 each	VMware ESXi 6.5.0

Table 3: Server configuration

Refer to Table 4 for a list of infrastructure VMs configured for the solution lab test environment.

Purpose of VM	CPUs	Memory (GB)	Disk space (GB)	Operating system
Active Directory/ DNS/DHCP server	4	32	40	Windows 2008 R2
VMware vCenter Server 6.5	8	32	600	Windows 2012 R2
Microsoft SQL Server 2014	2	16	300	Windows 2012 R2
Horizon Connection Server 7.4	4	64	250	Windows 2012 R2
Horizon Replica Server 7.4	4	64	250	Windows 2012 R2
View Composer Server 7.4	4	16	120	Windows 2012 R2

Table 4: Lab solution infrastructure VM list

Configuration of IBM FlashSystem 9100

This section describes the configuration overview of IBM FlashSystem 9100.

The IBM FlashSystem used in the lab setup is an IBM FlashSystem 9110 storage system, model AF7, with 24 3.49 TB NVMe drives configured as Tier 0 storage in a 2U chassis. These drives can be accessed through the IBM FlashSystem GUI.

1. To view the system overview page, log in to the IBM FlashSystem 9100 graphical user interface (GUI) using the cluster IP address and click on **System**.

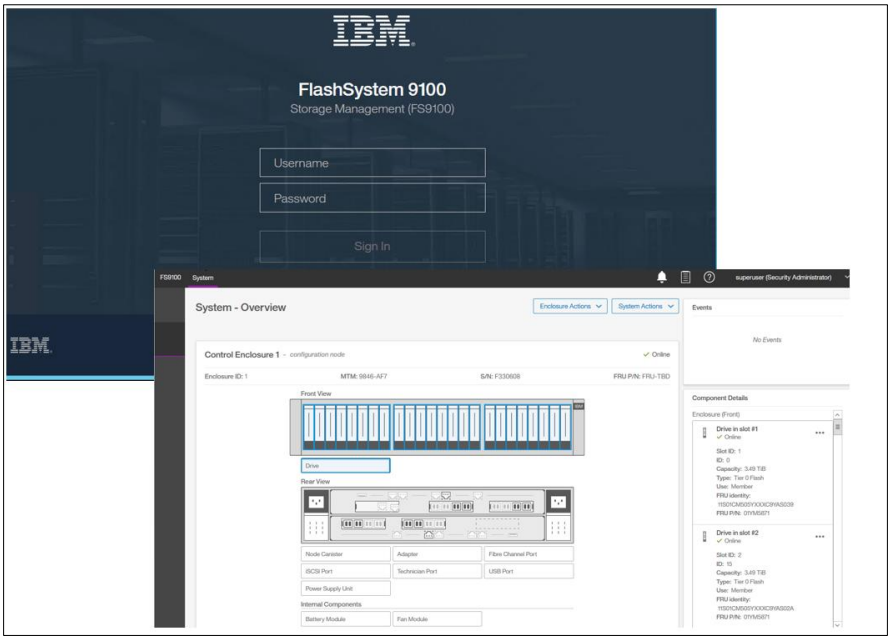

Figure 2: IBM FlashSystem 9100 login screen

2. Click **Pools → Internal Storage** as shown in Figure 3.

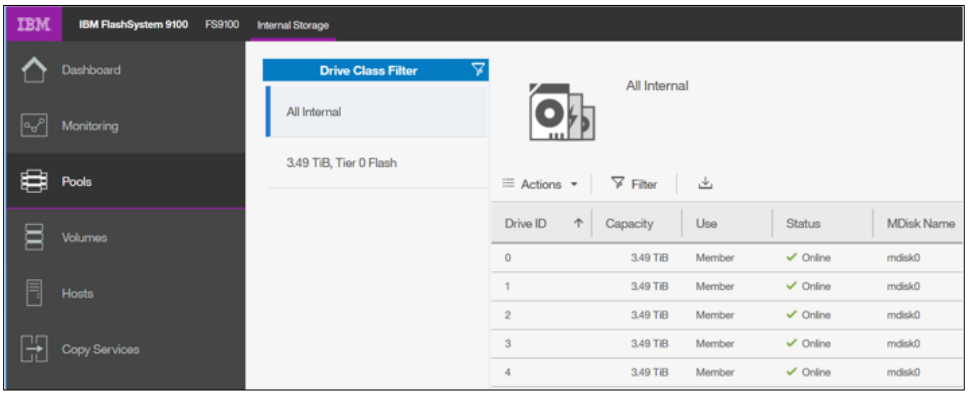

Figure 3: IBM FlashSystem 9100 disk information

3. The next step is to create a storage pool. Click **Pools → Create Pool** and follow the "Create Pool" wizard. Assign the managed disks (MDisks) to the pool as shown in Figure 4.

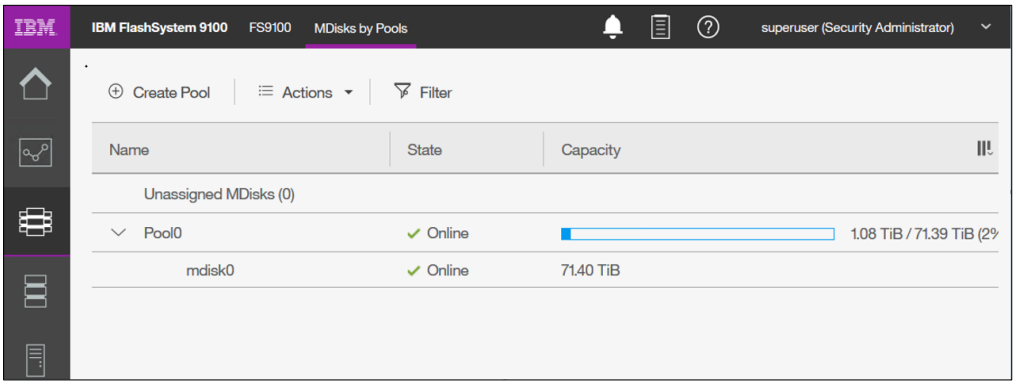

Figure 4: IBM FlashSystem 9100 Pool Creation

4. Once the pool is created, create virtual disks (vdisks) and map the vdisks to the ESXi host. Click **Volumes by Pool → Create Volumes** as shown in Figure 5.

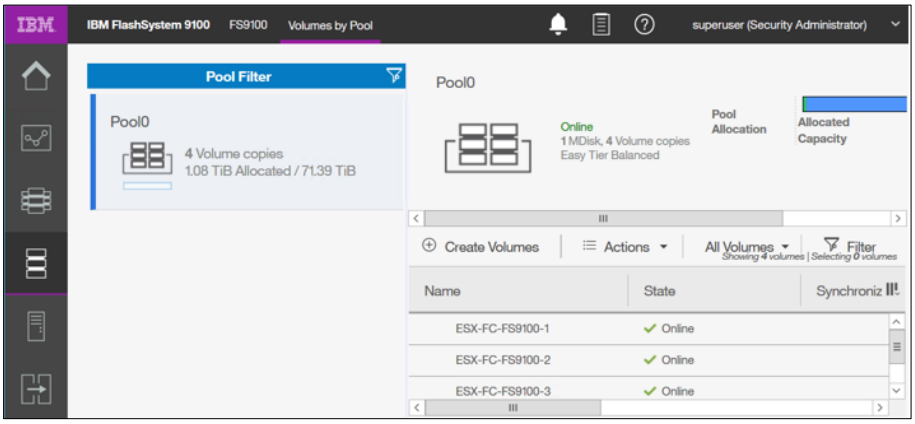

Figure 5: IBM FlashSystem 9100 volume creation

5. On the “Create Volumes” screen, select the pool and provide volume details such as capacity and name for the vdisk. Also select whether you want a thin-provisioned volume or a thick volume, and whether de-duplication needs to be enabled or disabled. Then click on **Create and Map** as shown in Figure 6. Follow the wizard and map the volume to the ESXi hosts.

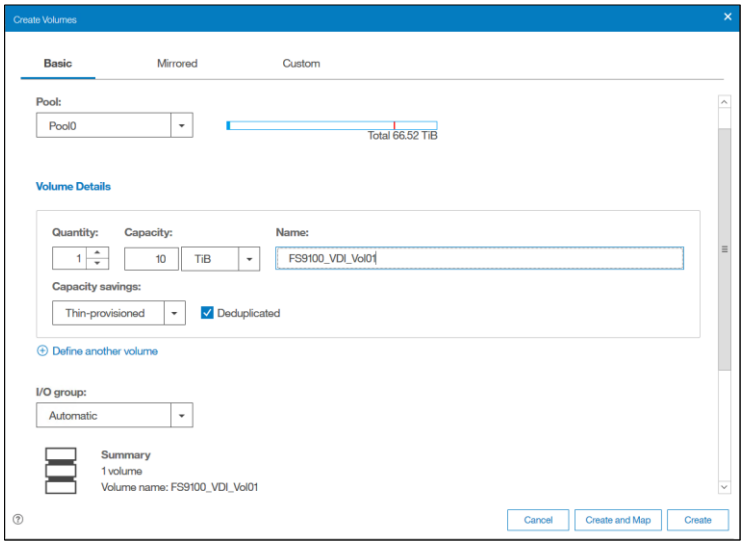

Figure 6: Create and Map a volume

Table 5 shows volumes configured on IBM FlashSystem 9100 for Horizon 7 infrastructure as well as for hosting virtual desktops and RDSH servers.

Name of volume	No. of volumes	Purpose	Volume size (TB)
FS9100_Infra_Vol01	1	Volume to host infrastructure VMs	2
FS9100_VDI_Vol01	1	Volume to host virtual desktops	10
FS9100_VDI_Vol02	1	Volume to host virtual desktops	10
FS9100_VDI_Vol03	1	Volume to host virtual desktops	10
FS9100_VDI_Vol04	1	Volume to host virtual desktops	10

Table 5: IBM FlashSystem 9100 volume configuration

Figure 7 shows these volumes configured on the IBM FlashSystem 9100 for hosting VDI, as they appear in the IBM FlashSystem GUI.

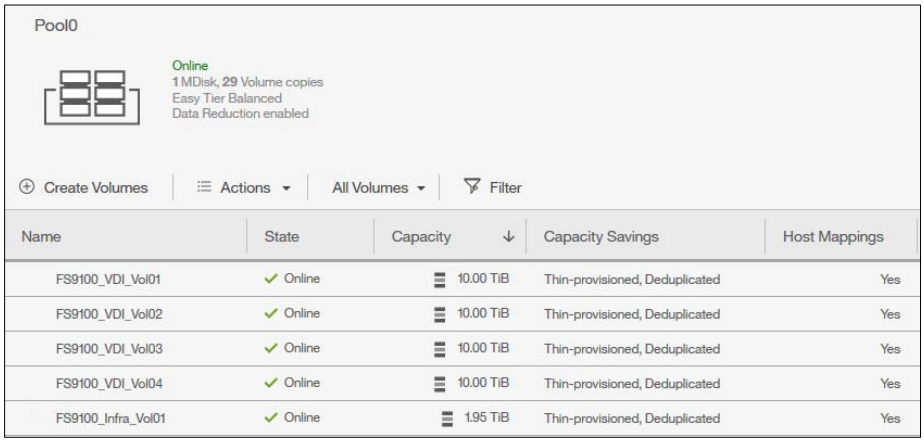

Figure 7: IBM FlashSystem 9100 volume configuration

Benefits of IBM FlashSystem 9100 data reduction technology in a VDI environment

Typical VDI deployments use View Composer linked-clone or instant-clone methods to provision virtual desktops, both of which use a master image to save storage space. These methods are generally used in a non-persistent deployment model where user data is not saved, and a new desktop image is provisioned each time a user logs in.

However, certain cases require persistent deployment of virtual desktops needing full-clone deployment of VMs based on copies of a master image. Typically, Windows 10 requires 15 GB to 20 GB of storage and extra user space of 20 GB to 40 GB per desktop. This results in many copies of the same guest operating system images and application files in a VDI environment—duplicate data that results in considerable storage space consumption for 1,000, 5,000 or more desktop deployments.

In a VDI environment with full clones deployed, inline deduplication can make a huge difference. It ensures that data blocks are never duplicated while writing to the storage system, thereby reducing the overall storage requirement. Inline deduplication eliminates unnecessary data writes to the storage system, reducing write cycles on NVMe drives and contributing to an overall increase in the lifespan of the drives.

IBM FlashSystem 9100 is an enterprise-class all-flash storage system equipped with NVMe drives to efficiently handle I/O-intensive VDI workloads. IBM FlashSystem 9100 with data reduction technology capabilities eliminates duplicated blocks by using inline deduplication, helping to ensure maximum efficiency and minimizing storage capacity requirements. In turn, this helps ensure a substantial overall reduction in rack space, power and cooling requirements, and management overhead.

In the lab validation, deduplication savings of up to 90 percent were observed in a deployment of 1,000 full-clone virtual desktops.

To check deduplication savings on IBM FlashSystem 9100, log in to the management GUI and browse to **Dashboard** to view **Capacity Savings**.

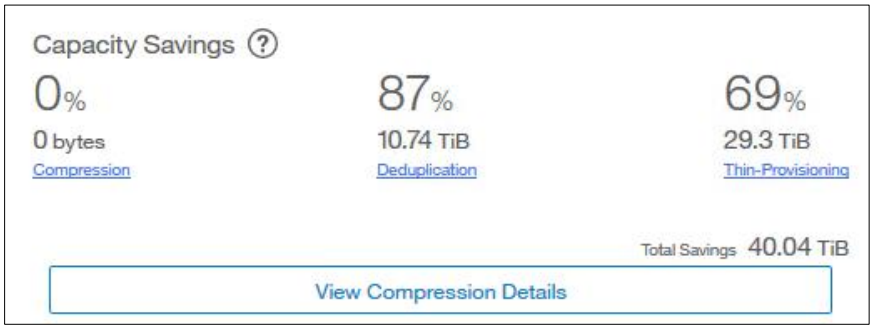

Figure 8: Capacity savings in an IBM FlashSystem 9100 deployment

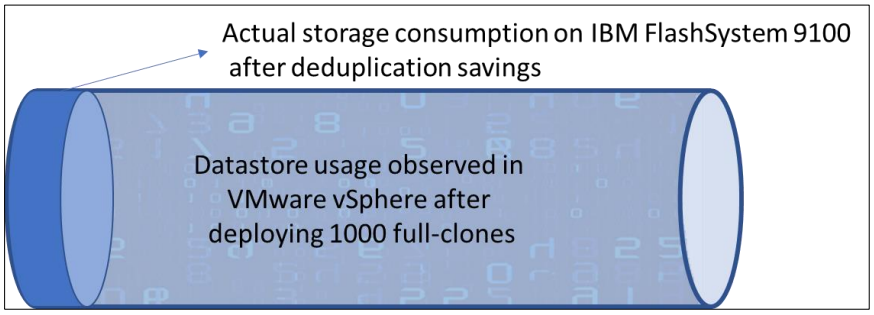

Figure 9: IBM FlashSystem 9100 deduplication savings

Configuring VMware Horizon

This section provides instructions for configuration of VMware Horizon 7.4 in the lab validation environment.

In this proof-of-concept solution lab test environment, only the components necessary to configure Horizon 7.4 inside a private cloud environment were considered. Access to the VDI from outside the lab firewall was not validated and is beyond the scope of this Blueprint.

Configuration of Active Directory, DHCP and DNS servers

This Blueprint assumes that DNS, DHCP and Active Directory are already installed and configured. If DNS, DHCP and Active Directory services must be installed from scratch, please refer to the appropriate documentation for each, which is not part of this Blueprint.

This section briefly describes the high-level configuration steps for DHCP server and Active Directory configuration.

DHCP server configuration

In this Blueprint, 1,000 virtual desktops are validated. Sufficient address space was therefore provisioned using DHCP to enable the validation. Follow the steps below to configure the appropriate scope.

1. Open the DHCP server configuration wizard. Click on **Edit** or **New scope**.

2. Enter the scope name and configure the DHCP scope as necessary. Figure 10 shows the properties of the configured DHCP scope.

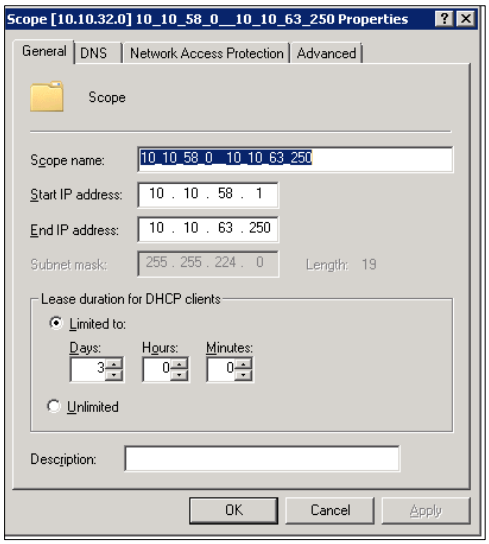

Figure 10: DHCP scope configuration

Configuring Active Directory server

You should create an Organizational Unit (OU) specifically for the remote-desktop deployment. An OU is a subdivision in Active Directory that contains users, groups, computers or other OUs. For this solution validation, a new OU is configured in the Active Directory and a new user is created for virtual desktops deployment.

1. Open Active Directory.

2. Right-click on the domain and click **New → Organizational Unit**.

3. Provide the name of the OU and click on **OK** to create the new OU in the Active Directory domain

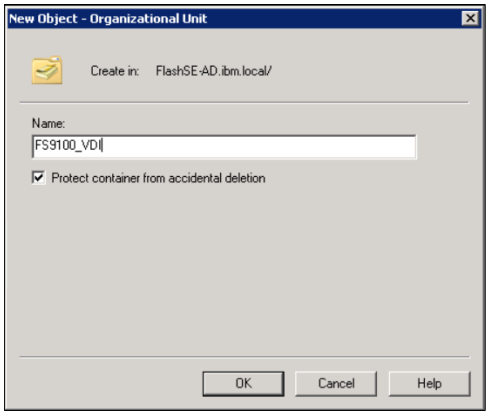

Figure 11: Creating a new Organizational Unit

4. Once the new OU is created, the new user *horizonadmin* is created. Right-click on the Active Directory domain and click on **New → User**. Provide the name and password of the new domain user to create the new domain user.

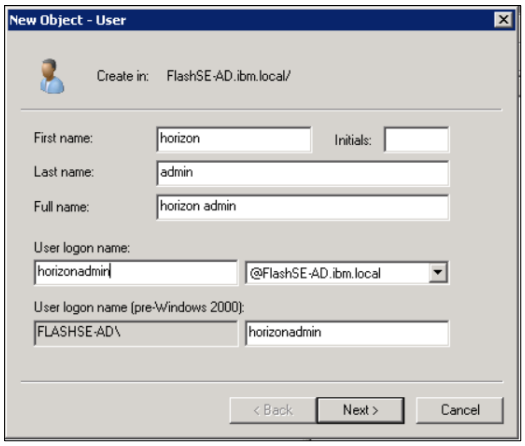

Figure 12: Specifying a new domain user

5. After the new user is created, delegate control for the OU to the newly created user. Open the Delegation of Control wizard by right-clicking the OU created in the prior step. In the wizard, select the newly created user to whom you want to delegate control.

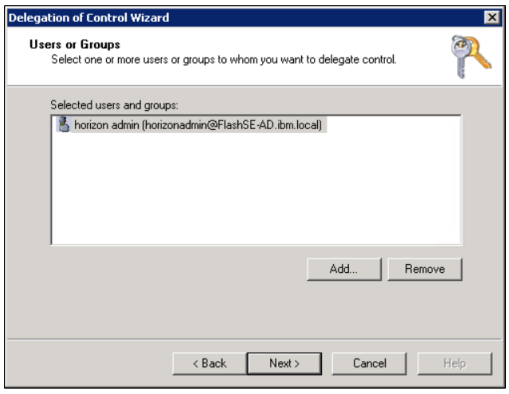

Figure 13: Delegating control to the user

6. In the screens that follow in the Delegation of Control wizard, select the tasks to be delegated to the user and configure the appropriate permissions you want to delegate. Click **Finish** to complete the delegation of control.

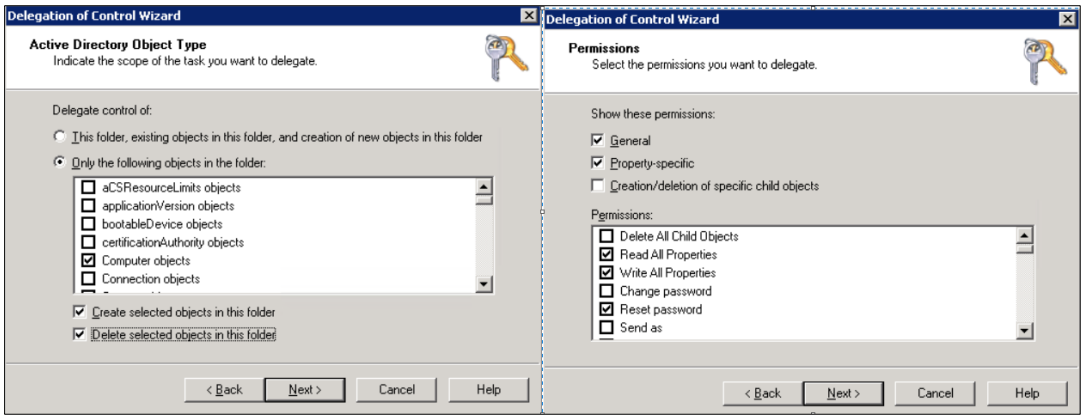

Figure 14: Delegation of Control wizard configuration

Configuring Microsoft SQL Server 2014

VMware vCenter Server requires a database to store and organize server data. For vCenter Server on Windows, you can either use the bundled PostgreSQL database (which can be installed and configured together with vCenter Server), or you can set up an external database prior to installing vCenter Server. Besides PostgreSQL, vCenter Server for Windows supports Oracle and Microsoft SQL Server as external databases.

Similarly, View Composer can store linked-clone desktop information in an SQL Server database. You can create a Composer database by adding it to SQL Server and configuring an Open Database Connectivity (ODBC) data source for it.

Horizon can also configure an event database in an SQL Server database. Horizon can send events to the SQL database configured to capture events.

This solution uses Microsoft SQL Server 2014 for vCenter, Composer and event databases.

1. Install the Windows 2012 R2 VM as SQL Server host, as per the configuration mentioned in Table 4 above.

2. Add the Microsoft .NET framework 3.5 feature to this server.

3. Proceed to install the VM and install the SQL Server 2014 database on it.

4. In the Features box on the Feature Selection menu, select the following features: Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tools Backward Compatibility, Management Tools - Basic and Management Tools - Complete.

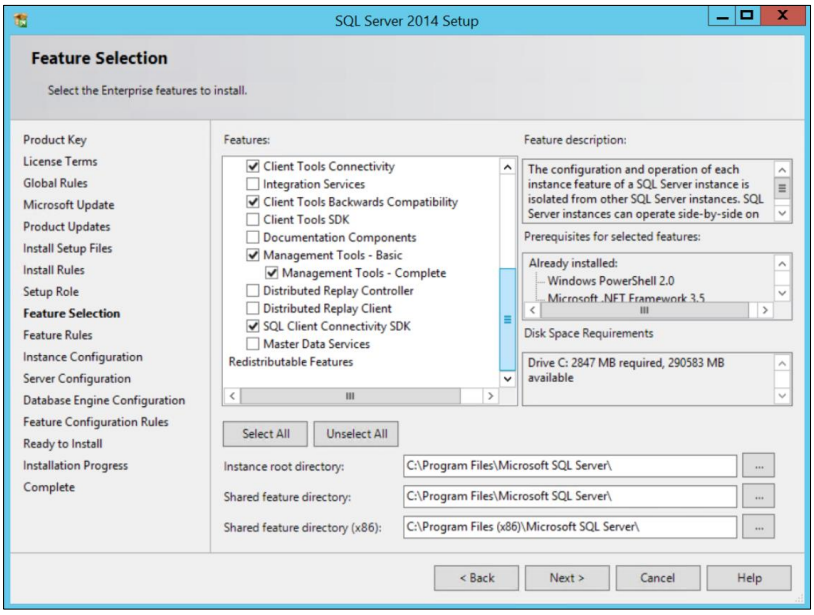

Figure 15: Microsoft SQL Server 2014 feature selection

5. In the Server Configuration tab on the Database Engine Configuration menu, choose Mixed Mode (SQL Server authentication and Windows authentication) as the authentication mode.

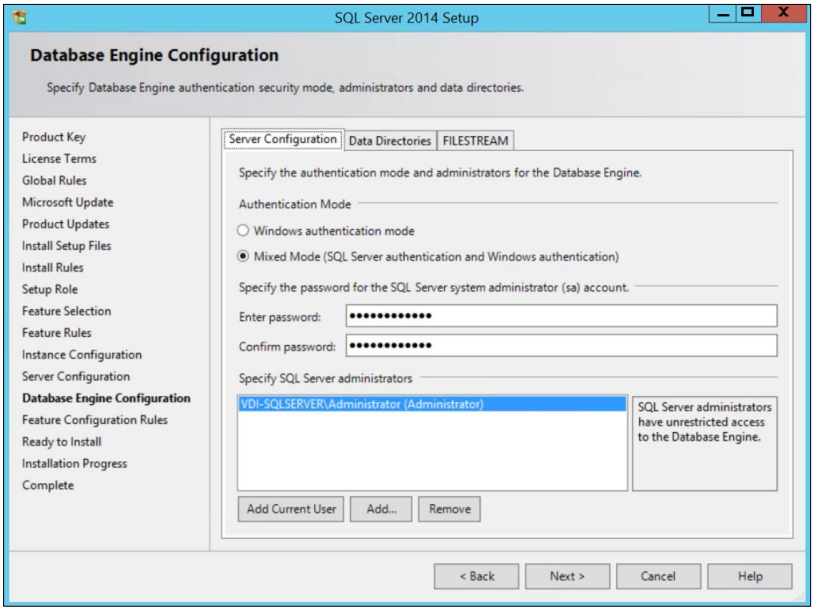

Figure 16: Microsoft SQL Server 2014 Database Engine configuration

6. After SQL Server 2014 has been installed, log in to the SQL Server with Domain\Administrator and open SQL Server Management Studio. Right-click **Database → New Database**. Provide the name of new database for vCenter and keep the **Options → Recovery Model** as “Simple” to create the database.

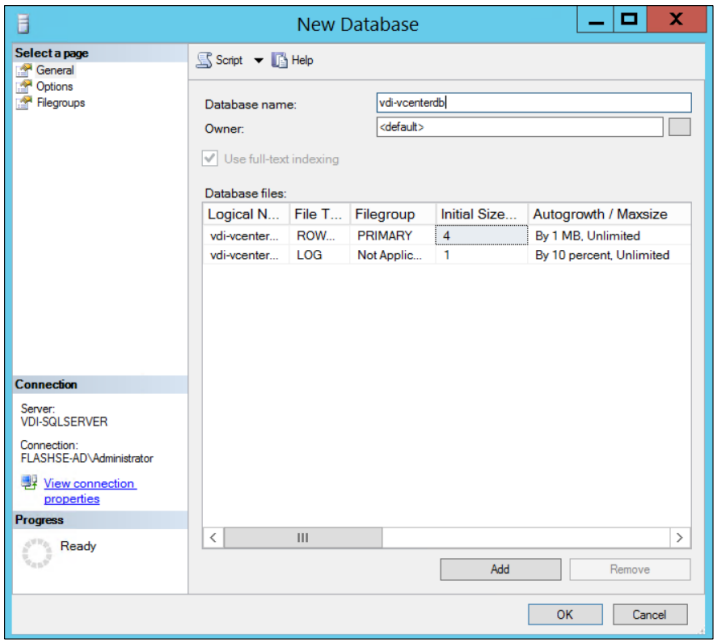

Figure 17: Creating new database in SQL server

7. After the database is created, Under the Security tab, right-click **Logins → New login** to create a new login for the vCenter database created above. Provide the login name, select SQL Server authentication and provide password. In the Default database drop-down menu, select the vCenter database created above.

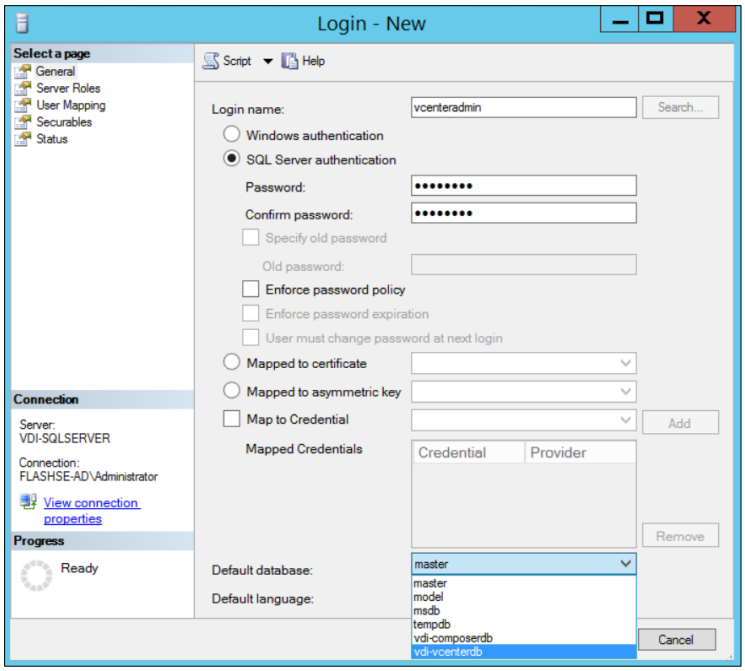

Figure 18: Creating a new login for the SQL Server database

8. Under the Server Roles menu, select the *sysadmin* server role to grant server-wide access to the user.

9. Under the User Mapping menu, select *db_owner* as database role membership for the user.

10. Follow steps 6 through 9 above to create databases for the View Composer and View event databases.

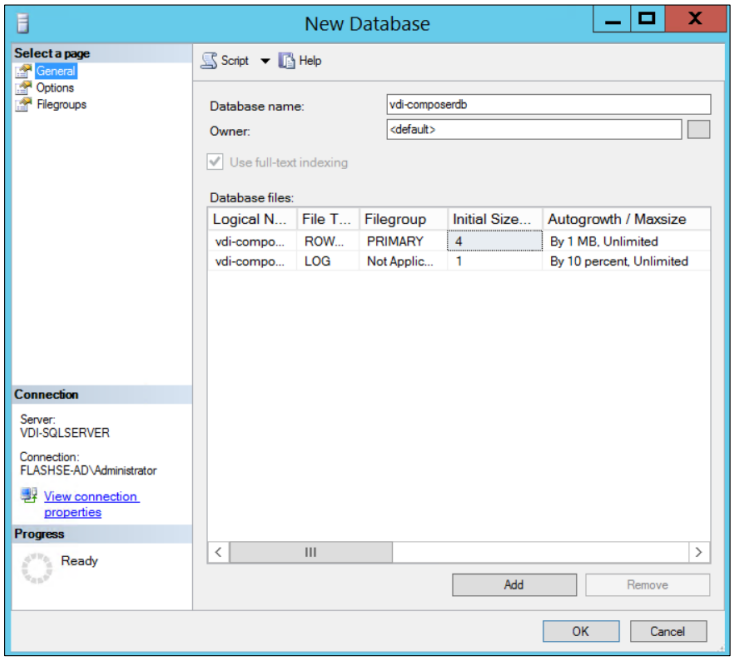

Figure 19: Creating a View Composer database in SQL Server

Configuring VMware vCenter Server 6.5

This solution is validated using a VMware vCenter Server 6.5 installation on a Windows 2012 R2 VM.

Installation of vCenter Server 6.5

1. Create a Windows 2012 R2 VM and log in as Domain\Administrator.

2. Before installing vCenter Server 6.5, download and install Microsoft SQL Server native client on a Windows 2012 R2 server.

3. Create an ODBC connection with SQL Server 2014 vCenter database. Launch Windows server manager and select **Tools → ODBC Data Sources (64 bit)**.

4. In the ODBC Data Source Administrator (64 bit) window, select the System DSN tab and click on **Add** to add System Data Sources.

5. In the Create New Data Source wizard, select **SQL Server Native Client**. Provide the name and description and select the SQL Server database instance from the drop-down menu. Then click **Next**.

6. On the next screen, provide the SQL Server user details and credentials to connect to the vCenter Server SQL Server database. Select the appropriate options in the next screen to configure ODBC connection with the SQL Server database instance.

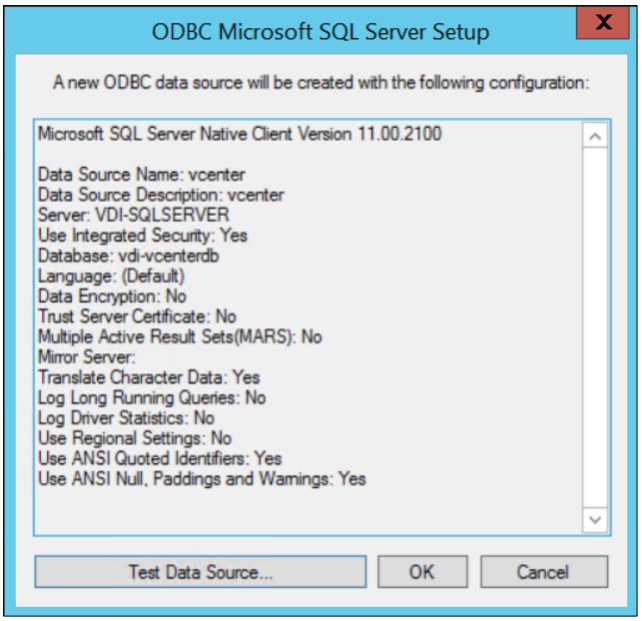

Figure 20: Configure ODBC data source with vCenter SQL Server database

7. Before creating, click on **Test Data Source** to validate the connectivity with the SQL Server database instance. After a successful test, click on **OK** to create the ODBC data source.

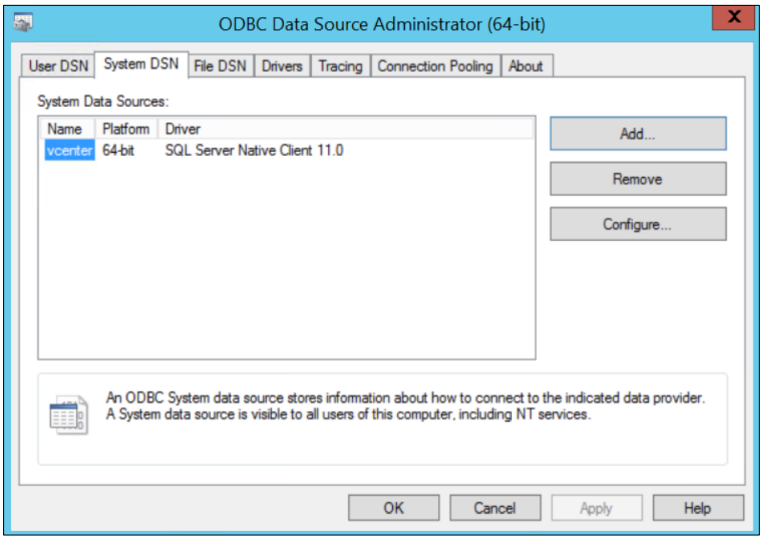

Figure 21: Creating an ODBC data source on vCenter Server

8. After successfully creating the ODBC connection with SQL Server, download and start the vCenter Server for Windows executable. Select Embedded Deployment type, provide the vCenter Server fully qualified domain name and provide the vCenter single sign-on configuration.

9. In the vCenter Server service account information, select Use Windows Local System Account. In Database Settings, select the Use an External Database option. Provide the name for System DSN and enter the vCenter database user name and database password for the vCenter SQL database created earlier.

10. Under Configure Ports, enter the appropriate details and installation location to proceed with vCenter Server installation.

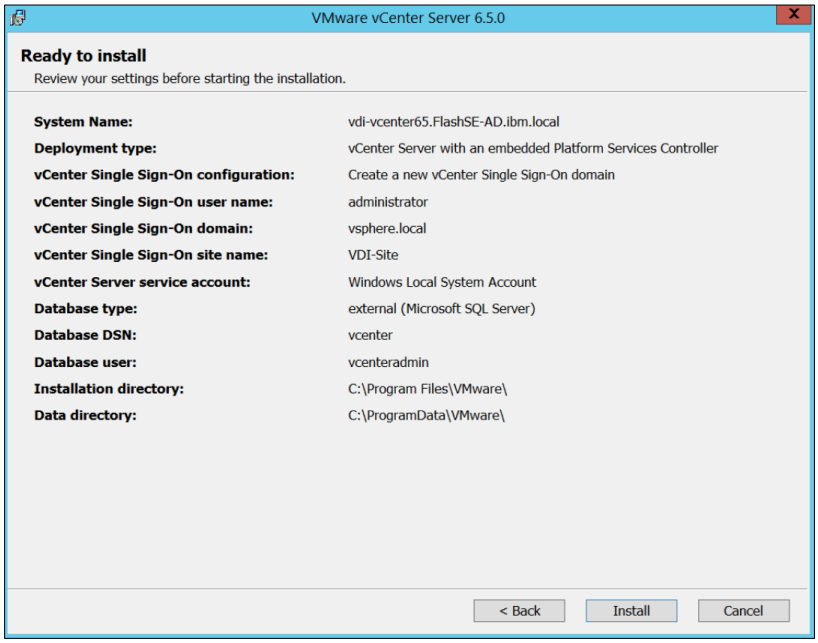

Figure 22: vCenter Server installation

vCenter Server 6.5 configuration

After vCenter Server has been installed, vCenter Server needs to be authorized for the Active Directory domain administrator.

1. Log in to vCenter Server 6.5 using the web interface.

2. Select **Home → Administration → Configuration → Identity Sources** tab and then add identity sources by clicking on the green "+" sign. On the next screen, select **Active Directory (Integrated Windows Authentication)**. Enter the domain name on the next screen to configure the identity source.

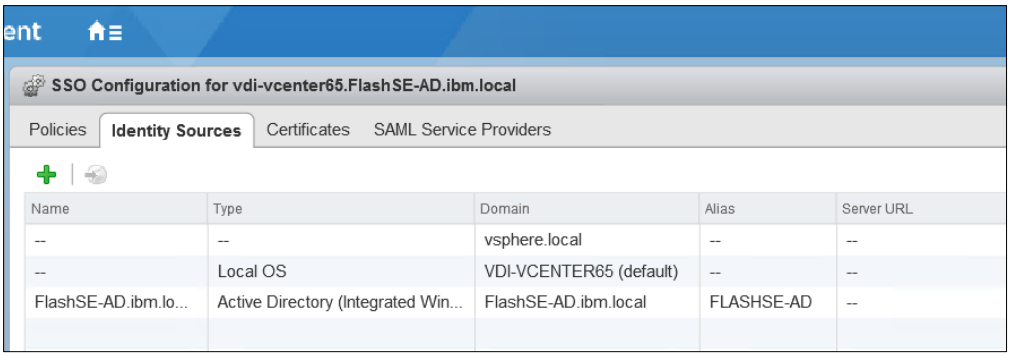

Figure 23: Active Directory configuration for vCenter Server

3. After the identity source has been added, provide the administrative permissions to the Active Directory vCenter administrator for this vCenter Server.

4. Select **Home → Access Control → Global Permissions → Manage** tab and then **Add permission**. Click on **Add** under Users and Groups. On the next screen, select the domain from the drop-down list and select the user from the domain. Provide the necessary permissions to the domain users (or groups) to provide vCenter Server privileges to the domain user.

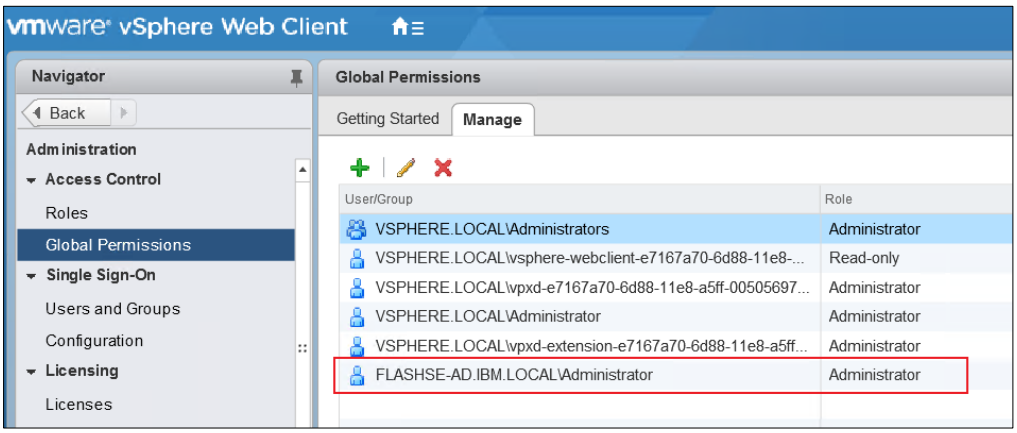

Figure 24: vCenter Server domain user permissions

5. Log out as local vCenter Server administrator and log in using domain vCenter administrator credentials.

6. After login, create a new datacenter for VDI desktop deployments.

7. Add a **New Cluster**. Select both **DRS** and **vSphere HA** for the cluster. Add new ESXi servers appropriately to the newly created cluster.

Configuring View Composer Server

View Composer Server enables users to manage a pool of desktops that share a common master image. Composer is used to manage linked clones that are copies of master images. Composer Server is an optional feature of Horizon and can be used when the instant-clone feature is not used. Even though linked clones share a master image, they operate as individual VMs. When changes are made using vSphere Web Client to a master image, it triggers Composer to apply the updates to all linked-clone desktops or automated RDSH farms, without affecting user settings or personal data.

1. Create a Windows 2012 R2 VM from the template and log in as Domain\Administrator.

2. Before installing Composer Server, download and install Microsoft SQL Server native client on Windows 2012 R2 server.

3. Create an ODBC connection with an SQL Server 2014 Composer database. Launch Windows server manager and select **Tools → ODBC Data Sources (64 bit)**.

4. On the ODBC Data Source Administrator (64-bit) window, select the **System DSN** tab and click on **Add** to add System Data Sources.

5. In the Create New Data Source wizard, select **SQL Server Native Client**. Provide the name, description and select SQL Server database instance from the drop-down menu and click **Next**. On the next screen, provide the SQL Server user details and credentials to connect to the Composer SQL Server database instance. Select the appropriate options in the next screen to configure the ODBC connection with the SQL Server database instance.

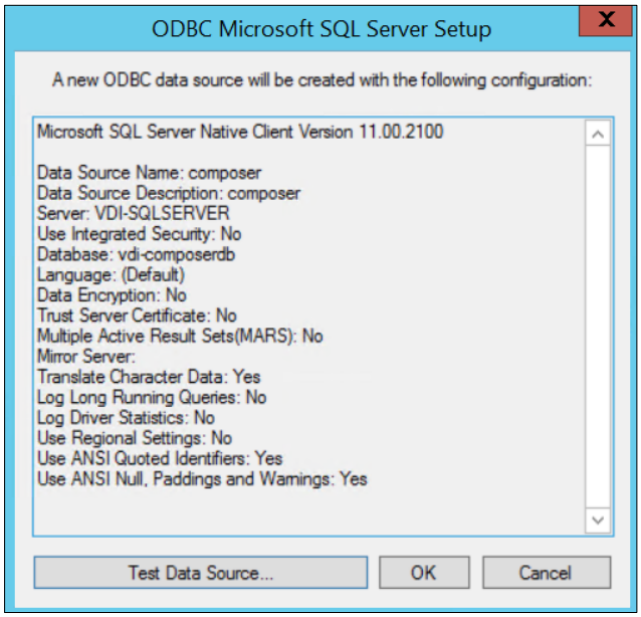

Figure 25: Configure an ODBC data source with a Composer SQL database instance

6. Before creating, click on **Test Data Source** to validate the connectivity with the SQL Server database instance. After a successful test, click on **OK** to create ODBC System Data Source.

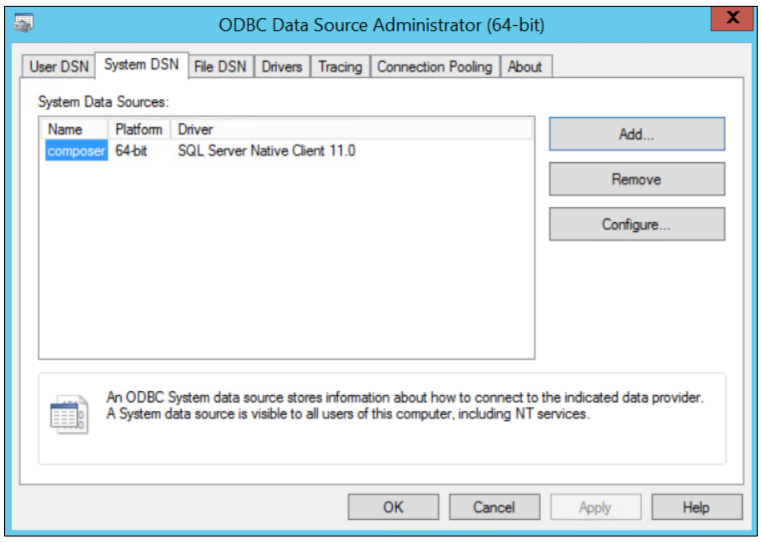

Figure 26: Creating an ODBC system data source on Composer server

7. After successfully creating the ODBC connection with SQL Server, download and start the installation of Composer Server. Start the installation wizard. Accept the license terms and select destination folder to install Composer Server.

8. In the Database Information window, enter the Data Source Name (DSN) for the Composer database and click on **Next**.

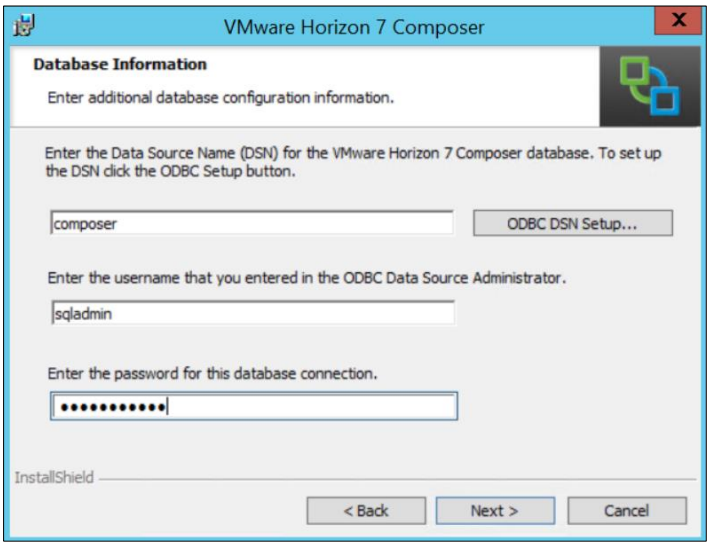

Figure 27: Composer server installation wizard

Enter Composer Server port settings and continue to follow the wizard to complete the installation of Composer Server.

Configuring Horizon Connection Server

Horizon Connection Server is the main component of Horizon. The Connection Server brokers client connections by authenticating users and directing incoming user desktop and application requests. Users connect to a Connection Server to access their virtual desktops and native, virtual, or RDSH-based applications.

The Connection Server provides the following management capabilities:

- Authenticating users
- Entitling users to specific desktops, applications and pools
- Assigning applications packaged with ThinApp to specific desktops and pools
- Managing local and remote desktop and application sessions
- Establishing secure connections between users and desktops or applications
- Enabling single sign-on
- Setting and applying policies
- Managing an instant-clone engine

Installing Horizon Connection Server

1. Create a Windows 2012 R2 VM from the template and log in as Domain\Administrator.

2. Download the Horizon Connection Server executable on the connection server and run it to start installation process.

3. Click **Next** on Welcome to the Installation Wizard for VMware Horizon 7 Connection Server. Accept the license agreement on the next window and select the destination folder for the connection server installation.

4. In the Installation Options window, select **Horizon 7 Standard Server** and click on the **Install HTML Access** checkbox. Then click **Next**.

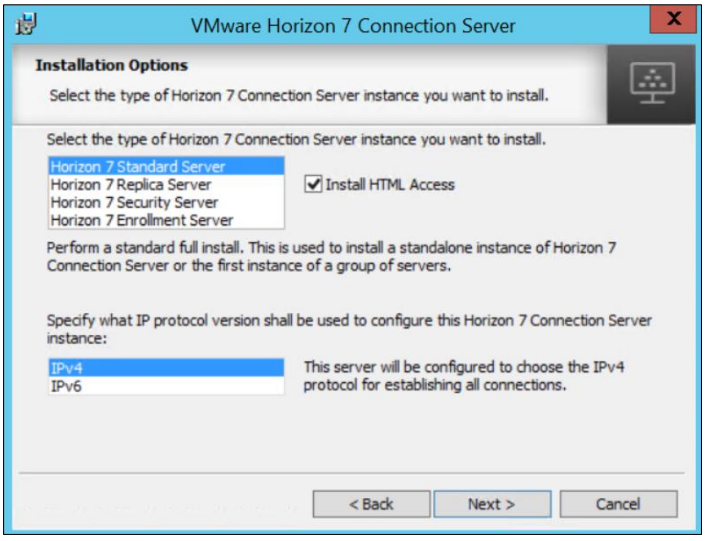

Figure 28: Horizon Connection Server installation wizard

5. In the Data Recovery page, enter the password and click **Next**.

6. In the Initial Horizon 7 Administrators page, enter the Horizon domain administrator or domain group and click **Next**.

7. Continue to follow the installation wizard to finish installation of Horizon Connection Server.

Installing Horizon Replica servers

In VMware Horizon, additional Connection servers are installed as Replica servers. After the installation of Replica Server, there is no difference between Replica Server and standard Connection Server. There could be multiple Replica servers in the environment. Follow the same installation procedure below on all Replica servers.

1. Create a Windows 2012 R2 VM from the template and log in as Domain\Administrator.

2. Download the Horizon Connection Server executable on the server and run it to start installation process.

3. Click **Next** on Welcome to the Installation Wizard for VMware Horizon 7 Connection Server. Accept the license agreement on the next window and select the destination folder for the connection server installation.

4. In the Installation Options window, select **Horizon 7 Replica Server** and click on the **Install HTML Access** checkbox. Then click **Next**.

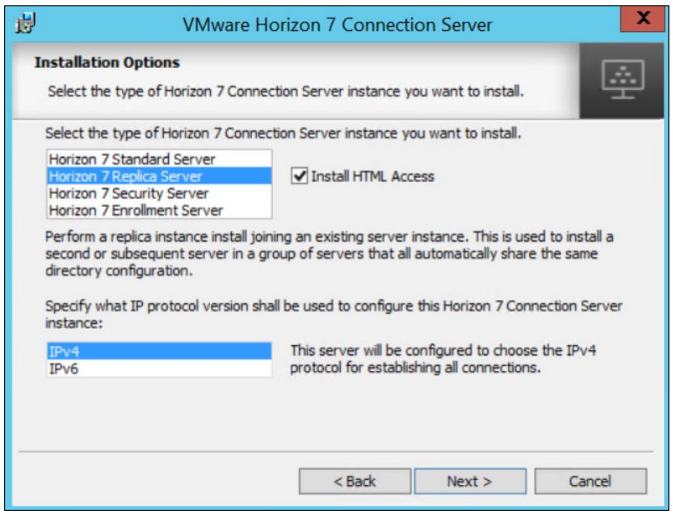

Figure 29: Selecting installation option for Replica server

5. In the Source Server page, enter the name of the Connection Server and click **Next**.

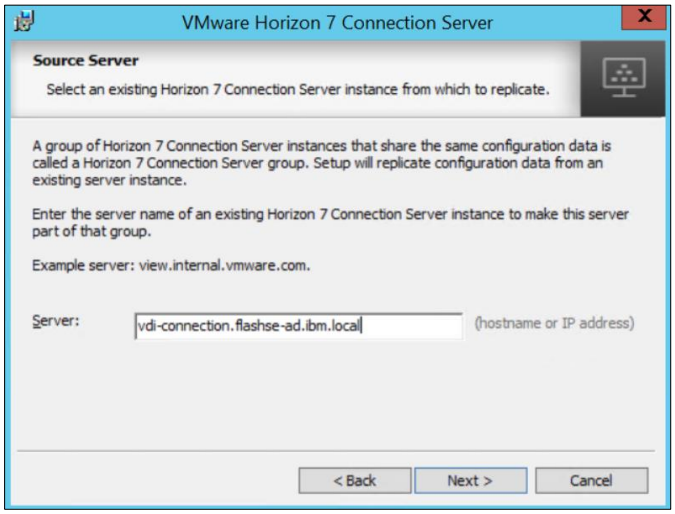

Figure 30: Selecting Source server option for Replica server installation

6. Continue to follow the installation wizard to finish installation of View Replica server.

Horizon Connection Server configuration

After the Connection Server and Replica servers are installed, log in to Horizon Connection Server configuration console. Horizon setup and administration can be performed from this console.

1. Log in to the VMware Horizon Administration Console as *horizon domain administrator*.

2. Under **Licensing**, click **Edit License** and enter valid license serial number.

3. Under **View Configuration → Servers → vCenter Servers** tab, click **Add** to add vCenter Server to Horizon. Enter vCenter Server credentials and configuration settings and click **Next**.

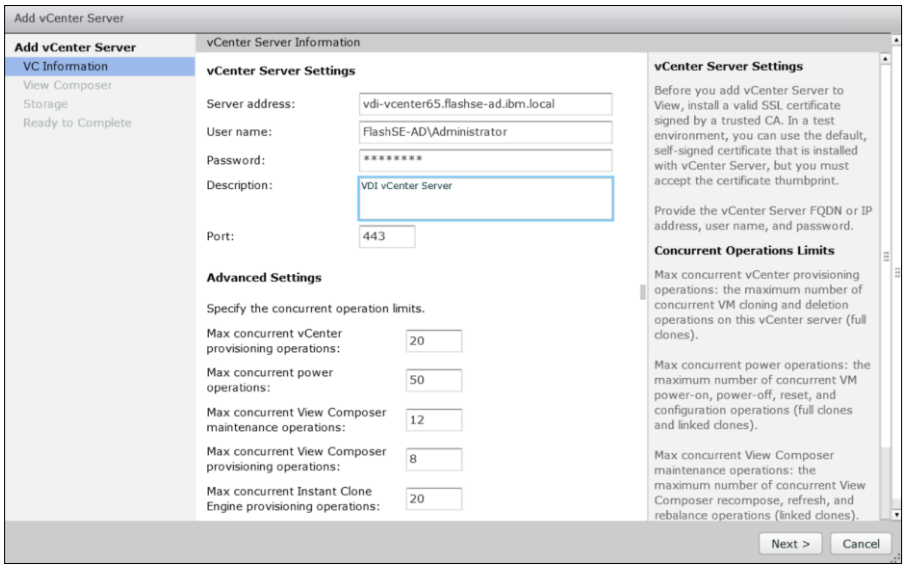

Figure 31: Adding vCenter Server to the Horizon Connection Server

4. In the View Composer screen, select **Standalone View Composer Server**, provide the details of Composer Server and click **Next**.

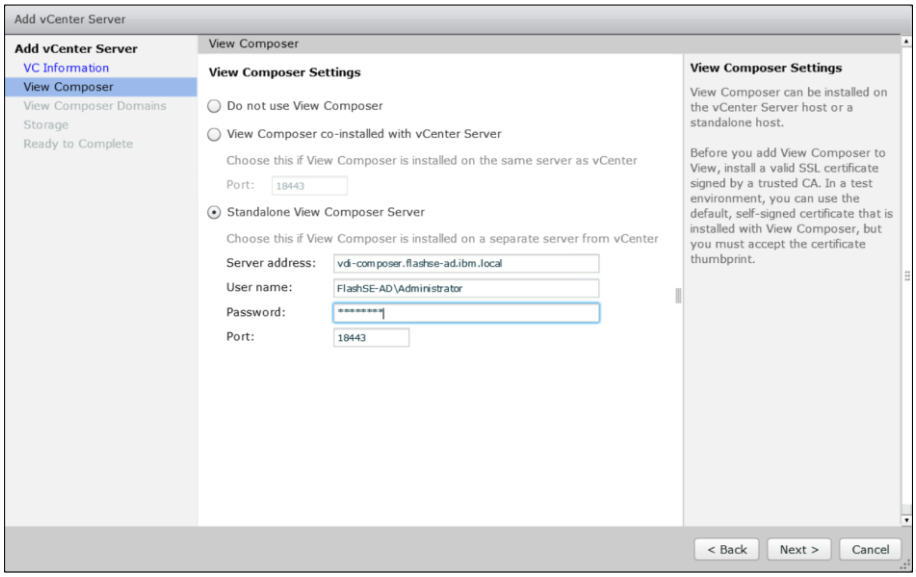

Figure 32: Adding Composer server to the Connection Server

5. In the View Composer Domain screen, click **Add** and enter the domain name and user credentials. Then click **OK** to add and **Next** to continue.

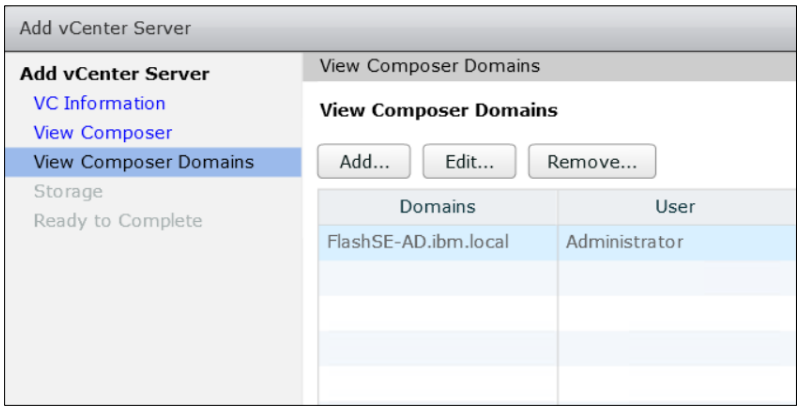

Figure 33: Adding View Composer domain to the Connection Server

6. In the Storage screen, select Enable View Storage Accelerator and Reclaim VM disk space as per your requirement and click **Next**.

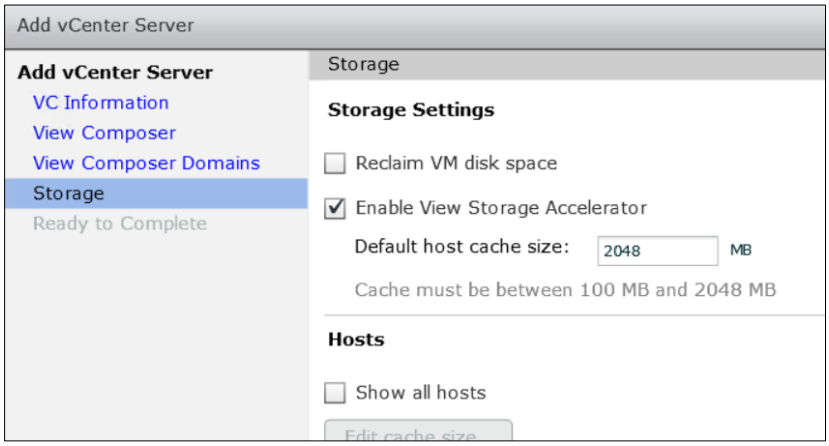

Figure 34: Storage configuration settings in the Connection Server

7. Verify the details on the next screen and click **Finish** to complete the Add vCenter Server wizard.

8. To configure the event database, browse to **View Configuration → Event Configuration**. Click **Edit** under Event Database and enter the event database details configured on the Microsoft SQL Server 2014.

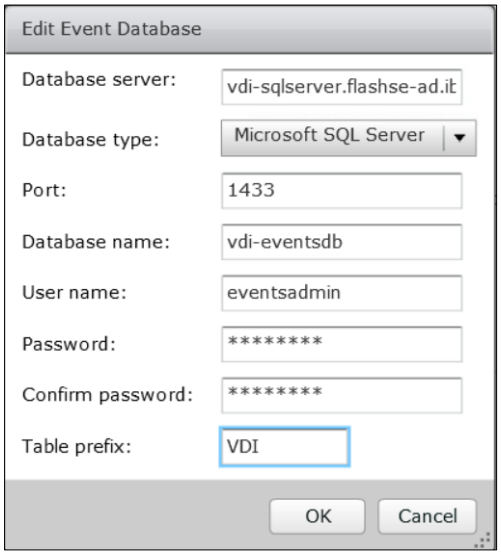

Figure 35: Event database configuration in the Connection Server

9. After the required configuration has been completed, browse to *Dashboard* to verify Horizon configuration.

Figure 36: Horizon 7 Administrator dashboard

Configuring Microsoft RDSH farm in Horizon

Remote Desktop Services (RDS) allows users to access centralized applications and desktops remotely. It provides secure remote desktop access and ability to the end users to run their applications and desktops from an RDSH server. An RDSH farm consists of multiple RDSH servers.

Horizon serves as point of integration between the Horizon Connection Server and the individual applications installed on each RDSH server. This integration allows RDS applications to be pushed out using Horizon, taking advantage of the PC-over-IP (PCoIP) protocol, view management, and single-pane-of-glass management to access applications and virtual desktops.

In order to create an RDSH farm in Horizon, first the master image needs to be created with RDSH servers.

Creating a master image for VMware Horizon RDS deployment

In this solution validation, a RDSH master image is configured as follows.

Configuration	Operating system	Virtual CPUs	Memory (GB)	Storage size (GB)
RDSH VM	Microsoft Windows 2012 R2 Standard	6	24	60

Table 6: RDSH server configuration

The RDSH master image has been set up with three core roles for this solution validation. In the production environment, these roles should be installed on separate servers.

Remote Desktop Session Host (RDSH): Applications are installed on RDSH servers, and this role allows publishing applications from RDSH servers.

Remote Desktop Connection Broker (RDCB): This role allows load-balancing between RDSH servers.

Remote Desktop Web Access (RDWA): This role allows web access to the remote desktop environment.

1. Create a Windows 2012 R2 VM from the template. Make sure *VMXNET3* has been selected as network adapter and install the latest patches on the VM.

2. Install the Remote Desktop role on the VM.

3. Start Server Manager and browse to **Manage → Add Roles and Features**. In the Installation Type, select Remote Desktop Service installation and click **Next.** Since we are installing all the roles on a single server, in the "Select deployment type" window, select **Quick Start** and click **Next**.

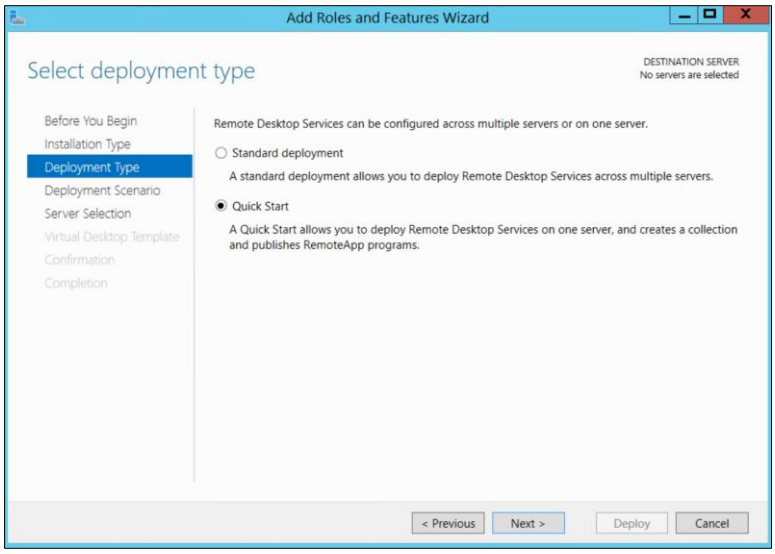

Figure 37: Selecting deployment type for the RDSH server master image

4. In the Select deployment scenario window, select Session-based desktop deployment and click **Next**.

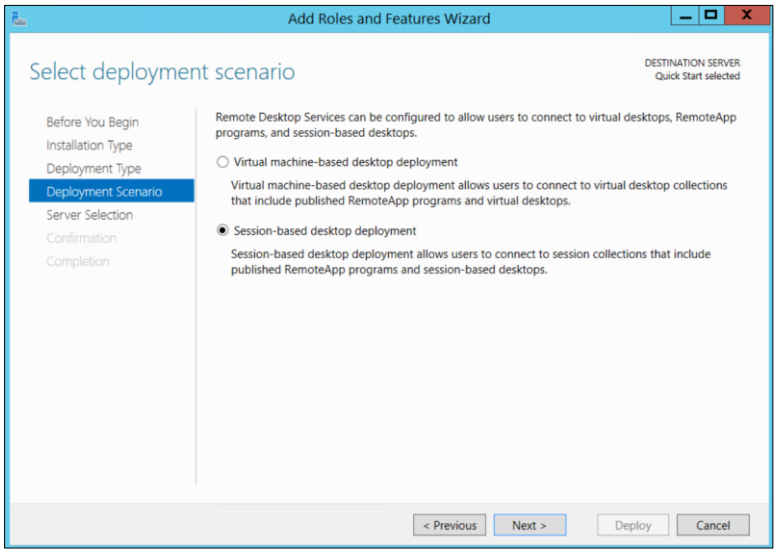

Figure 38: Selecting the deployment scenario for the RDSH server master image

5. Select the local server for installing all the Remote Desktop roles and continue to follow the wizard. Reboot the VM to complete installation of Remote Desktop server roles on the master VM.

6. After RDS roles have been installed, publish the applications from RDSH server. For publishing the applications, click **Start Server Manager → Remote Desktop Services → Collections → QuickSessionCollection**. Since Quick Start deployment type is selected, it will create QuickSessionCollection that will contain the following applications: WordPad, Calculator and MS Paint. To add new programs, in the REMOTEAPP PROGRAMS window, click on **TASKS → Publish RemoteApp Programs**. Follow the wizard to add and publish the programs.

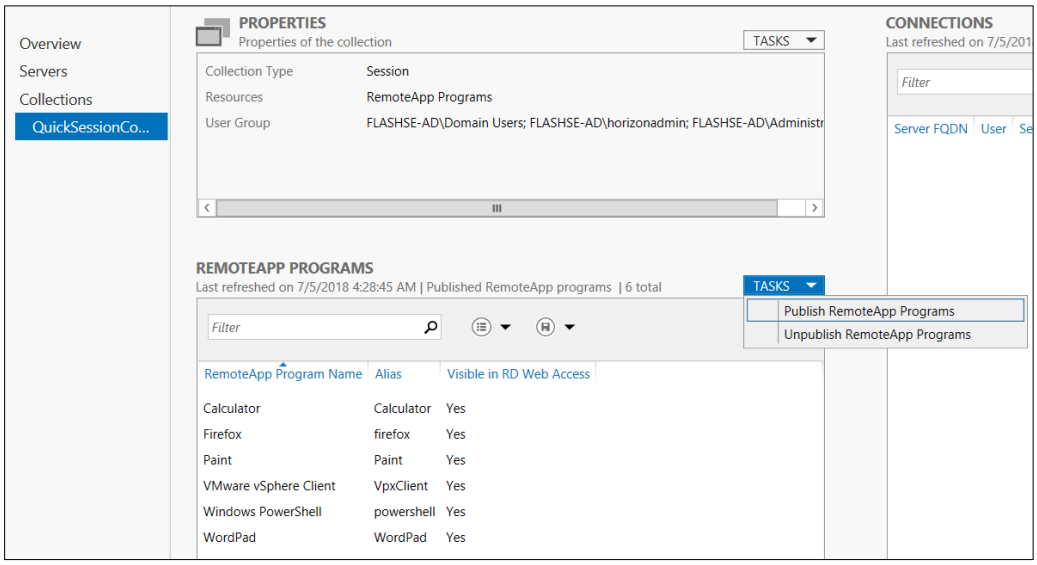

Figure 39: Publishing the programs from the RDSH server

7. After the programs are published, click **TASKS → Edit Properties** in the "Properties" window and continue to follow the wizard to specify the desired user permissions.

8. After Remote Desktop server installation and configuration is completed, download VMware Horizon Agent on the RDSH server and execute the installable to start installation.

9. In the installation wizard, accept the license agreement and select **Network protocol** configuration. In Custom Setup, select either VMware Horizon View Composer Agent or VMware Horizon Instant Clone, as both cannot be installed together on the same server.

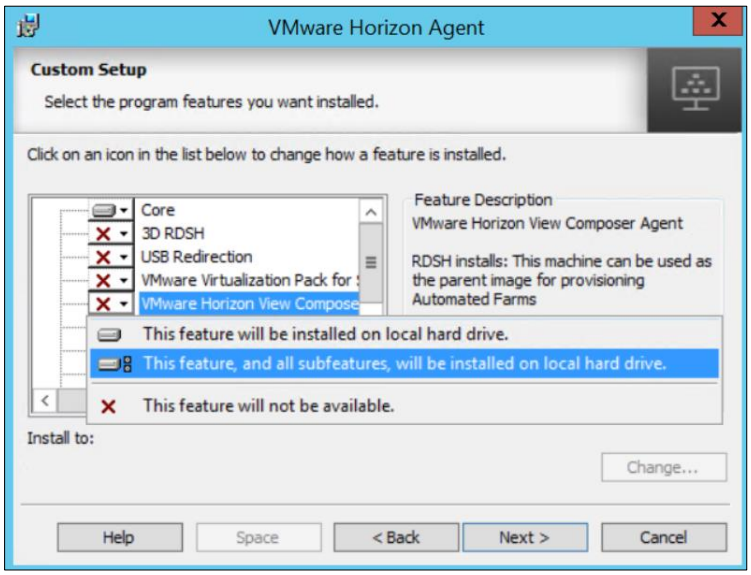

Figure 40: Installation of Horizon Agent on the RDSH master image

10. Continue to follow the installation wizard to complete installation of Horizon Agent on the RDS server master image.

11. Shut down the RDS server master VM and clone the master VM. Create a snapshot of the master VM.

Deploying RDSH farm using Horizon

In Horizon, RDSH farms can be created using newer methods of either instant clones or linked clones.

Prerequisites before deploying an RDSH farm in Horizon

Deploying an RDSH farm can be considered as final step in the process of deploying RDSH servers using Horizon. Confirm that following prerequisites are completed before deploying an RDSH farm in Horizon.

- Created the required infrastructure services such as DNS, Active Directory, DHCP as discussed in this Blueprint.
- vCenter Server is installed and configured for deploying RDSH servers.
- ESXi servers are configured and added to the vCenter Server.
- Storage is configured from IBM FlashSystem 9100 and mapped to ESXi servers.
- Horizon Connection Server (with multiple Replica servers) has been set up and configured.
- If View Composer linked clones are used, View Composer Server is deployed.
- The RDSH master image has been installed and configured.

If View Composer linked clones are used, first create a customization specification for RDSH servers inside vCenter Server.

1. Log in to vCenter and browse to **Home → Policies and Profiles → Customization Specifications** and click **Create a new specification**.

2. Follow the New VM Guest Customization Spec wizard and create a new customization specification for the RDSH server.

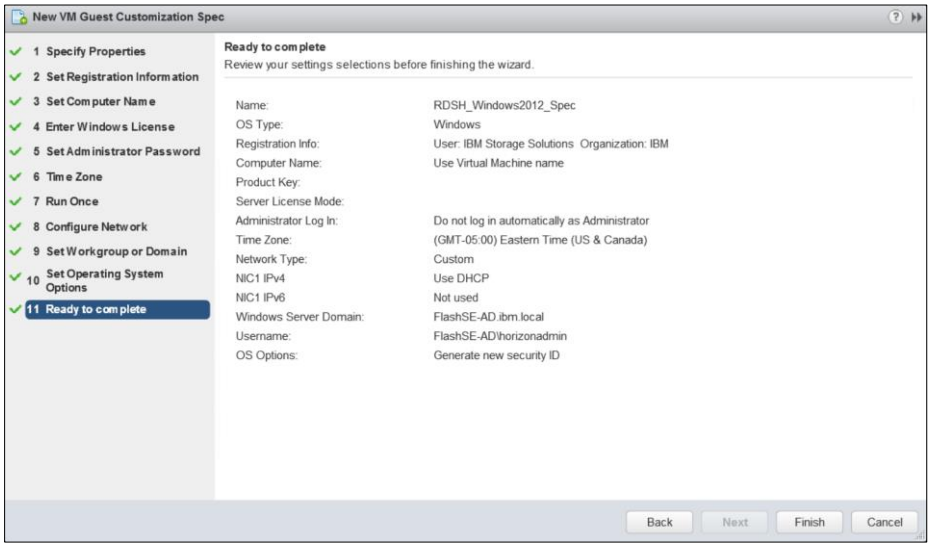

Figure 41: Creating customization specification for RDSH servers

3. After taking a snapshot of the master RDSH server image, power on the master RDSH server image.

4. Log in to Horizon Administrator console and browse to **Resources → Farms**. Click **Add** to start the Add Farm wizard.

5. Select Type as Automated Farm. In vCenter Server selection, select View Composer linked clones and select both vCenter Server and View Composer. Click **Next**.

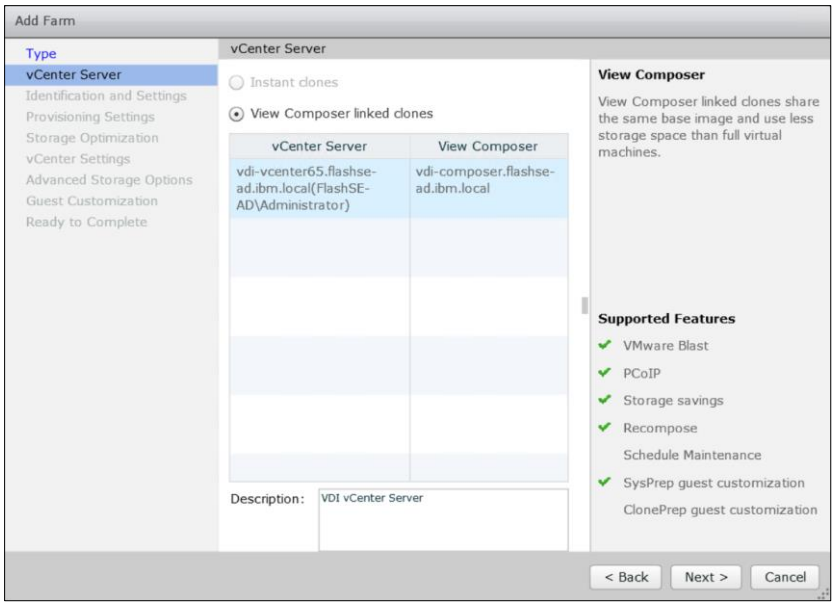

Figure 42: Selecting vCenter Server for View Composer linked clones in RDSH farm deployment

6. In the Identification and Settings menu, provide the ID and description of the RDSH farm and select PCoIP as Default display protocol and other settings appropriately.

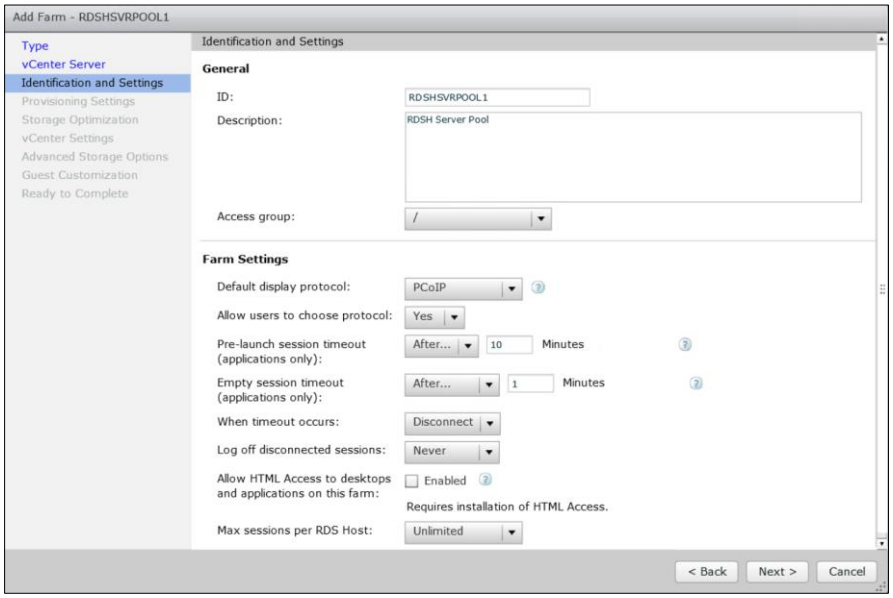

Figure 43: Selecting Identification and Settings in RDSH farm deployment

7. In the Provisioning Settings menu, select the Basic settings and provide the Virtual Machine Naming pattern. In Farm Sizing, provide the maximum number of VMs to be deployed automatically as RDSH servers.

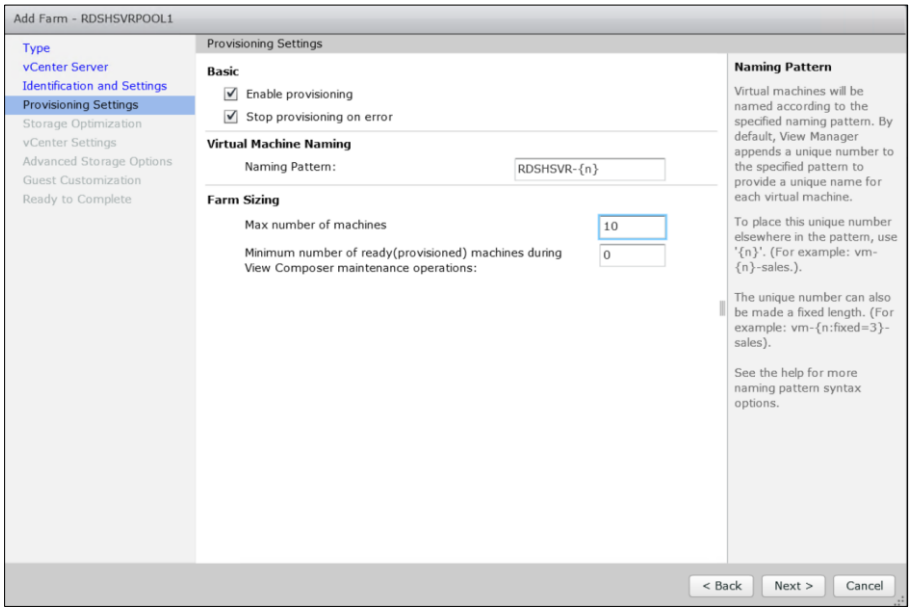

Figure 44: Selecting Provisioning settings in RDSH farm deployment

8. In the next window, go to the Storage Optimization menu and enter settings appropriately.

9. In the vCenter Settings menu, browse and select Parent VM and Snapshot under Default Image. Select Virtual Machine folder location. Under Resource Settings, select the appropriate Host or cluster where the RDSH farm is deployed and select Resource Pool for this farm.

10. In Datastores, click **Browse** and select the linked-clone datastore. Specify that Storage Overcommit is Conservative and click **OK**.

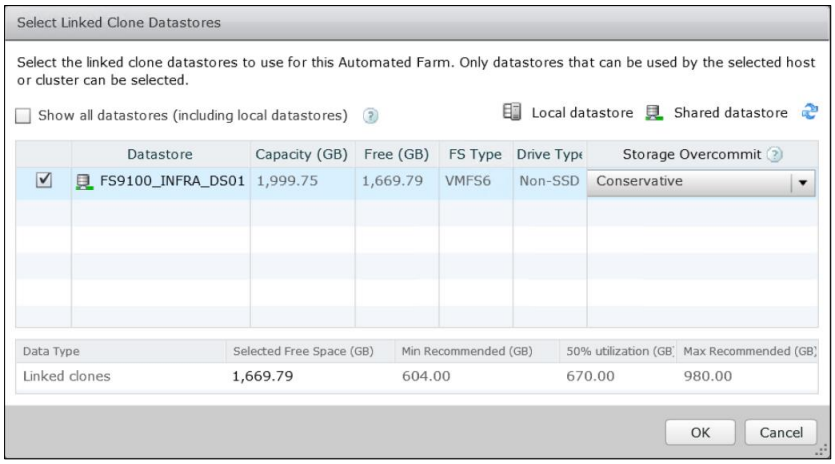

Figure 45: Selecting linked clone datastores setting in RDSH farm deployment

11. Verify all the vCenter Settings and click **Next** to continue.

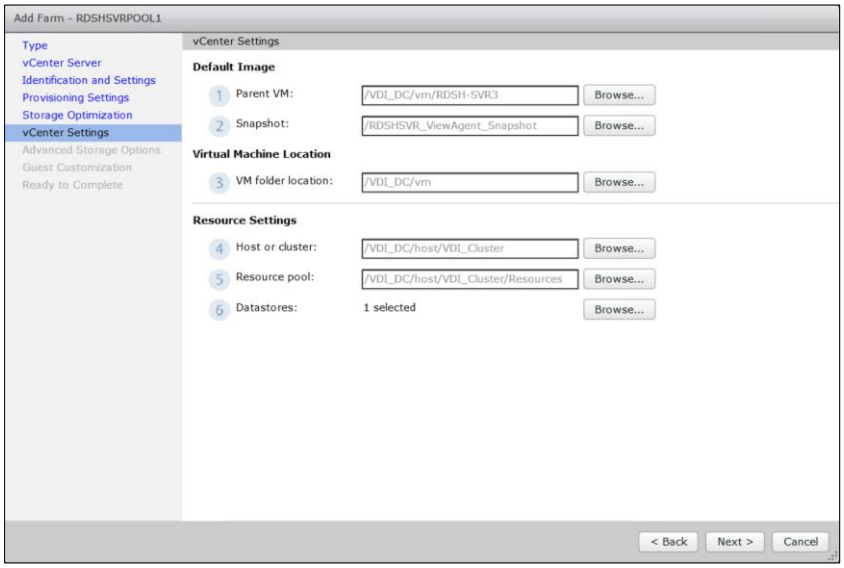

Figure 46: vCenter settings in RDSH farm deployment

12. In the Guest Customization menu, select the domain from the drop-down list and browse to the OU created. Select the customization specification and click **Next** to continue.

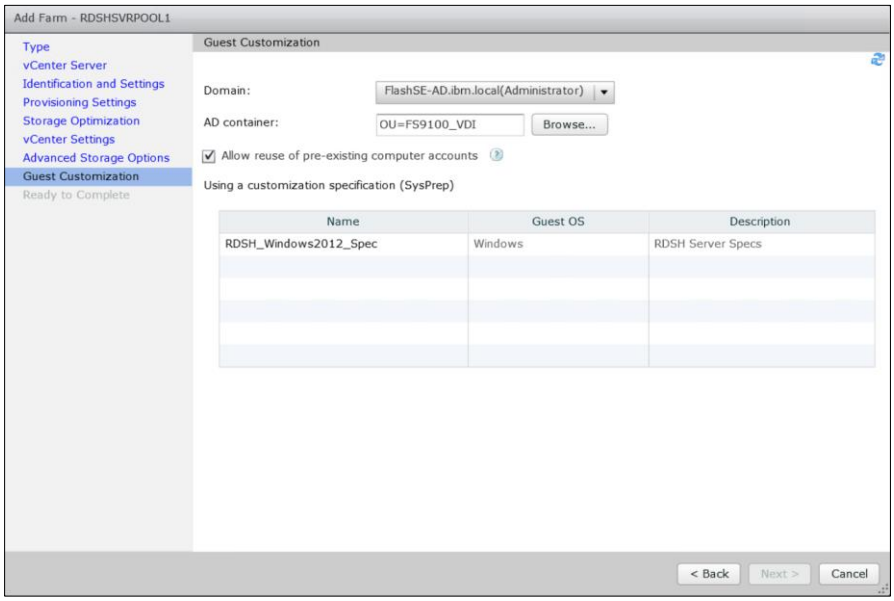

Figure 47: Applying customization to a newly created OU.

13. Summarize all the configuration and click **Finish** to complete creation of the RDSH farm. It should be listed under Farms on VMware Horizon Administrator.

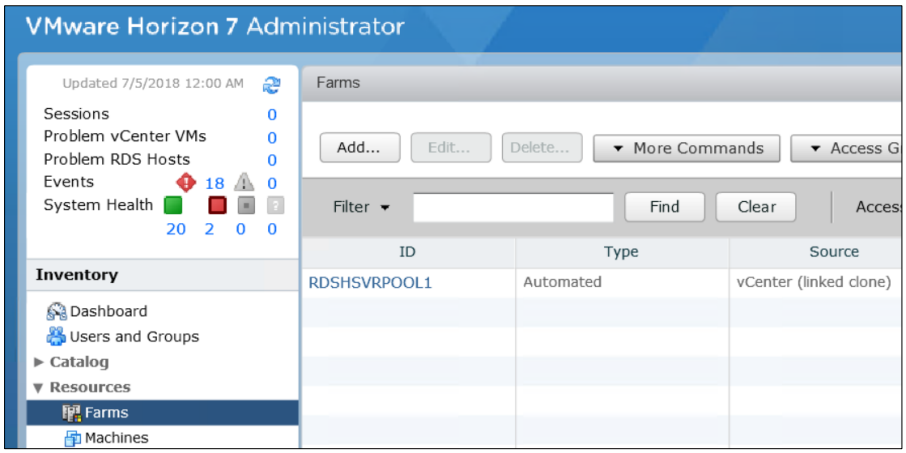

Figure 48: RDSH farm in Horizon

14. The newly created RDSH farm will start populating RDSH servers.

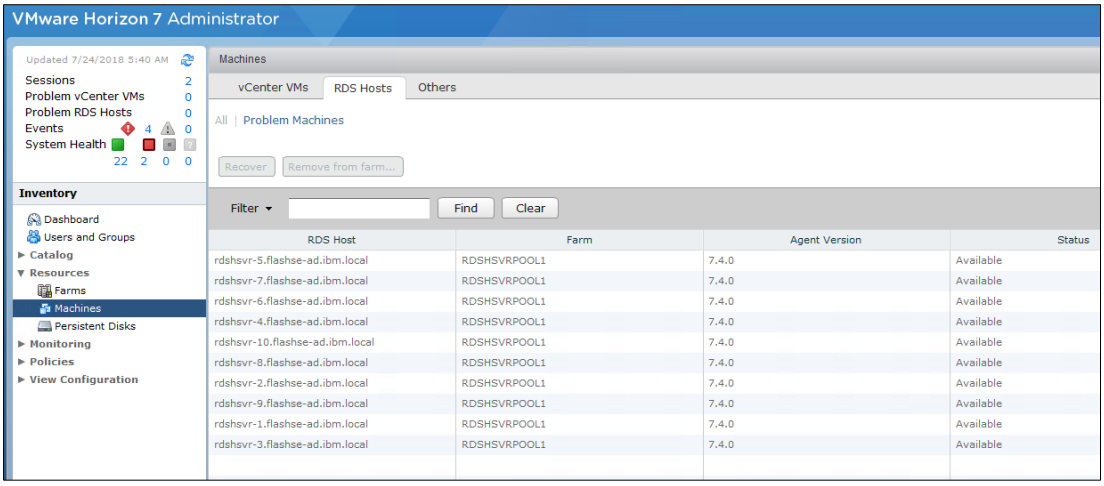

Figure 49: RDSH servers in Horizon

Configuring virtual desktop pools in VMware Horizon

A VMware View virtual desktop pool is a collection of desktops from which users can select when they log in using the View client. A pool can be created based on a subset of users, such as finance or HR departmental users, when you are deploying multiple virtual desktop master images. In Horizon, a pool acts as a central point of desktop management. From the pool, you create, manage and entitle access to View desktops. With Horizon Administrator, you create pools of desktops that deliver View desktop access to clients. Horizon Manager deploys pools from desktop sources, which can be VMs that are managed by vCenter Server.

In Horizon, the following desktop pools can be created:

Automated desktop pool: An automated desktop pool uses a vCenter Server template or VM snapshot to generate new VMs. These VMs can be created when the pool is created, or generated on demand based on pool usage.

Manual desktop pool: A manual desktop pool provides access to an existing set of VMs. Any type of machine that can install Horizon Agent is supported, including vCenter VMs and physical machines.

RDS desktop pool: A Microsoft RDS desktop pool provides RDS sessions as machines to View users. The Connection Server manages RDS sessions in the same way as normal machines. Microsoft RDS hosts are supported on vCenter VMs and physical machines.

An automated desktop pool or manual desktop pool can have the following assignment types:

Dedicated: In this arrangement, users receive the same machines each time they log into the desktop pool. In dedicated assignment, if automatic assignment is enabled and if user is connected to the desktop pool but does not have a machine, View automatically assigns a spare machine to the user. If no spare machine exists, a new machine may be created in the automatic desktop pool.

Floating: In this arrangement, users will receive machines picked randomly from the desktop pool each time they log in.

In Horizon, desktop pools can be of the following types:

Instant clones: Instant clones share the same base image but use less storage space than full VMs. Instant clones are created using vmFork technology. Instant clones always stay powered on and are recreated from the current published image after logoff.

View Composer linked clones: View Composer linked clones share the same base image and use less storage space than full VMs. The user profile for linked clones can be redirected to persistent disks that will be unaffected by OS updates and refreshes.

Full Virtual Machine: In this arrangement, VM sources will be full VMs that are created from a vCenter Server template. Since each is a full copy of VM, these consume large storage space and are not commonly used.

In order to create a desktop pool in Horizon, a master image must first be created.

Creating a Windows 10 master image for virtual desktop pools in Horizon

In this solution validation, Windows 10 master image is configured with the following configuration.

Configuration	Operating system	Virtual CPUs	Memory (GB)	Storage size (GB)
Windows 10 VM	Microsoft Windows 2010 Enterprise	1	2 GB	32 GB

1. Create a Windows 2010 VM from the template. Make sure *VMXNET3* has been selected as network adapter for the VM.

2. Install the latest patches on the VM and join the VM to the domain.

3. Download VMware Horizon Agent on the VM and execute the installable to start installation.

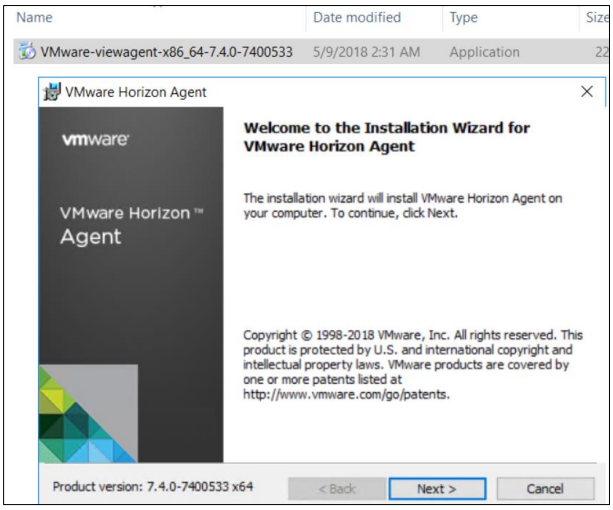

Figure 50: VMware Horizon Agent installation on a Windows 10 master image

4. In the installation wizard, accept the license agreement, and select the Network protocol configuration. In Custom Setup, select either VMware Horizon View Composer Agent or VMware Horizon Instant Clone, as both cannot be installed together on the same server.

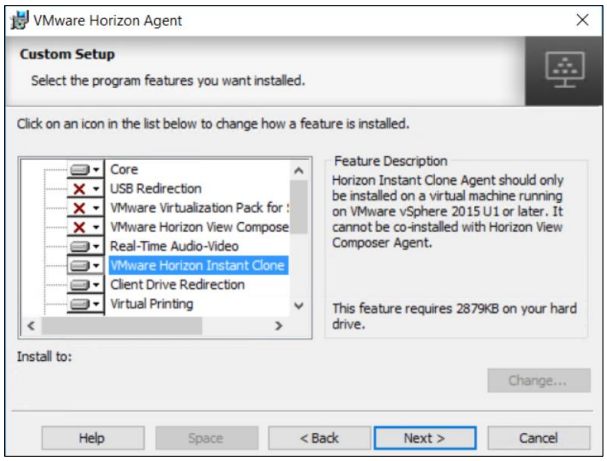

Figure 51: Selecting programs during Horizon Agent installation

5. Continue to follow the installation wizard to finish installation of Horizon View Agent on the Windows 10 master image. Reboot the VM to complete the installation.

6. Shut down the Windows 10 master VM and clone the VM. Create a snapshot of the master VM.

Deploying VM desktop pools in Horizon

Deploying desktop pools can be considered a final step in the process of deploying remote desktops using Horizon. Confirm that the following prerequisites are met before deploying desktop pools in Horizon.

Prerequisites before deploying VM desktop pools

- Required infrastructure services such as DNS, Active Directory and DHCP, as discussed in this Blueprint, have been created
- vCenter Server is installed and configured for deploying desktop pools.
- ESXi servers are configured and added to vCenter Server.
- Storage is configured from IBM FlashSystem 9100 and mapped to ESXi servers.
- Horizon Connection Server (with multiple Replica servers) has been set up and configured.
- Windows 10 master image has been deployed.

In this solution validation, desktop pools using both instant clones and View Composer linked clones are deployed.

However, only the steps for deploying a desktop pool using instant clones are illustrated below.

1. Log in to the VMware Horizon administration console and browse to **Catalogs → Desktop Pools**, then click **Add** to start the Add Desktop Pool wizard.

2. We are deploying an Automated Desktop Pool in this solution validation. Under Desktop Pool Definition, select Automated Desktop Pool as Type and click **Next**. Select User Assignment as Floating and click **Next**. On the vCenter server, select Instant clones and select the vCenter Server, then click **Next**.

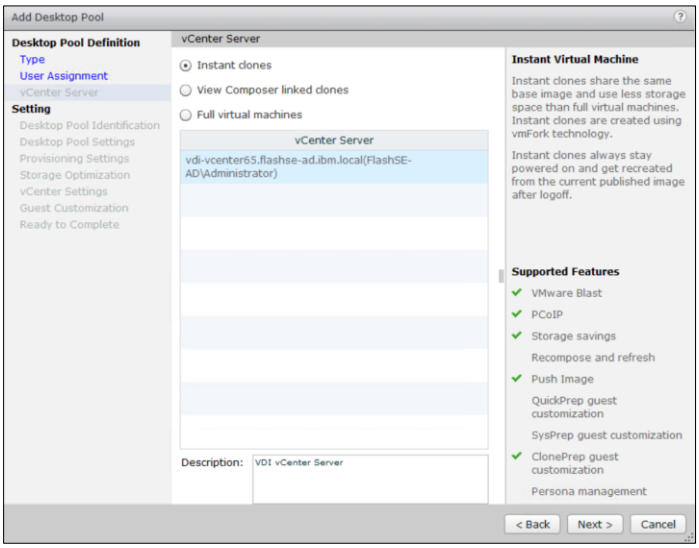

Figure 52: Selecting vCenter server configuration in desktop pool deployment

3. Provide the Desktop Pool ID, description and click on **Next**. Select appropriate Desktop Pool Settings and click **Next**.

4. In the Provisional Settings screen, select Basic settings, provide the Virtual Machine naming pattern and provide the maximum number of machines to be provisioned and click **Next**.

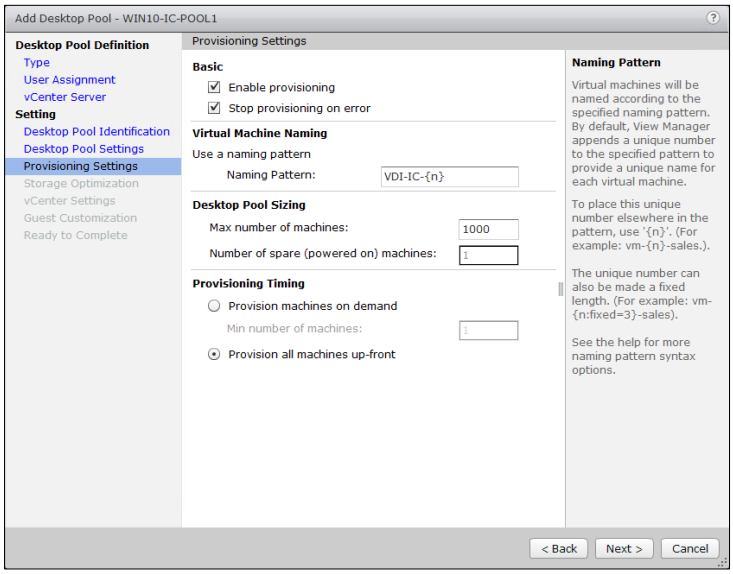

Figure 53: Selecting provisional settings for desktop pool deployment

5. In the next window, select Storage Optimization settings appropriately.

6. In vCenter Settings, browse and select Parent VM and Snapshot under Default Image. Select Virtual Machine folder location. Under Resource Settings, select the cluster where the desktop pool is deployed and select Resource Pool for this farm.

7. In Datastores, click on **Browse** and select the linked clone datastores created on IBM FlashSystem 9100 storage, then click **OK**.

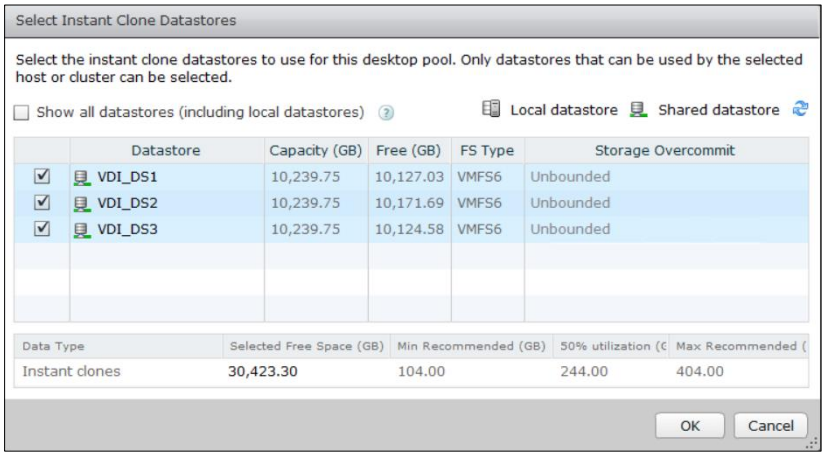

Figure 54: Selecting instant clone datastores for desktop pools deployment

8. In Networks, browse and select the networks for the VM deployments, then click **Next**.

9. In Guest Customization, select Domain from the drop-down list. Browse and select the Organizational Unit of Active Directory for VM deployment, then click **Next**.

10. Verify the configuration settings in the Ready to Complete screen. Check the box next to Entitle users after this wizard finishes, then click **Finish** to complete desktop pool deployment.

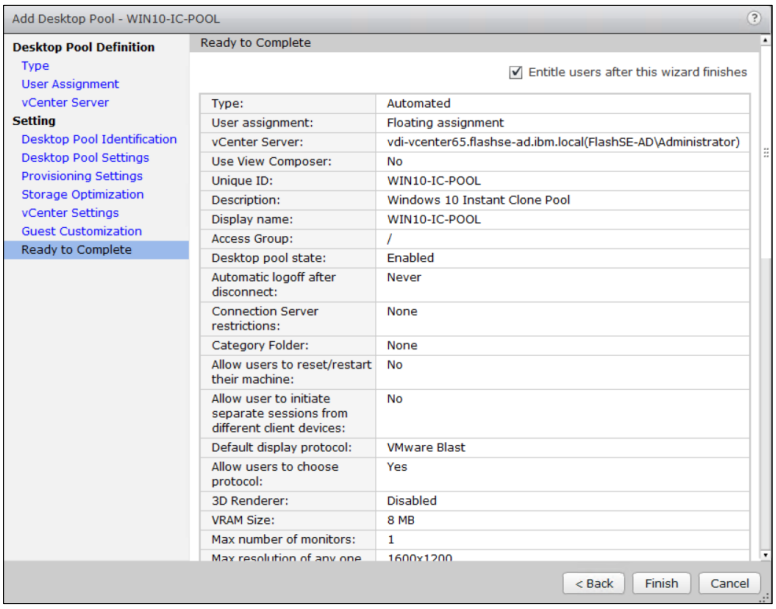

Figure 55: Desktop pool deployment summary configuration

11. The Entitlement wizard will open. Click on **Add** to add new users or groups who can use the desktop pool.

12. Select and add users or groups, then click **Close** to finish the Entitlement wizard.

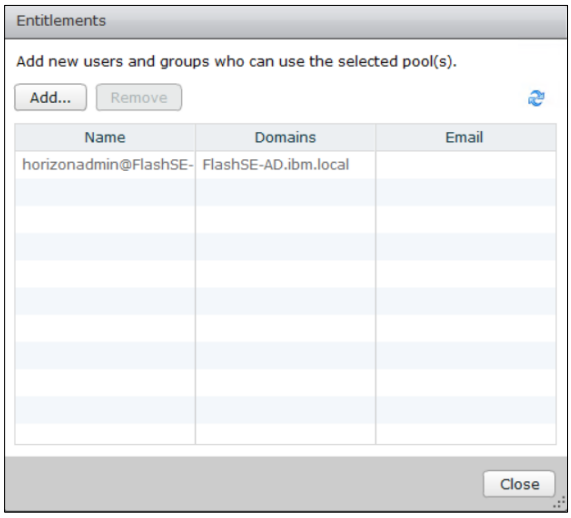

Figure 56: Entitling users for a desktop pool

13. The newly created desktop pool is displayed under **Catalog → Desktop Pools**.

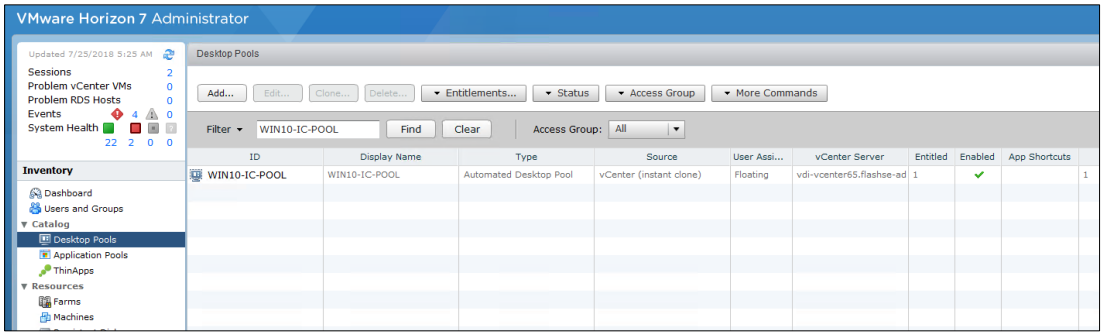

Figure 57: Desktop pools in Horizon

14. The newly created desktop pool will start deploying desktops. Browse to **Resources → Machines → vCenter VMs** tab to check the status of desktop deployments.

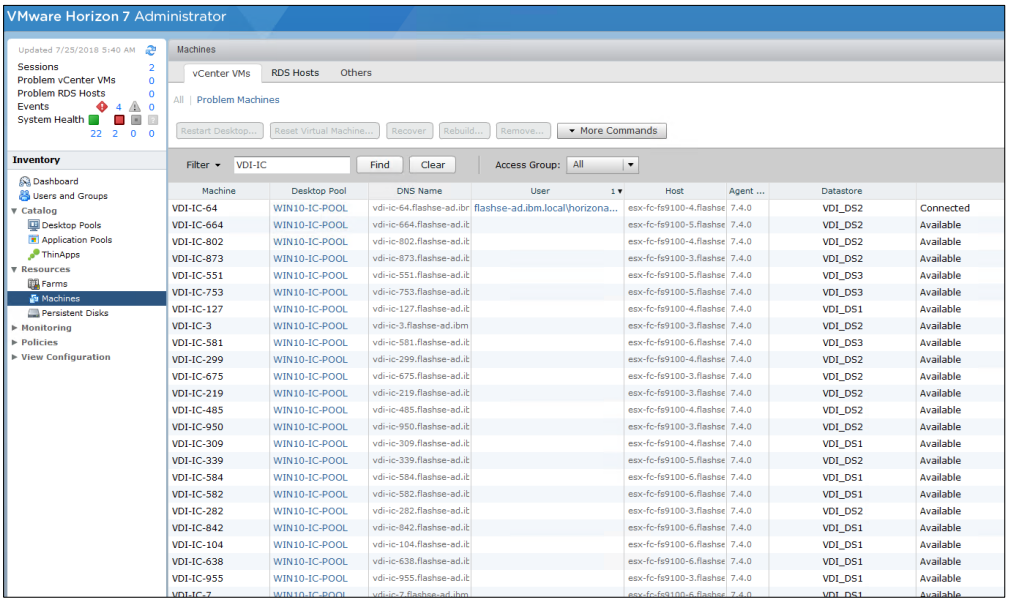

Figure 58: Virtual Desktops display in Horizon

15. Log in to the VMware Horizon web client or the VMware Horizon client to validate access to the desktop.

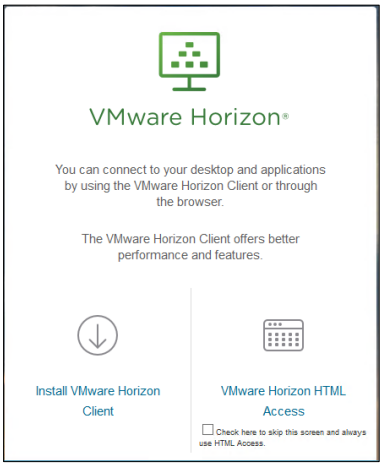

Figure 59: Horizon client access to the virtual desktops

16. Enter user credentials to log in and select the desktop pool to access.

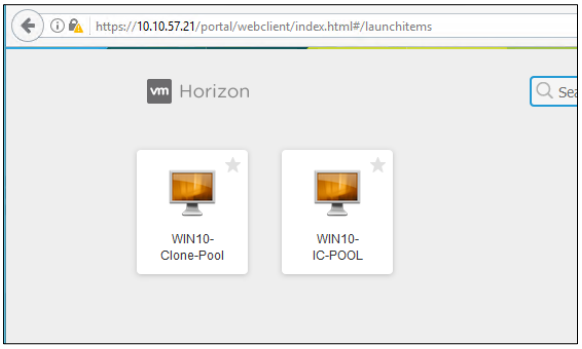

Figure 60: Selecting a desktop pool for virtual desktop access

17. The Horizon client will connect to one of the VMs in the desktop pool to provision a virtual desktop to the user.

Backing up VDI environment

VDI deployments offer cost savings and ease in management for users by simplifying management of data security, software updates and user access using centralized management platform. Typically, organizations adopting VDIs deploy thousands of VMs. It means thousands of users rely on the desktops and applications provisioned through VDI deployments. Failure in VDI infrastructure could leave thousands of users unable to perform their activities. Typical VM backups and restores procedures cannot be suitable while deciding Data Protection strategies for VDI environment. Even though backup is important step in protecting virtual desktop availability, additional steps are necessary to ensure virtual desktop availability.

One of the critical requirements in a VDI environment is protection of your all-flash storage system. IBM FlashSystem 9100 offers enterprise-class storage-availability features which help ensure maximum storage availability.

These include:

- High storage controller availability to sustain single-controller failure without disrupting your environment.
- Resilience to drive failures through distributed RAID (DRAID) configuration options, including RAID 5 or RAID 6 configurations allowing data to be distributed over larger set of drives and providing faster rebuilds in case of drive failure.
- IBM FlashCopy technology, designed to create almost instant copies of active data that can be used for backup purposes.
- Global Mirror and Metro Mirror technologies to provide replication capabilities to seamlessly copy data (synchronously or asynchronously) to a remote datacenter or to IBM Cloud using the IBM Spectrum Virtualize for Public Cloud offering.
- Tight integration with backup products such as IBM Spectrum Protect and IBM Spectrum Protect Plus to back up data at the VM level, allowing faster restores.

Another critical piece in backing up VMware Horizon VDI environment is to back up the virtual infrastructure itself, including your:

- VMware Horizon configuration
- Horizon Connection and Replica servers
- View Composer Server (when View Composer linked clones are used)
- Microsoft SQL Server, which hosts vCenter, Composer and events database
- DNS server
- Active Directory server
- DHCP server

The backup and recovery of each of these VDI components has its own procedures. Follow current best practices for backing up these components.

VMware Horizon configuration backup and restore

Horizon allows backing up the connection server configuration.

1. Log in to the Horizon administrative GUI.

2. Make sure there are no active create, recompose or delete operations in progress.

3. Browse to **View Configuration → Servers** and select a server, then click **Edit**.

4. In Edit Connection Server Settings, browse to the Backup tab, then select automatic backup frequency and other backup configuration settings. By default, Horizon keeps the backup configuration in *C:\ProgramData\VMware\VDM\backups*.

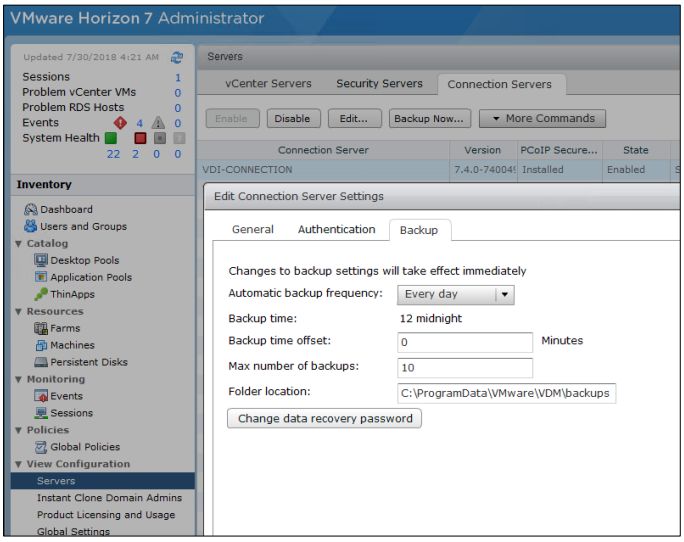

Figure 61: Horizon server automatic backup configuration

5. To back up a Connection Server manually, select a server and click **Backup Now**. Horizon keeps the backup in *C:\ProgramData\VMware\VDM\backups*.

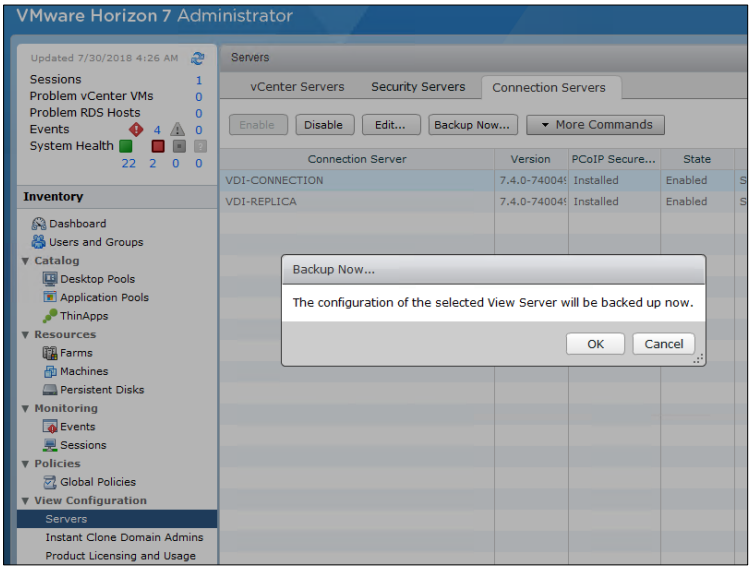

Figure 62: Horizon server manual backup

For a more detailed look at Horizon configuration backup and restoration, follow VMware Knowledge Base article 1008046, "Performing an end-to-end backup and restore for VMware View Manager."

Using IBM Spectrum Protect Plus for VMware Horizon data protection

IBM Spectrum Protect Plus is a data protection and availability solution for virtual environments and for applications in virtual and physical environments. IBM Spectrum Protect Plus can be implemented as a standalone solution, or can be integrated with your IBM Spectrum Protect environment to offload copies for long-term storage and governance.

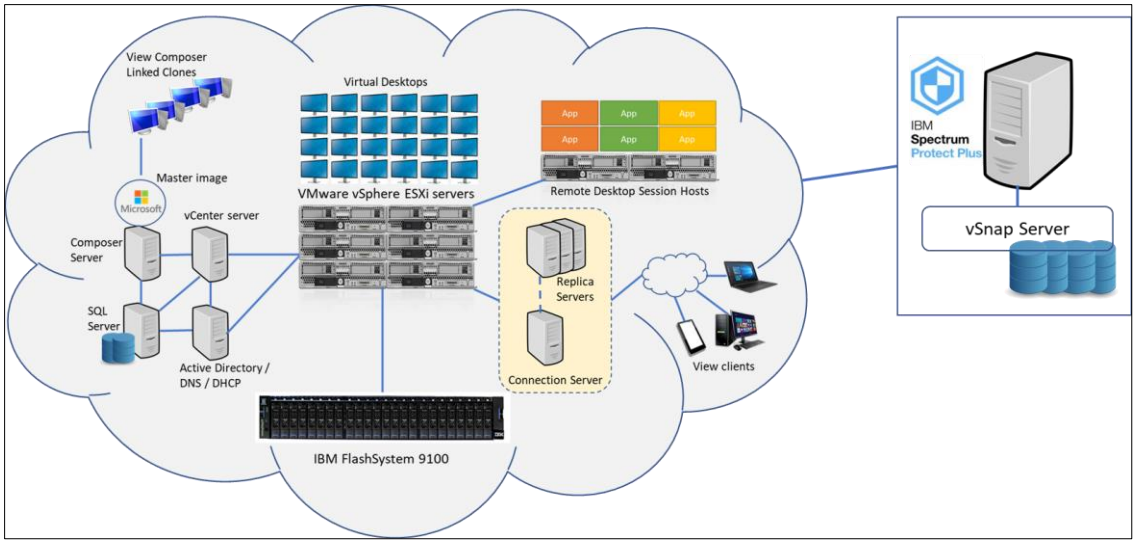

Figure 63: Backing up a VDI environment with IBM Spectrum Protect Plus: Architectural Overview

Figure 63 shows an architectural overview of a data-protection solution using IBM Spectrum Protect Plus to back up a Horizon environment in a private cloud. IBM Spectrum Protect Plus is deployed as a VM, along with a vSnap server to store backups.

The following steps outline the required IBM Spectrum Protect Plus configuration:

1. Install IBM Spectrum Protect Plus in the private cloud environment.
2. Install IBM Spectrum Protect Plus repositories ("vSnaps").
3. Create SLA policies that allow for a backup to the local vSnap.
4. Register the Horizon infrastructure VMs and run inventory jobs for each of them.
5. Register the Microsoft SQL Server with IBM Spectrum Protect Plus.
6. Assign SLA policies to the VMs and SQL Server databases.
7. Schedule backup jobs. Optionally, run the backup jobs manually.

For detailed installation and configuration of IBM Spectrum Protect Plus, please refer to the IBM Spectrum Protect Plus documentation.

Creating SLA policies

In IBM Spectrum Protect Plus, SLA policies define when and how often backup jobs will be run and how long the backup data will be kept. IBM Spectrum Protect Plus comes with three predefined SLA policies (Gold, Silver and Bronze), but allows administrators to create customized policies. In this lab validation, the Bronze policy is used for backups.

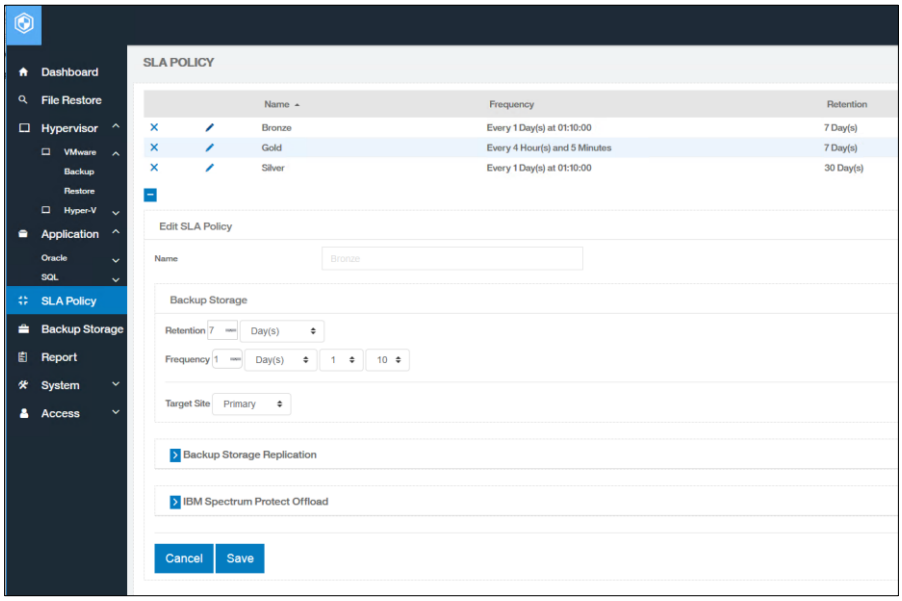

Figure 64: IBM Spectrum Protect Plus SLA policy

Register VMs to IBM Spectrum Protect Plus

Resources that IBM Spectrum Protect Plus needs to recognize are registered in the IBM Spectrum Protect Plus user interface with a one-time operation when defining a backup job.

1. Browse to **Hypervisor → VMware → Backup**, then click the **Manage vCenter** button and then the blue "+" sign. Enter the vCenter properties including a hostname or IP address, the administrator name and a password and click **Save**.

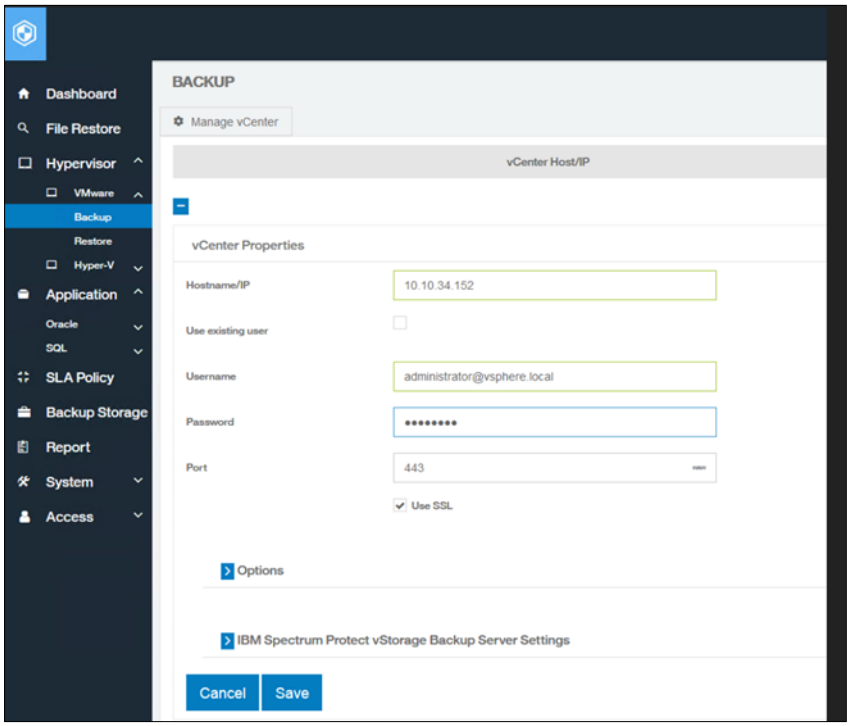

Figure 65: Adding a vCenter server to IBM Spectrum Protect Plus

2. After successful registration, run an IBM Spectrum Protect Plus inventory job to discover VMware objects such as VMs and datastores or database instances on a database server.

Perform VM backup using IBM Spectrum Protect Plus

To perform a backup using IBM Spectrum Protect Plus, assign an SLA policy to the object (such as VM or application) to be backed up.

1. Select the **Hypervisor → Backup** menu. Select the VM to back up and then click on the **Select SLA Policy** and click **Save**.

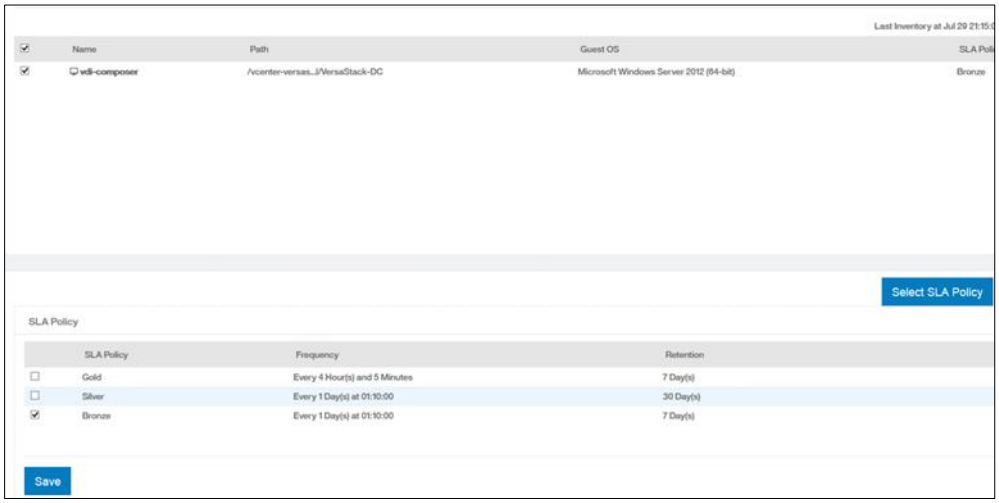

Figure 66: Selecting a VM to back up in IBM Spectrum Protect Plus

2. After an SLA policy has been assigned, IBM Spectrum Protect Plus will perform scheduled backups as defined in the policy. In addition, you can always initiate a backup manually. Then press the **Actions** button and click **Start** to initiate backup of a VM.

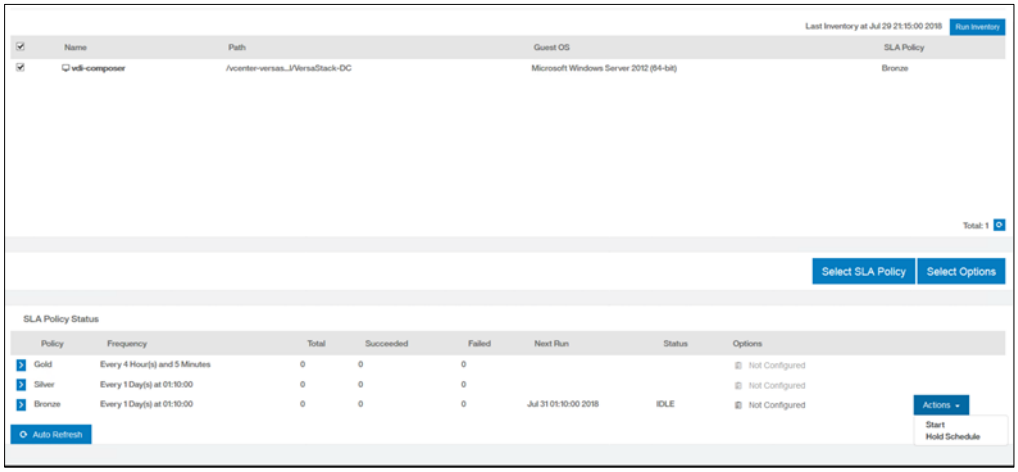

Figure 67: Starting a manual backup in IBM Spectrum Protect Plus

IBM Spectrum Protect Plus can also back up SQL Server vCenter server, Composer and View event databases. Refer to *Creating a SQL Server backup job* section in the IBM Spectrum Protect Plus documentation, at https://www.ibm.com/support/knowledgecenter/en/SSNQFQ_10.1.1/spp/t_spp_creating_sql_backup_job.html

Perform VM restore using IBM Spectrum Protect Plus

IBM Spectrum Protect Plus supports multiple restore modes:

- **Production Mode** replaces original machine images with recovery images.
- **Clone Mode** creates copies of VMs or databases/applications for DevOps, reporting, analytics, and other uses.
- **Test Mode** creates temporary VMs or new databases using the data files directly from the vSnap volume. This mode is suitable for use cases such as development/testing or snapshot verification.

In this section, we describe how to restore a VM backup from an IBM Spectrum Protect Plus repository ("vSnap") on another vCenter server.

To restore a VM backed up using IBM Spectrum Protect Plus:

1. Browse to **Hypervisor → VMware → Restore** and search for the VM to be restored.

2. Select the restore point of a VM by clicking the  icon in front of the restore point. It will then be displayed under *Restore list* pane on the right-hand side.

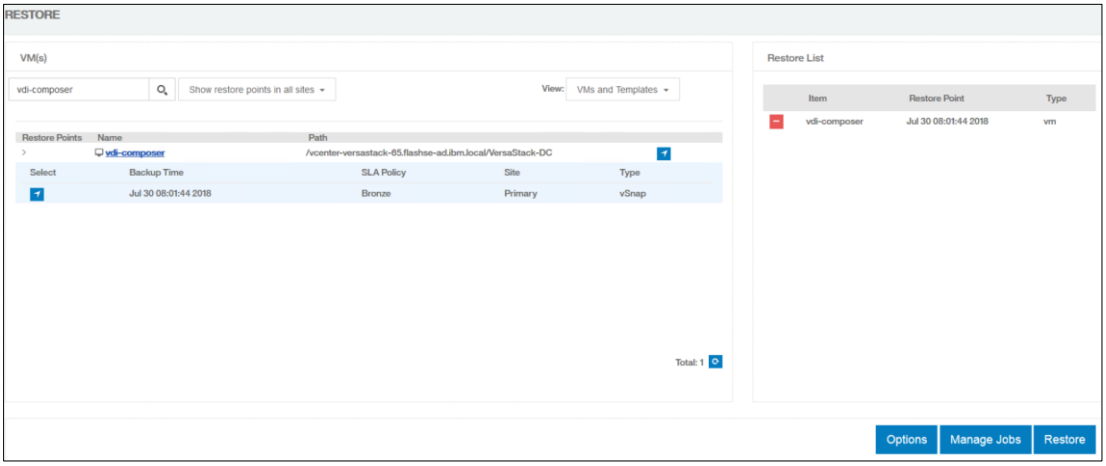

Figure 68: Selecting a VM for an IBM Spectrum Protect Plus restore operation

3. Select the Options tab and select the restore options such as Destination restore host or cluster on the same vCenter or another vCenter server, Destination datastore and other restore options appropriately, then select **Restore**. The VM should be restored to the specified location.

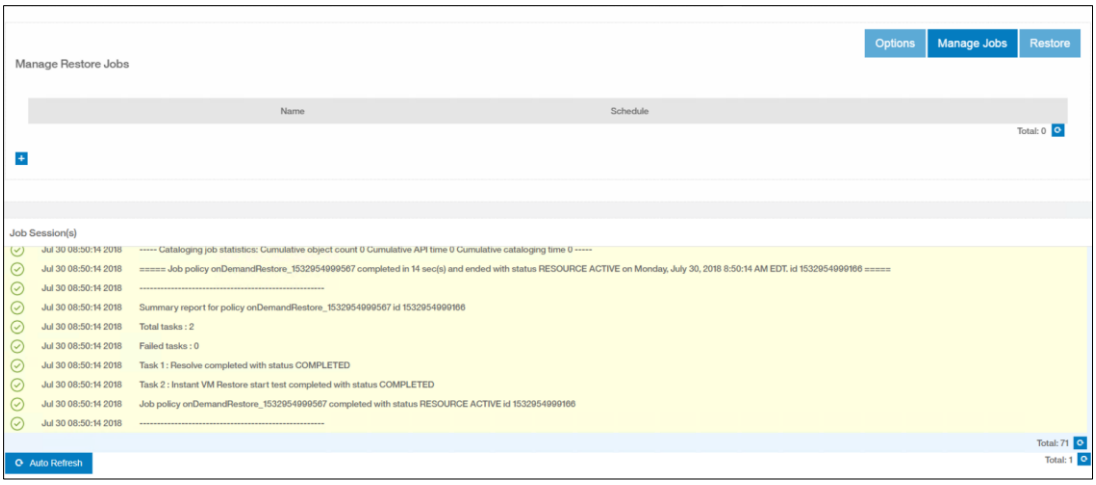

Figure 69: An IBM Spectrum Protect Plus restore operation in progress

For restoring a vCenter, Composer or events SQL Server database, refer to the *Backing up and restoring SQL Server data* section in IBM Spectrum Protect Plus documentation at https://www.ibm.com/support/knowledgecenter/en/SSNQFQ_10.1.1/spp/c_spp_sql_overview.html

Summary

Organizations adopting VDIs require an enterprise storage system. The IBM FlashSystem 9100 all-flash array with NVMe drives, deployed in a 2U chassis, is a high-performance, easy-to-manage, rapidly deployable VDI storage platform. IBM FlashSystem 9100 runs on proven IBM Spectrum Virtualize software and supports all the features of IBM Spectrum Virtualize. Data reduction technologies in IBM FlashSystem 9100 offer substantial storage space savings for VDI environments, potentially reducing overall storage costs and other operating expenses, such as the costs of data center space, cooling and power.

In the lab validation described in this Blueprint, with a deployment of 1,000 full-clone virtual desktops, deduplication savings of up to 90 percent[1] were observed—a significant storage space savings.

IBM Spectrum Protect Plus provides a policy-driven data protection approach for faster backups and near-instant operational recovery of VMs and virtualized environments. It offers an easy-to-install, unified solution offering low-cost data recovery and data reuse for virtual-environment and application data.

Get more information

- IBM Redbooks: IBM FlashSystem 9100
- VMware vCenter Configuration version 6.5
  https://docs.vmware.com/en/VMware-vSphere/6.5/vsphere-esxi-vcenter-server-65-installation-setup-guide.pdf
- VMware Horizon 7 Documentation
  https://docs.vmware.com/en/VMware-Horizon-7/index.html
- IBM FlashSystem 9100 Multi-Cloud Solution for Data Reuse, Protection and Efficiency
  https://www.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=65016865USEN&
- IBM Spectrum Protect Plus Documentation
  https://www.ibm.com/support/knowledgecenter/en/SSNQFQ_10.1.1/spp/welcome.html

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[1] Based on internal validation-testing lab results.

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