



NETWORK DESIGN & MANAGEMENT

IMPLEMENTATION METHODOLOGY

VMware Health Check Report

for

Customer

Prepared by

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Version History

Date	Ver.	Author	Description	Reviewers
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1. Executive Summary

1.1 Report Overview

This report summarizes activities and findings from a VMware Health Check that was conducted for Customer. This report contains:

- Recommended changes to configuration and/or usage per VMware best practices that may improve availability/management or performance of VMware components
- Inventory of components analyzed
- Checklist of assessment activities performed

1.2 Assessment Highlights

Analysis Period

- January 23-24, 2010

Datacenters

- Palo Alto Datacenter

Contributing Participants

- Customer Sponsor, Director
- Customer Architect, Virtualization Architect
- Customer Admin 1, Virtualization Administrator
- Customer Admin 2, Network and Security Administrator
- Customer Admin 3, Storage Administrator

Summary of Activities

- Performed Standard Health Check Assessment Checklist (see Appendix)
- Gathered system information collected from VMware HealthAnalyzer
- Interviewed participants to discuss priority issues and concerns
- Researched the following Customer issue:
 - review Java virtual machine configuration and offer suggestions for improving performance
- Conducted knowledge transfer to
 - clarify understanding of VMware component requirements and behavior
 - clarify changes to configuration and usage per VMware best practices
- Reviewed documents supplied by Customer

1.3 Next Steps

Customer should review this report and consider the recommended action items. A follow-up consult and/or Health Check is also advised. If required, VMware, through its Professional Services Organization or via one of its many partner organizations, is able to assist Customer in implementing the recommended actions as detailed within this report.

2. Recommended Action Items

Priority	Component	Recommended Action Item
1	Virtual Machines	Consider setting the memory reservation value for Java based (JVM) virtual machines to the OS required memory plus the JVM heap size Review actual VM memory usage and adjust the reservation amount in order to avoid excessive memory reservation
1	Virtual Machines	Use as few vCPUs as possible. Do not use virtual SMP if application is single threaded and will not benefit from additional vCPUs. Check if using only one vCPU in a SMP VM
1	Network	Set 1Gb physical adaptors to autonegotiation for optimum performance
2	Network	Change the default portgroup security settings ForgedTransmits and MACAddressChange to Reject
2	Network	Avoid mixing NICs with different speeds and duplex settings on the same uplink for a portgroup/dvportgroup
2	Host	Avoid installing additional agents in the service console
2	Host	For large systems and existing systems with additional agents in the service console, allocate the maximum size for service console memory (800MB) and swap size (1600MB)
2	Storage	Allocate separate space on shared datastores for templates and media/ISOs from datastores for VMs
2	Virtual Datacenter	Set up a redundant service console portgroup to use a separate vmnic on a separate subnet Specify "isolation address" for the redundant service console (<code>das.isolationaddress2</code>) Increase the failure detection time (<code>das.failedetectiontime</code>) setting to 20000 milliseconds or greater
2	Virtual Datacenter	Use vCenter Server roles, groups, and permissions in order to provide appropriate access and authorization for virtual infrastructure administration. Avoid using Windows built-in groups (Administrators)
3	Host	Automate the ESX installation and configuration process using a combination of kickstart, scripts, and host profiles
3	Host	Avoid logging on to the ESX service console and start managing existing ESX hosts like you would ESXi using vCenter Server, and vCLI, vMA, or PowerCLI

3. Health Check Assessment

3.1 Availability/Management

Item	Comments
Observation 1	vSwitch0 portgroup security setting for ForgedTransmits and MACAddressChange are currently set to the default value of Allow
Priority	2
Component	Network
Recommendation	Change the default portgroup security settings ForgedTransmits and MACAddressChange to Reject
Justification	<p>It is recommended that both of these options are set to Reject for improved security.</p> <p>In order to protect against MAC address impersonations and prevent ESX from honoring requests to change the effective MAC address to anything other than the initial MAC address, change the settings to Reject.</p> <p>By setting the MACAddressChange setting to Reject, ESX compares the source MAC address being transmitted by the Guest OS with the effective MAC address for its adapter to see if they match. If the addresses do not match, ESX drops the packet. This allows impersonated addresses to be dropped before they are delivered and the Guest OS assume that the packets have been dropped.</p> <p>For VMs that require overriding this setting (intrusion detection or MSCS VM), create a special port group for these (and only these) VMs with the modified settings.</p> <p>References: "Configuring the ESX/ESXi Host" section in <i>VMware Infrastructure 3 Security Hardening Guide</i> http://www.vmware.com/vmtn/resources/726</p>

Item	Comments
Observation 2	Agents are installed in the service console in order to get host hardware information and to monitor the status of host hardware components (fan, power supply, battery etc)
Priority	2
Component	Host
Recommendation	Avoid installing additional agents in the service console

Item	Comments
Justification	<p>VMware vSphere 4 uses Common Information Model (CIM) for monitoring of hardware resources. This output is readable by 3rd party management tools via standard APIs and is also integrated with vCenter Server and available from the vSphere Client.</p> <p>vCenter Server alarms can be configured to send alerts and perform actions when hardware failures occur.</p> <p>Check with your software vendor for appropriate version of the software that can be deployed outside the service console and uses the vSphere API.</p> <p>Installing agents in the service console impacts availability and performance of the ESX host. Also, future versions of the hypervisor will be COSless (ESXi) and it is a good idea to start reducing dependency on the service console.</p>

Item	Comments
Observation 3	Hosts are configured with the default service console memory (500MB) and swap sizes (1GB for San Jose). Agents are currently installed in the service console causing more memory to be consumed
Priority	2
Component	Host
Recommendation	For large systems and existing systems with additional agents in the service console, allocate the maximum size for service console memory (800MB) and swap size (1600MB)
Justification	<p>Since adjusting service console swap size is difficult, allocate the maximum amount of memory and swap size during installation. This provides headroom for agents and the ability to scale as more VMs are placed on the host.</p> <p>Reference: Performance Best Practices for VMware vSphere 4.0 http://www.vmware.com/resources/techresources/10041</p>

Item	Comments
Observation 4	Single service console with one isolation response gateway does not provide complete redundancy for HA heartbeats
Priority	2
Component	Virtual Datacenter

Item	Comments
Recommendation	<p>Set up a redundant service console portgroup to use a separate vmnic on a separate subnet</p> <p>Specify "isolation address" for the redundant service console (<code>das.isolationaddress2</code>)</p> <p>Increase the failure detection time (<code>das.failedetectiontime</code>) setting to 20000 milliseconds or greater</p>
Justification	<p>Although NIC teaming is used to account for NIC failures, overall redundancy for HA heartbeats and isolation response detection can be made more reliable by setting up a redundant service console on a separate subnet.</p> <p>Each service console network should have one isolation address it can reach. When you set up service console redundancy, you must specify an additional isolation response address for the secondary service console network. VMware also recommends increasing the failure detection time setting to 20000 ms or greater.</p> <p>References:</p> <p>"Best Practices for VMware HA Clusters" section in <i>vSphere Availability Guide</i> http://www.vmware.com/support/pubs</p> <p>"VMware HA Best Practices" section in <i>VMware High Availability: Concepts, Implementation, and Best Practices</i> http://www.vmware.com/resources/techresources/402</p>

Item	Comments
Observation 5	Default Administrator account and Administrators groups are used by all virtual infrastructure administrators
Priority	2
Component	Virtual Datacenter
Recommendation	<p>Use vCenter Server roles, groups, and permissions in order to provide appropriate access and authorization for virtual infrastructure administration.</p> <p>Avoid using Windows built-in groups (Administrators)</p>

Item	Comments
Justification	<p>Currently the Administrators group has full administrative access to vCenter Server. The Administrators group contains all system administrators (even those that do not administer the virtual infrastructure). Use the appropriate vCenter Server roles and assign them to the appropriate vCenter Administrators AD group to ensure access is limited to virtual infrastructure administrators.</p> <p>Before removing users or groups from vCenter Server, make sure that you create and test access to vCenter Server for the new users and groups.</p> <p>Reference:</p> <p>"Managing Users, Groups, Roles, and Permissions" section in <i>vSphere Basic System Administration</i> http://www.vmware.com/support/pubs</p>

Item	Comments
Observation 6	Hardware deployment and configuration is done manually
Priority	3
Component	Host
Recommendation	Automate the ESX installation and configuration process using a combination of kickstart, scripts, and host profiles
Justification	<p>Current manual deployment and configuration of ESX hosts results increases time to deploy ESX hosts, increases errors and misconfiguration.</p> <p>Automating the ESX installation and configuration process ensures a repeatable, consistent host configuration throughout the vSphere environment.</p> <p>Reference:</p> <p>"Installing ESX using scripted mode" in <i>ESX and vCenter Server Installation Guide</i> http://vmware.com/support/pubs/vs_pages/vsp_pubs_esx40_vc40.html</p>

Item	Comments
Observation 7	A number of current procedures involve logging into the ESX service console in order to perform the operational tasks
Priority	3
Component	Host
Recommendation	Avoid logging on to the ESX service console and start managing existing ESX hosts like you would ESXi using vCenter Server/vSphere Client, and vCLI, vMA, or PowerCLI

Item	Comments
Justification	<p>Manage the virtual infrastructure using vCenter Server/vSphere Client. For certain administrative and bulk operations on virtual infrastructure objects, use vCLI or PowerCLI. vCLI can be used by deploying a vSphere Management Assistant (vMA) appliance in the environment.</p> <p>Managing ESX hosts using these tools and reducing dependency on the service console will allow for easier migration to a COSless hypervisor (ESXi).</p>

3.2 Performance

Item	Comments
Observation 1	Java virtual machines do not have any memory reservation set, which could impact performance
Priority	1
Component	Virtual Machines
Recommendation	<p>Consider setting the memory reservation value for Java based (JVM) virtual machines to the OS required memory plus the JVM heap size. Current Java virtual machines are configured with JVM memory of 1.5 GB and the OS uses about 0.5 GB of memory. Consider setting the memory reservation of these virtual machines to 2 GB.</p> <p>Review actual VM memory usage and adjust the reservation amount in order to avoid excessive memory reservation.</p>
Justification	<p>All the best practices that are used when running Java on physical systems apply equally in the virtual machine case. Java programs tend to be very intensive in their use of memory.</p> <p>Sizing the Java VM with the appropriate amount of resources and ensuring that the VM has the appropriate amount of memory reserved can improve the performance of the VM.</p> <p>Reference:</p> <p>Java in Virtual Machines on ESX http://www.vmware.com/files/pdf/Java_in_Virtual_Machines_on_ESX-FINAL-Jan-15-2009.pdf</p> <p>Performance Best Practices for VMware vSphere 4.0 http://www.vmware.com/resources/techresources/10041</p>

Item	Comments
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Item	Comments															
Observation 2	<p>The following VMs are configured with 2 vCPU although the applications running in the VMs are single threaded applications:</p> <table border="1"> <thead> <tr> <th>Prod-Cluster</th> <th>QA-Cluster</th> <th>Infra-Cluster</th> </tr> </thead> <tbody> <tr> <td>prapp01</td> <td>qaapp01</td> <td>prad01</td> </tr> <tr> <td>prapp02</td> <td>qaapp01</td> <td>prad02</td> </tr> <tr> <td>prapp03</td> <td>qaapp03</td> <td>prfile01</td> </tr> <tr> <td></td> <td></td> <td>prfile02</td> </tr> </tbody> </table>	Prod-Cluster	QA-Cluster	Infra-Cluster	prapp01	qaapp01	prad01	prapp02	qaapp01	prad02	prapp03	qaapp03	prfile01			prfile02
Prod-Cluster	QA-Cluster	Infra-Cluster														
prapp01	qaapp01	prad01														
prapp02	qaapp01	prad02														
prapp03	qaapp03	prfile01														
		prfile02														
Priority	1															
Component	Virtual Machines															
Recommendation	Use as few vCPUs as possible. Do not use virtual SMP if app is single threaded and will not benefit from additional vCPUs. Check if using only one vCPU in a SMP VM.															
Justification	<p>Configure only as many vCPUs as needed for the VMs. Unused vCPUs in SMP VMs impose unnecessary scheduling constraints on ESX/ESXi and waste system resources (idle looping, process migrations, etc). Although with ESX 3.x relaxed CPU co-scheduling is performed instead of strict co-scheduling, and further improved in ESX 4.0, allocating the appropriate number of vCPUs as necessary is the recommendation.</p> <p>Reference:</p> <p>The CPU Scheduler in ESX 4.0 http://www.vmware.com/resources/techresources/10059</p> <p>Performance Best Practices for VMware vSphere 4 http://www.vmware.com/resources/techresources/10041</p> <p>Performance Troubleshooting for VMware vSphere 4 http://communities.vmware.com/docs/DOC-10352</p>															

Item	Comments
Observation 3	1Gb NICs vmnic3 and vmnic4 on vSwitch0 are set to 100Mb instead of auto-negotiate
Priority	1
Component	Network
Recommendation	Set 1Gb physical adaptors to auto-negotiate for optimum performance

Item	Comments
Justification	<p>Incorrect network speed and duplex settings can impact performance. The network adapter (vmnic) and physical switch settings needs to be checked and set correctly. If your physical switch is configured for a specific speed and duplex setting, you must force the network driver to use the same speed and duplex setting. For Gigabit links, network settings should be set to auto-negotiate and not forced.</p> <p>Setting network adapter speed and duplex settings can be done from the vSphere Client although a reboot is required for changes to take effect.</p> <p>Reference:</p> <p>Performance Best Practices for VMware vSphere 4.0 http://www.vmware.com/resources/techresources/10041</p>

Item	Comments
Observation 4	Virtual machine templates and ISOs are placed in the same datastores as virtual machines
Priority	2
Component	Storage
Recommendation	Allocate separate space on shared datastores for templates and media/ISOs from datastores for VMs
Justification	<p>To improve performance, separate VM files from other files such as templates and ISO files that have higher I/O characteristics. A best practice is to dedicate separate shared datastores/LUNs for VM templates and for ISO/FLP files, separate from the VMs themselves.</p> <p>ISO and FLP media files can be placed either locally in the /vmimages directory on each host or in a shared datastore. To avoid storing unnecessary copies, place media files on shared storage.</p>

4. Appendix A: Audited Inventory

4.1 Host Configuration 1

Platform Specifications:

- System: Dell Inc. PowerEdge R710
- CPU: 2 sockets, 8 total cores @ 2.93GHz Intel Xeon X5570 Nehalem
- RAM: 32 GB
- HBAs: 2 single channel QLE2460 4 GB PCIe
- NICs: 4 dual-port Broadcom NetXtreme II BCM5709 1000Base-T

ESX/ESXi Hosts:

- presx01.pa.customer.com
- presx02.pa.customer.com
- qaesx31.pa.customer.com
- qaesx32.pa.customer.com

4.2 Networking Configuration

Networking Configuration 1

Virtual Datacenter Name: PaloAlto-DC

Cluster Name: Prod-Cluster

ESX/ESXi Hosts: presx01, presx02

Switch Name	Total Ports	Available Ports	Port Group	Active NICs/Uplinks	Standby NICs/Uplinks
vSwitch0	120	52	Service Console	vmnic0	vmnic2
			VMotion (vmkernel)	vmnic2	vmnic0
			FT (vmkernel)	vmnic1	vmnic3
			VM100	vmnic4, vmnic5, vmnic6, vmnic7	
			VM200	vmnic4, vmnic5, vmnic6, vmnic7	
			VM300	vmnic4, vmnic5, vmnic6, vmnic7	

Networking Configuration 2

Virtual Datacenter Name: PaloAlto-DC

Cluster Name: QA-Cluster

ESX/ESXi Hosts: qaesx31, qaesx32

Switch Name	Total Ports	Available Ports	Port Group	Active NICs/Uplinks	Standby NICs/Uplinks
vSwitch0	120	46	Service Console	vmnic0	vmnic2
			VMotion (vmkernel)	vmnic2	vmnic0
			FT (vmkernel)	vmnic1	vmnic3
			VM100	vmnic4, vmnic5, vmnic6, vmnic7	
			VM200	vmnic4, vmnic5, vmnic6, vmnic7	
			VM300	vmnic4, vmnic5, vmnic6, vmnic7	

4.3 Storage

Storage Specifications:

- Array: EMC CLARiiON CX4-480

Datastore Name	Type	Size (GB)	Free Space (GB)	Comments
pasan01	VMFS	980	411	
pasan02	VMFS	980	410	
pasan03	VMFS	980	248	
pasan04	VMFS	980	431	
qasan01	VMFS	980	320	
qasan02	VMFS	980	360	

4.4 vCenter Server and Plug-Ins

vCenter Server:

- Server name: vcenter01.pa.customer.com
- Platform: VM
- OS: Windows Server 2008 Standard 64-bit
- Number of CPUs: 2
- RAM: 3 GB
- Cluster: Infra-Cluster

vCenter Server Database:

- Database name: vcenter
- Database server: db01.pa.customer.com
- Database type: MS SQL Server 2008 Enterprise

Update Manager:

- Server name: umds01.pa.customer.com
- Platform: VM
- OS: Windows Server 2003 Standard 32-bit
- Number of CPUs: 1
- RAM: 1 GB
- Cluster: Infra-Cluster

Update Manager Server Database:

- Database name: vum
- Database server name: db01.pa.customer.com
- Database type: MS SQL Server 2008 Enterprise

4.5 Virtual Datacenter

Specifications:

- Virtual datacenter name: PaloAlto-DC
- Physical datacenter: Palo Alto Datacenter

Cluster	Enabled Features	Hosts Checked	No. of VMs
Prod-Cluster	DRS, HA, FT	presx01 presx02	96
Infra-Cluster	DRS, HA		32
QA-Cluster	DRS, HA, FT	qaesx31 qaesx32	96

5. Appendix B: Health Check Assessment Checklist

Component	Check (per Best Practice)
Host	Verify all host hardware is on the VMware Hardware Compatibility List (HCL)
Host	Verify all host hardware meets minimum supported configuration
Host	Check CPU compatibility for vMotion and FT
Host	Check ESX/ESXi host physical CPU utilization to make sure that it is not saturated or running in a sustained high utilization
Host	Verify all hosts in the cluster are compatible versions of ESX/ESXi
Host	Check ESX/ESXi host active Swap In/Out rate to make sure that it is not consistently greater than 0
Host	Check to make sure that there is sufficient service console memory (max is 800MB)
Host	Verify that ESX service console root file system is not getting full
Host	Check if any 3 rd party agents are running in the ESX service console
Host	Verify that NTP is used for time synchronization
Network	Verify that networking is configured consistently across all hosts in a cluster
Network	Check to make sure there is redundancy in networking paths and components to avoid single points of failure (e.g. at least 2 paths to each network)
Network	If HA is being used, check that physical switches that support PortFast (or equivalent) have PortFast enabled
Network	Check that NICs for the same uplink have same speeds and duplex settings
Network	Check that Management/Service Console, Vmkernel, and VM traffic is separated (physical or logical using VLANs)
Network	Verify that portgroup security settings for ForgedTransmits and MACAddressChanges are set to Reject
Network	Check the virtual switch portgroup failover policy for appropriate active and standby NICs for failover
Network	Verify that vMotion and FT traffic is on at least a 1 Gb network
Network	Check that IP storage traffic is physically separate to prevent sharing network bandwidth
Storage	Verify that VMs are on a shared datastore

Component	Check (per Best Practice)
Storage	Check that datastores are masked/zoned to the appropriate hosts in a cluster
Storage	Check that datastores are consistently accessible from all hosts in a cluster
Storage	Check that the appropriate storage policy is used for the storage array (MRU, Fixed, RR)
Storage	Check to make sure there is redundancy in storage paths and components to avoid single point of failure (e.g. at least 2 paths to each datastore)
Storage	Check that datastores are not getting full
Virtual Datacenter	Check that all datacenter objects use a consistent naming convention
Virtual Datacenter	Verify that hosts within a cluster maintain a compatible and homogeneous (CPU/mem) to support the required functionality for DRS, DPM, HA, and VMotion
Virtual Datacenter	Check that FT primaries are distributed on multiple hosts since FT logging is asymmetric
Virtual Datacenter	Verify that hosts for FT are FT compatible
Virtual Datacenter	Check that reservations/limits are used selectively on VMs that need it and are not set to extreme values
Virtual Datacenter	Check that vCenter Server is not running other applications and vCenter add-ons (for large environments and heavily loaded vCenter systems) and is sized appropriately
Virtual Datacenter	Check that the DB log setting is Normal unless there is a specific reason to set it to High
Virtual Datacenter	Check that the vCenter statistics level is set to an appropriate level (1 or 2 recommended)
Virtual Datacenter	Check that appropriate vCenter roles, groups, and permissions are being used
VM	Check any VMs with CPU READY over 2000 ms
VM	Check any VMs with sustained high CPU utilization
VM	Check any VMs with incorrect OS type in the VM configuration compared to the guest OS
VM	Check any VMs with multiple vCPUs to make sure the applications are not single threaded

Component	Check (per Best Practice)
VM	Check the active Swap In/Out rate of VMs to make sure it is not consistently greater than 0
VM	Check that NTP, windows time service, or another timekeeping utility suitable for the OS is used (and not VMware Tools)
VM	Check that VMware Tools are installed, running, and not out of date for running VMs
VM	Check VMs that are configured and enabled with unnecessary virtual hardware devices (floppy, serial, parallel, CDROM) and any devices that prevent VMotion
VM	Check VMs that are not yet on virtual hardware v7
VM	Check VM configuration (memory reservation) for VMs running JVM to consider setting reservation to the size of OS+ java heap

6. Appendix C: References

Item	URL
Documentation	http://www.vmware.com/support/pubs
VMTN Technology information	http://www.vmware.com/vcommunity/technology
VMTN Knowledge Base	http://kb.vmware.com
Discussion forums	http://www.vmware.com/community
User groups	http://www.vmware.com/vcommunity/usergroups.html
Online support	http://www.vmware.com/support
Telephone support	http://www.vmware.com/support/phone_support.html
Education Services	http://mylearn.vmware.com/mgrreg/index.cfm
Certification	http://mylearn.vmware.com/portals/certification/
Technical Papers	http://www.vmware.com/vmtn/resources
Network throughput between virtual machines	http://kb.vmware.com/kb/1428
Detailed explanation of VMotion considerations	http://www.vmware.com/resources/techresources/1022
Time keeping in virtual machines	http://www.vmware.com/vmtn/resources/238 http://kb.vmware.com/kb/1006427
VMFS partitions	http://www.vmware.com/vmtn/resources/608
VI3 802.1Q VLAN Solutions	http://www.vmware.com/pdf/esx3_vlan_wp.pdf
VMware Virtual Networking Concepts	http://www.vmware.com/resources/techresources/997
Using EMC Celerra IP Storage (VI3)	http://www.vmware.com/resources/techresources/1036
VMware vCenter Update Manager documentation	http://www.vmware.com/support/pubs/vum_pubs.html
VMware vCenter Update Manager Best Practices	http://www.vmware.com/resources/techresources/10022
Performance Best Practices for VMware vSphere 4.0	http://www.vmware.com/resources/techresources/10041
Recommendations for aligning VMFS partitions	http://www.vmware.com/vmtn/resources/608
Performance Troubleshooting for VMware vSphere	http://communities.vmware.com/docs/DOC-10352
Large Page Performance	http://www.vmware.com/resources/techresources/1039
VMware vSphere PowerCLI	http://www.vmware.com/support/developer/windowstoolkit/
VI3 security hardening	http://www.vmware.com/vmtn/resources/726
VMware HA: Concepts and Best Practices	http://www.vmware.com/resources/techresources/402
Java in Virtual Machine on ESX	http://www.vmware.com/files/pdf/Java_in_Virtual_Machines_on_ESX-FINAL-Jan-15-2009.pdf
CPU scheduler in ESX 4.0	http://www.vmware.com/resources/techresources/10059
Dynamic Storage Provisioning (Thin Provisioning)	http://www.vmware.com/resources/techresources/10073

Item	URL
Understanding memory resource management on ESX	http://www.vmware.com/resources/techresources/10062

7. Appendix D: HealthAnalyzer Output

Host Details

Optionally include the appropriate VHA output spreadsheet data in here

Network Details

Optionally include the appropriate VHA output spreadsheet data in here

Storage Details

Optionally include the appropriate VHA output spreadsheet data in here

Virtual Datacenter Details

Optionally include the appropriate VHA output spreadsheet data in here

Virtual Machine Details

Optionally include the appropriate VHA output spreadsheet data in here