

# **HP Network Node Manager i Software** Deploying NNMi in a "Very Large" Tier VMWare ESXi Linux Environment

Release 9.20

This white paper details a tested implementation of NNMi 9.2 on VMWare ESXi in a "very large" scale tier on the Linux Operating System. See the *HP Network Node Manager i Software System and Device Support Matrix* for more information about possible NNMi tier sizes. It includes an example of the scale, setup and general configuration used for this environment. In addition, this document provides several suggestions for useful tools and other resources for high-scale ESXi deployments.

Use the steps outlined in this document as a guide to successfully run NNMi in large scale environments.

### Contents

Introduction	3
General Specifications of the Environment Physical Host	3 3 3 3
ESXi Configurations ESXi Host Kernel Configuration	3 3 4 8
Kernel Changes on the Guest	0
Additional Best Practices	1
Additional Resources       11         NNMi Health Report       11         top Tool       11         Disk Performance Tools       11         Esxtop       12         VMware Performance Resources       12	1 1 1 2 3
Conclusion	3

# Introduction

This example implementation uses a Virtual Machine to host NNMi 9.20 monitoring a large scale network. This implementation focuses strictly on VMware and does not cover other virtual technologies available. Similar implementations should work with other supported technologies, but this high scale environment was implemented only using VMware.

This document includes the configuration that was tested for this example implementation. In some instances, it includes a few alternative approaches. The most significant of these alternatives is the use of SAN storage versus a local RAID. This example implementation uses a local RAID. Settings appropriate for SAN storage are also mentioned.

# General Specifications of the Environment

### **Physical Host**

Model: ProLiant DL580 G7 CPU Cores: 32 CPUs x 2.264 GHZ Processor Type: Intel® Xeon® CPU X7560 @ 2.27 GHz Processor Sockets: 4 Cores per Socket: 8 Logical Processors: 64 Hyperthreading: Active RAM: 72 GB (32 GB split evenly between the two CPUs) Number of NICs: 8 Disk: 6-15k rpm disks in a RAID 10 configuration (local storage). Battery-backed write cache enabled on the RAID controller.

### ESXi

VMware ESXi, 5.0.0, 702118

### Linux Virtual Machine

Red Hat Enterprise Linux 5.8 CPU: 8 vCPU Memory: 32,768 MB

# ESXi Configurations

The section outlines the necessary configurations for the ESXi host and virtual machine configuration.

#### ESXi Host Kernel Configuration

The following settings were configured in the BIOS

- Enable VT (Virtualization Technology)
- Enable NX(No Execute on AMD)/XD(Execute Disabled on Intel)

- Enable hyper-threading
- Disable memory node interleaving
- Enable high-performance hypervisor settings
- Set power management to high-performance

### Virtual Machine Configuration

The following screens shots represent the virtual machine setup and configuration that was used for this example implementation. Note the following:

- Not all configuration pages are shown
- Other settings are valid

#### Virtual Machine Version: Virtual Machine Version: 8

🕜 Create New Virtual Machine	
Virtual Machine Version	
Configuration	Virtual Machine Version
Name and Location	This host or cluster supports more than one VMware virtual machine version. Specify the virtual
Storage Virtual Machine Version	machine version to use.
Guest Operating System	
CPUs	C Virtual Machine Version: 7
Memory	This version will sup on VMware ECV (ECV) 4.0 and later. This version is recommended when
Network	sharing storage or virtual machines with ESX/ESXi up to 4.1.
SCSI Controller	G Maturi Marking Varian 0
Select a Disk	
Ready to complete	This version will run on VMware ESXi 5.0 and later. Choose this version if you need the latest virtual machine features and do not need to migrate to ESX/ESXi 4
	Virdal indenne redal es and do norneed to higrate to EbyEsyl in
Help	< Back Next > Cancel

Guest Operating System: Linux 5 (64-bit)

🕜 Create New Virtual Machine	
Guest Operating System Specify the guest operation	g system to use with this virtual machine
Configuration Name and Location Storage Virtual Machine Version Guest Operating System CPUs Memory Network SCSI Controller Select a Disk Ready to Complete	Guest Operating System:
Help	≤Back Next ≥ Cancel

CPUs: 1 Virtual Socket, 8 cores per virtual socket

💋 Create New Virtual Machine	Accession Accession	-		x
CPUs Select the number of virtu	al CPUs for the virtual machine.		Virtual Machine Vers	sion: 8
Configuration Name and Location Storage Virtual Machine Version Guest Operating System CPUs Memory Network SCSI Controller Select a Disk Ready to Complete	Number of virtual sockets: Number of cores per virtual socket: Total number of cores: The number of virtual CPUs that you depends on the number of CPUs on number of CPUs supported by the gu The virtual CPU configuration specifi might violate the license of the guess Click Help for information on the num processors supported for various gu systems.	1     •       8     •       8     •       9 <th></th> <th></th>		
<u>H</u> elp		<u> </u>	k Next ≥ Cance	-

### Memory: 32GB

💋 Create New Virtual Machine	Concession, Name and		
Memory Configure the virtual machi	's memory size.	,	Virtual Machine Version: 8
Configuration Name and Location Storage Virtual Machine Version Guest Operating System CPUS Hemory Network SCSI Controller Select a Disk Ready to Complete	Memory Configuration	B2	ate information.
Help		<u>≤</u> Back Next	≥ Cancel

Network: VM Network, Adapter: VMXNET 3 (only 1 NIC is configured)

🕜 Create New Virtual Machine		
Network Which network connections	will be used by the virtual machine?	Virtual Machine Version: 8
Configuration Name and Location Storage Virtual Machine Version Guest Operating System CPUs Memory Network SCSI Controller Select a Disk Ready to Complete	Create Network Connections How many NICs do you want to connect? Network NIC 1: VM Network If supported by this virtual machine version virtual machine is created, via its Edit Settir Adapter choice can affect both networking per the VMware KnowledgeBase for more informa supported for various guest operating system	I       Connect at Power On         Adapter       Power On         Image: Eligence of the state of
Help		≤ Back Next ≥ Cancel

SCSI Controller: VMware Paravirtual

Tip: If VMware Paravirtual is not an option for your operating system setup, use LSI Logic SAS.

**Note**: VM Paravirtual is recommended for RHEL6 only.

💋 Create New Virtual Machine	A. TANCETON, MICH. MICH. MICh.	
SCSI Controller Which SCSI controller type	would you like to use?	Virtual Machine Version: 8
Configuration Name and Location Storage Wrtual Machine Version Guest Operating System CPUs Memory Network SCSI Controller Select a Disk Ready to Complete	SCSI controller     BusLogic Parallel (not recommended for this guest OS)     LSI Logic Parallel     LSI Logic SAS     VMware Paravirtual	
Help	E	lack Next ≥ Cancel

Disk Provisioning: Thick Provision Lazy Zeroed

🕜 Create New Virtual Machine	Assessment work would be	
Create a Disk Specify the virtual disk size	and provisioning policy	Virtual Machine Version: 8
Configuration Name and Location Storage Virtual Machine Version Guest Operating System CPUs Memory Network SCSI Controller Select a Disk <b>Create a Disk</b> Advanced Options Ready to Complete	Capacity Disk Size: 120 - GB - Disk Provisioning (• [Thick Provision Lazy Zeroed] (• Thick Provision Eager Zeroed (• Thick Provision Location • Store with the <u>vi</u> rtual machine (• Specify a <u>d</u> atastore or datastore cluster:	Browse
Help		_ ≤ Back Next ≥ Cancel

### Additional SAN Configuration

Although this example implementation was completed using local disks, consider the configurations in the following example when using SAN disk.

**Note**: The SAN disk example that follows is configured on the ESX server rather than on the specific Virtual Machine (VM).

To begin, choose the **Advanced Settings** on the **Configuration** tab.



#### Disk.SchedNumReqOutstanding

This setting determines the maximum number of active storage commands (IO) allowed at any given time at the VM kernel. This value defaults to 32 but for many SAN solutions, 16 is a more efficient number.

**Tip**: Make this number as large as possible without degrading your Enterprise Virtual Array (EVA). A heavily loaded EVA needs a smaller number.

🕢 Advanced Settings		x
Annotations BufferCache CBRC CORG CVpx COW CQW CQW DataMover Digest DirentryCache	Disk.ReturnCCForNoSpace     0       Return CC 0x7/0x27/0x7 in the event where a backing datastore has run out of space as opposed to     0       Min: 0     Max: 1       Disk.SchedNumReqOutstanding     16       Number of outstanding commands to a target with competing worlds     16       Min: 1     Max: 256	•
DISK FS FT HBR Irq LPage Mem Migrate	Disk.SchedQControlSeqReqs     128       Number of consecutive requests from a virtual machine required to raise the outstanding commands.       Min:     0       Max:     2048       Disk.SchedQControlVMSwitches     6	
Misc     Net     Net     Nes     Numa     PageRetire     Power     RdmFilter     Scsi	Number of switches between commands issued by different virtual machines required to reduce outs.         Min:       0       Max: 2048         Disk.SchedQuantum       8         Number of consecutive requests from one world       8         Min:       1       Max: 64	
	Disk.SectorMaxDiff 2000 Distance in sectors at which the disk BW schedules affinity stops Min: 0 Max: 2000000 OK Cancel Help	•

## Kernel Changes on the Guest

For significant performance improvements, make the following changes on the virtual machine.

1. On the Linux VM, modify the kernel parameters in your boot loader's configuration by editing the file /etc/grub.conf.

**Caution**: It is recommended that you work with a Linux system administrator when making changes to this file.

2. Add the following entry to the end of the "kernel" line:

divider=10

**Note**: Enter the command on a single line.

Example:

```
kernel /vmlinuz-2.6.18-308.1.1.el5 ro root=/dev/default/root rhgb quiet
divider=10
```

Using divider=10 reduces the frequency of timer interrupts by 10 times. This setting reduces the CPU overhead of processing timer interrupts. This setting is valid for all installations (SAN or local disk).

3. The Linux kernel attempts to optimize disk I/O by reordering requests so that the head of the disk moves in an orderly, sequential manner rather than going back and forth. This is not appropriate for SAN disk I/O and should be disabled using the elevator=noop.

If you are configuring the SAN disk, add elevator=noop to the kernel parameters in your boot loader's configuration (/etc/grub.conf):

**Note**: Enter the command on a single line.

Example:

```
kernel /vmlinuz-2.6.18-308.1.1.el5 ro root=/dev/default/root rhgb quiet
divider=10 elevator=noop
```

Tip: Consider using elevator=noop for RAID configurations as well.

# Additional Best Practices

When running NNMi on a VM, note the following best practices:

• Configure your VM with adequate RAM to avoid swapping. This ensures maximum performance.

Tip: Commands for evaluating swap on Linux include free  $\,$  -m and vmstat.

- Refrain from configuring your VM with more RAM than is allocated to a single CPU on your ESX server. Consult the hardware guide of your server for more information.
- Reduce your resources in a VM whenever possible. For example, configure the Virtual CPUs and RAM to the smallest value that can still meet your peak loads.

### Additional Resources

This section describes additional resources that might be useful in pinpointing problems. Common problems when working in virtual environments include over-allocation of physical resources, for example, too many virtual machines vying for the same resources. Another common problem is slow disk I/O.

#### NNMi Health Report

The NNMi health report provides valuable information about problems that might be happening on your server and that might affect NNMi.

View the NNMi health report using one of the following methods:

- From the NNMi console, select **Help > System Information.**
- Run \$nnmInstDir/bin/nnmhealth.ovpl. View the output in the \$nnmLogDir/health.log.

#### top Tool

The top tool is standard Linux and Unix tool that can highlight performance problems in the area of system load, memory, and swap space. Similar tools are available on Windows. For more information, see the top man page.

#### Disk Performance Tools

Disk performance tools, such as bonnie++, are useful resources to determine the performance of your disk and file system I/O. The source code for bonnie++ can be obtained through the Web.

**Tip**: If you can't find a binary download, you must compile it. To compile bonnie++ on Linux, run the make command. The bonnie++ command is a stand-alone tool that does not need to be installed. Simply copy it to the desired location and make it executable.

To measure your disk performance, you can also time how long it takes to execute a series of tests and gauge your results based on the overall time to execute. Measuring the total real time is a good estimator for NNMi success. For example:

time ./bonnie++ -d /var/opt/OV/tmp -u nobody -r 256 -b

**Tip**: The /var/opt/OV/tmp directory is created when NNMi is installed. You can replace this directory with another directory that is on the same partition where the NNMi data directory will be installed. For example, if you have a partition dedicated to /var, you could run this test using /var/tmp rather than /var/opt/OV/tmp.

If you have reasonably good disk I/O, this command should run in **2 minutes or less**. If it takes much longer than two minutes, continue to tune your disk I/O.

The following table includes possible tuning parameters with example execution times.

RAID	Write Cache	Time to Execute
RAID 5	Disabled	114 minutes
RAID 1 + 0	Enabled	1 minute 10 seconds

Here is an example output:

```
# time ./bonnie++ -d /var/opt/OV/tmp -u nobody -r 256 -b
Using uid:99, gid:99.
Writing with putc()...done
Writing intelligently...done
Rewriting...done
Reading with getc()...done
Reading intelligently...done
start 'em...done...done...done...
Create files in sequential order...done.
Stat files in sequential order...done.
Delete files in sequential order...done.
Create files in random order...done.
Stat files in random order...done.
Delete files in random order...done.
                -----Sequential Output----- --Sequential Input- --Random-
Version 1.03e
                  -Per Chr- --Block-- -Rewrite- -Per Chr- --Block-- --Seeks--
              Size K/sec %CP K/sec %CP K/sec %CP K/sec %CP /sec %CP
Machine
perrytemp2vml. 512M 67404 98 111641 28 104108 65 78111 99 +++++ +++ 4292 156
                   -----Sequential Create----- -----Random Create----
                   -Create-- --Read--- -Delete-- -Create-- --Read--- -Delete--
             files /sec %CP /sec %CP /sec %CP /sec %CP /sec %CP
                16 1382 18 +++++ +++ 2037 6 1456 19 +++++ +++ 2076
                                                                           6
perrytemp2vm1.,512M,67404,98,111641,28,104108,65,78111,99,+++++,+++,4292.3,156,16,1382,18,+++++,+
++,2037,6,1456,19,+++++,+++,
2076,6
       1m10.780s
real
       0m12.758s
user
      0m15.368s
SYS
```

#### Esxtop

Esxtop, provided by VMware, enables monitoring and the collection of data for all system resources (for example: CPU, memory, disk, and network) on the ESXi host. For more information, see the VMware website.

### VMware Performance Resources

The following VMware resources can be found on the VMware website or through a Web search:

- vSphere Resource Management ESXi 5.0 and vCenter Server 5.0
- Performance Best Practices for VMware vSphere 5.0
- Performance Troubleshooting for VMware vSphere
- Interpreting esxtop Statistics
- Recommendations for Aligning VMFS Partitions

## Conclusion

This document details a tested implementation of NNMi 9.20 on VMWare ESXi in the "very large" scale tier environment on a Linux Operating System. It includes an example of the scale, setup and general configuration used for this environment. In addition, this document provides several suggestions for useful tools and other resources for high-scale ESXi deployments. Use the steps outlined in this document as a guide to successfully run NNMi for "very large" scale environments.

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#### Acknowledgements

This product includes software developed by the Apache Software Foundation.

(http://www.apache.org)

This product includes software developed by the Indiana University Extreme! Lab.

(http://www.extreme.indiana.edu)

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