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Reference Architecture

Large-Scale VM Migration Using VMware Live Site Recovery 9.0.3 and Hitachi VSP One Block 20 in a Stretched Cluster Environment

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Notices and Disclaimer

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About This Document

Introduction

In today's enterprise IT landscape, organizations are increasingly driven by the need to modernize infrastructure, consolidate data centers, and ensure uninterrupted service availability across geographies. Large-scale virtual machine (VM) migration becomes a critical enabler in these scenarios – whether because of mergers and acquisitions, hardware refresh cycles, cloud adoption strategies, or disaster recovery planning. Customers often face the challenge of relocating thousands of VMs without impacting business operations, risking data loss, or incurring extended downtime. Traditional migration methods fall short in scalability, automation, and resilience, making them unsuitable for enterprise workloads. VMware Live Site Recovery (VLSR), in conjunction with the Hitachi Storage Replication Adapter (SRA), addresses these challenges by automating the recovery of virtual machines across sites with consistency, speed, and minimal manual intervention. SRA enables VLSR to communicate directly with external Storage Area Network (SAN) storage systems to orchestrate replication, failover, and failback operation, automating complex storage tasks. A key advantage is the ability to conduct non-disruptive test recoveries that mirror actual failover scenarios, allowing organizations to validate recovery plans confidently.

This document demonstrates how VMware vSphere 9.0 and VMware Live Site Recovery 9.0.3 in conjunction with Hitachi Virtual Storage Platform One Block (VSP One Block) model storage systems, integrated through SRA in a stretched cluster environment, can run seamless, large-scale VM migrations with precision, transparency, and minimal risk.

The migration design outlined in this document emphasizes minimal service disruption, assured data integrity, and business continuity across geographically distributed sites. By leveraging the advanced orchestration capabilities of VLSR alongside the high availability features of VSP One Block, This document demonstrates a proven approach for handling complex mobility and recovery operations at scale. This paper details the migration strategy, technical architecture, implementation methodology, and validation results to provide IT leaders and architects with a trusted reference for similar large-scale implementations.

Intended Audience

This document is intended for IT Infrastructure Architects and Engineers who design and maintain large-scale virtualized environments. To use this document, you must have the following knowledge and experience:

- VMware vSphere architecture and operations
- VMware Live Site Recovery
- Hitachi storage systems
- Hitachi replication technologies (Global-active device, ShadowImage)
- Disaster recovery planning and stretched storage cluster configurations
- Storage Area Networks

Value Proposition

One of the key challenges customers face when planning large-scale virtual machine migrations with VMware Live Site Recovery Manager is the lack of real-world reference documentation and validation results at enterprise scale. Most available resources focus on relatively small workloads, typically a few dozen to a few hundred VMs, leaving uncertainty around the feasibility, risks, and operational considerations of migrating thousands of VMs in a single coordinated workflow. This document addresses that gap by presenting a real-world, scalable solution for the migration of 1,000 virtual machines using VMware Live Site Recovery 9.0.3 in a stretched storage cluster environment with VSP One Block 20. It delivers one of the first documented large-scale validations at enterprise scale, combining practical insights, architectural guidance, and operational best practices with real-life test results, detailed infrastructure configurations, and key adjustments – such as recovery plan power-on delay tuning – to provide IT leaders and architects with a reliable framework for running migrations of comparable size and complexity.

- Accelerate large-scale VM migrations with minimal disruption and risk
- Leverage automation and orchestration through VLSR to streamline disaster recovery and mobility operations
- Maximize infrastructure availability and performance using high-resiliency stretched clusters
- Reduce downtime and complexity associated with traditional migration methods

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Document Revisions

Revision Number	Date	Details
v1.0	October 2025	Initial release

Comments

Send any comments on this document to Docs-Feedback@hitachivantara.com. Include the document title, including the revision level, and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Vantara LLC.

Thank you.

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Introduction

This document shows a detailed overview of a large-scale VM migration involving 1,000 virtual machines using VMware vSphere 9.0, VMware Live Site Recovery (VLSR) 9.0.3, and VSP One Block 20, implemented within a stretched storage cluster environment. It also highlights how advanced orchestration, robust replication, and highly available storage infrastructure can enable seamless workload mobility across geographically dispersed data centers.

By combining the automation and failover capabilities of VLSR with the high performance and redundancy of VSP One Block 20, this migration strategy demonstrates a resilient, scalable, and low-risk approach to enterprise VM mobility.

Test environment

The following diagram illustrates the end-to-end architecture supporting the large-scale VM migration between the protected site and the recovery site. At the protected site, 10 servers host 1,000 virtual machines, and are connected through Fibre Channel (FC) switches to the VSP One Block primary storage system. The recovery site mirrors this setup with its own set of servers connected to the secondary VSP One Block storage system.

Hitachi Ops Center Protector is deployed on a dedicated protector server, with management handled through a central management server over IP network connectivity. Synchronous replication between the primary and secondary storage systems is achieved using Global-active Device (GAD) pairs, with a quorum storage system providing arbitration for high availability. This configuration ensures real-time data consistency, high availability, and seamless failover capabilities across both sites.

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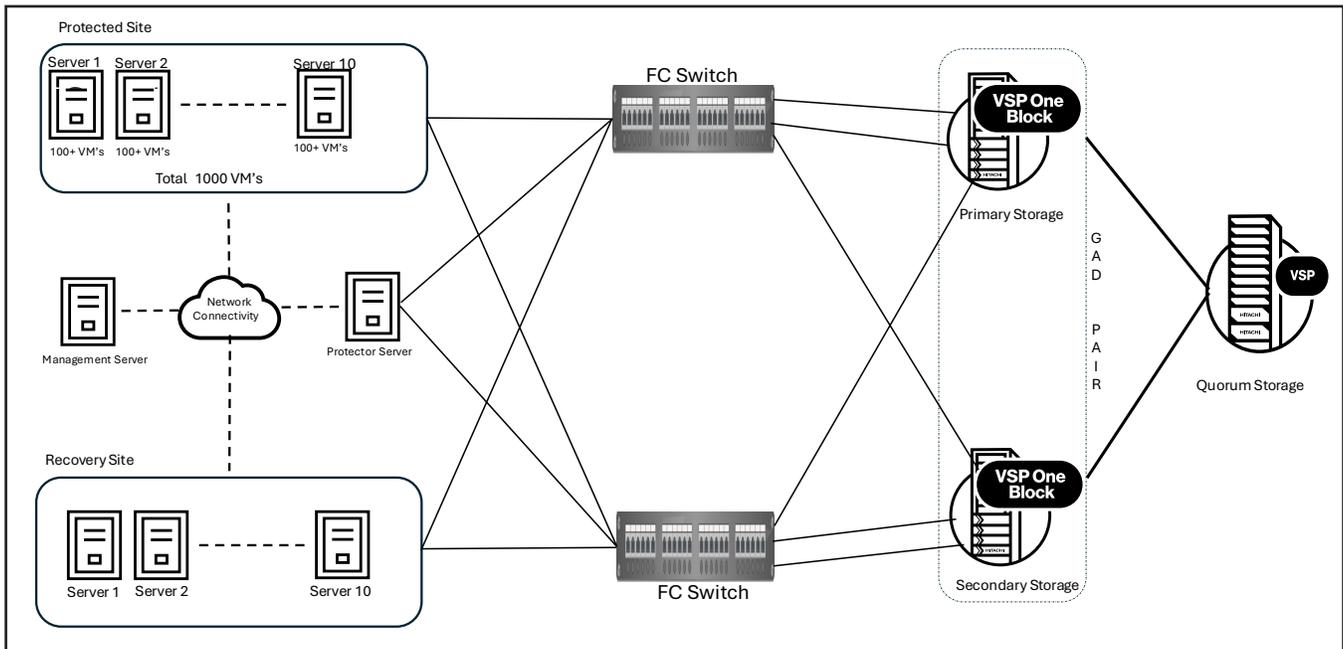
Hardware and Software

Table 1 provides the hardware specifications used in this document.

Item	Description	Version	Function
1	VSP One Block 20 (primary and secondary)		Enterprise storage platform deployed in stretched cluster for high availability and synchronous replication.
2	Enterprise servers (protected and recovery sites)		Hosts approximately 1,000 virtual machines across 130 datastores.
3	Fibre Channel (FC) switches		Provides high-speed, low-latency connectivity between servers and storage.
4	Quorum storage		Ensures cluster arbitration and integrity during site-level failures.
5	VMware vSphere	9.x	Virtualization layer for managing VM workloads.
6	VMware vCenter Server	8.x, 9.x	Centralized management for virtual infrastructure at both sites.
7	VMware Live Site Recovery	9.0.3	Automation framework for disaster recovery and migration workflows.
8	Ops Center Protector	7.10	Policy-driven replication management and integration with VLSR.
9	Ops Center Protector Storage Replication Adapter	5.0.1	Enables seamless integration of Hitachi storage replication with VMware VLSR for automated recovery operations.

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Solution Components

Overview

This large-scale migration environment, involving 1,000 virtual machines, is underpinned by a tightly integrated combination of high availability storage, robust replication software, and advanced disaster recovery orchestration. The architecture leverages VMware vSphere 9.0 for virtualization, VSP One Block 20 in a stretched storage cluster, Ops Center Protector for replication, and VMware Live Site Recovery 9.0.3 for automated migration workflows. They work together to ensure minimal downtime, zero data loss, and operational predictability.

Storage Systems

The migration is supported by VSP One Block 20 in a stretched storage cluster, delivering high availability, synchronous data replication, and consistent performance across sites. This architecture ensures zero data loss, rapid failover, and seamless integration with VMware Live Site Recovery 9.0.3, enabling smooth coordination between the storage system and VM recovery during the large-scale migration of 1,000 virtual machines.

Key Implementation Highlights

- 17 TB capacity DP pool created from RAID 5 (3D+1P) parity groups on both primary and secondary storage systems to host all primary LDEVs and their replicated secondary LDEVs.
- 130 DP volumes of 65 GB each created on the primary site; each LDEV hosts eight virtual machines, totaling approximately 1,000 VMs.
- 20 host groups configured with host mode set to VMware Extension (0x21), distributed evenly between the primary and secondary sites (10 per site) to facilitate provisioning.
- 130 GAD pairs established to enable synchronous replication between sites, ensuring real-time data consistency.

Storage Replication Adapter

Select the SRA type based on the replication software method used in your environment.

Ops Center Protector Storage Replication Adapter (SRA) enables seamless integration between VMware Live Site Recovery 9.0.3 and VSP One Block 20 storage systems. The SRA acts as the communication bridge, allowing VLSR to orchestrate storage-based replication and failover tasks in alignment with recovery plans.

Alternatively, Hitachi RAID Manager Storage Replication Adapter (SRA) supports VMware Live Site Recovery 9.0.3.

Replication Software

Ops Center Protector, used for this large-scale validation, serves as the replication engine, enabling policy-based synchronous replication between the protected site and the recovery site. Operating in tandem with the VSP One Block 20 in a stretched cluster, it safeguards data integrity with zero data loss and maintains application consistency throughout the migration process. Its automation capabilities streamline replication configuration, orchestration, and monitoring, reducing the operational overhead of large-scale migrations. Integration with VMware Live Site Recovery 9.0.3 ensures storage replication states are always in sync with VM recovery operations, supporting predictable failover and failback during migration.

Alternatively, you can use RAID Manager (Command Control Interface) to configure and manage replication pairing between the two sites.

Both the Ops Center Protector and RAID Manager methods have their own respective SRAs. For the purpose of this test, we used the former, but VLSR 9.0.3 is supported with either SRA and its corresponding configuration method.

Key Implementation Highlights

- 10 block hosts configured in Ops Center Protector for replication, each containing approximately 15 LDEVs from the primary storage system.
- 10 data flows established for replication using GAD and SI operations, enabling successful run of VMware Live Site Recovery operations.

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VMware Live Site Recovery

VLSR 9.0.3 acts as the orchestration layer, automating the failover, failback, and migration of virtual machines between sites. Integrated with both VSP One Block 20 and Ops Center Protector, VLSR ensures that recovery plans are synchronized with the storage replication state, enabling policy-driven recovery with minimal manual intervention. Features such as runbook automation, dependency mapping, and non-disruptive testing provide operational assurance, while real-time health checks and recovery group orchestration help maintain service continuity. This integration ensures that the migration of 1,000 virtual machines is performed with zero data loss, optimized recovery times, and reduced operational risk.

Key Implementation Highlights:

- 130 storage system pairs were mapped between the protected site and the recovery site.
- Required VMware Live Site Recovery mappings were configured to ensure seamless integration between the two sites.
- Protection group created to configure recovery for 130 datastores and approximately 1,000 virtual machines.
- Recovery plan was created and attached to the protection group, enabling automated recovery operations between the primary and recovery site.

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Configuration and Setup

Ops Center Protector and GAD

Ops Center Protector was implemented as the replication management layer to automate and control data protection operations across the protected and recovery sites. In this migration setup, 10 block hosts were configured within Ops Center Protector, each managing approximately 15 LDEVs from the primary storage system. To support synchronous data replication, 130 GAD pairs were established between the primary and secondary VSP One Block storage systems. GAD configuration ensures that write operations are simultaneously committed to both sites, maintaining real-time data consistency. In addition, the orchestration capabilities of Ops Center Protector streamline the creation and management of replication data flows, enabling integration with VMware Live Site Recovery for automated failover and failback. Together, Ops Center Protector and GAD provide resiliency, automation, and consistency required to support the migration of 1,000 virtual machines with minimal risk and downtime.

For more information, see:

https://www.hitachivantara.com/content/dam/hvac/pdfs/implementation-guide/configuring-srm-8-7-stretched-storage-certification-with-ops-center-protector-sra-5-0-1.pdf

vCenter and VLSR Configuration

As part of the migration setup, VMware vCenter and VMware Live Site Recovery were configured to provide centralized management and orchestration of the recovery environment. vCenter was deployed at both the protected and recovery sites to manage the virtual infrastructure and ensure consistent administrative control. Within VLSR, 130 array pairs were mapped between the sites, and the required mappings were configured to establish seamless connectivity. A protection group was created to safeguard 130 datastores and approximately 1,000 virtual machines, ensuring that all workloads were included in the recovery workflow. A comprehensive recovery plan was then developed and associated with the protection group, enabling automated failover and failback operations between the primary and recovery sites.

For more information, see:

https://www.hitachivantara.com/content/dam/hvac/pdfs/implementation-guide/configuring-srm-8-7-stretched-storage-certification-with-ops-center-protector-sra-5-0-1.pdf

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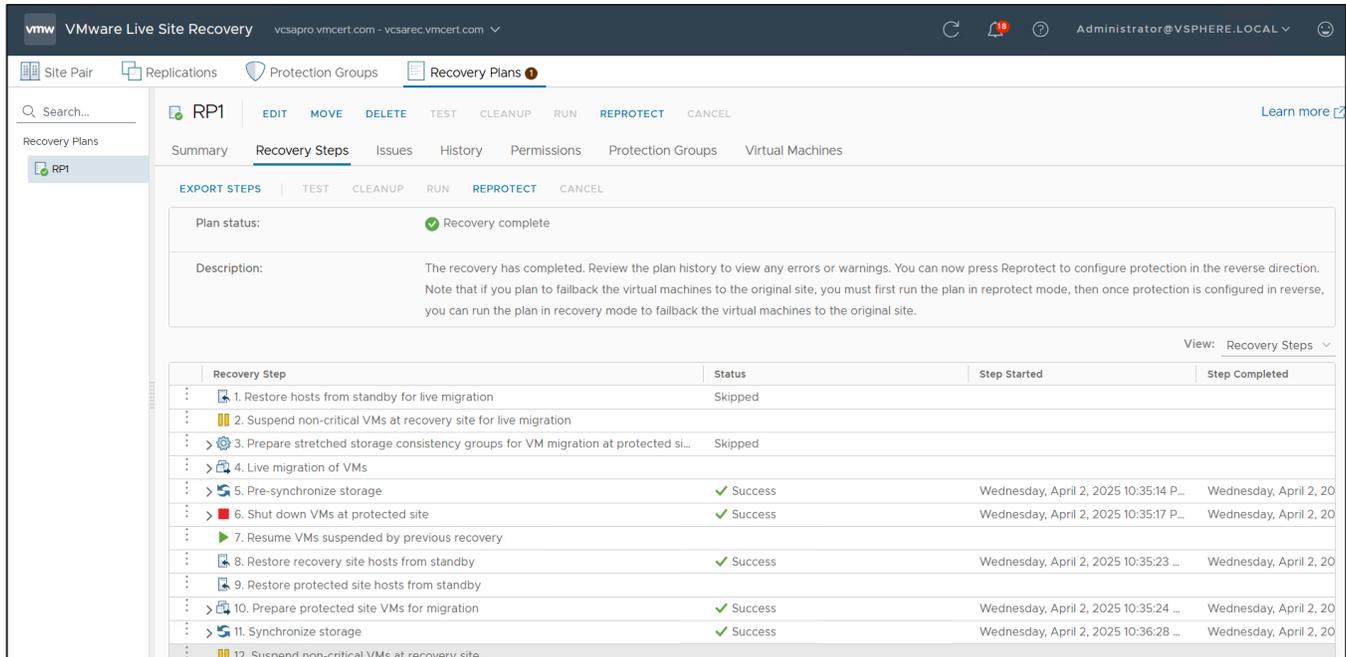**Hitachi Vantara**

VLSR operations

Test Operation

VMware Live Site Recovery provides a powerful test recovery capability that allows organizations to validate disaster recovery and migration plans without disrupting production services. In this migration project, the test operation was run to simulate the recovery of approximately 1,000 virtual machines across 130 datastores in an isolated test network. This approach enabled verification of array pair mappings, protection groups, and recovery plans configured between the protected and recovery sites. The test verified that virtual machines powered on successfully at the recovery site and that application dependencies were maintained, while production workloads remained unaffected at the primary site.

Planned Migration

Planned migration in VMware Live Site Recovery enables the seamless relocation of virtual machines from a protected site to a recovery site under controlled conditions. Unlike disaster recovery failover, which is triggered during site outages, planned migration is run during scheduled events such as data center relocation, hardware refresh, or large-scale infrastructure upgrades. VLSR coordinates closely with Ops Center Protector SRA and the VSP One Block stretched cluster to ensure that all replication data is synchronized prior to migration. Once synchronization is validated, VLSR automates the shutdown of VMs at the protected site, transitions storage ownership, and powers on workloads at the recovery site in a predefined sequence.

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Disaster Recovery

Disaster recovery in VMware Live Site Recovery 9.0.3, in conjunction with VSP One Block 20, delivers recovery of virtual machines and applications during unplanned site outages. In the event of failures such as power loss, hardware malfunction, or network disruption, VLSR works in coordination with Hitachi Ops Center Protector SRA and the VSP One Block stretched cluster to initiate failover to the recovery site. The solution integrates with underlying storage replication technologies, including Hitachi Global Active Device (GAD) for stretched cluster deployments and True Copy (TC) for standard to ensure data integrity and consistency.

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Test Scenarios

Table 2 lists the test scenarios performed in the validation.

Test	Description	Success Criteria
1	**Test Operation** – A non-disruptive recovery test was run to validate recovery plans for 1,000 VMs across 130 datastores in an isolated test network.	All VMs powered on successfully at the recovery site without affecting production workloads at the protected site.
2	**Planned Migration – Synchronization Validation** – Replication states were validated to ensure all data between the protected and recovery sites was fully synchronized before initiating migration.	Zero data loss confirmed and all VMs prepared for migration.
3	**Planned Migration** – Recovery plan run to shut down VMs at the protected site, transition storage ownership, and power on VMs at the recovery site in sequence.	All VMs successfully migrated to the recovery site with minimal downtime.

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Guidelines and Recommendations

During the creation of the recovery plan in VMware Live Site Recovery, the team identified the need to fine-tune virtual machine startup sequencing to align with infrastructure readiness. To address this, the power-on delay parameters of the virtual machines were modified within the recovery plan. This adjustment ensured that dependent services had sufficient time to initialize before subsequent workloads were brought online, preventing resource contention and application startup failures. By introducing controlled delays in the recovery sequence, the migration-maintained system stability and improved overall reliability of the failover process. This scenario highlights the importance of customizing VLSR recovery plans to reflect the unique infrastructure requirements of large-scale environments.

VM Recovery Properties - VM109_DS66_114   ×

Changes to these properties will apply to this VM in all recovery plans.

Recovery Properties   IP Customization

Priority Group	3 (Medium) ∨
	All virtual machines within a priority group will be started before proceeding to the next priority group. The startup order of virtual machines within a priority group may be specified by adding VM dependencies. The virtual machines within a priority group will start in parallel, unless ordered by VM dependencies.
＞ VM Dependencies	None
vMotion	Disabled (VM is not placed on stretched storage)
＞ Shutdown Action	Shutdown guest OS before power off (requires VMware Tools) ∨
	Shutdown actions are used to power off VMs at the protected site during a Recovery. Shutdown actions are not used for Test or Cleanup.
∨ Startup Action	Power on ∨
	Startup actions are used to power on VMs at the recovery site during Test and Recovery.
VMware Tools	☑ Wait for VMware tools
	59 minutes 0 seconds
Additional Delay	☐ Additional delay before running Post Power On steps and starting dependent VMs.
	0 minutes 0 seconds

CANCEL   OK

Validation Results

Test Operation Validation

- Non-disruptive VLSR test operations were run to validate the recovery of 1,000 VMs across 130 datastores.
- All virtual machines powered on successfully at the recovery site within an isolated test environment.
- Production workloads at the protected site remained unaffected during the test.
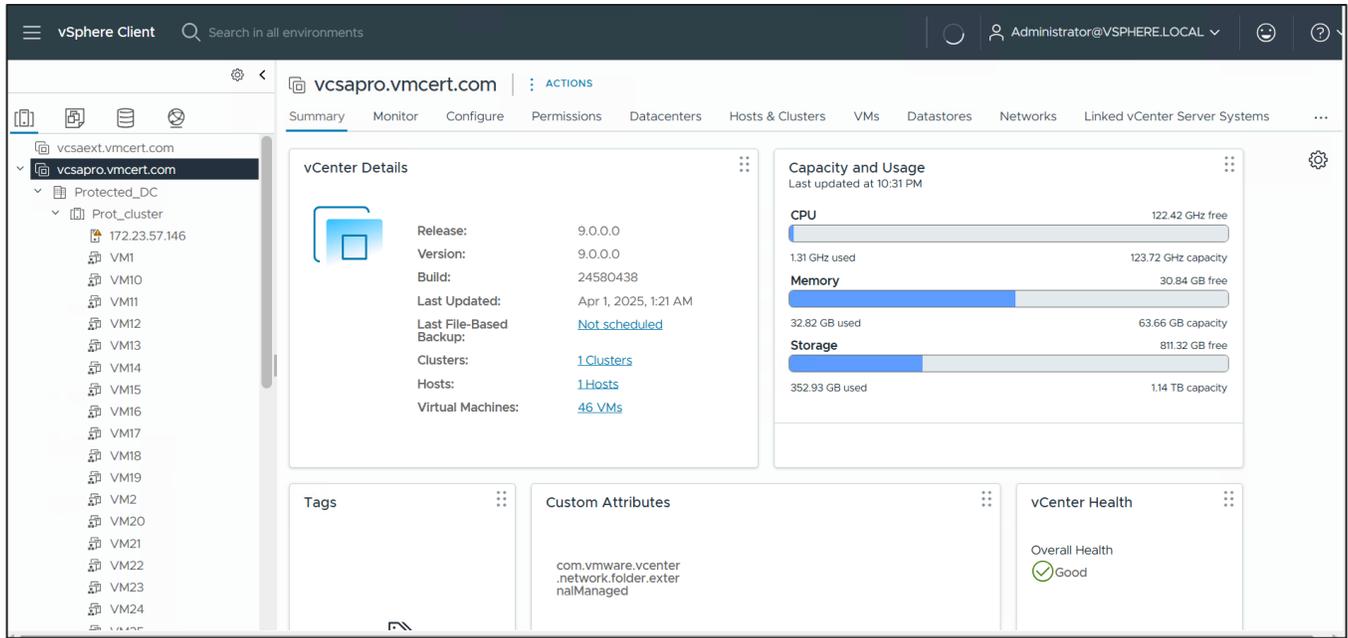- Validation confirmed readiness of protection groups, array mappings, and recovery plans.

The following screenshot shows the status of the recovery site (Recovery_DC) after the test. All VMs are powered on in the recovery site.
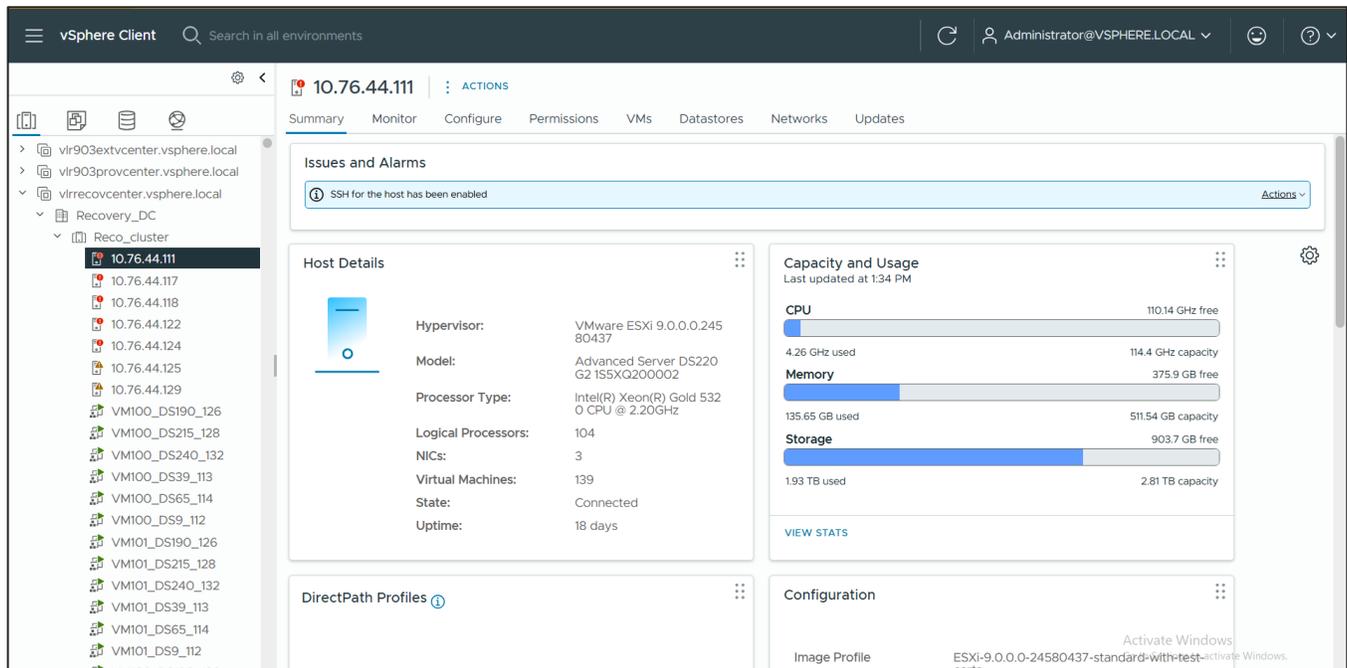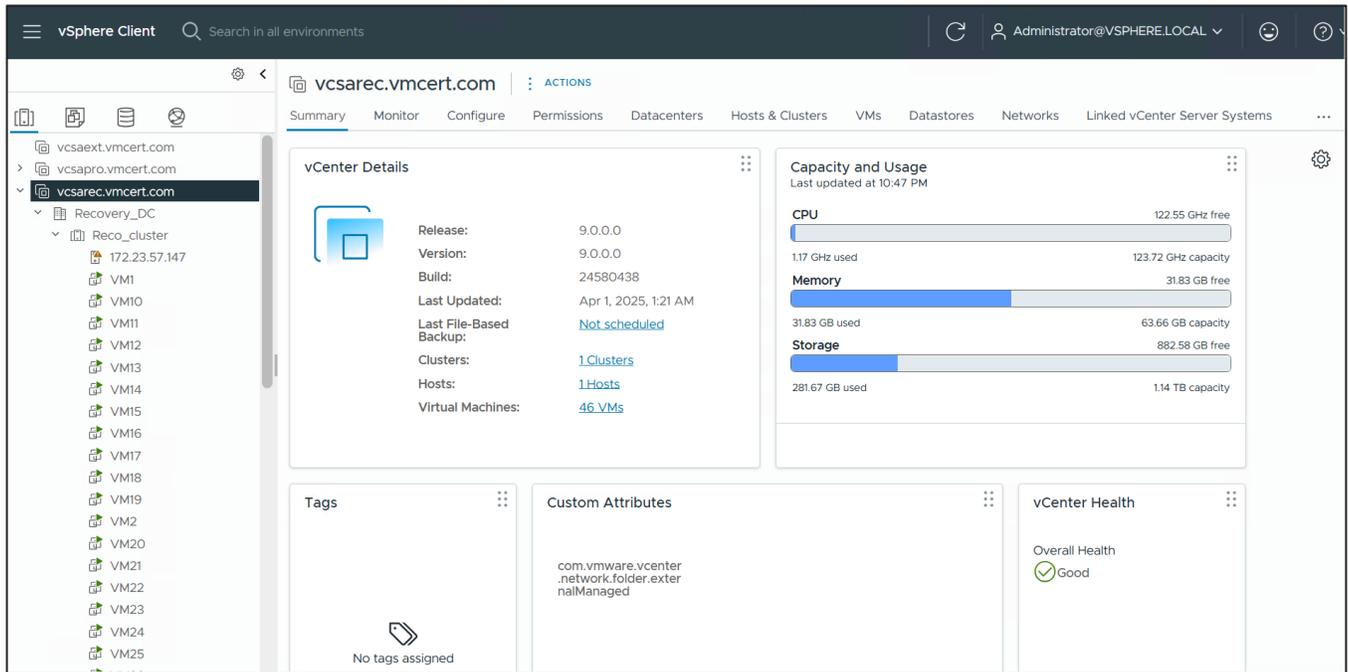

Planned Migration Validation

- Planned migration workflows were run to relocate approximately 1,000 VMs across 130 datastores from the protected site to the recovery site.
- Replication states were validated to ensure all data was fully synchronized prior to migration, confirming zero data loss.
- Virtual machines were cleanly shut down at the protected site and powered on in sequence at the recovery site.
- Adjustment of VM power-on delay parameters ensured smooth application startup and prevented resource contention.
- All workloads achieved application-consistent recovery with minimal downtime.

After planned migration, all virtual machines on the specified host in the protected site (Protected_DC) are in powered-off state:

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After planned migration, all virtual machines from the protected site (Protected_DC) were successfully migrated to the recovery site (Recovery_DC). The following screenshot shows a host in the recovery site with all VMs in powered-on state:

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Lessons Learned

- **Thorough planning is essential** – Proper assessment and planning of resources must be completed in advance to ensure smooth run of large-scale migrations.

- **Infrastructure parity is critical** – Both primary and recovery site hosts must have equivalent capabilities to enable seamless operation and performance consistency.

- **High-performance connectivity is required** – Using high-speed HBAs, switches, and storage ports significantly improves migration speed and reduces bottlenecks.

- **Licensing must be validated early** – All ESXi hosts and vCenter servers must be properly licensed to avoid unexpected disruptions during setup and configuration.

- **Ops Center Protector licensing is mandatory if using Ops Center Protector SRA (alternatively, you can use Hitachi RAID Manager SRA – consult your Hitachi Vantara Technical Expert for guidance)** – Appropriate licensing is required to activate dataflow for replication and enable successful run of recovery workflows.

- **VLSR enterprise licensing enables scale** – Both primary and secondary VLSR servers require enterprise licenses to configure recovery for more than 75 virtual machines.

- **Recovery plan tuning may be necessary** – In some cases, VM power-on delay parameters must be adjusted to ensure dependent services have sufficient time to initialize before subsequent workloads, preventing resource contention and application startup failures.