Pivot3 Reference Architecture for VMware View 5.0

Version 1.04

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Test and Document History

Date	Summary	Who
4/14/2011	Initial Document	Greg Pellegrino
4/21/2011	Updated per initial external review	Greg Pellegrino
4/21/2011	Review and update following customer calls	Lee Caswell
8/21/2011	Update per RAWC test results	Greg Pellegrino
12/15/2012	Update for vSTAC VDI product	Suzanne Attenborough
1/13/2012	Add performance graphs	Stuart Callison / Greg Pellegrino

Test Goals

There are four test goals in the Pivot3 View test methodology:

1. **Load-balanced Performance**: Validate that 230 concurrent VMware View non-persistent virtual desktops can be serviced with a Pivot3 unified storage and compute vSTAC^{TM} made up of three 2U vSTAC VDI™ Appliances where each virtual desktop receives 20 IOPs, 20 GB SAS Tier storage, 1 GB RAM and 1 vCPU.
2. **Automatic Self-healing:** Validate that an appliance failure will not affect SAN storage and that VMware HA will restart affected virtual desktops within the cluster without user intervention.
3. **Dynamic Scaling**: Validate that virtual desktops can be added dynamically. This test will comprehend adding a vSTAC VDI appliance to a live vSTAC so that compute and storage resources for 115 additional virtual desktops are added without affecting the initial 230 virtual desktops.
4. **vMotion Support**: Validation that VMware vMotion can be deployed so that live virtual desktops can be migrated live across the cluster to balance resource needs.

All tests were conducted using VMware View 5.0 and vSphere 5.0.

Reference Architecture Design

Design Overview

The design goal is to provide a scalable architecture for floating non-persistent desktops.

The Pivot3 vSTAC VDI

Pivot3 vSTAC VDI Appliances deliver both server and shared storage requirements for VMware View customers and eliminate the need for a standalone SAN. vSTAC VDI Appliances can be "stacked" together to dynamically scale the number of supported virtual desktops while offering a familiar server appliance model and self-healing architecture.

Each appliance, called a vSTAC VDI, is a high performance server running both the VMware vSphere Hypervisor and the Pivot3 vSTAC Operating System. Up to eight vSTAC VDI appliances can be configured together. The limit of eight appliances is a VMware cluster limit not a Pivot3 scaling limit.

Each Pivot3 vSTAC VDI Appliance includes:

- Two 6 core Intel Xeon X5675 Processors (12M Cache, 3.06 GHz)
- 96 GB Memory
- Two 10 GB Ethernet NICs
- Two 1 GB Ethernet NICs
- Two 100 GB SSD allocated for write cache (50GB) and SSD Tier (150GB)
- Ten 300 GB 10K SAS
- Redundant Hot Swap Components: Disks, Power Supplies
- Pivot3 vSTAC OS 5.1
- VMware vSphere Hypervisor 5.0 with the Enterprise feature set

Pivot3 Scale-out SAN Storage Features:

- No single point of failure
- RAID 6x protection for up to 5 simultaneous drive failures or a full appliance failure
- RAID 6e protection for up to 3 simultaneous drive failures or a full appliance failure
- RAID 5e protection for up to 1 disk failure or a full appliance failure
- Virtual distributed sparing across appliances
- Background verification for data integrity
- Load balancing across all available disk drives and network connections
- Direct Disk Access DDA™ technology for performance using Intel VT IO pipelining technology
- Dynamic expansion of logical or physical capacity
- Scale-out SAS, write cache and SSD Tier storage elements which are aggregated across appliances; performance is automatically load-balanced across all elements
- Multi-path across all iSCSI connections for port aggregation and failover

Storage Configuration

Pivot3 vSTAC VDI tiered storage allows separation of high IOP storage requirements from larger capacity needs. Network RAID-protected SSDs contain replica base images. Network RAID-protected

10k SAS drives contain linked clones, user data, parent base images, and swap files (.vswp's) for each desktop.

User data is separated from the desktop images by redirecting key folders utilizing roaming profiles. Folders redirected include:

- Application Data
- Documents
- Media
- Desktop
- Favorites

These folders may be located on shared network storage.

Network Configuration

The network configuration consists of three layers; an internal virtual network, a 10 Gigabit network, and a 1 Gigabit network.

The vSphere virtual network within each vSTAC VDI appliance has

- Two storage networks, each connected to individual 10 Gigabit NICs.
- A desktop virtual network connected to both 10 Gigabit NICs.
- A management network connected to both 10 Gigabit NICs.

The 10 Gigabit network consists of two Force10 S4810 10 Gigabit Switches. The pair of 10 Gigabit switches provides redundant networks for storage and desktop connections. Each 10 Gigabit switch provides 1-port for each vSTAC VDI and 1-port for each switch in the 1 Gigabit network.

The 1 Gigabit network consists of several Force10 S55 1 Gigabit switches. The 48 port switches provide fan-out to the desktop clients. Five S55s are required for 240 desktops, 17 S55s for 800 desktops. 10 Gigabit uplink ports connect to the 10 Gigabit network.

Test Setup

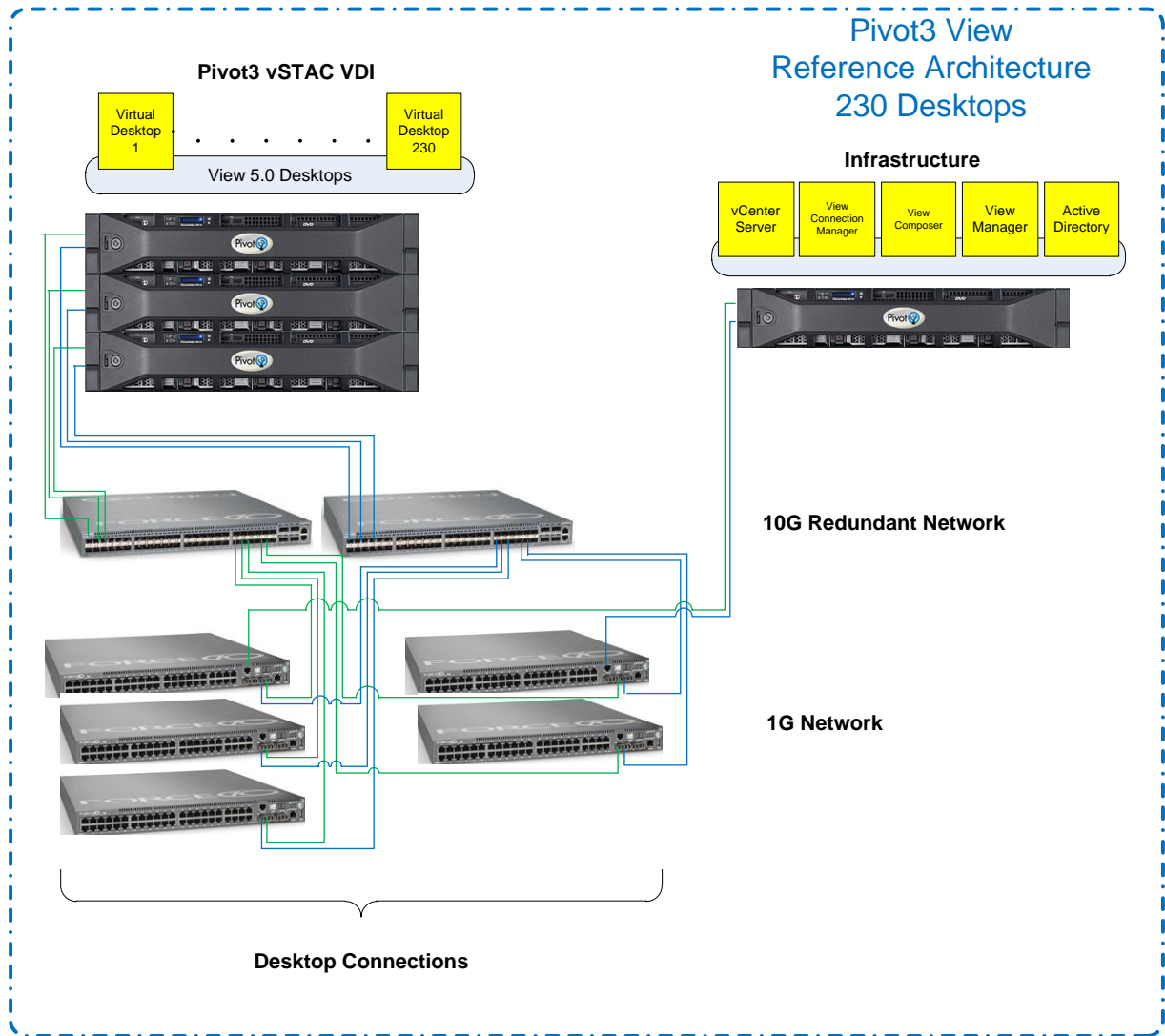### VMware View Reference Architecture Components

Pivot3 offers self-healing for both server and storage resources in the case of an appliance failure. From the storage perspective, a Pivot3 array of N appliances remains fully operational when an appliance fails leaving the array at N-1. Similarly, VMware HA clusters running in virtual machines in a Pivot3 vSTAC offer appliance failure protection when configured with N+1 vSphere servers.

For this reference architecture, the desktop count is sized to satisfy performance requirements anticipating the event of a vSTAC VDI appliance failure.

Each vSTAC VDI appliance provides CPU, memory, and tiered storage resources for 115 virtual desktops while an additional vSTAC VDI appliance provides shared storage and is configured for VMware HA. Therefore, the minimum configuration of three vSTAC VDI appliances supports 230 failover-protected virtual desktops.

Additional vSTAC VDI appliances can be dynamically added to a vSTAC where each additional appliance

allows an additional 115 virtual desktops along with the load-balanced shared storage needed for the new load. An eight appliance vSTAC can accommodate 800 virtual desktops.
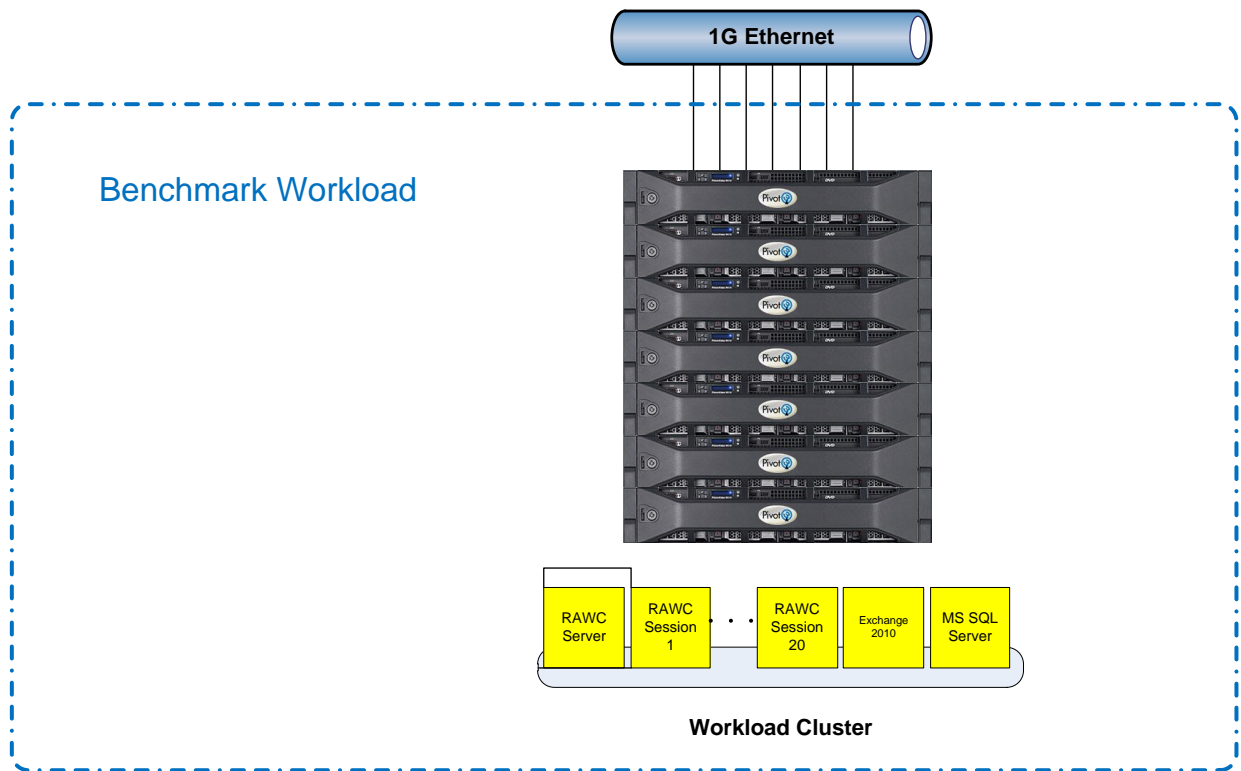
VMware View Reference Architecture Design

Component	Purpose / Usage
Pivot3 vSTAC	**Storage And Compute**
3 x Pivot3 vSTAC VDI Appliances	vSphere 5.0 View Cluster
	VMware View Desktop Client Stores: - ISOs, Software, VM Templates
Servers	
Dell PowerEdge R510 Rack Server	VMware vSphere 5.0 Infrastructure Server (vCenter Server, domain controller, Active Directory, View Connection Manager)

Network Switches	
Force10 S4810	48-port 10GbE switch with SFP+ ports.
Force10 S55	48-port 1GbE switch with 2 SFP+ ports for 10 Gigabit uplinks. Client and Server LANs
Software	
vSphere 5.0 Enterprise	Hypervisor; HA and vMotion, DRS, VAAI for clone creation
VMware View 5.0 Premier Edition	VMware Virtual Desktop Infrastructure Application. Premier Edition enables View Composer required for Linked Clones and Tiered Storage
Windows Server 2008 R2 Standard	For vCenter Server, View Connection Manager, View Composer, and Domain Controller
Storage Management	
Pivot3 vSTAC Manager 5.1	Physical and logical storage configuration, dynamic expansion, security access, RAID and tier setting by volume
SNMP Alerts	Set traps for physical state changes within the Pivot3 array

Test Components	Purpose / Usage
Test Servers	
7x Super Micro X8DTT Servers	VMware vSphere 5.0 Infrastructure Cluster - 12x RAWC Session Launchers - Exchange 2010 - IP Router - MS SQL Server - MGMT VM - RAWC Server

Test Software	
RAWC 1.2	VMware View VDI workload generation
Windows 7 Enterprise Edition	View Client OS for characterization testing
Windows Server 2008 R2 Standard	For MS SQL server, Exchange 2010 and other infrastructure VMs
MS Office 2010	Application used to generate user workload
MS Internet Explorer 8	Application used to generate user workload
Adobe Acrobat Reader 9	Application used to generate user workload

Virtual Desktop

Each desktop image will be a user instance of Windows 7. The desktop image will be optimized following the *VMware View Optimization Guide for Windows 7*.

Validation

Three Pivot3 vSTAC VDI appliances will be initially configured as VMware VDI Cluster with an embedded SAN. Each vSTAC VDI is targeted to support 115 Desktops.

The scale-out SSD Tier of 150GB SSD capacity (450GB over three vSTAC VDI appliances) is dedicated for Linked Clone Replica Base images.

Tests

1. Performance Test

230 concurrent VMware View non-persistent virtual desktops are tested with three vSTAC VDI Appliances in a Pivot3 unified storage and compute vSTAC.

Task Worker Profile

A task worker profile will be exercised utilizing VMware's Desktop Reference Architecture Workload Simulator (RAWC). The task worker profile will be generated utilizing Adobe Reader, MS Word, MS PowerPoint, MS Outlook, and MS Internet Explorer. An IO rate per desktop is targeted at 3-5 IOPs.

Login Storm

RAWC will also be used to simulate a login storm by starting all client sessions within a set timeframe.

2. Automatic Self-healing

This test will validate that one of the vSTAC VDI Appliances can be powered off and that 1) the storage

is unaffected and 2) VMware HA will restart the affected virtual desktops without user intervention.

3. Dynamic Scaling

This test validates that a fourth vSTAC VDI appliance can be dynamically added to the Pivot3 vSTAC so that additional storage resources are available and an additional 115 virtual desktops can be launched without affecting the initial 230 virtual desktops.

4. vMotion Support

This test will validate that VMware vMotion can be deployed so that virtual desktops can be migrated live across the cluster to balance resource needs.

Performance Test Results

Application response time was carefully tracked in all tests to ensure experience would be acceptable.

Average Application Response Time, seconds, 230 Desktops in 3 vSTAC VDI Cluster
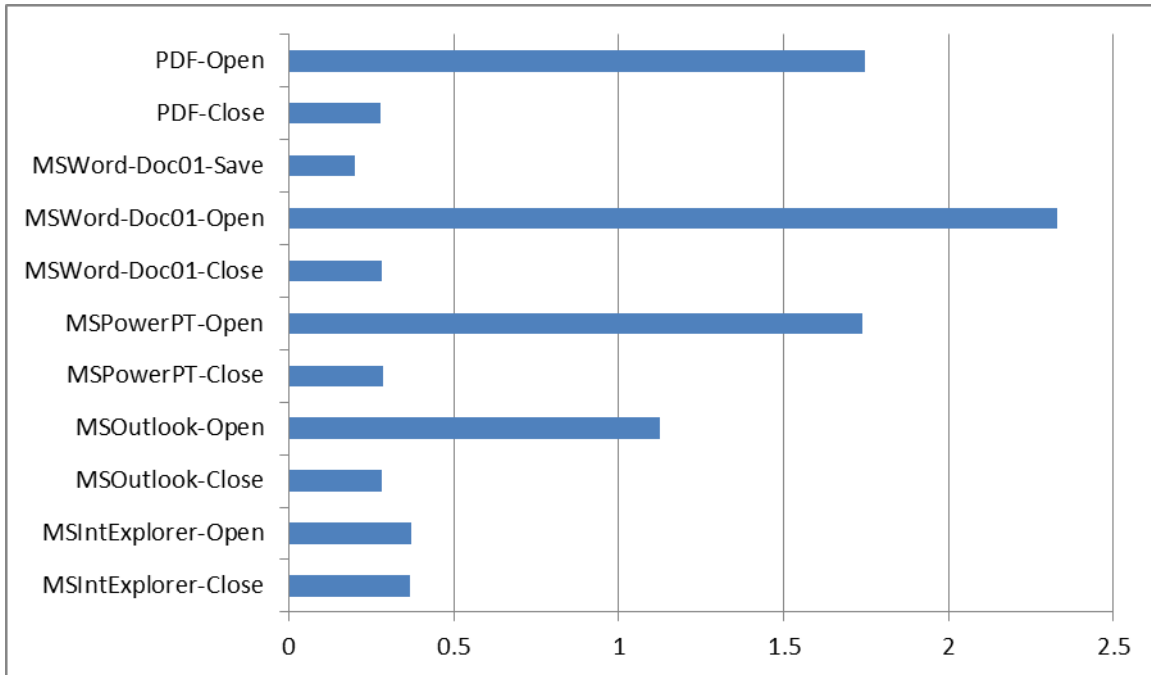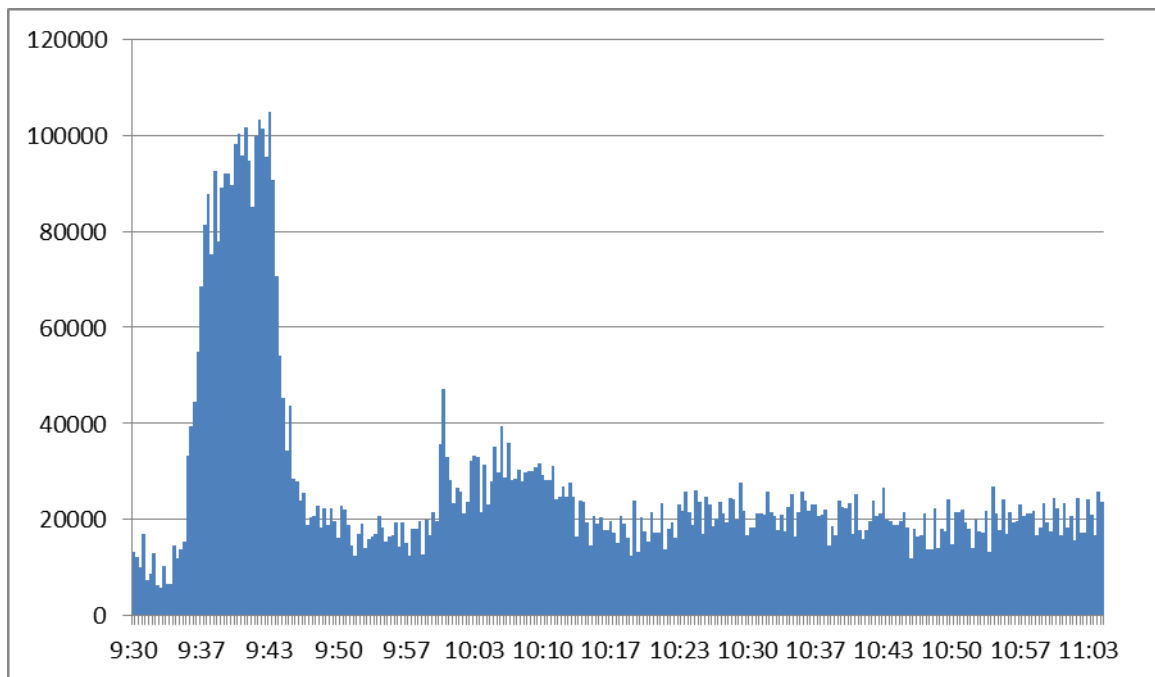

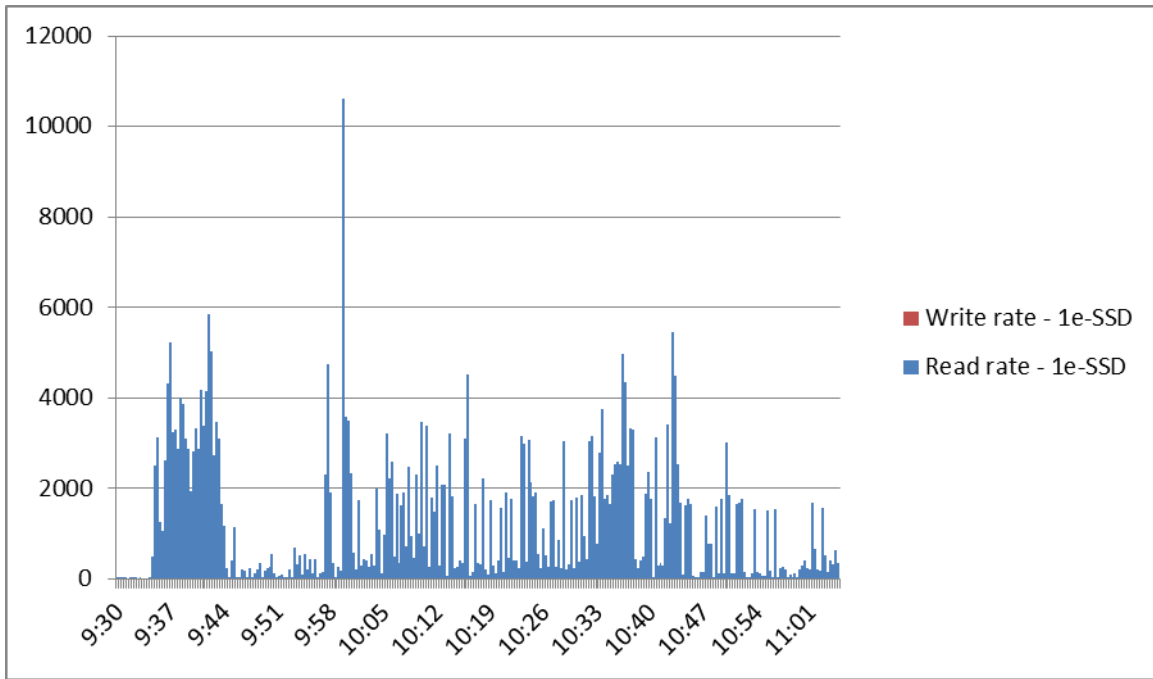**vSTAC VDI CPU Usage Percent, 230 Desktops in 3 vSTAC VDI Cluster**
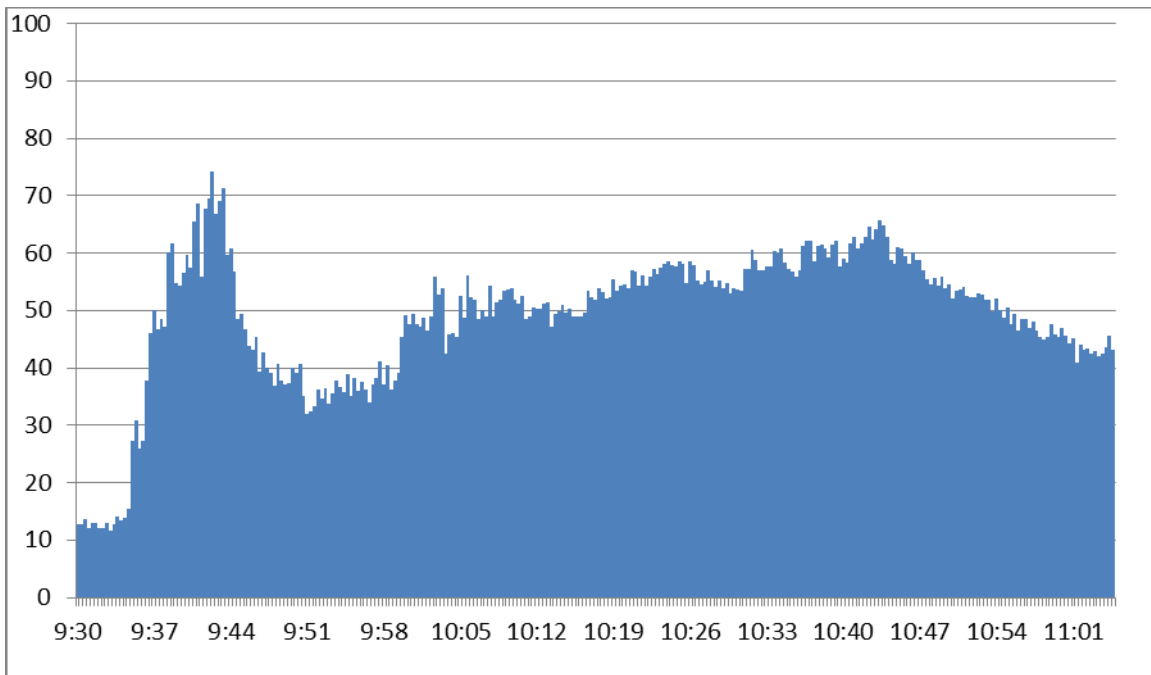
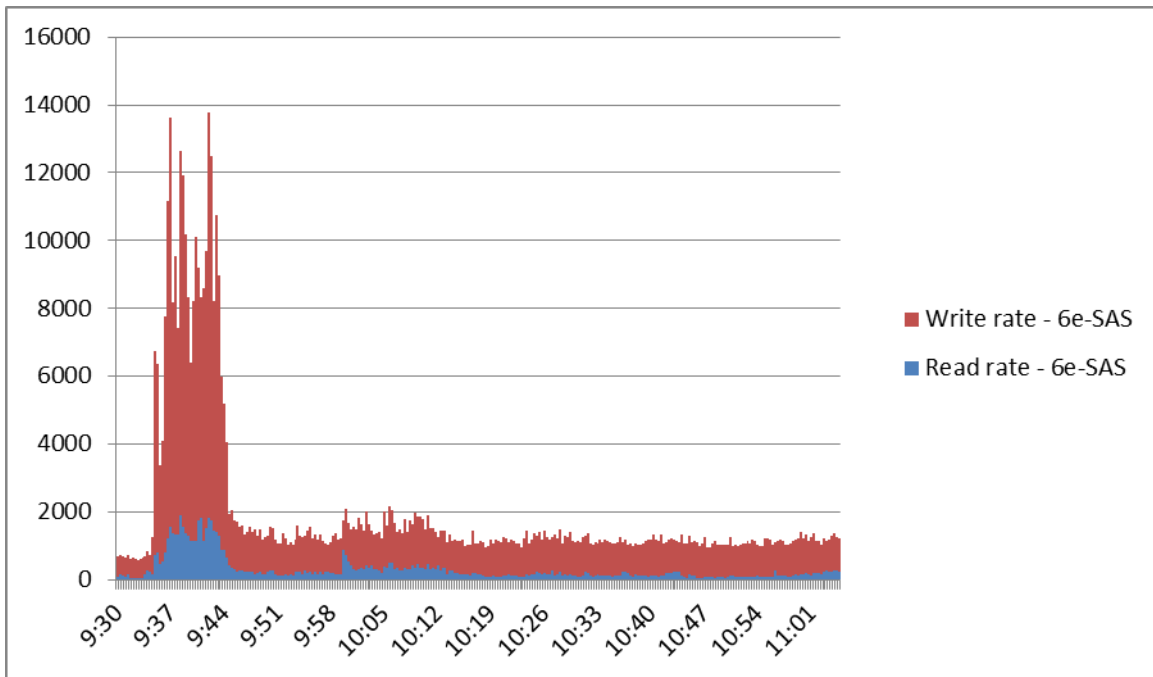**vSTAC VDI Memory Usage, KB, 230 Desktops in 3 vSTAC VDI Cluster**
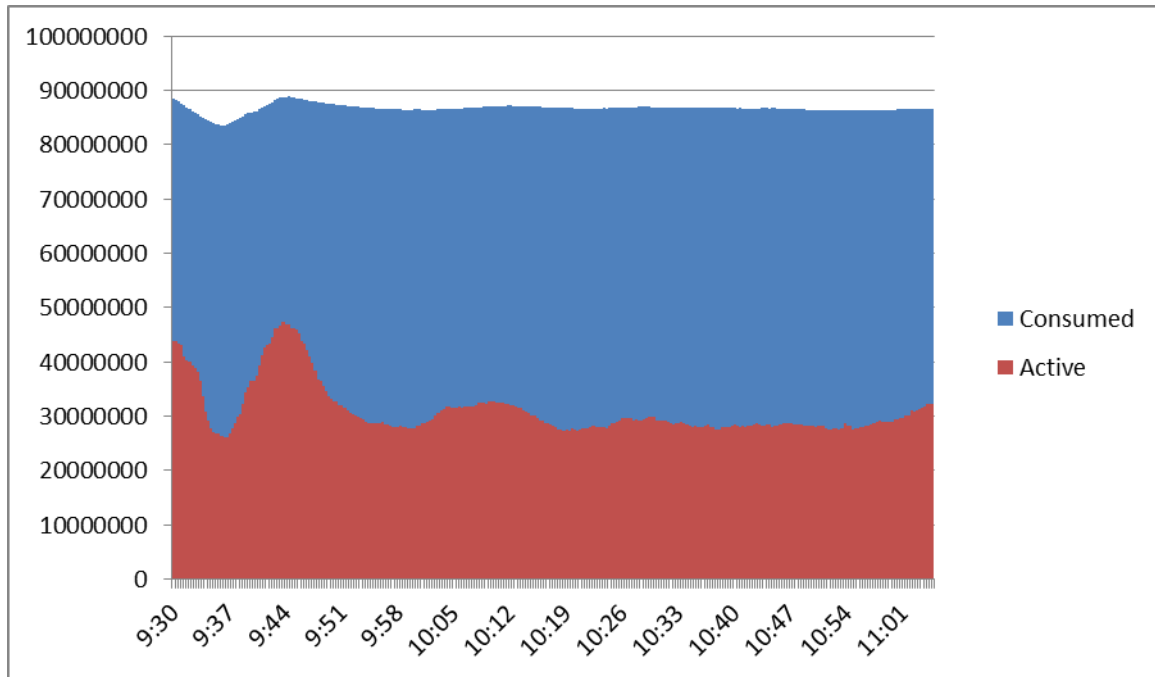
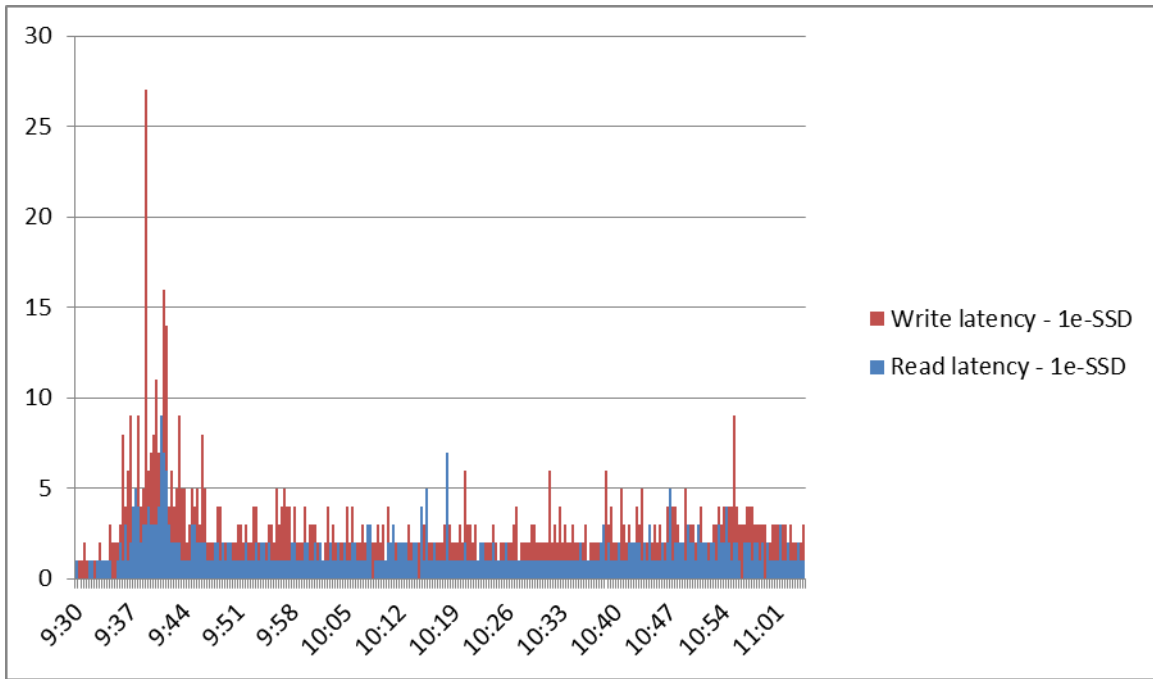**vSTAC VDI Network Usage, KBps, 230 Desktops in 3 vSTAC VDI Cluster (includes iSCSI and VM Desktop traffic)**

vSTAC VDI SSD Tier IO, RAID 1e volume, KBps, 230 Desktops in 3 vSTAC VDI Cluster
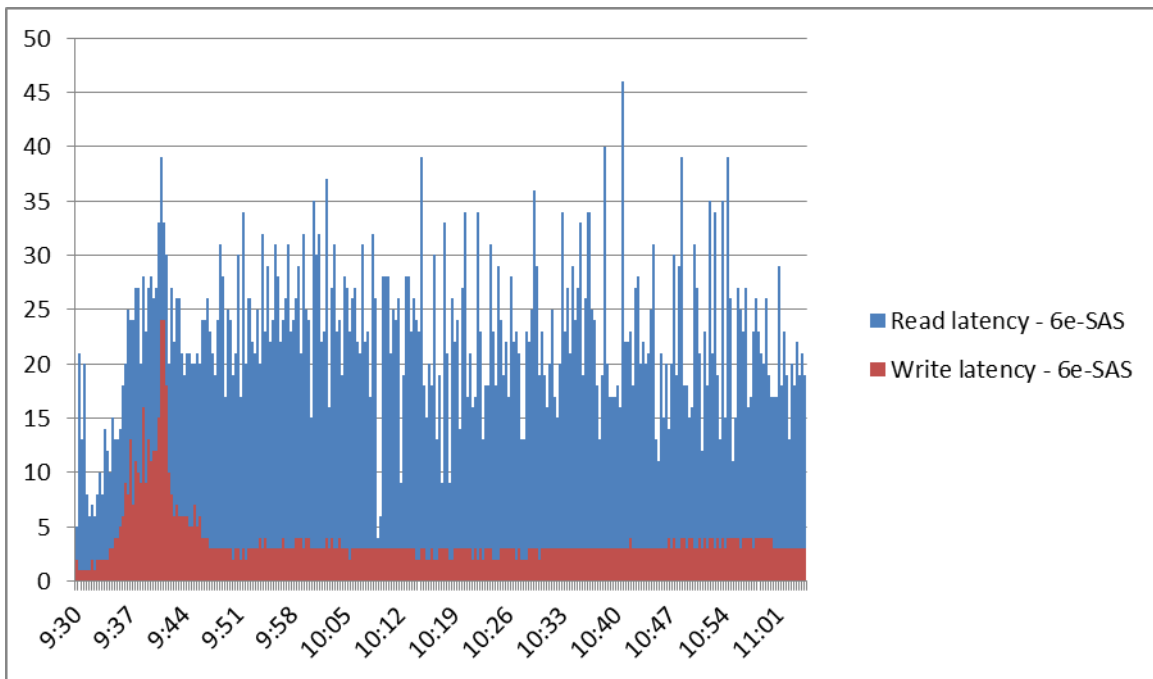

vSTAC VDI SAS Tier IO, RAID 6e volume, KBps, 230 Desktops in 3 vSTAC VDI Cluster

vSTAC VDI SSD Tier Latency, RAID 1e volume, ms, 230 Desktops in 3 vSTAC VDI Cluster

vSTAC VDI SAS Tier Latency, RAID 6e volume, ms, 230 Desktops in 3 vSTAC VDI Cluster

References

Desktop Reference Architecture Workload Simulator (RAWC) Installation and User Guide Version 1.2

Workload Considerations for Virtual Desktop Reference Architectures

The VMware Reference Architecture for Stateless Virtual Desktops with VMware View 4.5

The VMware View 4.5 Floating Reference Architecture