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Introduction

Solution overview

Desktop virtualization is a key initiative for many organizations looking to reduce administrative overhead while providing a more secure, flexible, and reliable desktop computing environment for end users.

Virtual Desktop Infrastructure (VDI) technologies are becoming increasingly important for organizations for several reasons including the demand for greater security and compliance, workforce mobility, business agility, mobile and Bring Your Own Device initiatives, and operational savings. Total cost of ownership (TCO) advantages continue to drive VDI adoption and companies continue to look for ways to better manage costs associated with software licenses and IT deployments as well as ongoing usage, maintenance, and technical support costs.

In addition to VDI services, Remote Desktop Services (also called terminal services, server-based computing, and presentation virtualization), a component of Microsoft Windows, allows a user to access applications and data on a remote computer over a network using a remote display protocol.

Remote Desktop Services is functionally similar to VDI in that it hosts the users' desktop environments on remote servers; however, it differs from VDI in two important ways. A VDI service provides individual desktop operating system instances for each user and delivers full desktop environments. Remote Desktop Services sessions run in a single shared server operating system and provide connections to both individual applications and full desktops as needed.

Based on real-world test scenarios, user workloads, and infrastructure system configurations, this solution architecture features VMware Horizon 6 (with View) running on the Vblock® System 340.

Extensive testing of mixed workload use cases and environments on the Vblock 340 has yielded exceptional performance. For this solution, the Vblock 340 utilizes Cisco UCS rack mount servers with EMC VNX 5600 storage to support a scalable and cost-effective deployment on VMware vSphere 5.5. Validation of the solution included both VDI and Remote Desktop Session Host (RDSH) configurations.

Users may not need an entire desktop or may need access to other applications in other systems in addition to their desktop. One of the significant benefits of using VMware Horizon View for this solution is that it supports application publishing using Microsoft Remote Desktop Services.

NOTE: This paper contains a solution architecture that is intended for a real-world deployment and mix of desktop applications. As a result, the test metrics reflect a lower density of virtual desktops to blades than is possible in tests designed to show maximum potential VDI densities. The results outlined in this solution architecture are specific to the Vblock 340. You may experience different results in your environment.

Key highlights

Extensive user experience and operations testing of VMware Horizon 6 (with View) on the Vblock System 340, including Login VSI performance benchmark testing, revealed excellent performance at an extremely low cost.

Key results demonstrate that the Vblock System 340 easily supports a deployment of 1000 Linked-Clone or RDSH session-based desktops with 100 percent concurrency and acceptable CPU, memory, and storage use, along with acceptable application response times.
The results are summarized here and further described later in this paper.

- All 1000 Linked-Clone desktops were:
  - Deployed in 1 hour and 45 minutes.
  - Recomposed in 2 hours and 53 minutes.
  - Refreshed in 59 minutes.
- An average steady-state IOPS of 12169 was observed on the VNX 5600 during the execution of the workload.
- 1000 RDSH session-based virtual desktops were validated.

### Purpose

This document describes the architecture, design guidelines, validation, and performance data for a Vblock System 340 with VMware Horizon 6 (with View) deployment.

We have used the results of this validation to demonstrate that the Vblock 340 meets the functional and technical requirements of a high-density user desktop deployment in VMware Horizon View environments.

### Audience

This document is intended for enterprise and service provider decision-makers and system administrators deploying large-scale end-user computing environments with VMware Horizon 6 (with View) on the Vblock System 340.
Technology overview

Vblock System 340

To ensure the performance and responsiveness needed to support massively scalable solutions, all VMware Horizon View desktops were hosted on the VCE Vblock System 340.

The Vblock System 340 is an agile and highly scalable converged infrastructure for rapid deployment or expansion of virtualized data centers, cloud environments, and service provider implementations. Pre-engineered, pre-configured, and validated, the Vblock 340 arrives ready to meet your specific workload and service level agreement (SLA) requirements, while minimizing the costs and risks to your business operations. It can handle a mix of different workloads that may include virtual desktop infrastructure (VDI), Microsoft Exchange Server, Oracle, and SAP enterprise applications, as well as vertical industry solutions.

The following diagram provides a high-level overview of the components in the Vblock 340 architecture:
**Compute components**

The Cisco UCS data center platform combines x86-architecture blade and rack servers with networking and storage access into a single system. Innovations in the platform include a standards-based, unified network fabric, Cisco Virtual Interface Card (VIC), and Cisco UCS Extended Memory Technology. A wire-once architecture with a self-aware, self-integrating, intelligent infrastructure eliminates the need for manual assembly of components into systems.

Cisco UCS B-Series two-socket blade servers deliver record-setting performance to a wide range of workloads. Based on Intel Xeon processor E7 and E5 product families, these servers are designed for virtualized applications, and reduce CapEx and OpEx through converged network fabrics and integrated systems management.

Fabric extenders (FEX) within the Cisco UCS chassis connect to Cisco fabric interconnects over converged Ethernet. Up to eight 10 GbE ports on each FEX connect northbound to the fabric interconnects, regardless of the number of blades in the chassis. These connections carry IP and storage traffic.

Each fabric interconnect has multiple ports reserved by VCE for 10 GbE ports. VCE has reserved some of these ports to connect to upstream access switches within the Vblock 340. These connections form a port channel to the Cisco Nexus switch and carry IP traffic destined for the external network 10 GbE links. In a unified storage configuration, this port channel can also carry NAS traffic to the X-Blades within the storage layer.

Each fabric interconnect also has multiple ports reserved by VCE for Fibre Channel (FC) ports. These ports connect to Cisco SAN switches. These connections carry FC traffic between the compute layer and the storage layer. In a unified storage configuration, port channels carry IP traffic to the X-Blades for NAS connectivity. For SAN connectivity, SAN port channels carrying FC traffic are configured between the fabric interconnects and the upstream Cisco MDS or Nexus switches.

**Storage components**

EMC VNX series are fourth-generation storage platforms that deliver industry-leading capabilities. They offer a unique combination of flexible, scalable hardware design and advanced software capabilities that enable them to meet the diverse needs of today’s organizations.

The VNX series platform implements a modular architecture that integrates hardware components for block, file, and object with concurrent support for native NAS, iSCSI, Fibre Channel, and FCoE protocols. Optimized for VMware virtualized applications, they feature flash drives for extendable cache and high performance in the virtual storage pools. Automation features include self-optimized storage tiering and application-centric replication.

Regardless of the storage protocol implemented at startup (block or unified), the Vblock 340 can include cabinet space, cabling, and power to support the hardware for all of these storage protocols. This arrangement makes it easier to move from block storage to unified storage with minimal hardware changes.

For this solution, the Vblock 340 uses the VNX storage platform as primary storage for user data and VMware Horizon View virtual desktops. User data and View persona data are directed to a CIFS share presented from the VNX 5600 in the Vblock 340. Placing the virtual desktops on the VNX storage increases desktop footprint capacity.

**Networking components**

The Cisco Nexus Series Switches in the network layer provide 10 or 40 GbE IP connectivity between the Vblock 340 and the outside world. In the unified storage architecture, the switches also connect the fabric interconnects in the compute layer to the X-Blades in the storage layer.
In the segregated architecture, the Cisco MDS 9000 series switches in the network layer provide Fibre Channel (FC) links between the Cisco fabric interconnects and the EMC VNX storage. These FC connections provide block level devices to blades in the compute layer. In unified network architecture, there are no Cisco MDS series storage switches. FC connectivity is provided by the Cisco Nexus 5548UP switches or Cisco Nexus 5596UP switches.

Ports are reserved or identified for special Vblock 340 services such as backup, replication, or aggregation uplink connectivity. The Vblock 340 contains two Cisco Nexus 3048 switches to provide management network connectivity to the different components of the Vblock System. These connections include the EMC VNX service processors, Cisco UCS fabric interconnects, Cisco Nexus 5500UP switches or Cisco Nexus 9396PX switches, and power output unit (POU) management interfaces.

**VMware vSphere 5.5**

VMware vSphere 5.5 provides a scalable and extensible platform that forms the foundation for virtualization management in the Vblock System 340.

VMware vSphere 5.5 is the latest release of the flagship virtualization platform from VMware. The core VMware vSphere components are the VMware vSphere Hypervisor (ESXi) and VMware vCenter Server for management.

VMware vSphere ESXi is a bare-metal hypervisor that installs directly on top of the physical server and partitions it into multiple virtual machines (VMs). Each VM shares the same physical resources as the other VMs and they can all run at the same time. Unlike other hypervisors, all management functionality of VMware vSphere is possible through remote management tools. There is no underlying operating system, reducing the install footprint to less than 150MB.

Deployed in a cluster configuration, the hypervisors can scale up to 32 nodes per cluster. The cluster allows dynamic allocation of resources, such as CPU, memory, and storage. The cluster also provides workload mobility and flexibility with the use of VMware vMotion and Storage vMotion technology.

In a VDI environment, VMware vCenter creates:

- Virtual machine folders to organize VDI VMs
- Resource pools to segregate physical resources for different groups of VDI VMs
- VDI virtual machines
- Snapshots

**VMware Horizon View**

VMware Horizon View delivers virtualized and remote desktops and applications through a single platform and supports end users with access to all of their Windows and online resources through one unified workspace.

VMware Horizon View provides unified access to virtual desktops and applications from a wide variety of devices. It allows IT to manage desktops, applications, and data centrally while increasing flexibility and customization at the endpoint for the user. It enables levels of availability and agility of desktop services unmatched by traditional PCs at about half the total cost of ownership (TCO) per desktop.
Unlike other desktop virtualization products, VMware Horizon View is a tightly integrated, end-to-end solution built on the industry-leading virtualization platform, VMware vSphere. VMware Horizon View allows customers to:

- Deliver desktops and applications through a single platform
- Provide a consistent end user experience across devices, locations, media, and connections
- Dynamically allocate resources with virtual storage, compute, and networking to simply and cost-effectively manage and deliver desktop services on-demand
- Extend business continuity and disaster recovery features to their desktops
Architecture

Logical component configuration

This solution requires two VMware vCenter instances: one for infrastructure and management and one for View desktops and RDSH virtual machines.

The infrastructure and management vCenter manages two clusters, one each for the following components:

- Vblock System element managers
- View infrastructure VMs

The View desktop vCenter manages two clusters, one each for the following components:

- View desktops
- RDSH virtual machines (VMs)

**NOTE:** VMware recommends that you do **not** mix RDSH workloads with VDI desktops.
The following diagram illustrates placement of the logical components in the solution.
VDI management infrastructure

The VDI management components reside on the AMP in the Vblock System 340.

The View infrastructure and management components reside in a dedicated cluster of two B200 M3 blade servers in the AMP vCenter.

The following diagram illustrates the logical configuration of management components.

VDI desktop infrastructure

The VDI desktop infrastructure resides on a separate vCenter instance.
We deployed a dedicated vCenter instance with two clusters: one cluster for View desktops and one cluster for RDSH VMs.

Hardware and software

This solution was tested on Vblock System 340 with Cisco UCS compute and Cisco Nexus networking components, and EMC VNX 5600 storage.

The following tables summarize the hardware and software used to validate this solution:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute</td>
<td>Cisco UCS 5108 blade chassis</td>
<td>4</td>
</tr>
<tr>
<td>Layer</td>
<td>Component</td>
<td>Quantity</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Layer 1</td>
<td>Cisco UCS C220 M3 rack server</td>
<td>2</td>
</tr>
<tr>
<td>Storage</td>
<td>Cisco UCS B200 M3 blade server (2 Intel Xeon 8-core E5-2697 CPUs, 256GB RAM)</td>
<td>20</td>
</tr>
<tr>
<td>Network</td>
<td>EMC VNX 5600 storage system</td>
<td>1</td>
</tr>
<tr>
<td>Network</td>
<td>Cisco Nexus 3048 Switch</td>
<td>2</td>
</tr>
<tr>
<td>Network</td>
<td>Cisco Nexus 5548UP Switch</td>
<td>2</td>
</tr>
<tr>
<td>Network</td>
<td>Cisco Nexus 6248UP Fabric Interconnect</td>
<td>2</td>
</tr>
<tr>
<td>Software</td>
<td>VMware vCenter Server</td>
<td>5.5</td>
</tr>
<tr>
<td>Software</td>
<td>VMware ESXi</td>
<td>5.5</td>
</tr>
<tr>
<td>Software</td>
<td>VMware Horizon (with View)</td>
<td>6.0</td>
</tr>
<tr>
<td>Software</td>
<td>Microsoft SQL Server</td>
<td>2012 Standard</td>
</tr>
<tr>
<td>Software</td>
<td>Microsoft Server</td>
<td>2008 R2 SP1</td>
</tr>
</tbody>
</table>
Validation

Workload generation and measurement

For this solution, we used the Login VSI workload generation and measurement tool to generate and measure rigorous and realistic desktop workloads.

Login VSI is an industry-standard tool designed to measure the maximum capacity of VDI infrastructures by simulating unique user workloads. The simulated users work with the same applications as typical employees, such as Microsoft Word, Excel, Outlook, and Internet Explorer. The results of several testing measurements are compiled into a metric known as VSimax, which quantifies the maximum capacity of VDI workloads running on a given infrastructure while delivering an acceptable user experience.

Test methodology

We used Login VSI to simulate application workloads and measure in-session resource utilization and response times to validate utilization and user experience.

Login VSI testing

Login Virtual Session Indexer (Login VSI) is the industry-standard benchmarking tool for measuring the performance and scalability of centralized desktop environments such as Virtual Desktop Infrastructure (VDI).

We used Login VSI to generate a reproducible, real-world test case that simulated the execution of various applications, including Microsoft Internet Explorer, Adobe Flash video, and Microsoft Office applications. The objective of the testing was to determine how many virtual desktop users, or sessions, each solution could support on the system under test.

Workload

We configured Login VSI to run a pre-defined knowledge workload against a VMware Horizon View pool of 1000 virtual desktops, with the tests set up to log users in to the virtual desktops incrementally every 30 seconds between sessions per physical host (blade). We used a knowledge worker workload because it consumes more memory and CPU resources due to the increased number of applications simultaneously running, which addresses most hosted virtual desktop user classes.

During testing, Login VSI sessions were initiated by launchers (simulated user endpoints) that ran on separate compute and storage infrastructure. Forty launchers were utilized, each running an average of 25 sessions. Each launcher was configured with two vCPUs and 6GB of vRAM, following Login VSI sizing guidelines.

Other test parameters included:

- Once a session has been started, the knowledge worker workload repeats every 12 minutes.
- During each loop, the response time is measured every two minutes.
- The knowledge worker workload opens up to five applications simultaneously.
- The type rate is 160ms for each character.
• Approximately two minutes of idle time is included to simulate real-world users.

Metrics

We measured response times for the following transactions:

<table>
<thead>
<tr>
<th>Transaction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCTS</td>
<td>Copy a text document from VSIShare to temp directory.</td>
</tr>
<tr>
<td>FCTL</td>
<td>Copy a local random text file from local temp directory to home drive</td>
</tr>
<tr>
<td>NSLD</td>
<td>VSI-Notepad starts and loads a 1500KB document.</td>
</tr>
<tr>
<td>NFO</td>
<td>Measure how long it takes to show the file-open dialog in VSI notepad.</td>
</tr>
<tr>
<td>ZHC*</td>
<td>Create a zip file with high compression.</td>
</tr>
<tr>
<td>ZLC*</td>
<td>Create a zip file with low compression.</td>
</tr>
<tr>
<td>CPU</td>
<td>Calculates a large array of random data.</td>
</tr>
<tr>
<td>IO</td>
<td>Write the CPU random data file to disk.</td>
</tr>
<tr>
<td>UMEM</td>
<td>The percentage of memory used by the sessions.</td>
</tr>
</tbody>
</table>

Deployment and recompose testing

Deployment and recompose time measurements are often overlooked in VMware Horizon View designs because they are considered infrequent events. However, deployment and recompose times are critical beyond the initial setup for several reasons:

• Deployment and recompose events have a direct impact on the IT agility and responsiveness. Consider the example of a large company that completes an acquisition and must roll out a corporate desktop and applications to all the newly acquired employees. Deployment times are directly correlated to the speed at which this can be accomplished.

• Linked-Clone VDI images are recomposed and redeployed periodically to apply OS patches or application updates, which requires a maintenance window. The recompose operation must be completed as rapidly as possible.

• Many customers employ a regular, automated recompose policy by setting desktops to Refresh on Logoff.

To simulate a more realistic test than simple creation of image clones, all pool deployment and recompose timing tests included the duration of the master image cloning process and virtual desktop customization, power on, domain registration, and View Agent registration.

Test procedure

During testing, we measured CPU utilization, memory utilization, storage processor utilization, and application response times.

We used the following test procedure to ensure consistent results.

1. Clean start of all desktop virtual machines (VMs) and clients before each test.
2. Restart all the launchers before the test.
3 Idle all desktop VMs and client launchers until startup services on the operating system settle down and memory and CPU on the launchers show no usage.

4 Execute at least two Login VSI loops in each active test phase session.

5 Log off all users after VSI completion.

6 Generate test run reports and data.

**VSI\text{max} and View session concurrency**

**Test 1: Linked-Clone desktops**

First, we tested 1000 Linked-Clone virtual desktops with 100 percent concurrency.

**Highlights**

Test results showed **VSI\text{max} not reached**.

At this level of session concurrency, host CPU resources are consumed up to 75 percent on average and memory resources are consumed up to 95 percent on average. All 1000 desktops demonstrated normal performance. The sustained upper CPU utilization threshold for most production implementations is 85 percent.

Highlights of the test include:

- Desktop access using PCoIP protocol and knowledge worker workload (with Flash enabled by default)
- VSI\text{max} not reached
- Excellent host performance (memory consumed up to 95 percent and CPU consumed up to 75 percent)
- Average steady state IOPS of 12169 on VNX 5600 (75 percent writes, 25 percent reads)
Application and host performance

Linked-Clone Desktops

Application Performance

<table>
<thead>
<tr>
<th>Applications</th>
<th>Response Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCTS</td>
<td>300</td>
</tr>
<tr>
<td>FCTL</td>
<td>600</td>
</tr>
<tr>
<td>NSLD</td>
<td>1200</td>
</tr>
<tr>
<td>NFO</td>
<td>500</td>
</tr>
<tr>
<td>NFP</td>
<td>1400</td>
</tr>
<tr>
<td>ZHC</td>
<td>800</td>
</tr>
<tr>
<td>ZLC</td>
<td>500</td>
</tr>
</tbody>
</table>

CPU Usage

- Average 51%
- Peak 78%

Memory Usage

- Average 67%
- Peak 95%

Disk Usage

- Average 20574
- Peak 28859

Network Performance

- Usage
**Storage performance**

We captured the performance of the VNX 5600 Storage Processors (SP A and SP B) during the 1000 VDI Linked-Clone desktop testing. We observed that the overall utilization was less than 40% on average for the respective workload.

![SP Utilization Graph](image)

**Desktop pool deployment and recompose**

We observed fast, consistent, and reliable desktop pool deployments even with background workloads in the compute and shared storage environments. We measured the time to deploy a 1000-desktop Linked-Clone pool and observed that all 1000 desktops were deployed in 1 hour and 45 minutes.
We observed similarly fast, consistent, and reliable desktop pool recompose operations. We measured the time to recompose a 1000-desktop Linked-Clone pool and observed that all 1000 desktops were recomposed in 2 hours and 53 minutes.

Test 2: RDSH session-based virtual desktops

Next, we tested 1000 Remote Desktop Session Host (RDSH) session-based virtual desktops with 100 percent concurrency.

**Highlights**

Test results showed **VSI\text{max} not reached**.
At this level of session concurrency, host CPU resources are consumed up to 60 percent on average and memory resources consumed up to 50 percent on average. All 1000 RDSH sessions demonstrated normal performance.

Highlights of the test include:

- Desktop access using PCoIP protocol and knowledge worker workload (with Flash enabled by default)
- VSI_max not reached
- Excellent host performance (memory consumed up to 60 percent and CPU consumed up to 50 percent)
- Average steady state IOPS of 3243 on VNX 5600 (75 percent writes, 25 percent reads)
Application and host performance

RDSH Session-Based Desktops

Host Performance

Transactions

Response Time (ms)

FCTS  FCTL  NSLD  NFO  NFP  ZHC  ZLC

CPU Usage

Average 37%
Peak 58%

Memory Usage

Average 50.34
Peak 50.35

Disk Usage

Average 11834
Peak 18691

Network Performance

Network usage in KB/s

Time
Storage performance

We captured the performance of the VNX 5600 Storage Processors (SP A and SP B) during the 1000 RDSH session-based desktop testing. We observed that the overall utilization was less than 20% on average for the respective workload.
Design guidelines

Virtual infrastructure

VMware vSphere cluster and data store configurations

The following diagrams illustrate cluster and data store layouts.

VDI management infrastructure

We created a dedicated cluster on the AMP vCenter to host the VDI management components. The cluster consisted of two UCS B200 M3 blade servers configured to use two 600 GB FC LUNs from the VNX 5600.

VDI desktop infrastructure

For the VDI desktop infrastructure, we deployed a dedicated vCenter and created two clusters. The VDI desktop cluster consisted of 10 UCS B200 M3 blade servers. We configured the blades with the following shared FC LUNs from the VNX 5600:

- 16 x 1.8TB data store for VDI clones
- One 500GB data store for Master VMs
- One 750GB data store for Replica disks
Remote Desktop Session Host infrastructure

For the RDSH infrastructure, we created a single cluster with eight UCS B200 M3 blade servers. We configured the blades with two shared 900 GB FC LUNs from the VNX 5600.

Infrastructure and management servers

Two vCenter instances were deployed, one for infrastructure and management servers and one for desktops.

We used the vCenter on the Vblock System 340 AMP for managing infrastructure servers. For View desktops, we deployed a dedicated vCenter Server instance, in conformance with VMware Horizon 6 (with View) architecture planning guidelines.

All additional vCenter roles (Inventory, Single Sign-On, vCenter Server) for the desktop vCenter were divested to separate servers to avoid any resource contention that might have resulted from combining roles on a busy vCenter Server.

Server resources were sized according to current best practices from VMware.

Storage

During testing, we used the EMC VNX 5600 for Linked-Clone system disk storage, and we redirected user and user persona data to a CIFS share configured in the same VNX 5600.
Storage pools

The following table lists the storage pool configurations in the VNX 5600:

<table>
<thead>
<tr>
<th>Storage pool</th>
<th>RAID type</th>
<th>Disk type</th>
<th>No. of Drives</th>
<th>Total capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replica image</td>
<td>5</td>
<td>200 GB EFD</td>
<td>10</td>
<td>1.2 TB</td>
</tr>
<tr>
<td>Fast Cache</td>
<td>1+0</td>
<td>200 GB EFD</td>
<td>10</td>
<td>1000 GB</td>
</tr>
<tr>
<td>View desktops with Fast Cache</td>
<td>5</td>
<td>300 GB SAS at 15K RPM</td>
<td>110</td>
<td>30 TB</td>
</tr>
<tr>
<td>View infrastructure VMs</td>
<td>5</td>
<td>300 GB SAS at 15K RPM</td>
<td>5</td>
<td>1.2 TB</td>
</tr>
</tbody>
</table>

LUN requirements

The following table lists the LUNs that you must create and present to the ESXi blades for running View desktop workloads:

<table>
<thead>
<tr>
<th>Virtual desktop pool size</th>
<th>Component</th>
<th>LUN size</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 VDI infrastructure</td>
<td>600 GB</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1000 VDI desktops</td>
<td>1.8 TB</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>1000 Master VMs</td>
<td>500 GB</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>16 Replica Disks</td>
<td>750 GB</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2 RDSH VMs</td>
<td>900 GB</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1 User Persona (optional)</td>
<td>2 TB</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Virtual desktop storage capacity

The following table lists the storage requirements for each virtual desktop type:

<table>
<thead>
<tr>
<th>Virtual desktop type</th>
<th>Capacity</th>
<th>Number</th>
<th>Total capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linked-Clone virtual desktop</td>
<td>30 GB</td>
<td>1000</td>
<td>30 TB</td>
</tr>
<tr>
<td>Linked-Clone Replica disks (one per desktop data store)</td>
<td>44 GB</td>
<td>16</td>
<td>704 Gb</td>
</tr>
<tr>
<td>Full-Clone virtual desktop</td>
<td>44 GB</td>
<td>1000</td>
<td>43 TB</td>
</tr>
</tbody>
</table>

Network

For this solution, the Vblock System 340 was configured with a unified storage architecture.
Cisco Nexus switches

Each fabric interconnect in the Vblock 340 has multiple ports reserved for 10GbE ports. These connections form a port channel to the Cisco Nexus switch and carry IP traffic destined for the desktop network 10GbE links. In a unified storage configuration, this port channel can also carry IP traffic to the storage layer.

The Cisco Nexus 5548UP switches in the network layer provide 10GbE IP connectivity between the infrastructure and the external network. In a unified storage architecture, the switches connect the fabric interconnects in the compute layer to the storage layer also.

View infrastructure networking

We used the vSphere Standard Switch (vSwitch 0) for the View management and infrastructure servers with a redundant 10 GbE uplink to the Nexus 5548UP.

View desktop networking

We deployed a vSphere Distributed Switch (vDS) for View desktops with a redundant 10GbE uplink to the Nexus 5548UP.

IP network components

To support the Ethernet and SAN requirements in the traditional segregated network architecture, two Cisco Nexus 5548UP switches provide both 10GbE Ethernet and Fibre Channel (FC) connectivity.

The Cisco Nexus 5548UP switches have 32 integrated, low-latency unified ports, each providing line-rate 10GB Ethernet or FC connectivity. The Cisco Nexus 5548UP switches each have one expansion slot that can be populated with a 16-port unified port expansion module.

Horizon View configuration

VMware Horizon View is a tightly integrated, end-to-end solution built on the industry-leading virtualization platform, VMware vSphere.

For this validation, we installed the following core systems:

- Two connection servers
- A dedicated vCenter with roles split to separate servers as follows:
  - vCenter
  - vCenter Single Sign-On (SSO)
  - vCenter Inventory Service
  - vCenter Web Client
  - vCenter Update Manager
- View Composer running on a separate standalone server
Desktop pool configuration

VMware Horizon 6 (with View) offers the ability to create and provision pools of desktops as its basis of centralized management.

To validate this solution, we deployed a single Automatic Floating Linked-Clone desktop pool with 1000 desktops.

Configuration of the Linked-Clone pool conformed to a typical knowledge worker profile with the exception of the Storage Overcommit policy. The Storage Overcommit policy must be set to Aggressive with any storage platform that has an inline deduplication or data reduction capability.

Virtual machine configurations

In production environments, virtual machine configurations vary based on individual use case requirements.

Master virtual machines

We configured the virtual hardware of the master desktop virtual machine according to standard Login VSI specifications. The master image used in this test environment underwent VDI optimization as defined in the VMware Horizon with View Optimization Guide for Windows 7 and Windows 8.

NOTE: VMware strongly recommends that the Windows image be optimized when master images are prepared for use with Horizon View.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop OS</td>
<td>Microsoft Windows 7, 64-bit</td>
</tr>
<tr>
<td>VMware virtual hardware</td>
<td>Version 9</td>
</tr>
<tr>
<td>VMware tools version</td>
<td>Up-to-date</td>
</tr>
<tr>
<td>Virtual CPU</td>
<td>2</td>
</tr>
<tr>
<td>Virtual memory</td>
<td>4096MB</td>
</tr>
<tr>
<td>OS page file</td>
<td>1.5GB starting and maximum</td>
</tr>
<tr>
<td>vNICs</td>
<td>1</td>
</tr>
<tr>
<td>Virtual network adapter 1</td>
<td>VMXNET 3</td>
</tr>
<tr>
<td>Virtual SCSI controller 0</td>
<td>LSI Logic SAS</td>
</tr>
<tr>
<td>Virtual disk (VMDK)</td>
<td>40Gb</td>
</tr>
<tr>
<td>Virtual floppy drive 1</td>
<td>Removed</td>
</tr>
<tr>
<td>Virtual CD/DVD drive 1</td>
<td>Removed</td>
</tr>
<tr>
<td>Horizon View Agent</td>
<td>6.0</td>
</tr>
</tbody>
</table>
**Installed applications (per Login VSI standards)**
- Microsoft Office 2010
- Adobe Acrobat Reader 10
- Doro PDF Printer
- FreeMind
- Notepad

**RDSH virtual machines**

A Remote Desktop Session Host (RDSH) is a server computer that has Windows Remote Desktop Services and View Agent installed. An RDSH hosts applications and desktop sessions that users can access remotely. An RDSH can be a physical or a virtual machine. The ESXi host for an RDSH virtual machine can be part of a VMware HA cluster to guard against physical server failures.

The following table lists specifications for an RDSH virtual machine:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating system</td>
<td>Windows Server 2008 R2 SP1</td>
</tr>
<tr>
<td>RAM</td>
<td>64 GB</td>
</tr>
<tr>
<td>Virtual CPU</td>
<td>4</td>
</tr>
<tr>
<td>System disk capacity- VMDK</td>
<td>70 GB</td>
</tr>
<tr>
<td>Virtual SCSI adapter type</td>
<td>LSI Logic SAS (the default for Windows Server 2008)</td>
</tr>
<tr>
<td>Virtual network adapter</td>
<td>VMXNET 3</td>
</tr>
<tr>
<td>1 NIC</td>
<td>1 Gigabit</td>
</tr>
<tr>
<td>Virtual SCSI controller 0</td>
<td>LSI Logic SAS</td>
</tr>
<tr>
<td>Maximum number of client connections (including session-based remote desktop connections and remote application connections)</td>
<td>50</td>
</tr>
</tbody>
</table>
References

Refer to the following technical resources for additional information.

VMware

• Server and Storage Sizing Guide for Windows 7 desktops in a Virtual Desktop Infrastructure
• VMware Horizon with View Optimization Guide for Windows 7 and Windows 8
• Workload Considerations for Virtual Desktop Reference Architectures
• Storage Considerations for VMware Horizon View 5.2

VCE

• VCE End User Computing

EMC

• Sizing EMC VNX Series for VDI Workloads

Cisco

• Cisco Desktop Virtualization Solutions with VMware Horizon View
• Design Considerations for Increasing VDI Performance and Scalability with Cisco Unified Computing System

Login VSI

• Login VSI Technical Documentation
Conclusion

VDI can help save time and money, provide greater defense against catastrophic failure, improve update speeds, and provide an easy way to customize desktops for certain users or groups of users.

This solution architecture provides service providers and organizations with detailed design considerations for providing a centrally managed, robust, scalable, and secure hosted and virtual shared desktop environment on the Vblock 340 using VMware Horizon View. When designing and estimating capacity for this solution architecture, we adhered closely to published VMware, Cisco, and EMC sizing and estimation standards, and best practices for VDI deployments.

The Vblock 340 provides an enterprise-class IT infrastructure for VDI rollouts, ensuring the response times, security, availability, and agility IT requires. It has been engineered for greater scalability and performance to support large enterprise deployments of mission-critical applications, cloud services, VDI, mixed workloads, and application development and testing. VMware Horizon View is the industry's leading desktop virtualization platform and the only solution built expressly to deliver desktop as a service.

Our test results demonstrate that the Vblock System 340 easily supports a deployment of 1000 Linked-Clone or RDSH session-based desktops with 100 percent concurrency and acceptable CPU, memory, and storage use, along with acceptable application response times. Rapid desktop pool deployment and recompose times show that desktop maintenance is feasible even with extensive background workloads running simultaneously.
Next steps

To learn more about this and other solutions, contact your VCE representative or visit www.vce.com.