Deploy Hitachi Unified Compute Platform Director for VMware vSphere with Hitachi NAS Platform

Technical Marketing White Paper

By Francis Hong

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Hitachi Data Systems Unified Compute Platform (UCP) Director provides a seamless management interface for Hitachi compute servers, infrastructure equipment, and storage arrays in a VMware environment. This paper outlines how to extend UCP with Hitachi Data Systems enterprise NFS/NAS platforms to add NFS datastores to be consumed by the vCloud Suite platform, all managed through the same VMware vCenter interface. Many customers want to exploit the unique capabilities exposed by Fibre Channel and NFS datastores for maximum datacenter efficiency while maintaining Service Level Objectives (SLOs), leverage the combination in support of various cloud tenants, or differentiate based on application needs/production/pre-production usage. This paper outlines how to combine both high performance Hitachi NAS (HNAS) Clustered Platform into a UCP configuration. This allows a UCP administrator/Virtual Infrastructure (VI) administrator to leverage both NFS and VMFS datastores to best match different business, efficiency, and SLO needs.

To illustrate this solution performing within a production environment, four use cases were successfully validated in the test lab. These use cases were designed to simulate the production use of Hitachi Unified Compute Platform (UCP) with Hitachi NAS (HNAS) nodes in a VMware environment.

In the tests, we showcase using resource groups for logical separation and subsequently both NFS datastores and VMFS datastores were created on Unified Compute Platform. Then, vCenter management with Hitachi NAS Virtual Infrastructure Integrator, Hitachi System Management Unit, and UCP Director were integrated in the deployment of the NFS and VMFS datastores. VMs were provisioned and I/O load was generated to showcase seamless concurrent use of SAN and NFS datastores and Storage vMotion was successfully executed between NFS datastores and VMFS datastores on VM servers running realistic workloads with a VDBench simulator. The test concluded that UCP with Hitachi Unified Compute Platform Director, Hitachi Unified Storage VM (HUS VM), and Hitachi NAS Platform (HNAS) systems provide an integrated solution for VMware vSphere.

The solution provides a simple gateway for deploying and managing complex physical layers with VMware virtualization. This gateway enables businesses to meet changing needs in all dimensions.
Solution Highlights

- A converged platform provides high data fluidity between different physical storage devices. Different VM/vApps want to take advantage of different capabilities exposed by FC and NFS datastores that meet their SLAs or move when policies change.
  - Seamless Storage of vMotion across NFS and VMFS datastores between HNAS and HUS VM.
- Flexible, Reliable, Effective, and Effortless data protection solutions. These backup solutions fully utilize the snapshot capability and extend the snapshots to disk-to-disk backups.
  - Hitachi NAS Virtual Infrastructure Integrator with VM level backups and vaulting provides cost effective operational VM snapshot backup and recovery and monitoring disk-to-disk protection.
  - Hitachi Data Protection Suite, CommVault, IntelliSnap, and Hitachi Thin Image.
- Fast VM cloning with Hitachi NAS Virtual Infrastructure Integrator and/or VAAI-HNAS adapter.
  - VAAI for HNAS adapter offloads the VM cloning workload to storage hardware, and provides fast and space efficient VM deployment. HNAS VAAI utilizes the file clone feature. Virtual Infrastructure Integrator also provides managed multiple VM clone operations.
- Monitor and provision storage in VMware environment with Virtual Infrastructure Integrator.
- Deploy datastores and monitor compliance to best practice
- VMware certified Site Recovery Manager adapters (SRA) with both HNAS and HUS VM provide an automated failover and failback disaster recovery solution between sites.
  - Hitachi data storage platforms are certified and fully supported by VMware SRM. Hitachi Storage Replication Adapter utilizes Hitachi storage controllers and HNAS server replication engines to offload the work from ESXs hosts, creating an effective high availability solution across different sites.
- Enhanced storage awareness during provisioning with Hitachi Storage Provider for VMware vCenter, commonly referred to as VASA adapter.
- HNAS deduplication capability fully utilizes the hardware-accelerated filesystem platform, performing 1 TB/sec dedupe processing capabilities and throttling on production filesystems to achieve space saving without compromising the performance of live data serving.

- You can monitor and manage all the Hitachi Data Systems components in VMware environments by using Hitachi Unified Compute Platform Director and Hitachi NAS Virtual Infrastructure Integrator.

How to use this Document

- This document provides;
  - Proof point for the value position of the solution
  - High level performance data
  - Implementation details
  - Best practices or considerations for using the solution
  - High level comparison with competitor's similar solution

- This document does not cover;
  - Sizing information
  - Detailed performance studies

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**Note** — Testing of this configuration was in a lab environment. Many things affect production environments beyond prediction or duplication in a lab environment. Follow the recommended practice of conducting proof-of-concept testing for acceptable results in a non-production, isolated test environment that otherwise matches your production environment before your production implementation of this solution.
Solution Overview

Managing and deploying IT infrastructure components can be a complicated and costly overhead for a virtualization initiative. Hitachi Data Systems partnered with VMware to create a converged solution that uses a unified interface to deploy and manage Hitachi platforms and selected end-to-end components in VMware environments. The converged solution unified the best of VMware virtualization features, Hitachi Compute Blade servers and storage platforms.

Why We Need this Solution

- Simplify deployment/management/monitoring of physical layer in virtualized environment:
  - Improve time to usage
  - Provide a consistent deployment schema
  - Assure consistent quality
  - Flexibility through automation
  - Unified interface to analyze and provision performance and capacity planning

- Unified interface enables IT staff that has either Ethernet skills or SAN skills to deploy/manage Hitachi systems in the physical layer.
  - Hitachi Unified Compute Platform Director
  - Hitachi NAS Virtual Infrastructure Integrator

- File based cloning for fast VM deployment to reduce test/development CAPEX and OPEX.

- Solution for all size businesses: from small to enterprise class.

- Offload resource utilization (for example, CPU, network bandwidth, and memory) from the virtualized layer to the Hitachi high performance, physical layer.
  - Certified VAAI, VASA, and SRM with all the storage platforms.
Hitachi Unified Compute Platform for VMware vSphere

Hitachi Unified Compute Platform for VMware vSphere (UCP for VMware vSphere) offers the following:

- Full parity across the RESTful API
- Command line interface
- Graphical user interface

Unified Compute Platform Director software on the Unified Compute Platform integrates directly into VMware vSphere. It provides unified end-to-end infrastructure orchestration within a single interface.

Unified Compute Platform for VMware vSphere leverages your existing storage in one of two ways:

- Connect to your existing Hitachi Virtual Storage Platform or Hitachi Unified Storage VM.
- Virtualize other storage arrays that you have from other vendors using Virtual Storage Platform or Unified Storage VM.

UCP for VMware vSphere provides the following benefits:

- Centralization and automation of compute, storage, and networking components.
- Significant reduction of time to value and operational costs across data centers.
- Faster deployment of converged infrastructure with more efficient resource allocation.
- Provides a foundation for the journey to the software defined datacenter using full support of the RESTful API.

Hitachi NAS Platform

Hitachi NAS Platform is an advanced and integrated network attached storage (NAS) solution. It provides a powerful NFS/SMB platform for server virtualization workloads, file sharing, file server consolidation, data protection, and business-critical NAS workloads.

- Powerful hardware-accelerated file system with multi-protocol file services, dynamic provisioning, intelligent data tiering, virtualization, and cloud infrastructure.
- Scalable from 1 to 8 nodes per cluster, seamless integration with Hitachi SAN storage and management with Hitachi Command Suite.
- Integration with Hitachi Content Platform for deep archiving, regulatory compliance, and large object storage for cloud infrastructure.
Combining Hitachi Unified Compute Platform for VMware vSphere and Hitachi NAS Platform provides a unified management environment to leverage both NFS and VMFS datastores. This solution allows business to best match different needs and Service Level Agreements (SLAs). The cost effective, reliable, and mid-range, HUS VM delivers a solid foundation on the backend storage data management. UCP for VMware vSphere with Unified Compute Platform Director and HUS VM is fully integrated with the VMware vSphere environment. High Performance Hitachi NAS Platform extends flexibility in managing data over the Ethernet infrastructure. HNAS and HUS VM are certified with VMware in NAS-NFS, NAS-SVD, VAAI, VASA and SRM (Please visit www.vmware.com/resources/compatibility for the latest information).
Lab Validation Tests

Four use cases were created to simulate production use of Hitachi converged solutions for VMware. The first use case is creation of NFS/FC storage pools and deployment of those datastores in a Hitachi Unified Compute Platform environment. The test cases in the first use case were demonstrating NFS datastores and VMFS datastore being created with Hitachi Command Suite (HCS), Hitachi NAS Virtual Infrastructure Integrator, and Unified Compute Platform Director. The second use case was validating that UCP cloud was executing VM workloads on both NFS and FC datastores concurrently. Third use case validates that capabilities available in vSphere WebClient with UCP and NAS Virtual Infrastructure Integrator can be accessed concurrently and seamlessly. The fourth use case validates that Hitachi converged solution for VMware is fully integrated with storage vMotion. This feature involved many different components in Hitachi Unified Compute Platform. It was also one of the best ways to illustrate that all these components were working well in the VMware environment. These test cases were designed to validate the seamless integration of HNAS, UCP and Unified Compute Platform Director with VMware vSphere.

Figure 1
The testbed high level infrastructure can be found in Figure 1. Figure 2 shows the connectivity of the backend storage HUS VM. The network connectivity and VLAN assignments can be found in Figure 3.
Use Case 1 - VMware Environment and Hitachi Unified Storage VM Back End Using Hitachi Unified Compute Platform Director and Hitachi Command Suite

Three different resource groups were created from Hitachi Command Suite v7.6. One resource group assigned to UCP management, one assigned to Hitachi Compute Blade servers for VMFS datastores, and the last one assigned to Hitachi NAS Platform for NFS datastore. The UCP compute and UCP management resource groups were successfully created during the UCP implementation.

Separate resource groups were successfully created for HNAS servers on the same backend storage HUS_VM@10.0.0.252 and a screenshot was captured in Figure 4 to show all the essential resource groups in this testbed. Then a Dynamic Pool (DP) was successfully created for the HNAS resource group (see Figure 5). Dynamic Pool Volumes (DP-Vols) were successfully created and allocated to the HNAS cluster. A screenshot was captured in figure 6 to show the allocated DP-Vols.
Test Case 1.2
Deploy two VMFS and two NFS datastores from Unified Compute Platform Director and vSphere.

Four datastores were successfully provisioned in total. Two VMFS datastores (VMFS-01-02 and VMFS-01-02) were successfully created using Unified Compute Platform Director and two NFS datastores were deployed using vCenter. These datastores were co-existing on an HUS VM.

VMFS datastores were successfully created from the vCenter web client interface and the screenshot was captured in Figure 6. After the test, ESXi host was selected and right clicked to show all Unified Compute Platform Director options on the bottom. The "Configure Host Storage" option was selected to create VMFS datastore. The datastores were created by following the instructions on the screen of the Unified Compute Platform Director wizard. Figure 7 shows the first screen of this wizard.
Figure 6

Hitachi UCP Director

Configure Host Storage: r1-hi-cb500-1-b01.ucp.local

- Create New Volume
  Create a new volume for the host from an existing storage pool

- Attach Existing Volume
  Attach existing volume in inventory to the host

- Configure Existing Volumes
  Detach or expand the volumes connected to the host

Figure 7
Two NFS exports from the HNAS servers were then successfully mounted as two datastores (NFS-05-02 and NFS-06-01) in the test ESXi host. The NAS Virtual Infrastructure Integrator auto-deploy was used to deploy the NFS datastores to all ESXi hosts.

In Figure 8 the NFS datastores have been created through the vCenter web client without using Unified Compute Platform Director. In Figure 9 four datastores were created successfully during the test.
Test Case 1.3
Provision VMs on UCP for VMware vSphere using VASA with Hitachi Storage Provider for VMware vCenter.

After VASA Provider was successfully installed (Storage Provider for VMware vCenter), test VMs were provisioned using VM Storage Policy, and VASA provider was used to distinguish between FC and NFS datastores. Three sets of five VMs (fifteen VMs in total) were created. One set of five VMs across the two FC datastores and two sets (ten VMs) on the two NFS datastores. Each of the five VM sets contained servers simulating different workloads:

- 1 × Microsoft® SQL Server®
- 1 × OLTP database server
- 1 × Microsoft Exchange Server
- 2 × Web servers

This can be a use case example where UCP for VMware vSphere is being used to serve up production VMs while also being used for pre-production/staging of those same VMs.
Figure 10 and Figure 11 show the tested steps of VM Storage Policies for both NFS and VMFS being created with VASA (Storage Provider for VMware vSphere). In Figure 12, a VM was being provisioned by cloning with VM Storage policy selected.
Figure 12

Figure 13 and Figure 14 show the test steps to add the NFS-based VM Storage Policy to an existing VM.

Figure 13
Figure 14

Figure 15 and Figure 16 show a validated proper VM Storage Policy with VASA provider applied to all 15 VMs.

Figure 15

Figure 16
Test Case 1.4
Provision one additional VM that uses VMDKs from both FC and NFS datastores on UCP for VMware vCenter.

A VM Storage policy can be applied to individual disks in a VM. This can be a good use case of applying different types of drives to achieve the best return on investment when setting up database servers. Storage Provider for VMware vCenter (with VASA) helps to select compatible drive types based on the VM storage policy.

A VM was successfully created with a different VM Storage Policy. Figure 17 shows a VM that was being cloned with a different VM Storage Policy.

![Figure 17]

Test Case 1.5
Check compliance to best practice.

Hitachi NAS Virtual Infrastructure Integrator compliance dashboard will check for devices that are not compliant with the Hitachi NAS best practices settings in the vSphere environment. The NAS Virtual Infrastructure Integrator compliance dashboard will also provide recommendations to correct the non-compliance settings for those devices. This feature ensures that HNAS servers, ESXi Hosts, and datastores (served by HNAS servers) are configured to the most optimal condition in the vSphere environment.

In Figure 18 the compliance dashboard detected the test ESXi host r1-hi-cb500-b01.ucp.local with non-compliance settings. The TCP/IP Heap size for host was set to 0 and the compliance dashboard recommended setting the value to 30 to match the best practice.

In Figure 19 the compliance dashboard detected the test HNAS server HNAS-4100-C1-1 with a non-compliance cache-bias setting and provided a recommendation to correct the setting.
In Figure 20 the compliance dashboard recommended enabling Storage I/O control on datastore nfs-05-01 match the best practice.
Figure 20
Use Case 2 - Simulating Concurrent Workloads to All VMs

All fifteen VMs created from the previous test cases were successfully running VDbench to simulate different workloads. There were three sets of five VMs (fifteen VMs total).

The workload simulation types can be found in Table 1 for each set of five VMs. The backend storage performance was monitored by Hitachi Unified Compute Platform Director and the output can be found in Figure 21. Unified Compute Platform Director was also used to monitor the Ethernet switches and the output can be found in Figure 22. A virtual Hitachi NAS Platform system monitor unit (SMU) was used to monitor the HNAS servers, and the output can be found in Figure 23. Figure 24 provides the VDbench performance outputs from the VMs that were using NFS datastores. Figure 25 provides the VDbench performance outputs from the test VNs that were using VMFS datastores. These are two of the fifteen VMs running the VDbench simulation.

Table 1. Workload Simulation Types

<table>
<thead>
<tr>
<th>Simulation Type</th>
<th>I/O size (Bytes)</th>
<th>Workload</th>
<th>Number of VMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL Server</td>
<td>64K</td>
<td>66%Read_100%Random</td>
<td>1</td>
</tr>
<tr>
<td>Web Server</td>
<td>8K</td>
<td>95%Read_75%Random</td>
<td>2</td>
</tr>
<tr>
<td>Exchange Server</td>
<td>8K</td>
<td>55%Read_80%Random</td>
<td>1</td>
</tr>
<tr>
<td>OLTP</td>
<td>8K</td>
<td>70%Read_100%Random</td>
<td>1</td>
</tr>
</tbody>
</table>
Figure 22

System Load HNAS-4100-C1-1

System Load HNAS-4100-C1-2

Figure 23
Use Case 3 - Validate that UCP for VMware vSphere and NAS Virtual Infrastructure Integrator can be Used Within the Same vCenter Web Client Interface

When logging in to vCenter with Web Client, both Hitachi NAS Platform (with NAS Virtual Infrastructure Integrator) and Hitachi Unified Compute Platform Director can be accessed from the icons under the Monitor section. This screenshot of the vCenter Web Client Home page is captured in Figure 26. Different Hitachi Unified Compute Platform actions can be called from a specific ESXi host. When right clicking the ESXi host in the vCenter Web Client interface, all the available Hitachi UCP actions show up on the bottom. In Figure 27 the test host r1-hi-cb500-b01 was selected with a right click. All the UCP management actions can be found on the bottom. vCenter manage actions, Hitachi NAS Platform service actions, and UCP actions can be engaged from right clicking on a specific VM. The details can be found in Figure 28.
In Figure 29 Hitachi NAS Platform services actions were expanded and the VM can have a snapshot backup taken from the NAS Virtual Infrastructure Integrator interface directly by selecting the “Snapshot Backup Now” or other actions can be performed. Figure 30 shows the Hitachi UCP actions available for the test VM in View Network Topology.
Figure 27
Figure 30
Use Case 4 - Storage vMotion Between NFS and VMFS Datastores and Vice Versa.

Storage vMotion was successfully performed between the NFS datastore and VMFS datastore (and vice versa) without impacting the live workload that was being generated by VDbench workload simulator. The storage vMotion was performed on the test VM 111-Exchange-24 (configured with NFS-based VM Storage Policy). Figure 31 shows that the storage vMotion was in progress and VDbench was still running without impact. Since the storage vMotion was migrating VM disks from NFS datastore to VMFS datastore, the VM Storage Policy was shown to be non-compliant after the completion of migration. This expected result is validated in Figure 32. Then the same test was performed by migrating the VM disks from VMFS to the NFS datastore, and the resulting screenshots were captured in Figure 33 and Figure 34.

Figure 31

Figure 32
Test Components

Table 2 and Table 3 list both hardware and software components.

### Table 2. Hardware Components

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Version</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hitachi Unified Storage VM</td>
<td>73-03-01-00/00</td>
<td>1</td>
</tr>
<tr>
<td>Hitachi Compute Blade servers (530HB1)</td>
<td>6 Intel Xeon CPU E5-2640 0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Firmware 01-81</td>
<td></td>
</tr>
<tr>
<td>Hitachi Compute Blade 500</td>
<td>04-15</td>
<td>1</td>
</tr>
<tr>
<td>Hitachi Compute Blade chassis</td>
<td>A0160-E-8004</td>
<td>1</td>
</tr>
<tr>
<td>Hitachi NAS Platform 4100</td>
<td>12.0.3528.04</td>
<td>2</td>
</tr>
</tbody>
</table>

### Table 3. Software Components

| Software                                                        | Version                     |
|                                                               |                             |
| Hitachi Command Suite                                        | v7.6.0                      |
| VMware vCenter server                                        | 5.5.0 176327                |
| VMware vCenter Client                                        | 5.5.0 1474107               |
| VMware vCenter Web Client                                    | 5.5.0 1441077               |
| VMware ESXi                                                   | 5.5.0 1331820               |
| VM Server to run the test workload (server OS)               | Microsoft Windows Server®  |
| Hitachi Unified Compute Platform Director                     | 3.0.1.4102                  |
| Hitachi NAS Virtual Infrastructure Integrator                | 2.1                         |
| System management unit software (SMU) for Hitachi NAS Platform| 11.3450.12                  |
| Hitachi Unified Compute Platform                             | 3.02                        |
| VDbench                                                       | 5.02                        |
Conclusion

From the test results we can conclude that Hitachi NAS Platform servers and HNAS with Virtual Infrastructure Integrator are compatible with Hitachi Unified Platform Director in vSphere environments. Hitachi Unified Compute Platform for VMware works well with HNAS servers and can co-exist with Unified Compute Platform Director with a shared Hitachi Unified Storage VM as backend storage.

Best Practices or Considerations

- Follow the recommendations from Hitachi NAS Virtual Infrastructure Integrator compliance dashboard.
- Create a dedicated resources group for HNAS Cluster as described in test case 1.1.
- Install a virtual system management unit for HNAS in the UCP management cluster.
- Create a VM in the UCP management cluster to host the NAS Virtual Infrastructure Integrator server and install the NAS Virtual Infrastructure Integrator client plugin on the vCenter server.
- Dedicate a pair of Fibre Channel adapters for HNAS server (node) to use when sharing the HUS VM between HNAS and UCP for VMware vSphere with Unified Compute Platform Director. Then connect the dedicated Fibre Channel adapter ports to a pair of external SAN switches other than the SAN switches that come with the UCP rack. Figure 2 shows the SAN connectivity with HUS VM.
- The max configuration of UCP for VMware vSphere can't be configured when a HUS VM is shared between the UCP solution and HNAS. Since one pair of Fibre Channel adapters is dedicated for HNAS use, Unified Compute Platform Director can't manage all the Fibre Channel ports.
- When using Hitachi NAS Virtual Infrastructure Integrator for data protection, it's recommended to have VMDKs served from HNAS platforms as opposed to a VM with mixed VMFS and NFS based VMDKs to ensure consistent reliable backup.
References

- Hitachi Unified Compute Platform for VMware vSphere v3.02
  - Administration Manual
  - Administering Hitachi Unified Compute Platform Director Console in vSphere Client
  - Administering Hitachi Unified Compute Platform Director Console in vSphere Web Client
  - Installation Plan
  - Assembly and Configuration: Book 1 - Brocade (this is intended for use by Hitachi Data Systems and authorized resellers only and should not be given to customers. Unauthorized duplication or redistribution is prohibited.)
  - Customer Deployment (this is intended for use by Hitachi Data Systems and authorized resellers only and should not be given to customers. Unauthorized duplication or redistribution is prohibited.)
- Hitachi NAS Platform and Hitachi Unified Storage VM Best Practices Guide
- Hitachi NAS Virtual Infrastructure Integrator Administration Guide
- Hitachi Storage Provider for VMware vCenter - User’s guide
- Hitachi NAS Platform and VMware vSphere APIs for Array Integration - Installation Guide
For More Information

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