NEXGEN N5 REFERENCE ARCHITECTURE

For VMware Horizon View

Introduction

Desktop management at any scale is a tedious job. Imaging, reimaging, and troubleshooting desktop systems consume valuable IT resources, and keep employees from being productive. Securing the information generated on desktops, tablets, and smartphones is no simple job either. For these reasons, many IT organizations are deploying virtual desktop infrastructure (VDI). Virtualizing and centralizing desktops enables end user computing environments consisting of various endpoint devices such as desktops, laptops, tablets, and smartphones to be managed from a central point. It simplifies operational responsibilities such as asset management and patch management, and streamlines the definition and implementation of desktop policies.

By decoupling applications, data and operating system from the endpoint device—and by moving these components into the datacenter, where they can be centrally managed in your cloud—desktop and application virtualization offers IT a more streamlined, secure way to manage users and provide agile, on-demand desktop services.

For a deployment to be successful, the computing and storage infrastructure must deliver a high-quality, predictable, and productive user experience. Storage in particular, has proven critical to both the operational and financial success of a VDI deployment. It is generally acknowledged that flash storage is the best storage medium to address VDI, due to its low latency/high IOPS nature. There are two shared flash storage architectures that are typically considered for this need, all-flash arrays and hybrid arrays. All-flash are 100% flash-based, and are able to serve all read and write requests from flash. But for many, all-flash solutions do not fit their budget. Hybrid flash arrays combine flash with high capacity disk drives, making it the cost effective alternative to all-flash arrays.

Objectives

The purpose of this reference architecture is to validate a proven VDI configuration comprised of NexGen N5 Hybrid Flash Array, VMware Horizon View, Cisco Unified Computing System ™ (UCS), and Cisco Nexus Switches.

It will demonstrate the ability of the reference architecture to support VMware Horizon View based Windows 7 desktops by simulating real user interaction and experience with VMware View Planner. Additionally, testing will validate the unique low latency architecture and predictable end-user experience delivered by NexGen N5. This document will present performance and scalability testing results and offer implementation guidance.

Audience

This reference architecture is intended to assist solution architects and IT decision makers responsible for VDI projects. Resellers will also find this document useful for defining solutions for their customers.

This is intended as an overview document and additional reference documents are highlighting in the appendix. A working knowledge of VMware vSphere, VMware View, Cisco UCS, Cisco Nexus switches, and SAN storage is helpful, but not a prerequisite for reading this document.

Summary of Reference Architecture Findings

1. The desktop user experience is highly dependent on application latencies, which are dependent on host server and storage performance. Accurate and meaningful modeling is critical to successfully planning and sizing a Horizon View deployment.
2. The slowest component in most environments, in terms of bandwidth and latency, is storage. NexGen N5 maximizes storage performance by integrating flash directly onto the PCIe bus, bypassing storage controller bottlenecks completely. With storage able to deliver the required bandwidth and IOPS at low latency, the user experience is more influenced by the processing power within the VDI cluster.
3. The NexGen N5 Hybrid Flash Array effortlessly supported 500 desktops without reaching IOPS, bandwidth, or storage latency limits. This reference architecture can easily support more virtual desktops by adding more compute resources

VDI SOLUTION CONSIDERATIONS

There are a number of considerations when deciding how to design and architect the right VDI solution that fits your company's needs. The following decisions will define the scalability, performance characteristics, and deployment model required for a successful VDI experience.

- How many desktops are you trying to virtualize initially, and in the future?
- If VDI is rolled out in phases, how many desktops will be added in each phase?
- What type of user desktops will be virtualized? The type of user impacts server and storage resource requirements.
- Will the virtual desktops be full virtual machines, linked clones or a mixture of both?
- Will the desktops be persistent (contain the entire user configuration and customization) or non-persistent/state-less (does not maintain user data, personalized settings, or any other changes made by the end user).
- How many different master images will need to be created and managed?
- What will be the amount of disk capacity per desktop?
- How much CPU and RAM will be assigned to each desktop?
- Can you afford to dedicate storage to VDI, or prefer to share the storage with other applications to lower costs?
- How do you eliminate resource contention between virtual desktops and other applications especially during high I/O events such as during boot storms, log-in storms, application launches, or virus scans?
- How will high availability be achieved?

User Classifications and Resource Requirements

The type of desktop user being virtualized determines the server and storage resources that will be required to support the desired user experience.

USER/WORKER TYPE	APPLICATIONS (OPEN SIMULTANEOUSLY)	VIRTUAL MACHINE CONFIGURATION	IOPS
Task-based worker (light)	Limited (1–5 applications, light use)	1 virtual CPU 1GB memory	3–7
Knowledge worker (medium)	Standard office (1–5 applications, regular use)	2 virtual CPUs 2GB memory	8–16
Power user (heavy)	Compute-intensive (5+ applications, regular use)	2 virtual CPUs 4GB memory	17–25
Power user plus (heavy)	Compute-intensive (5+ applications, intense use)	2+ virtual CPUs 4GB memory	26+

Source: VMware Server and Storage Sizing Guide for Windows 7 Desktops in a Virtual Desktop Infrastructure

STORAGE CONSIDERATIONS

Adopting VDI puts enormous pressure on storage, so the storage platform you choose is critical to making the economics of VDI work, while maintaining high quality of service levels to satisfy user requirements. The following storage considerations must be acknowledged prior to selecting storage for VDI.

1. **Performance:** High I/O performance and low latency are key to a successful VDI user experience. Nothing stalls VDI adoption faster than user frustration caused by slow desktop boot-ups, and application response time being slower than physical desktops. It is important to note that VDI is generally characterized as write heavy. While this is not an issue with all-flash storage arrays since all reads and writes go to flash, it can be for hybrid arrays that do not use flash for writes.
2. **Predictable user experience:** Virtual desktop users will expect the same, if not better, experience as they have with their physical desktops. For the storage system, this means that performance must remain consistent, even during boot storm, virus scans, and other updates. If virtual desktops are hosted on the same storage system as other applications, resource contention must not affect user experience.
3. **Cost:** Flash storage can solve the performance requirements of VDI, but cost can put the project out of reach. Hybrid flash arrays can be an affordable alternative. Many hybrids promise high capacity and performance, most sacrifice capacity for performance by consuming HDD trays with SSDs. Ideally, the storage solution should provide maximum performance and maximum capacity.

4. **Flexible Scalability:** Confidence that your storage system can scale to meet VDI demands is reassuring. Being able to scale performance and capacity independently allows your storage system to grow in the dimension needed without having to incur unnecessary costs. Furthermore, the ability to scale performance without swapping out controllers or needing to add flash as capacity is scaled makes scaling less cumbersome and less costly.
5. **Storage Sprawl:** While not an obvious consideration, the ability to run VDI alongside other applications would be a desirable capability for most companies, especially mid-sized or small-to-medium enterprises, since it reduces the costs and management complexity associated with storage sprawl across the organization.
6. **Validation:** Having documentation that the storage is validated with your VDI software platform of choice and what results should be expected takes risks and unknowns out of the VDI deployment.

Reference Architecture Overview

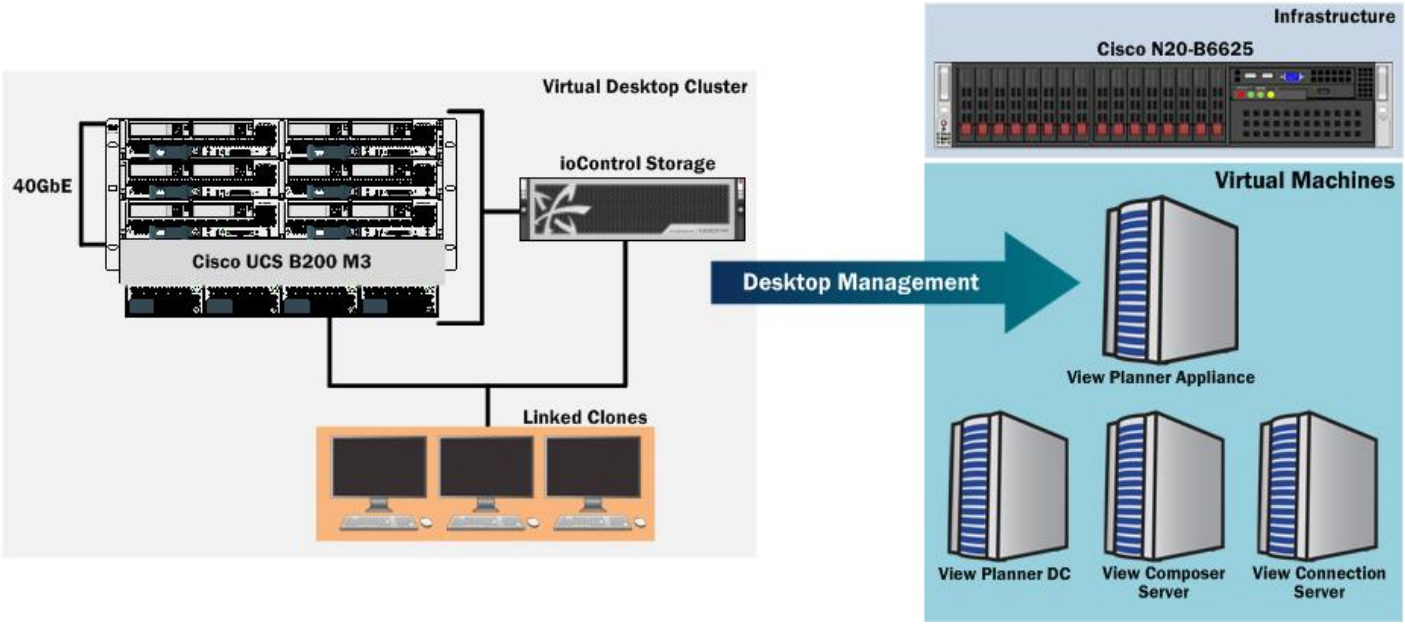


Figure 1: Reference Architecture overview

Reference Architecture Building Blocks

NEXGEN N5 HYBRID FLASH ARRAY

- NexGen model n5-150 with 2.4TB ioMemory flash capacity and 48TB raw disk capacity.
- Software includes Performance QoS, Dynamic Data Placement, Phased Data Reduction, Snapshot, and Replication.

The NexGen N5 Hybrid Flash Array combines PCIe flash memory with disk, to make flash performance affordable. NexGen's integrated software allows you to provision, prioritize, and control shared storage performance. The result is a perfect balance of high-performance memory-attached flash and affordable disk capacity. NexGen storage QoS (Quality of Service) software delivers consistent virtual desktop performance and eliminates contention with other applications to keep VDI end users happy.

NexGen n5 Series storage arrays are available in different models that vary in flash and disk capacity, and have the ability to add additional flash and disk drives to scale performance and capacity independently. All software features are included with the NexGen N5.

CISCO UNIFIED COMPUTING SYSTEM (UCS)

- Cisco UCS 5108 Series Blade Server Chassis
- 8 - B200 M3 Blade Servers with 16 cores and 256GB RAM

Cisco UCS combines Cisco UCS B-Series Blade Servers and C-Series Rack Servers with networking and storage access in a single converged system that simplifies management and delivers greater cost efficiency and agility with increased visibility and control and serves as an ideal infrastructure for both server and desktop virtualization environments. Innovations in the platform include a standards-based unified network fabric, Cisco virtualized interface card (VIC), and Cisco UCS Extended Memory technology. The system uses a wire-once architecture with a self-aware, self-integrating, intelligent infrastructure that eliminates the time-consuming, manual, error-prone assembly of components into systems.

The Cisco UCS B200 M3 uses latest Intel® Xeon® processor E5-2600 and E5-2600 v2 product families, with up to 768 GB of RAM (using 32-GB DIMMs), two disk drives, and up to dual 4x 10 Gigabit Ethernet throughput.

See http://www.cisco.com/en/US/products/ps10265/products.html for more details.

CISCO NEXUS 5500 SERIES

- 2- Nexus 5548UP Switches

Cisco Nexus 5500 Series Switches deliver an innovative architecture to simplify data center transformation by enabling a high-performance, standards-based, multiprotocol, multipurpose, Ethernet-based fabric. They help consolidate separate LAN, SAN, and server cluster network environments into a single 10 Gigabit Ethernet fabric. This unification enables network consolidation and greater utilization of previously separate infrastructure and cabling, reducing by up to 50 percent the number of adapters and cables required and eliminating redundant switches. It also lowers power and cooling costs significantly.

See http://www.cisco.com/en/US/products/ps9670/index.html for more details.

VMware Horizon View

- Horizon View Add-On (for configurations that already have vSphere and vCenter)

VMware® Horizon View™ (formerly VMware View) is a virtual desktop infrastructure solution that simplifies desktop management. With Horizon View, IT can simplify and automate the management of thousands of desktops and securely deliver desktop as a service to users from a central location at levels of availability and reliability unmatched by traditional PCs. By delivering secure access to applications and data to any device—when and where users need it—Horizon View gives end users maximum mobility and flexibility.

VMware Horizon View includes VMware vSphere Desktop, vCenter Server Desktop, Horizon View Desktop, Horizon View Composer, and other features.

Unlike other desktop virtualization products, VMware View is built on, and tightly integrated with, VMware vSphere, the industry-leading virtualization platform, allowing customers to extend the value of VMware infrastructure and its enterprise-class features such as high availability, disaster recovery, and business continuity. See http://www.vmware.com/products/horizon-view/ for more details.

VMware vSphere

- VMware vSphere Enterprise Edition

VMware vSphere 5 is the leading virtualization platform used in IT environments around the world. The VMware vSphere Hypervisor Architecture provides a robust, production-proven, high-performance virtualization layer. It enables multiple virtual machines to share hardware resources with performance that can match (and in some cases exceed) native throughput. VMware vSphere Virtual Machine File System (VMFS) allows virtual machines to access shared storage devices such as NexGen N5 hybrid flash storage used in this Reference Architecture and is a key enabling technology for other vSphere components such as VMware vSphere Storage vMotion®.

VMware vSphere comes in three Editions – Standard, Enterprise and Enterprise Plus with each offering a range of powerful business continuity and security, resource prioritization, and management and automation features depending on your needs. See http://www.vmware.com/products/vsphere/ for more details.

Test Methodology

VMware View Planner was used to validate the capabilities of the Reference Architecture to support Horizon View virtual desktops. View Planner is a VMware tool designed to simulate a large-scale deployment of virtualized desktop systems. This is achieved by generating a workload representative of many user-initiated application operations that take place in a typical VDI environment. View Planner uses workload applications that are representative of those typically used for virtual desktop users, such as word processor, spreadsheet, web browsing, document viewing, etc.

As a View Planner test is being executed the completion times for the application operations are measured. Operations are grouped as CPU intensive (Group A), I/O intensive (Group B), and operations that apply load in the background (Group C). A resulting View Planner score is the number of desktops for which at least 95 percent of both the operations in Group A and in Group B had completion times under defined thresholds.

VMware View Planner is implemented in one of three ways:

1. Local-mode executes the View Planner workloads only on the VDI infrastructure, without clients performing remote desktop connections as would be the norm in an actual VDI deployment. This method is only applicable for basic scaling exercises.
2. Passive-mode implementation requires a more extensive test infrastructure to include remote desktop clients that connect to the VDI environment with Windows RDP, View RDP, or View PCoIP display protocol. Passive mode is a one-to-many client to desktop model.
3. Remote-mode is a one-to-one client to desktop model. This mode includes a Horizon View Connection server to manage View PCoIP desktop connections and a Horizon View Composer server for rapid deployment of linked clone desktops. It provides the most realistic simulation of a VDI environment and is therefore the most robust implementation of View Planner.

As of View Planner 3, VMware requires full remote-mode execution of View Planner for compliant benchmark scoring. This was the View Planner deployment used by NexGen to certify this reference architecture.

Building the Reference Architecture

For this reference architecture we deployed an ESXi 5.1 cluster with 8 hosts to provide enough CPU and memory to support more than the 500 desktops targeted. A basic resource pool evenly distributed VMs across the servers. DRS and fully automated migration were enabled on the cluster.

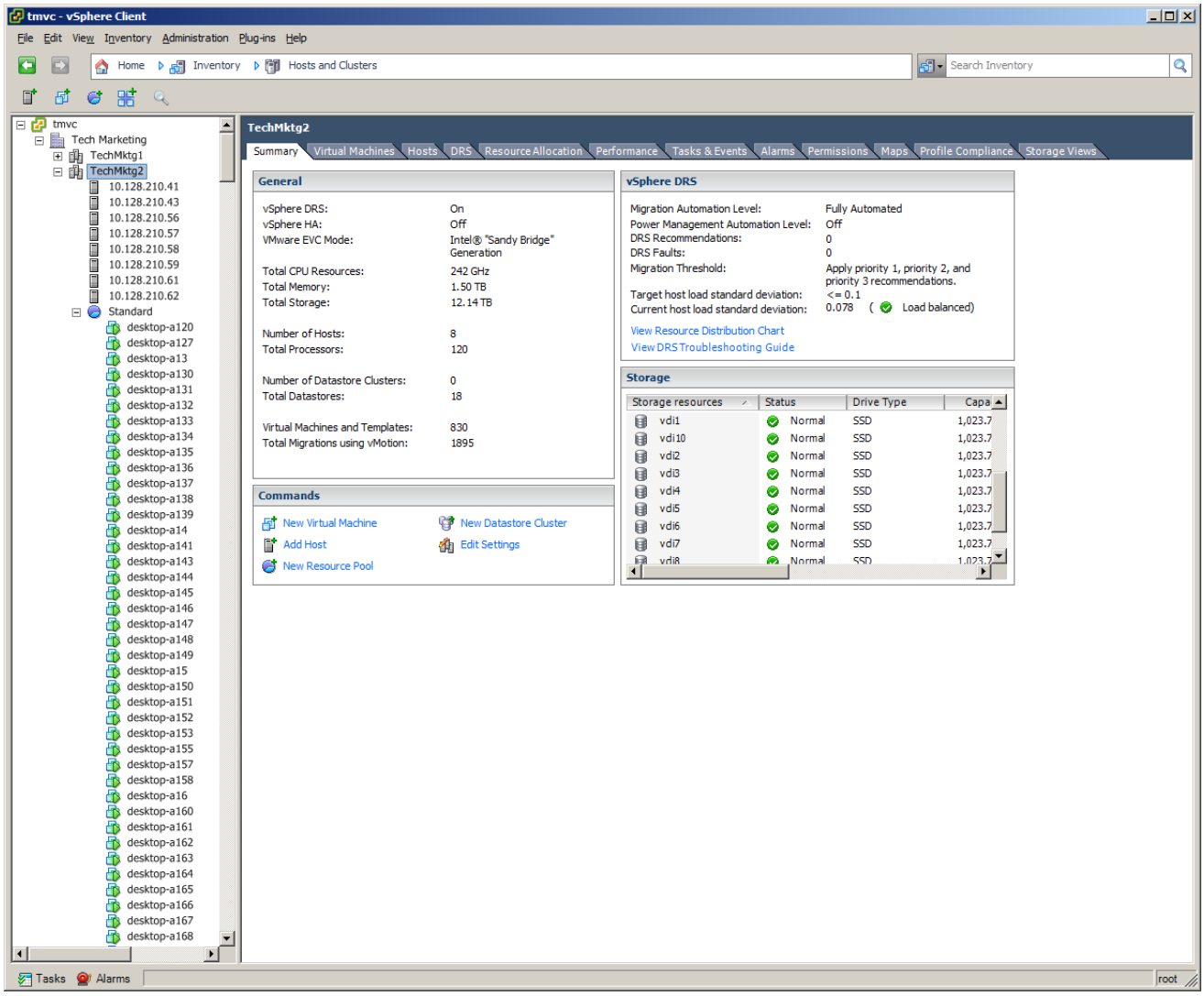


Figure 2: vCenter view of VDI cluster with hosts and resource pools

A separate ESXi cluster was also provisioned to support the client virtual machines that would remotely connect to and execute workload on the desktops. This cluster did not share any resources with the primary VDI cluster.

To support both client to desktop and vMotion traffic, a 40GbE network was deployed between all VDI hosts and clients. We configured a local DHCP server to provide enough addresses for the 500 plus desktops and 500 plus clients.

Ten 1TB volumes from the NexGenN5 hybrid flash array were provisioned as datastores to host the desktop VMs, which were evenly distributed across all 10 datastores.

NexGen storage volumes are assigned a predefined Quality of Service (QoS) service level each with its own unique performance policies that manage IOPS, bandwidth and latency. This allows vSphere administrators to easily match volume performance with application importance to the end business users. QoS prioritization can be adjusted real-time without the need to migrate volumes between storage tiers. This allows Horizon View administrators to meet end user Service Level Agreements (SLAs) by changing volume performance based upon set schedules, or real-time analysis of performance data. QoS policy changes can be scheduled to accommodate VDI boot storms or virus scans or to reflect new end user workloads.

NexGen QoS also allows Horizon View administrators to meet SLAs for different user types by specifying different service levels for each group. This ensures that heavy user profiles do not negatively impact other works sharing the same infrastructure.

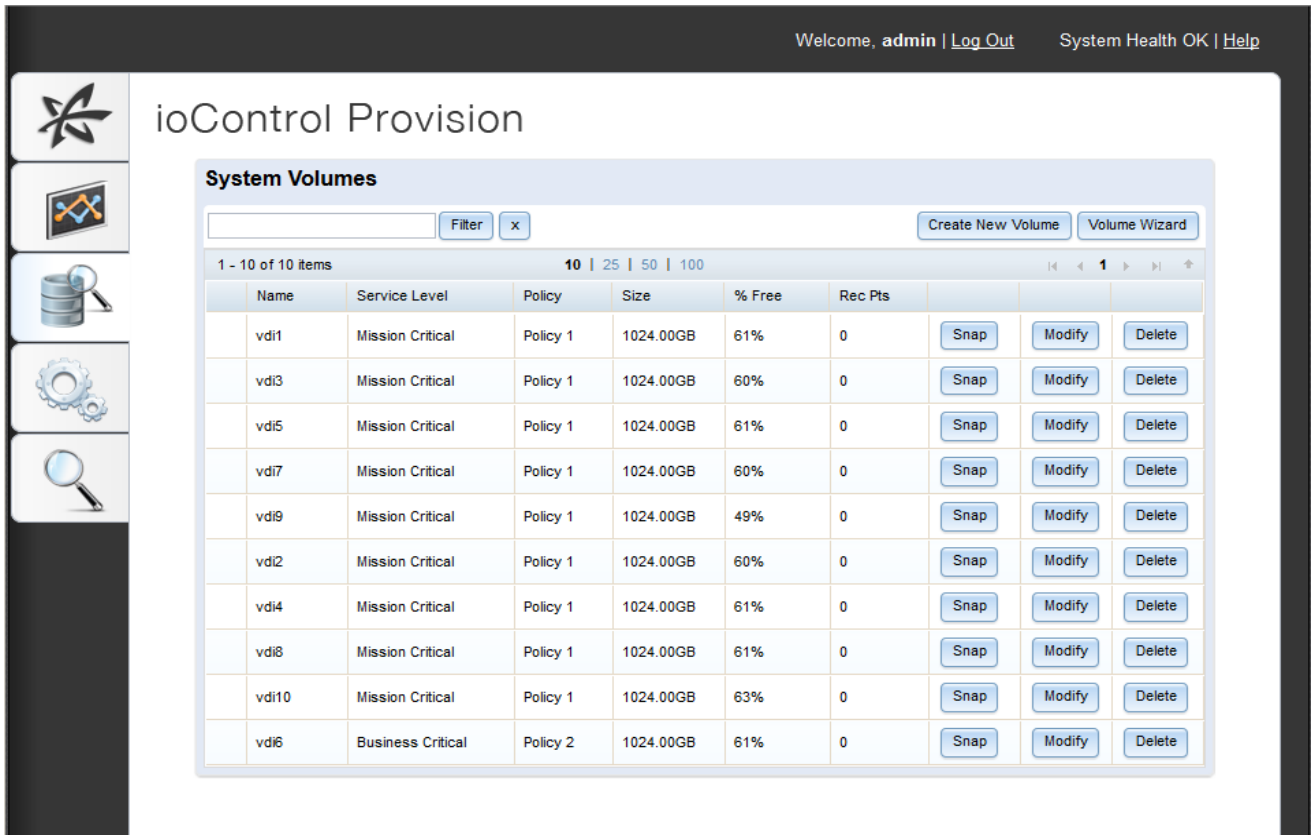


Figure 3: NexGen N5 management console displaying provisioned volumes

The ViewPlanner infrastructure components, including VMware Horizon View Connection and Composer servers, an Active Directory Server, and the ViewPlanner Appliance were deployed as virtual machines on a standalone ESXi host

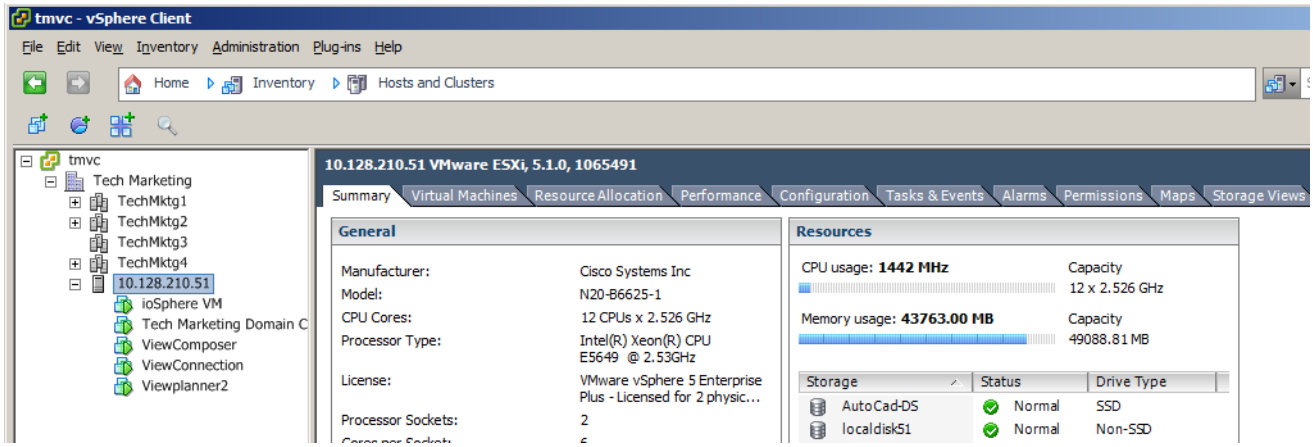
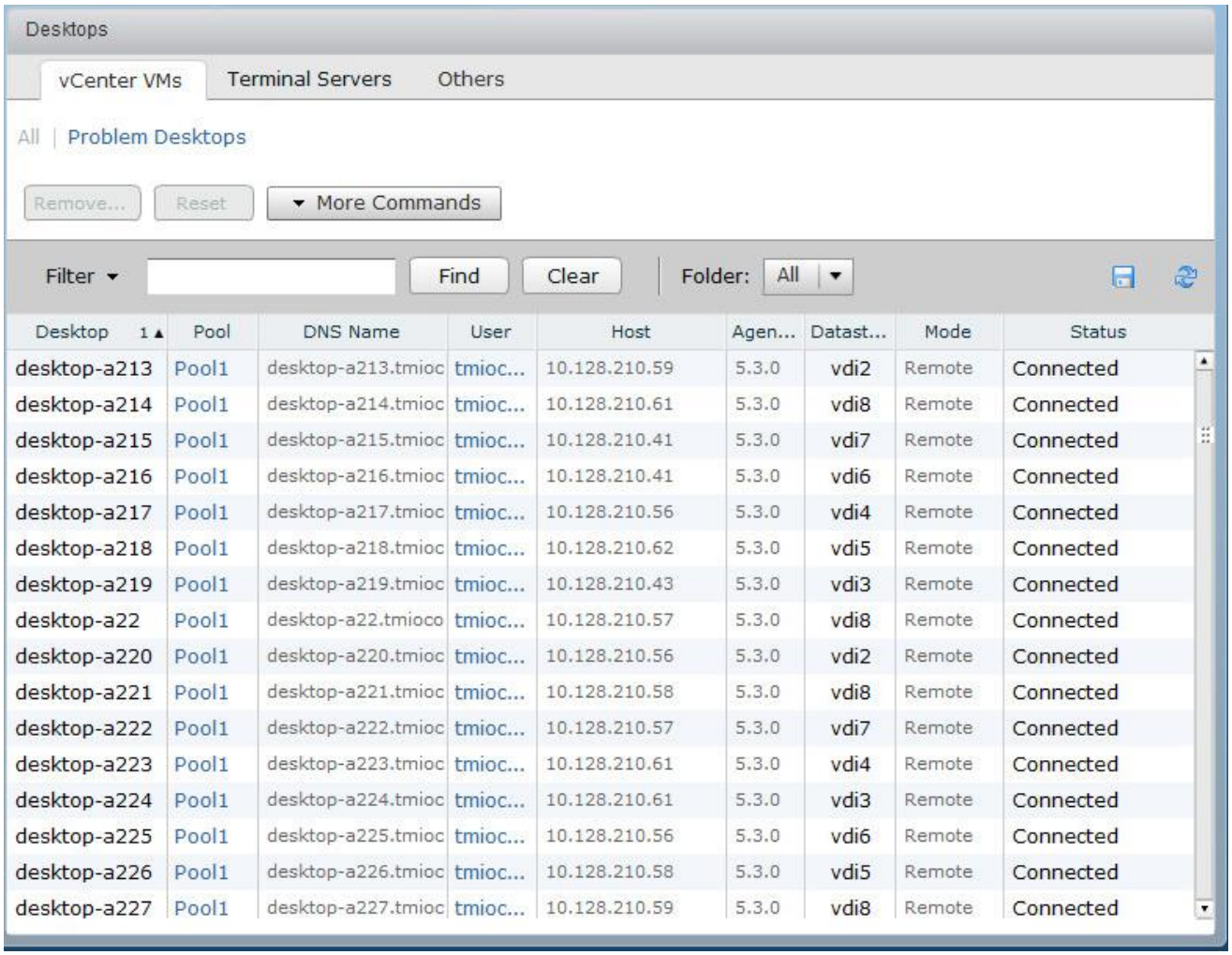


Figure 4: vCenter view of vSphere client hosting Horizon View infrastructure

The Horizon View Administrator was configured with connection settings to vCenter and the View Composer per the View Planner 3 manual, and we used the View Administrator to provision linked clones from a "golden desktop" built to View Planner 3 benchmark requirements using the View Composer.



Desktop	Pool	DNS Name	User	Host	Agen...	Datast...	Mode	Status
desktop-a213	Pool1	desktop-a213.tmioc	tmioc...	10.128.210.59	5.3.0	vdi2	Remote	Connected
desktop-a214	Pool1	desktop-a214.tmioc	tmioc...	10.128.210.61	5.3.0	vdi8	Remote	Connected
desktop-a215	Pool1	desktop-a215.tmioc	tmioc...	10.128.210.41	5.3.0	vdi7	Remote	Connected
desktop-a216	Pool1	desktop-a216.tmioc	tmioc...	10.128.210.41	5.3.0	vdi6	Remote	Connected
desktop-a217	Pool1	desktop-a217.tmioc	tmioc...	10.128.210.56	5.3.0	vdi4	Remote	Connected
desktop-a218	Pool1	desktop-a218.tmioc	tmioc...	10.128.210.62	5.3.0	vdi5	Remote	Connected
desktop-a219	Pool1	desktop-a219.tmioc	tmioc...	10.128.210.43	5.3.0	vdi3	Remote	Connected
desktop-a22	Pool1	desktop-a22.tmioco	tmioc...	10.128.210.57	5.3.0	vdi8	Remote	Connected
desktop-a220	Pool1	desktop-a220.tmioc	tmioc...	10.128.210.56	5.3.0	vdi2	Remote	Connected
desktop-a221	Pool1	desktop-a221.tmioc	tmioc...	10.128.210.58	5.3.0	vdi8	Remote	Connected
desktop-a222	Pool1	desktop-a222.tmioc	tmioc...	10.128.210.57	5.3.0	vdi7	Remote	Connected
desktop-a223	Pool1	desktop-a223.tmioc	tmioc...	10.128.210.61	5.3.0	vdi4	Remote	Connected
desktop-a224	Pool1	desktop-a224.tmioc	tmioc...	10.128.210.61	5.3.0	vdi3	Remote	Connected
desktop-a225	Pool1	desktop-a225.tmioc	tmioc...	10.128.210.56	5.3.0	vdi6	Remote	Connected
desktop-a226	Pool1	desktop-a226.tmioc	tmioc...	10.128.210.58	5.3.0	vdi5	Remote	Connected
desktop-a227	Pool1	desktop-a227.tmioc	tmioc...	10.128.210.59	5.3.0	vdi8	Remote	Connected

Figure 5: Horizon View administrator showing desktop VMs

For full compliance with View Planner 3 benchmarking, we created a run profile using the View PCoIP display protocol and the StandardBenchmarkProfile5i (a five iteration benchmarking workload provided pre-build with the appliance) and a ramp up time of not more than 600 seconds.

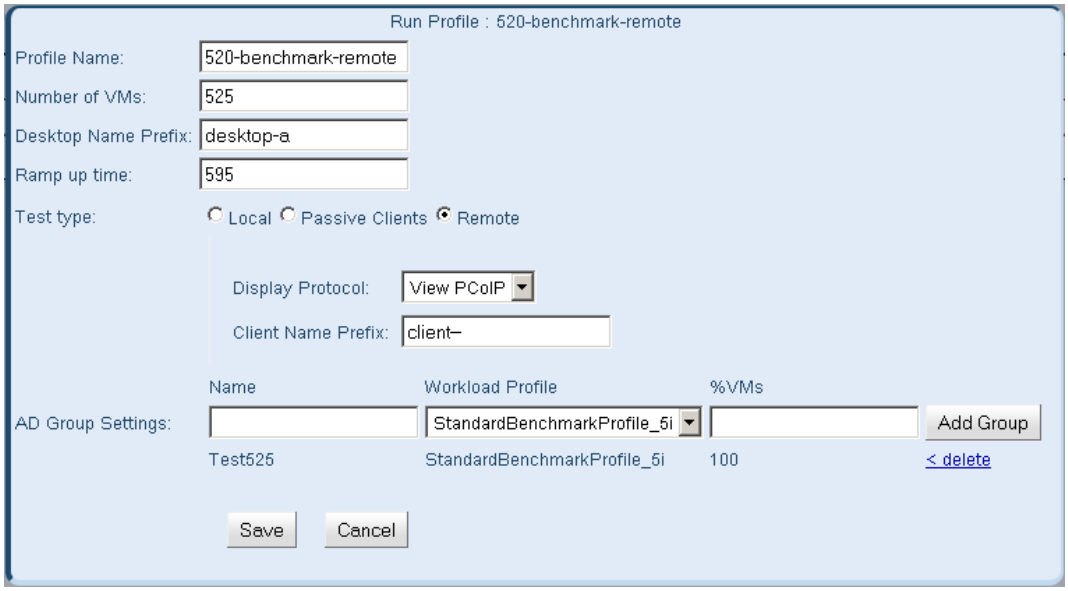


Figure 6: View Planner Run Profile showing benchmark compliant configuration for 500 + desktops

Execution of the View Planner 3 benchmark compliant workload ran for a little less than 2 hours.

A few extra desktops were provisioned above the target of 500 to account for the inevitable handful expected to fail to report back to View Planner at the end of the run.

TEST RESULTS

When executing View Planner 3 as a benchmark, a score is generated from the 95th percentile of the Group A and Group B QoS results. These QoS results must be less than, or equal to, defined thresholds during a steady-state phase (three out of five iterations) of the View Planner run. The Group A QoS threshold is 1.0 second and Group B is 6.0 seconds. The View Planner benchmark score is then the number of desktop virtual machines that participated in the compliant run.

This reference architecture's QoS results were as follows:

Group A: 95th percentile: 0.884162s (BR: <= 1.0s)

Group B: 95th percentile: 5.684192s (BR: <= 6.0s)

This produced a View Planner benchmark score of **514**, above the targeted 500 desktops.

View Planner QoS:

QoS is measured from the user experience, which is why it is reported in seconds. Computer systems deal in much smaller units of measure, milliseconds and even microseconds. However, those small latencies can combine to affect the overall latency experienced by users, and are particularly noticeable in large or complex environments.

Controlling latencies:

We can control latencies introduced by compute power, or lack thereof, by increasing the number of nodes in the vSphere cluster. We have fewer options when it comes to storage devices, so it is critical that the storage architecture executes I/O operations within an acceptable upper latency limit.

For mechanical drive arrays (i.e. spinning hard drives) latencies under 20ms are often considered the high end of acceptability, while a latency less that 2ms is generally unachievable due to the limitations of the physically moving mechanisms (spinning platters and arms) involved. The NexGen N5 hybrid flash array supplements traditional spinning media with PCIe flash to reduce latency significantly.

Measured from each vSphere host in the VDI cluster, NexGen latency was consistently at or below 6ms for write operations and frequently under 2ms for reads, which easily supports the QoS thresholds required by View Planner.

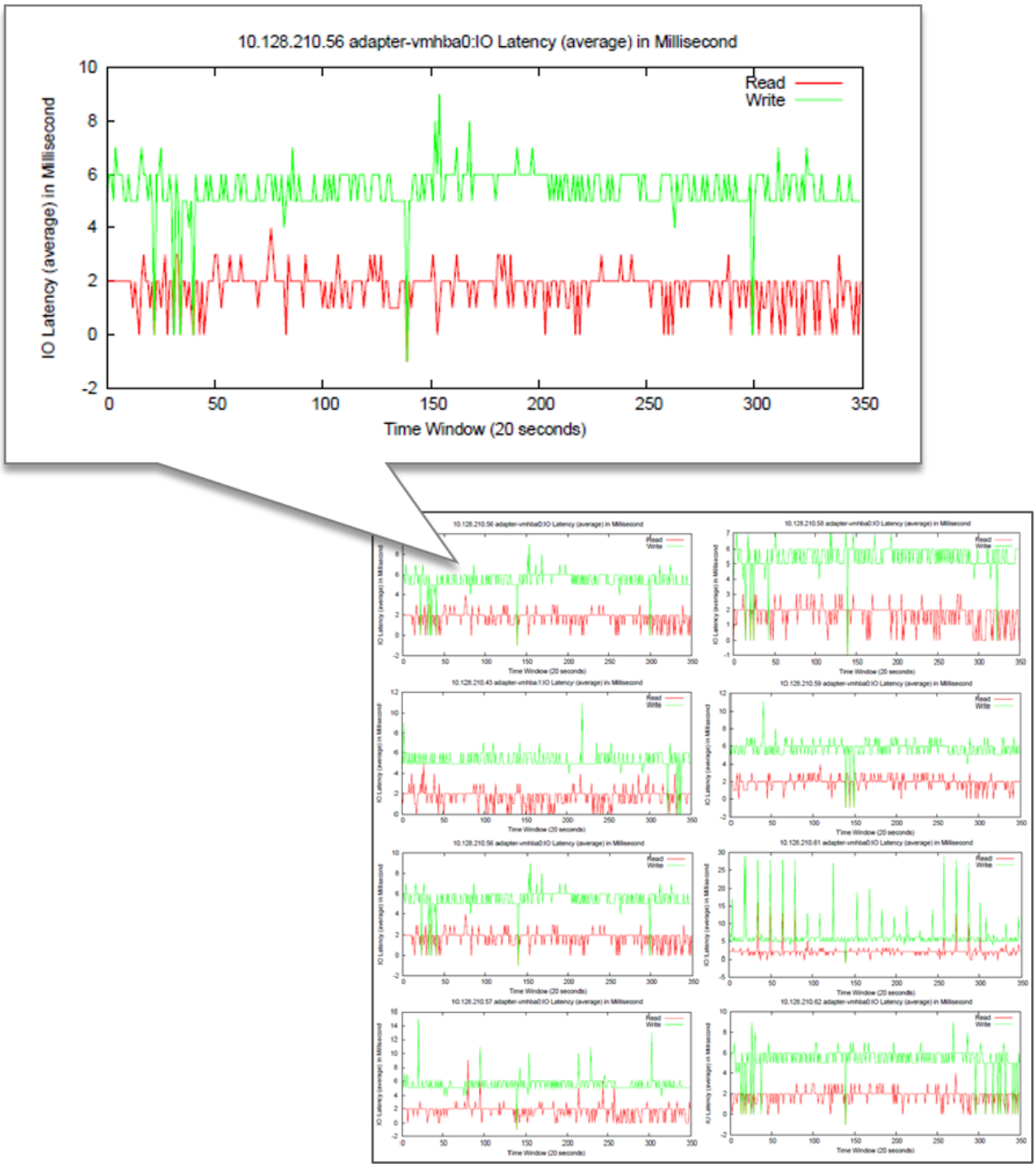


Figure 6: Storage latency measured from each VDI cluster host showing NexGen read and write latencies which easily support the View Planner user experience

NexGen N5 storage-side performance metrics confirm the vSphere figures and demonstrates NexGen's ability to scale to a higher virtual desktop count, or support other application workloads along with the 500 desktops. The lack of any "plateaus" in the IOPS and bandwidth curves proves that additional performance headroom is available. Note that on the NexGen Monitor View below, latency metrics are reported as the combined read and write latency values.

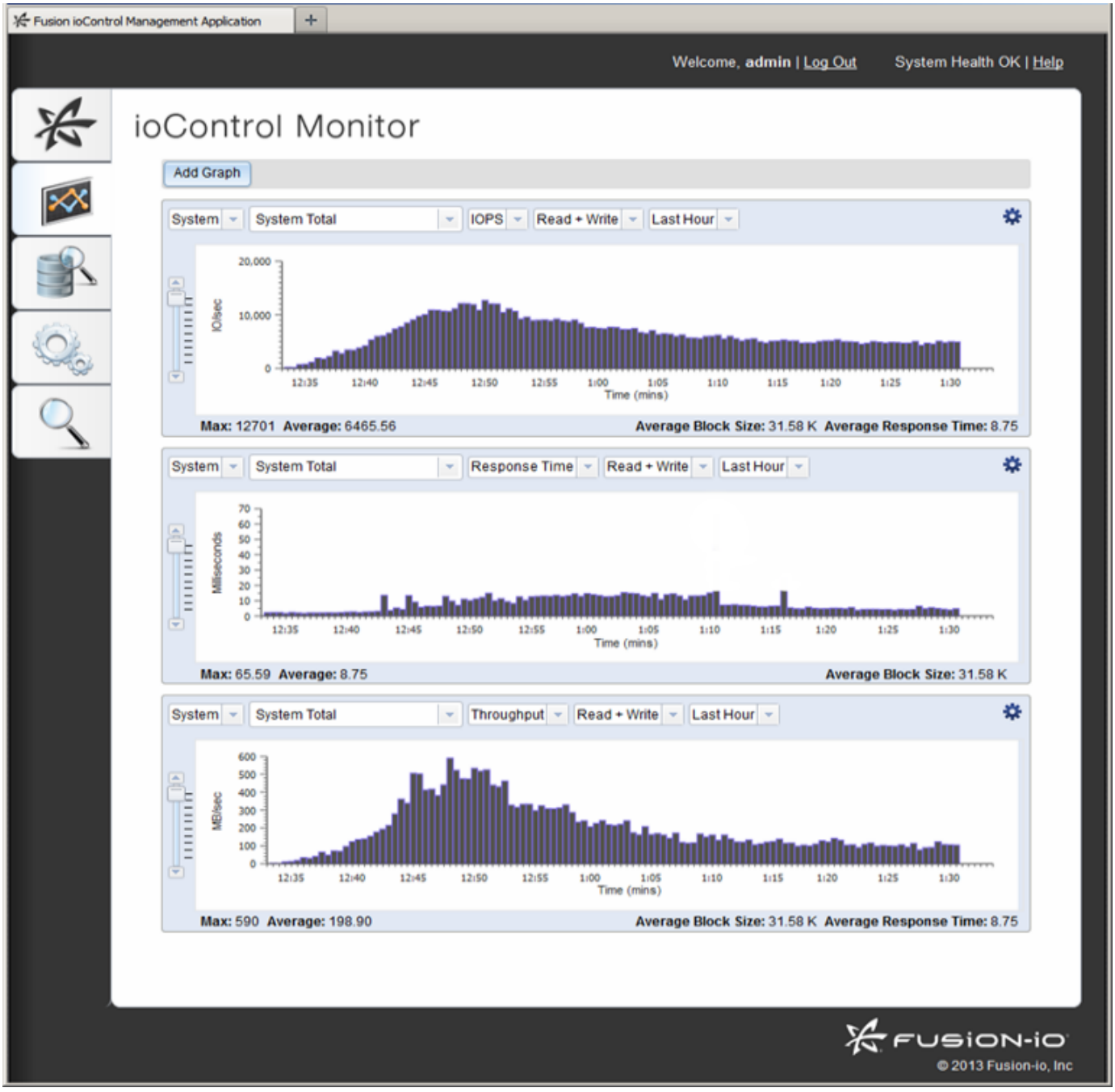


Figure 7: NexGen Monitor view of hosts aggregate IOPS, latency (response time) and bandwidth (throughput)

Reference Architecture Scalability

The NexGen n5-series of storage is available in several models depending on the amount of flash and disk storage required for a specific implementation. Larger NexGen Storage systems are able to support more Horizon View workers.

VDI Worker Profile	n5-50	n5-100	n5-150	n5-150+PP
Task-based (3-7 IOPS)	300	600	1000	2000
Knowledge (8-16)	225	450	800	1700
Power (17+)	125	250	450	900

VDI Worker Profile	n5-200	n5-300	n5-500	n5-1000	n5-1000+PP
Task-based (3-7 IOPS)	600	1000	2000	4000	6000
Knowledge (8-16)	450	850	1700	3400	5100
Power (17+)	250	450	900	1800	2700

NexGen Storage Systems scale performance independently from capacity by adding additional PCIe flash to the storage system through Performance Packs (PP). The Performance Pack doubles the number of IOPS the system can deliver, as well as the maximum number of desktops supported.

Additionally, NexGen Storage Systems can scale storage by adding up to three additional 48TB disk shelves for a maximum of 192TB total storage per system.

NexGen N5 Hybrid Flash Array Advantages for VDI

- ***Flash-first Hybrid Architecture:*** VDI workloads can be very write-heavy. Most hybrid arrays use flash for read cache, but write requests are serviced by disk (disk-first hybrids). NexGen Storage utilizes a flash-first data path, where every write request is serviced by flash resulting in faster response times for desktop users.
- ***Predictable Performance with QoS:*** Unlike other hybrids, NexGen Storage allows you to provision and manage flash performance with Quality of Service (QoS). NexGen QoS is a policy based management mechanism that allows you to prioritize workloads by business importance.
- ***More Performance, Less Waste:*** NexGen N5 Hybrid Flash Storage was architected to maximize both performance and capacity at a reasonable cost. Flash is integrated into the CPU bus via PCIe, it runs at

microsecond speeds with no need to traverse a RAID controller like other hybrids. Fusion ioMemory flash consumes zero drive bays; no capacity is sacrificed for performance.

- ***Grow On Your Terms:*** NexGen allows you to scale performance online by adding Fusion ioMemory flash into the system, doubling system performance, without consuming drive bays. If capacity is required, up to three disk shelves can be added to every NexGen N5. Additionally, NexGen allows you to scale performance to the host, via Fusion-io server-side read cache, to address ultra-low latency requirements.
- ***More Consolidation, Less Footprint:*** Storage arrays are often a dedicated resource for VDI workloads to prevent resource contention with other applications. With flash-first performance and QoS policies, NexGen allows you to confidently support multiple applications, while isolating VDI workloads from other applications. This eliminates contention, while reducing storage sprawl and administration and maintenance costs.
- ***Validated with VMware Horizon View:*** NexGen N5 has been validated with VMware Horizon View and is a member of the VMware Horizon View Fast Track Program. Customer case studies of NexGen N5 deployed to support VDI are also available.

CONCLUSIONS

This reference architecture validates the NexGen N5 hybrid flash array suitability as backend storage for VMware Horizon View deployments. Specifically pertaining to the following:

1. The NexGen N5 effortlessly provides support for more than 500 virtual desktops with an acceptable user experience as simulated by VMware View Planner 3.0, in the more demanding remote-mode implementation.
2. The NexGen N5-150 used in this reference architecture testing has the visible performance headroom to scale to a higher number of desktops, or support other application workloads through the addition of more compute resources.
3. NexGen storage QoS allows Horizon View administrators to customize performance service levels for different user types, avoid impact from IO storms, and avoid contention between VDI and other application workloads.
4. The NexGen N5 demonstrates the benefit of using a cost-effective hybrid array solution for VDI as opposed to more expensive all flash arrays.

Reference Architecture Contents

Reference Architecture BOM		
Storage	NexGen N5 Hybrid Flash Array Model n5-150	2.4TB ioMemory flash capacity 48TB raw disk capacity All Inclusive Software Features including QoS, Dynamic Data Placement, Data Reduction, Snapshot, Replication, vCenter Plug-in
Servers	Cisco UCS 5108 Series Blade Server Chassis 8 - B200 M3 Blade Servers	 16 cores and 256GB RAM
Networking	Cisco Nexus 5500 Series	2- Nexus 5548UP Switches
Software	VMware Horizon View VMware vSphere 5.1 Enterprise Edition	View Connection Server View Composer

REFERENCE MATERIAL

- Deployment Guide: Deploying NexGen N5 Hybrid Flash Storage with Cisco UCS
- VMware View Planner Documentation
- VMware Horizon View Documentation
- Cisco UCS 5100 Series Blade Server Chassis Install and Upgrade Guides
- Cisco UCS B-Series Blade Servers Install and Upgrade Information