HPE Reference Configuration for VMware Horizon (with View) 6.1.1 on HPE Hyper Converged 250

Technical white paper

Contents

Executive summary

The demands of IT implementations continue to escalate, requiring both high performance and high availability, as well as flexible solutions for supporting an increasingly mobile workforce. Faster transaction processing speeds, scalable capacity, and increased flexibility are required to meet the needs of today's business. This document presents a solution with "VMware® Horizon (with View)" virtual desktops on a Hewlett Packard Enterprise next-generation data center in-a-box, with emphasis on simplifying the deployment of virtual desktops on an appliance that integrates storage, networking and computing. HPE tested the virtual desktops on an HPE Hyper Converged 250 (HPE HC 250, formerly known as CS 250-HC) appliance, leveraging HPE best-in-class technologies, StoreVirtual storage, OneView InstantOn startup and expansion wizard, and Apollo Gen9 server computing.

Taken together, this solution demonstrates a truly integrated end-user computing solution that can:

- Decrease the cost of client infrastructure while meeting the SLA and user experience demands of the business and users
- Accelerate and streamline desktop deployments with integrated components designed for end-user computing
- Reduce risk with pre-tested server, storage and network configurations on systems that are workload-optimized for Virtual Desktop Infrastructure (VDI)
- Streamline operations by automating configuration tasks for administrative staff using HPE OneView and intuitive wizards

Target audience: This document is intended for IT professionals who use, program, manage, or administer medium size VDI implementations that require high availability and high performance. Specifically, this information is intended for those who evaluate, recommend, or design new IT high performance architectures, and who want to understand HPE's approach to end-user computing with hyper-converged platforms and the value of the HPE validated hyper-converged VDI solution. The reader should have a solid understanding of end-user computing, familiarity with VMware Horizon suite, VMware vSphere products and an understanding of sizing/characterization concepts and limitations in end-user computing environments.

Document purpose: The purpose of this document is to validate the HPE HC 250 appliance as a platform for running VMware Horizon (with View) 6.1.1 and to document recommendations for a successful implementation.

HPE HC 250 and VMware Horizon (with View) installations are standard configurations except where explicitly stated in the reference configuration. This white paper describes testing performed in September and October of 2015.

Introduction

One of the key drivers in the end-user computing market is end-user productivity. Today's end-users expect a fully integrated and seamless experience that integrates mobile and static devices with applications and connectivity to quickly perform business tasks. HPE Hyper Converged 250 is an enterprise-grade solution designed for virtual desktops. This hyper-converged appliance offers a highly available virtualized server and storage infrastructure that can be configured in minutes. Businesses of all sizes are looking for flexible infrastructure solutions that will allow them to quickly deploy and run new desktops in a cost-effective and simple-to-manage fashion. VMware Horizon (with View) on the HPE HC 250 delivers an end-user computing experience which meets the high expectations of both end-users and IT staff alike. HPE storage, servers and networking provide the resilient and integrated infrastructure that meets the reliability, performance and security needs of end-user computing architects.

HPE has fully tested this solution with the integration of VMware AppVolumes, delivering applications to nonpersistent desktops in seconds. AppVolumes makes it easy to deliver, manage and update business critical applications. Administrators can quickly package their applications within vSphere and deploy them in minutes to their users using the AppVolumes manager. This ability to deploy and update applications quickly empowers administrators to provide applications to users in real-time, reducing the time to deploy applications from hours to seconds.

The validation testing in this reference configuration focused on demonstrating the viability of knowledge worker users as defined by Login VSI, in order to showcase an integrated solution with the latest advancements in converged infrastructure and desktop virtualization technologies. HPE and VMware have laid out the connectivity components of an easily scalable and rapidly deployable client virtualization solution.

Solution overview

The HPE Hyper Converged 250 is a four (4) node hyper-converged appliance that offers a highly available server and storage infrastructure that is deployable in about 15 minutes. Its virtual infrastructure is complete with server, storage, networking and management. It is available in a 4-node or 3-node configuration with simple and rapid expansion of appliances to facilitate easy growth. The HPE HC 250 is pre-configured for vSphere 5.5 or 6.0 and uses HPE OneView InstantOn to automate and simplify both standup and expansion. The HPE OneView for VMware vCenter plug-in facilitates simplified platform management and solution deployment. With VMware Horizon licensing applied, the HPE HC 250 platform becomes an ideal solution for customers looking for the rapid deployment and expansion of non-persistent end-user computing solutions.

The first solution that HPE validated used VMware Horizon (with View) 6.1.1 with Linked Clones. Figure 1 below presents an overview of that solution. In this solution, a single management volume housed the management infrastructure (including Horizon (with View) Connection Server, Horizon (with View) Composer and Microsoft® SQL Server, VMware vCenter version 5.5, VMware AppVolumes server and Microsoft Windows® 7 templates) in separate virtual machines. (See Table 4 for specifications of management virtual machines.) This management volume was created during the initial deployment process for the platform. For our purposes, the volume was expanded within vCenter to 1TB. For linked clones, four (4) volumes of 1.4TB each were created within vCenter using the HPE OneView Plugin for vCenter Management menus. A single master Windows 7 image was created along with a floating pool of 460 Windows 7 x64 Enterprise linked clones that were distributed across the four (4) 1.4TB volumes. A total of only 1.4TB of space was consumed after accounting for savings from thin provisioning.

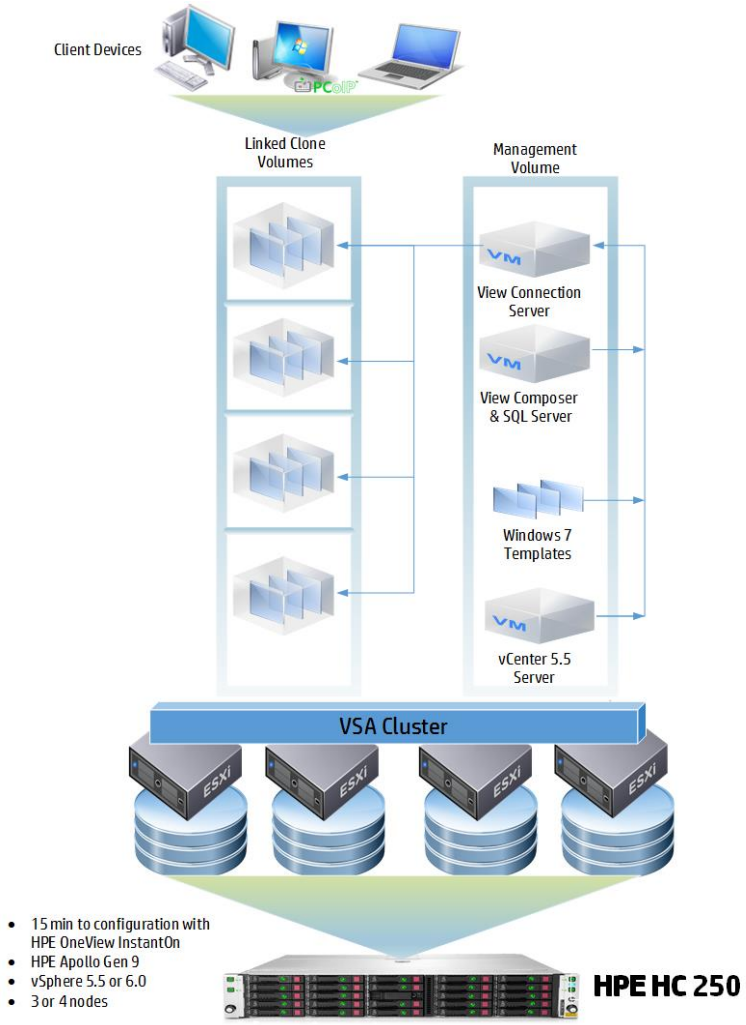

Figure 1. Solution components built on HPE HC 250 System

The second solution HPE validated involved testing VMware Horizon (with View) with Linked Clones and AppVolumes. VMware AppVolumes was used to provide Microsoft Office 2010 Professional applications to the linked clones. An additional volume was created in vCenter of 1.5TB to house the AppVolumes application disks. Though this resulted in overprovisioning the array, a total of only 2.3TB of space was consumed after accounting for savings from thin provisioning. Figure 2 below reflects this layout.

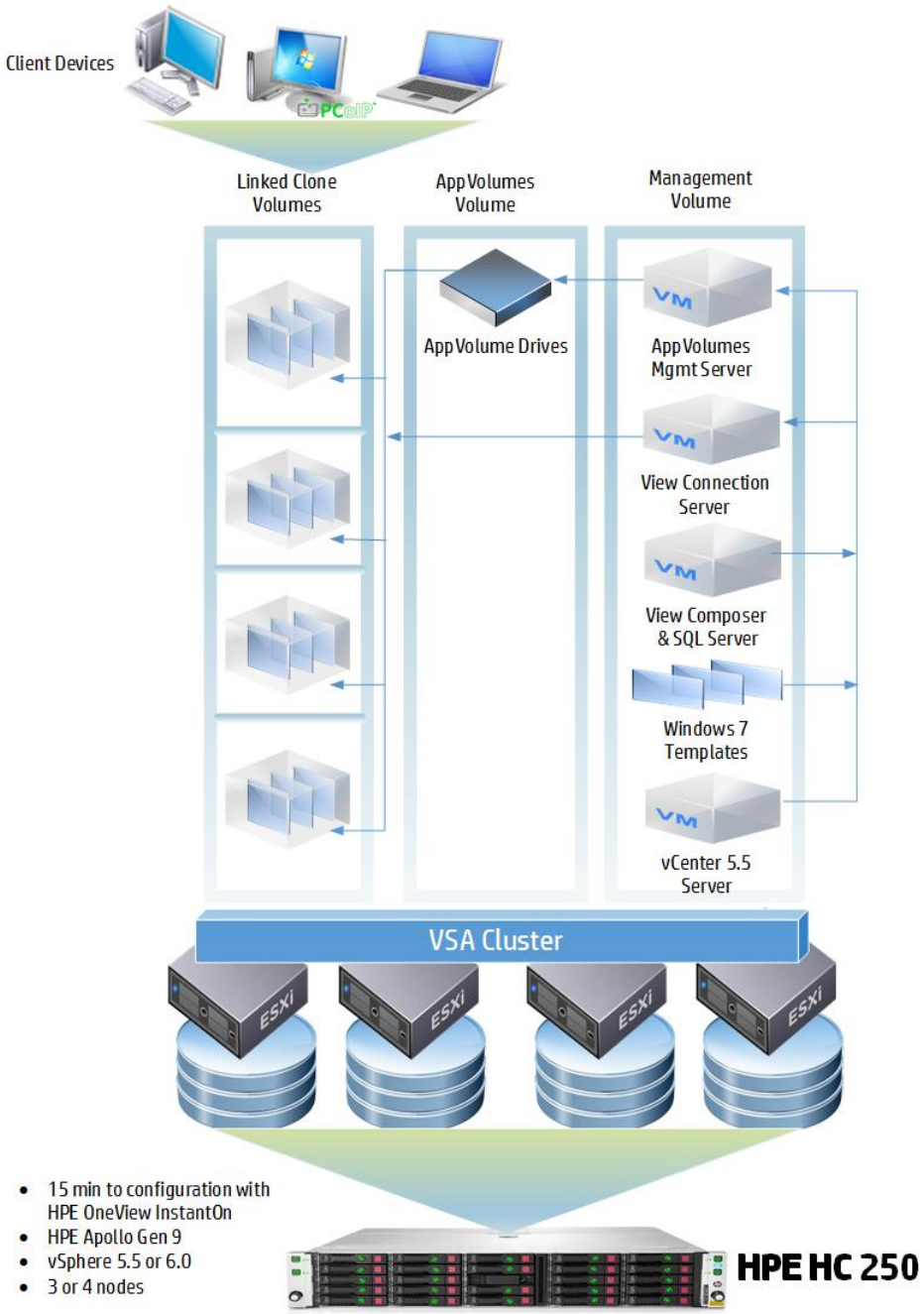

Figure 2. Solution components built on HPE HC 250 System with VMware AppVolumes

Solution components

Hardware

For this evaluation, an HPE Hyper Converged 250 with the Hybrid Storage Kit was used. The 10GbE networking is the primary connectivity on the HPE HC 250 platform. The StoreVirtual 256GB Memory Kit was used for this testing. HPE OneView InstantOn was used to create a highly-redundant cluster of shared storage utilizing the local disks. Adaptive Optimization was enabled to facilitate tiering of the SSDs and rotating media layers which optimizes performance based on the frequency with which blocks are accessed. In end-user computing environments, this translates to faster boot and recovery times as well as a greatly enhanced user experience.

Storage Clustering allows a customer to consolidate multiple storage nodes into pools of storage. All available capacity and performance is aggregated and available to every volume within the cluster. As storage needs increase, the HPE HC 250 can scale performance and capacity on-line. Each time new nodes or systems are added to an HPE HC 250 StoreVirtual environment, the capacity, performance, and redundancy of the entire storage solution increases.

The HPE Hyper Converged 250 is also VMware certified for multi-site disaster recovery (DR), delivering business continuity with failover that is transparent to users and applications. The multi-site configuration maintains data availability beyond a single physical or logical site, and validates full compatibility with VMware high availability (HA) and fault tolerant (FT) features. Administrators can add capacity, increase performance, grow and migrate volumes between HPE HC 250 clusters on the fly with no application downtime.

Any StoreVirtual product can be added to the same environment as HPE HC 250. This allows for more flexibility when additional storage capacity, or storage with different performance characteristics is needed. Adding another storage pool is easy with the StoreVirtual Centralized Management Console (CMC) and HPE OneView for vCenter Storage Portal. HPE recommends StoreVirtual VSA Software or StoreVirtual 4335 Storage for additional storage. See Appendix B: Configuration Expansion for more information on how to expand your HPE HC 250 VDI implementation.

Figure 3. Front view of HPE HC 250 chassis with 24 drives

Figure 4. Back view of HPE HC 250 chassis with 4 nodes

Software

The HPE Hyper Converged 250 is a software defined solution. As such, software plays a crucial role in scalability and performance of the overall system. Table 1 below highlights the versions of HPE Software included with the tested solution.

Table 1. HPE Software specifications

SOFTWARE	VERSION
HPE OneView InstantOn	1.1.0.54
HPE StoreVirtual Centralized Management Console	12.5.0.547
HPE StoreVirtual Virtual SAN Appliance	12.5
HPE OneView Plugin for vCenter	7.7.1

Table 2 below highlights the VMware software used to complete the testing and validation of this solution.

Table 2. VMware software specifications

SOFTWARE	VERSION
VMware Horizon (with View) Connection Server	6.1.1
VMware Horizon (with View) Composer	6.1.1
VMware AppVolumes Manager	2.9.0.1343
VMware vSphere 5.5 U3	5.5.0.2403361
VMware vCenter Server 5.5 U3	5.5.0.2183111

Table 3 below highlights the Microsoft software used to deliver the solution described in this document. See Table 4 to determine where each piece of software was deployed. All Microsoft operating systems and applications are virtualized and hosted within the context of this solution. It is possible to host many of these components outside of this solution stack on existing infrastructure.

Table 3. Microsoft software utilized for the testing of this solution

SOFTWARE	VERSION
Microsoft SQL Server 2012 R2	Express
Microsoft SQL Server 2012 R2	Standard
Microsoft Windows Server® 2012	Standard
Microsoft Windows Server 2012 R2	Standard
Microsoft Windows 7 x64	Enterprise

Virtual machines

A variety of virtual machines were deployed in the creation of this reference configuration. Table 4 below highlights the configuration of each VM. Desktop VM counts varied based on the test conducted. Management VMs were protected by the highly available configuration of the platform. In larger scale implementations it is expected that the design will follow VMware's best practices for deploying redundant management infrastructure.

Table 4. Virtual machine specifications

VM	VCPU	MEMORY	HDD	NETWORKS	OS
VMware Horizon (with View) Connection Server	4	10GB	70GB	mgmtVMNetwork vm virtsw	Windows 2012 R2
VMware Horizon (with View) Composer and Microsoft SQL Server 2012 R2 Standard	4	8GB	80GB	mgmtVMNetwork vm virtsw	Windows 2012 R2
VMware vCenter 5.5 U3	4	16GB	70GB	mgmtVMprivate mgmtVMNetwork VSAeth0 VM Network	Windows 2012 (provided as part of the solution)
VMware AppVolumes Management Server	4	8GB	50GB	mgmtVMNetwork vm virtsw	Windows 2012 R2 Standard
3 Win7 image templates	2	2GB	32GB	mgmtVMNetwork	Windows 7 Enterprise x64

Capacity and sizing

The goal of testing for this solution was to validate that a recommended number of users could run within a specified set of parameters. As mentioned in the Solution overview section of this document, two use cases were examined using Login VSI 4.1 to drive load. Those use cases were VMware Horizon (with View) Linked Clones with User Data Disks and the same configuration using VMware AppVolumes to deliver Microsoft Office applications to the user.

About Login VSI

Login VSI is a load generating test tool designed to test remote computing solutions via a variety of different protocols. The Login VSI environment was hosted outside the HPE Hyper Converged 250 environment. Login VSI works by starting a series of launchers which connect remotely to VDI hosts via a connection protocol which simulates the load of actual end users. The base workload of a "knowledge worker" using 2GB of memory and 2 vCPUs was used for these tests. The launchers execute a series of end-user actions on hosts to simulate the load of actual end users. The test suite utilized a series of desktop applications running via automated scripts within the context of the VMware Horizon virtual desktop environment.

A standardized set of applications are installed within every virtual machine and actions are taken against the installed applications. The set of applications HPE tested against is listed below.

- Adobe® Acrobat® 9.1
- Adobe Flash Player 11
- Adobe Shockwave Player 11
- Bullzip PDF printer
- Freemind
- Kid-Keylock
- 7-Zip

- Microsoft Office Professional 2010
- Microsoft Internet Explorer 9

Login VSI presents a relatively replicable set of tests that can be used to compare platforms and solutions within a fairly close range. The test uses a standardized set of workloads to create those comparison points. In the real world it is highly unlikely that a customer will be running the exact set of applications featured in the test. As a result, the numbers in this document are guidelines only. Customers that are new or inexperienced in regards to VDI should undergo a deeper assessment of their environment prior to implementing VDI to insure the best overall results. If such an assessment interests you, please engage with your HPE account team for further information on our Client Virtualization Assessment services.

Linked clones with user data disks

HPE validated the hosting of 460 Knowledge Worker user sessions on individual linked clone virtual desktops on the HPE HC 250. Figure 5 shows the output of this test. Rather than testing for a VSImax score which is difficult to achieve in hyper-converged environments, HPE tested a recommended number of users. Of note are the response times both for the initial set of users and for the final count of 460 users. Response times were a very low 674ms initially and increased to only 1.1 seconds with a full load of 460 users. Both times denote an exceptional end-user experience.

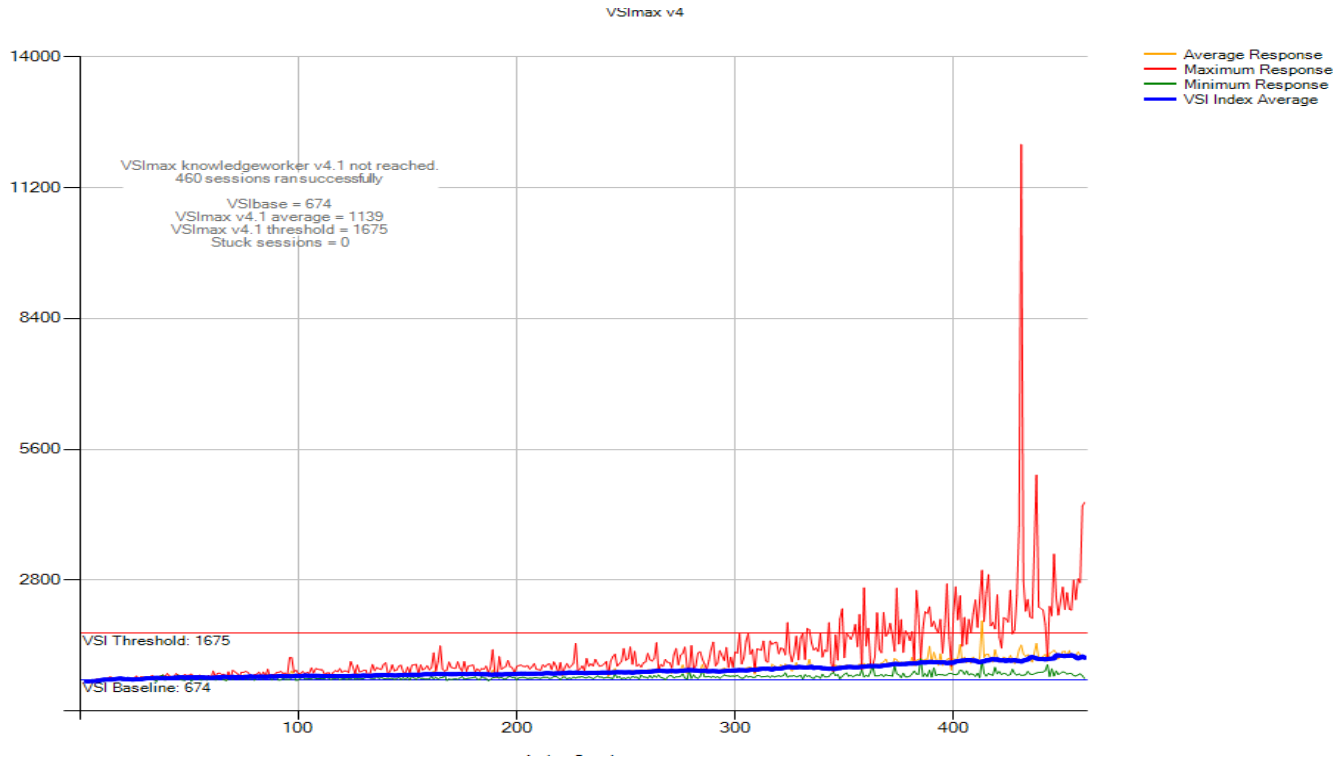

Figure 5. Login VSI results hosting 460 Windows 7 virtual desktops with Microsoft Office 2010 on the HPE HC 250

Linked clones with AppVolumes

The second test case was approached in the same fashion as the first. Figure 6 shows the outputs from this test. This test validated a slightly lower peak recommended user count of 430 users. In exchange for slightly higher overhead from AppVolumes, administrators gain the ability to produce a functionally persistent virtual machine while using a single master image. This saves space and enhances administrative control.

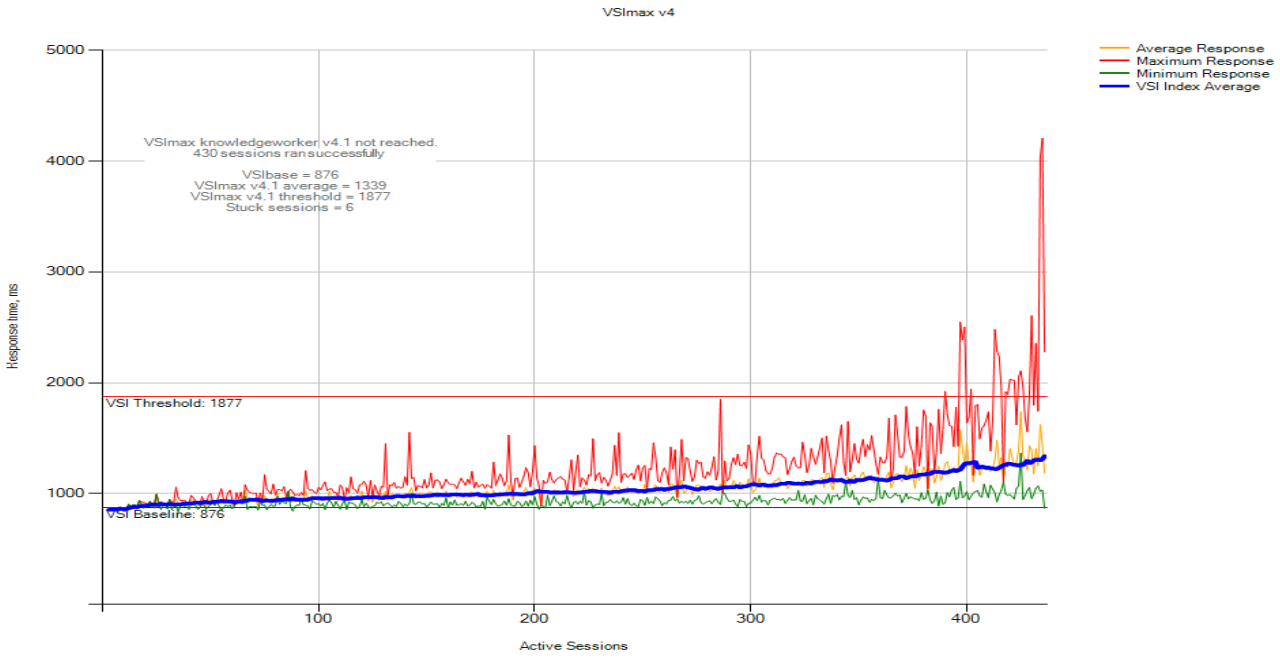

Figure 6. Login VSI results hosting 430 Windows 7 virtual desktops with AppVolumes on the HPE HC 250

IOmark-VDI testing

In addition to Login VSI, HPE contracted testing with the Evaluator Group, using their IOmark VDI benchmark suite. Since storage can sometimes be a limiting factor in end-user computing deployments, the IOmark-VDI testing provides a storage-specific perspective on the validated solution. Results of the IOmark-VDI testing demonstrate the robust storage performance and availability of the HPE Hyper Converged 250, with the HPE StoreVirtual storage system significantly exceeding performance I/O baselines for VDI response times. (See Appendix C.)

Analysis and recommendations

Key point

The numbers documented in this paper are representative of what customers can achieve if they were to utilize the tested workload with the VM configuration tested. Configurations for corporate images and application sets are highly varied. HPE recommends that for best results, customers new to VDI or end-user computing partner with HPE services or an HPE reseller to conduct a deeper assessment of their environment and users. This will yield the best overall end-user experience and optimal return on investment.

Scaling the solution

One of the major value propositions of this approach to end-user computing is that the systems utilized scale in a linear fashion. In order to scale to 920 linked clone users, this solution stack needs only one identical appliance added to achieve not only a doubling of user counts but also introduce a highly available infrastructure. Like the base appliance, expansion is a simple and rapid process which greatly enhances time to value.

Summary

The decentralization of resources including applications and devices has caused customers to rethink how to deliver an optimal end-user experience. Beyond this, user behaviors have also changed including where they work and on what device they prefer to work. HPE and VMware have addressed these challenges. The HPE Reference Configuration for VMware Horizon (with View) 6.1.1 on HPE Hyper Converged 250 with VMware vSphere builds off of the strength and versatility of the existing VMware portfolio and leverages years of HPE innovation delivering end-user computing solutions. Unique improvements in HPE server, storage and networking technologies make this newest architecture the highest-performing, lowest costing and easiest to manage solution that HPE has ever developed. It is ideally suited for the performance and scalability requirements of a VMware Horizon (with View) 6.1.1 deployment that requires architectural flexibility, extreme performance and rapid yet simple scaling to meet IT and line of business needs.

Key findings:

- The HPE Hyper Converged 250 solution provides the basis for scalable, high performance VDI workloads running on VMware Horizon (with View) 6.1.1
- HPE OneView InstantOn with Adaptive Optimization enabled, creates a highly redundant cluster of shared storage providing uncompromising performance for end-user computing workloads.

Appendix A: Bill of materials

The following bill of materials (BOM) contains electronic license to use (E-LTU) parts. Electronic software license delivery is now available in most countries. HPE recommends purchasing electronic products over physical products (when available) for faster delivery and for the convenience of not tracking and managing confidential paper licenses. For more information, please contact your reseller or an HPE representative.

Note

Part numbers listed are current as of the time of testing and subject to change. The bill of materials does not include complete support options or other rack and power requirements. If you have questions regarding ordering, please consult with your HPE Reseller or HPE Sales Representative for more details. hpe.com/us/en/services/consulting.html

Table 5. Bill of materials

QTY	PART NUMBER	DESCRIPTION
1	M0T03A	HPE Hyper Converged 250 System
4	M0T04A	HPE Hyper Converged 250 Node
4	M0T05A	HPE Hyper Converged 250 Intel® Xeon® E5-2680v3 CPU Kit
4	M0T08A	HPE Hyper Converged 250 256GB Memory Kit
4	M0T10A	HPE Hyper Converged 250 2P 10GbE SFP+ Kit
4	M0T12A	HPE Hyper Converged 250 5.6TB Hybrid Storage Kit
4	M0T20A	HPE Hyper Converged 250 VMware vSphere 5.5 FIO Kit
1	676277-B21	HPE 36pin Suv Dongle Cord Kit
4	D4U77A	HPE ConvergedSystem 250-HC StoreVirtual Software LTU
1	H1K92A3	HPE 3Y 4 hr 24x7 Proactive Care SVC
1	H1K92A3 YMW	HPE Hyper Converged 250 System Support
4	H1K92A3 YMX	HPE Hyper Converged 250 Node Support
4	H1K92A3 YMY	HPE Hyper Converged 250 SW LTU Support
1	HA114A1	HPE Installation and Startup Service
1	HA114A1 5WG	HPE 200 Series HC StoreVirtual Strtup Svc
43-46	M7K12AAE	VMware Horizon Enterprise 10 Pack 1yr Concurrent Users E-LTU

Note

HPE HC 250 requires valid VMware vSphere Enterprise or higher, and vCenter Standard licenses. VMware licenses can only be removed from the order if it is confirmed that the end-customer has a valid licenses in place (Enterprise License Agreement (ELA), vCloud Air Partner or unused Enterprise Purchasing Program tokens). HPE supports vSphere Enterprise, vSphere Enterprise Plus or Horizon on the HPE HC 250. When quoting VMware Horizon for HPE HC 250, only the vSphere hypervisor components are pre-integrated. Ordering systems automatically add 8x BD715A (vSphere Enterprise Plus 1P 3yr Service and Subscription) and 1x BD723A (VMware vCenter) to an HPE HC 250 order.

Appendix B: Configuration expansion

Scaling up to eight HPE Hyper Converged 250 for VDI will allow up to 16 nodes in a single management group which gives a maximum of 384 cores, 8TB of memory, and 115TB of disk capacity in a single cluster.

When designing the expansion of the appliance it is critical to factor in individual needs for availability as well as the requirements presented by VMware Horizon (with View). For example, in a VMware Horizon (with View) 6.1.1 implementation, it is important to keep the total VM count to no more than 2,000 seats per vCenter server. This is primarily due to the scale of VDI environments and resources behaving much differently (especially in regards to host and storage resources) than that of a traditional virtual server environments. Based on the sizing in this document, scaling to 4 appliances would likely not reach that limit. However, most IT shops desire levels of redundancy not just at the hardware level, but also for software. The HPE Hyper Converged 250 makes this expansion simple. Adding additional appliances, scales storage space, I/O capacity, compute and memory and is a rapid process just like the initial appliance deployment. Figure 7 below shows how adding a second HPE HC 250 would double your linked clone capacity.

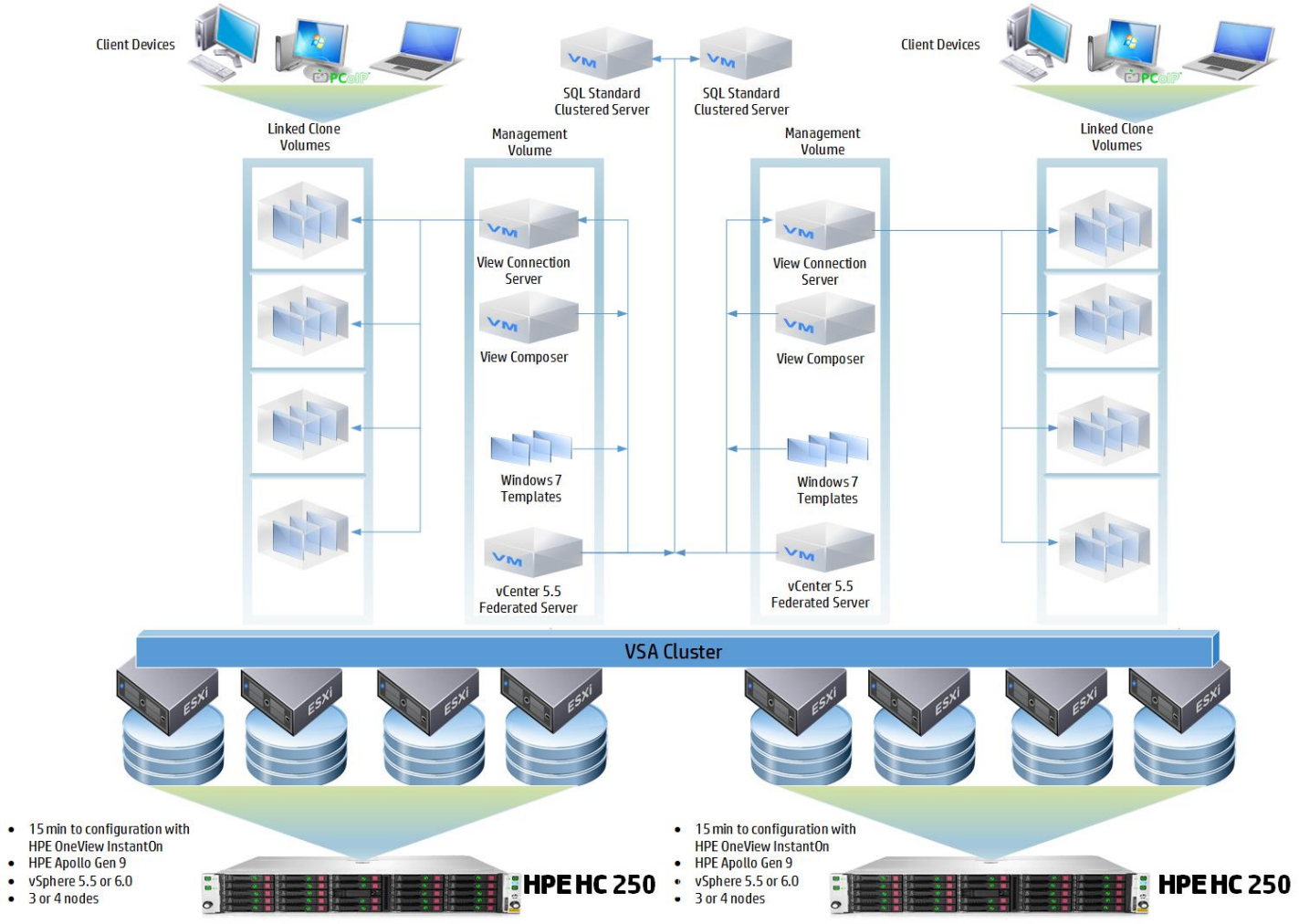

Figure 7. Configuration Expansion of the HPE HC 250 for VDI

The configuration tested in this document, which is protected by the highly available design of the appliance, can be altered as well to increase availability. Note in the figure above that the individual software pieces within the VMware Horizon (with View) deployment have been distributed across the infrastructure. Special attention should be given to separate the management VMs so that they reside on separate servers

and chassis. For an even more resilient design, vCenter servers should be federated and Microsoft SQL servers should be clustered. Figure 7 shows the SQL cluster on separate infrastructure but it may be installed within the solution stack.

Appendix C: IOmark-VDI testing

In addition to Login VSI, HPE contracted testing with the Evaluator Group using their IOmark-VDI benchmark suite. The purpose was to provide a complete description of the capabilities of the solution from both an end-user standpoint (Login VSI) and a storage performance perspective (IOmark-VDI) since storage is often a limiting factor of user experience in end-user computing deployments. IOmark-VDI is a storage-specific benchmark that tests VDI environments from a storage perspective.

IOmark-VDI is designed to test VDI storage by:

- Recreating a non-synthetic storage workload, including several standard applications that are commonly used in VDI environments.
- Capturing the I/O streams of those applications and then "replaying" those streams, so that the exact sequence and I/O commands are issued.
- Allowing additional VDI workloads to be added to the same hosts or to other physical hosts. With IOmark-VDI, the only limitations to the scale of the test are the physical infrastructure supporting the workload. Sufficient CPU, memory and I/O capabilities must be available to run additional workload sets.

With this approach to VDI testing, IOmark-VDI enables direct comparison of storage system configurations, in support of storage sizing and VDI planning

IOmark-VDI user profiles, application workload set and benchmark criteria
The specific user profiles and applications comprising an IOmark-VDI workload set are detailed below.

Steady state operation:

1. Heavy Worker Profile – Average / VDI User
    a. 12.52 IOPS / User
    b. 1.06 MBps / User
2. Standard Worker Profile – Average / VDI User
    a. 6.26 IOPS / User
    b. 0.53 MBps / User
3. Office Worker Profile – Average / VDI User
    a. 9.24 IOPS / User
    b. 0.24 MBps / User

The Evaluator Group established the following benchmark criteria for the IOmark-VDI workload.

- For all application workloads:
    - 70% of response times for I/Os must not exceed 30ms.
    - All storage must reside on the storage system under test.
    - The replay time must complete within 1 hour and 15 seconds for each 1 hour workload.

HPE Hyper Converged 250 results

IOmark-VDI performance results were measured against all VDI application workloads. The average storage response times for all VDI applications are shown below in Figure 8, plotted as a Cumulative Distribution Function (CDF) for results. (The CDF is a measure of statistical probability, and indicates the probability that a response time is less than a specific value.) Figure 8 shows the Cumulative Response Times of all the I/Os for the HPE Hyper Converged 250 using vSphere 5.5 Update 2 on each of the 4 nodes.

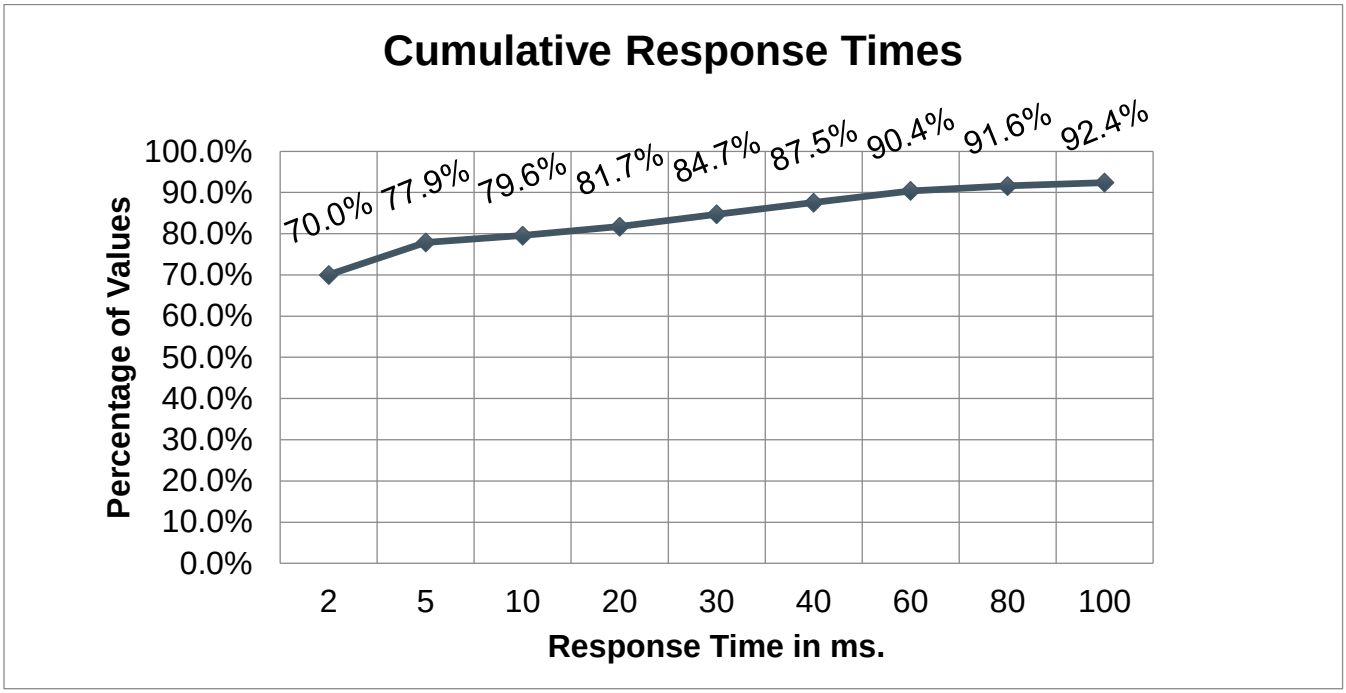

Figure 8. Cumulative Response Time of I/Os tested on HPE HC 250. Total I/Os processed during test = 956,302.

The HPE StoreVirtual storage system significantly exceeded the performance I/O baseline requirement of 70% cumulative response times for the IOmark-VDI test, with response times of <=30ms in 84.7% of cases. Cumulative response times measured at <=20ms in 81.7% and at <=10ms in 79.6%.

This test reinforces the high-availability and performance strengths of HPE StoreVirtual technology integrated and engineered into the HPE Hyper Converged 250. Given the high storage performance requirements of VDI deployments, HPE StoreVirtual, with its high availability and high performance attributes, is an ideal storage choice within the HPE Hyper Converged 250.

Resources and additional links

HPE Converged Architectures
hp.com/us/en/business-solutions/converged-systems/converged-architectures.html

HPE HC 250 System
http://www8.hp.com/us/en/products/solutions/product-detail.html?oid=8160461

HPE ConvergedSystem for Client Virtualization
hpe.com/us/en/integrated-systems/converged/virtualization.html

HPE Information Library
hpe.com/info/convergedinfrastructure

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