

Wonderware

# ArchestrA System Platform in a Virtualized Environment

## Implementation Guide



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# Welcome

This guide describes the implementation of ArcestrA System Platform in a virtualized environment, using Microsoft Hyper-V technology, failover clustering, and other strategies to create High Availability, Disaster Recovery, and High Availability with Disaster Recovery capabilities.

You can view this document online or you can print it, in part or whole, by using the print feature in Adobe Acrobat Reader.

## Documentation Conventions

This documentation uses the following conventions:

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<b>Convention</b>	<b>Used for</b>
Initial Capitals	Paths and file names.
<b>Bold</b>	Menus, commands, dialog box names, and dialog box options.
Monospace	Code samples and display text.

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## Technical Support

Wonderware Technical Support offers a variety of support options to answer any questions on Wonderware products and their implementation.

Before you contact Technical Support, refer to the relevant section(s) in this documentation for a possible solution to the problem. If you need to contact technical support for help, have the following information ready:

- The type and version of the operating system you are using.
- Details of how to recreate the problem.
- The exact wording of the error messages you saw.
- Any relevant output listing from the Log Viewer or any other diagnostic applications.
- Details of what you did to try to solve the problem(s) and your results.
- If known, the Wonderware Technical Support case number assigned to your problem, if this is an ongoing problem.

# Chapter 1

## Getting Started with Virtualization

Virtualization technologies are becoming high priority for IT administrators and managers, software and systems engineers, plant managers, software developers, and system integrators.

Mission-critical operations in both small- and large-scale organizations demand availability—defined as the ability of the user community to access the system—along with dependable recovery from natural or man-made disasters. Virtualization technologies provide a platform for High Availability and Disaster Recovery solutions.

### Using this Guide

The purpose of this guide is to help you to implement ArcestrA System Platform in a virtualized environment, including:

- Implementing some of the new features in Microsoft Windows Server 2008 R2
- Implementing High Availability, Disaster Recovery, or High Availability with Disaster Recovery using Windows Server 2008 R2 virtualization technologies such as Hyper-V

This chapter introduces and defines virtualization concepts in general, as well as in a System Platform context. This chapter also defines a basic workflow and planning framework for your virtualization implementation.

Subsequent chapters describe in detail the features of Windows Server 2008 R2 and how to use them, configuring High Availability, Disaster Recovery, High Availability with Disaster Recover, creating virtual images, and implementing a virtualized backup strategy.

Subsequent chapters also provide test and performance metrics for a wide variety of system configurations, including Recovery Time Objective (RTO), Recovery Point Objective (RPO), and data trend snapshots.

# Understanding Virtualization

Virtualization is the creation of an abstracted or simulated—virtual, rather than actual—version of something, such as an operating system, server, network resource, or storage device. Virtualization technology abstracts the hardware from the software, extending the life cycle of a software platform.

In virtualization, a single piece of hardware, such as a server, hosts and coordinates multiple guest operating systems. No guest operating system is aware that it is sharing resources and running on a layer of virtualization software rather than directly on the host hardware. Each guest operating system appears as a complete, hardware-based OS to the applications running on it.

## Definitions

This implementation guide assumes that you and your organization have done the necessary research and analysis and have made the decision to implement ArcestrA System Platform in a virtualized environment that will replace the need for physical computers and instead run them in a virtualized environment. Such an environment can take advantage of advanced virtualization features including High Availability and Disaster Recovery. In that context, we'll define the terms as follows:

- Virtualization can be defined as **creating a virtual, rather than real, version of ArcestrA System Platform or one of its components, including servers, nodes, databases, storage devices, and network resources.**
- High Availability (HA) can be defined as **a primarily automated ArcestrA System Platform design and associated services implementation which ensures that a pre-defined level of operational performance will be met during a specified, limited time frame.**
- Disaster Recovery (DR) can be defined as **the organizational, hardware and software preparations for ArcestrA System Platform recovery or continuation of critical System Platform infrastructure after a natural or human-induced disaster.**

While these definitions are general and allow for a variety of HA and DR designs, this implementation guide focuses on virtualization, an indispensable element in creating the redundancy necessary for HA and DR solutions.

The virtualized environment described in this guide is based on Microsoft Hyper-V technology incorporated in the Windows Server 2008 R2 operating system.

## Types of Virtualization

There are eight types of virtualization:

<b>Hardware</b>	A software execution environment separated from underlying hardware resources. Includes hardware-assisted virtualization, full and partial virtualization and paravirtualization.
<b>Memory</b>	An application operates as though it has sole access to memory resources, which have been virtualized and aggregated into one memory pool. Includes virtual memory and memory virtualization.
<b>Storage</b>	Complete abstraction of logical storage from physical storage
<b>Software</b>	Multiple virtualized environments hosted within a single operating system instance. Related is a virtual machine (VM) which is a software implementation of a computer, possibly hardware-assisted, which behaves like a real computer.
<b>Mobile</b>	Uses virtualization technology in mobile phones and other types of wireless devices.
<b>Data</b>	Presentation of data as an abstract layer, independent of underlying databases, structures, and storage. Related is database virtualization, which is the decoupling of the database layer within the application stack.
<b>Desktop</b>	Remote display, hosting, or management of a graphical computer environment—a desktop.
<b>Network</b>	Implementation of a virtualized network address space within or across network subnets.



## Virtualization Using a Hypervisor

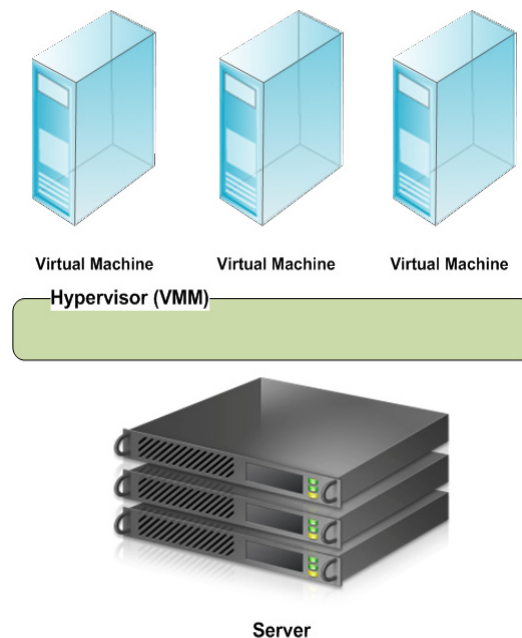
Microsoft Hyper-V technology implements a type of hardware virtualization using a hypervisor, permitting a number of guest operating systems (virtual machines) to run concurrently on a host computer. The hypervisor, also known as a Virtual Machine Monitor (VMM), is so named because it exists above the usual supervisory portion of the operating system.

There are two classifications of hypervisor:

- **Type 1:** Also known as a bare metal hypervisor, runs directly on the host hardware to control the hardware and to monitor the guest operating systems. Guest operating systems run as a second level above the hypervisor.
- **Type 2:** Also known as a hosted hypervisor, runs within a conventional operating system environment as a second software level. Guest operating systems run as a third level above the hypervisor.

## Hyper-V Architecture

Hyper-V implements Type 1 hypervisor virtualization, in which the hypervisor primarily is responsible for managing the physical CPU and memory resources among the virtual machines. This basic architecture is illustrated in the following diagram.



## VM and Hyper-V Limits in Windows Server 2008 R2

The following tables show maximum values for VMs and for a server running Hyper-V in Windows Server 2008 R2 Standard and Enterprise editions, respectively. By understanding the limits of the hardware, software, and virtual machines, you can better plan your ArcestrA System Platform virtualized environment.

### Virtual Machine Maximums - Windows Server 2008 R2 Standard Edition

Component	Maximum	Notes
Virtual processors	4	
Memory	64 GB	
Virtual IDE disks	4	The boot disk must be attached to one of the IDE devices. The boot disk can be either a virtual hard disk or a physical disk attached directly to a virtual machine.
Virtual SCSI controllers	4	Use of virtual SCSI devices requires integration services to be installed in the guest operating system.
Virtual SCSI disks	256	Each SCSI controller supports up to 64 SCSI disks.
Virtual hard disk capacity	2040 GB	Each virtual hard disk is stored as a .vhd file on physical media.
Size of physical disks attached to a VM	Varies	Maximum size is determined by the guest operating system.
Checkpoints (Snapshots)	50	The actual number depends on the available storage and may be lower.  Each snapshot is stored as an .avhd file that consumes physical storage.

<b>Component</b>	<b>Maximum</b>	<b>Notes</b>
Virtual network adapters	12	8 can be the “network adapter” type. This type provides better performance and requires a virtual machine driver that is included in the integration services packages.  4 can be the “legacy network adapter” type. This type emulates a specific physical network adapter and supports the Pre-execution Boot Environment (PXE) to perform network-based installation of an operating system.
Virtual floppy drives	1	
Serial (COM) ports	2	

## Hyper-V Server Maximums - Windows 2008 R2 Enterprise Edition

<b>Component</b>	<b>Maximum</b>	<b>Notes</b>
Logical processors	64	
Virtual processors per logical processor	8	
Virtual machines per server	384 (running)	
Virtual processors per server	512	
Memory	1 TB	
Storage	Varies No limits imposed by Hyper-V.	Limited by what the management operating system supports.

Component	Maximum	Notes
Physical network adapters	No limits imposed by Hyper-V.	
Virtual networks (switches)	Varies No limits imposed by Hyper-V.	Limited by available computing resources.
Virtual network switch ports per server	Varies No limits imposed by Hyper-V.	Limited by available computing resources.

## Virtualizing ArcestrA System Platform

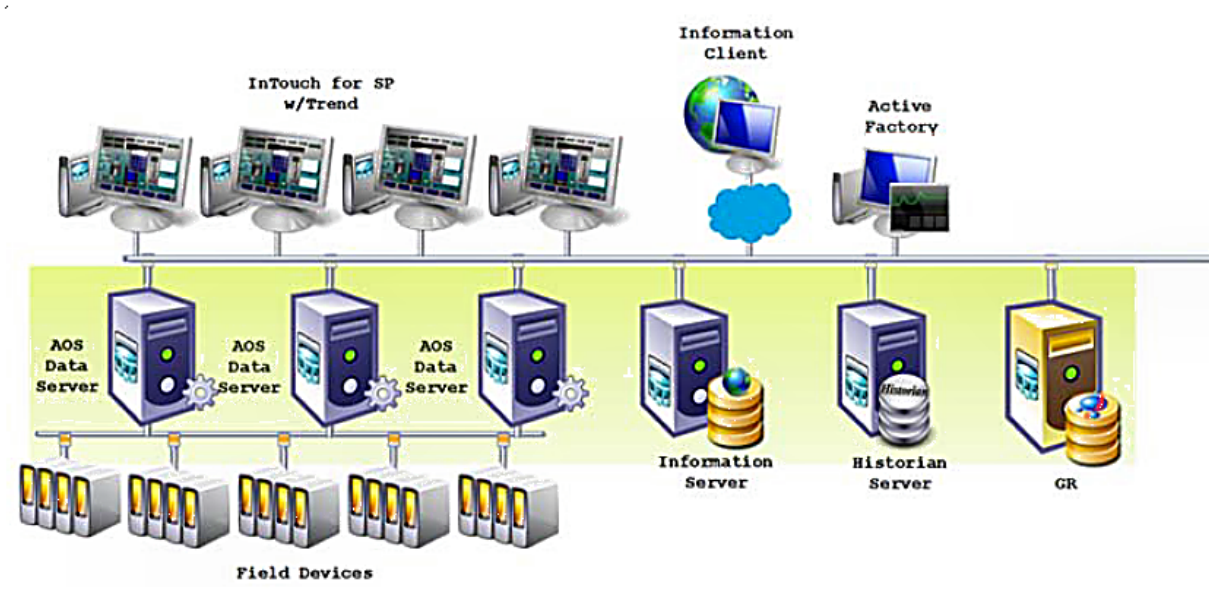
### Abstraction versus Isolation

With the release of InTouch 10.0, supporting the VMWare ESX platform, Wonderware became one of the first companies to support virtual machine operation of industrial software. VMWare ESX is referred to as a "bare metal" virtualization system. The virtualization is run in an **abstraction layer**, rather than in a standard operating system.

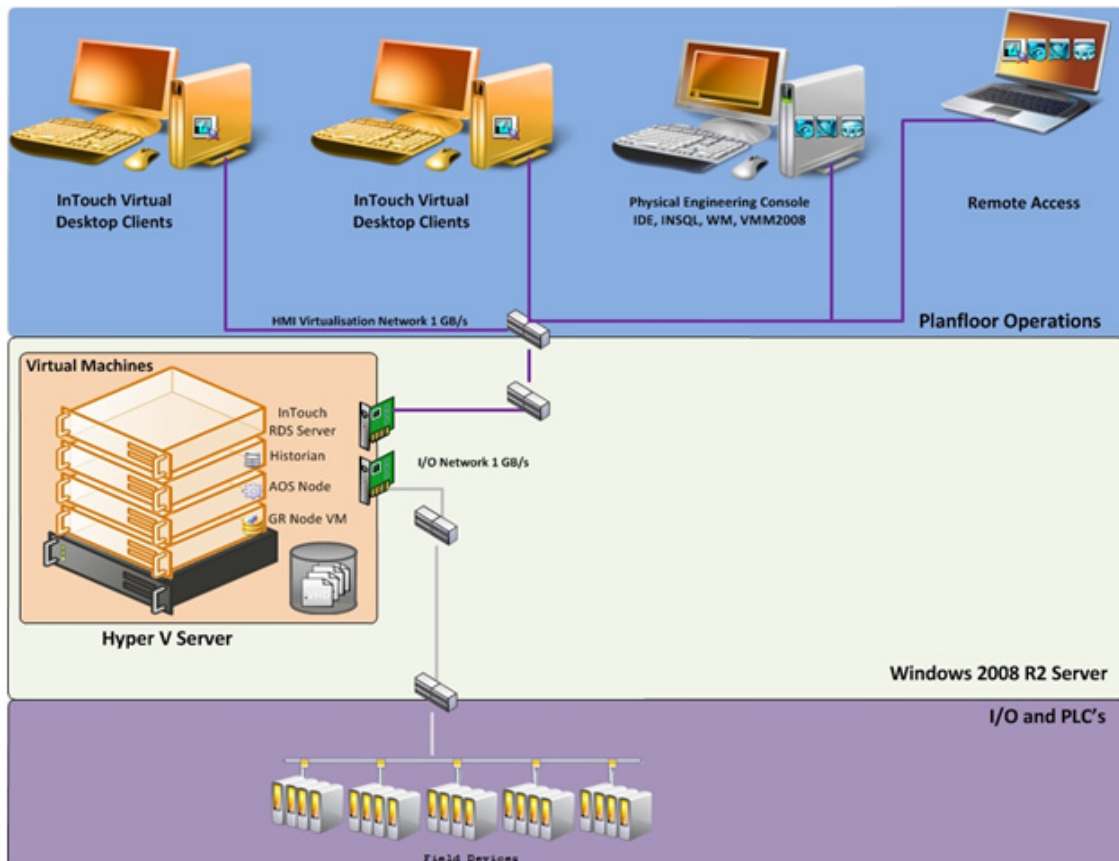
Microsoft takes a different approach to virtualization. Microsoft Hyper-V is a hypervisor-based virtualization system. The hypervisor is essentially an **isolation layer** between the hardware and partitions which contain guest systems. This requires at least one parent partition, which runs Windows Server 2008.

**Note:** An abstraction layer is a layer with drivers that make it possible for the virtual machine (VM) to communicate with hardware (VMware). In this scenario the drivers need to be present for proper communication with the hardware. With an isolation layer, the VM uses the operating system, its functionality, and its installed drivers. This scenario does not require special drivers. As a comparison, the abstraction layer in VMware is 32MB and in Hyper-V it is 256kb.

The following diagram shows a common ArchestrA System Platform topology, non-virtualized:



The following diagram shows the same environment virtualized using Hyper-V:



## Levels of Availability

When planning a virtualization implementation—for High Availability, Disaster Recovery, Fault Tolerance, and Redundancy—it is helpful to consider levels or degrees of redundancy and availability, described in the following table.

Level	Description	Comments
Level 0 Redundancy	No redundancy built into the architecture for safeguarding critical architectural components	Expected failover: None
Level 1 Cold Stand-by Redundancy	Redundancy at the Application Object level  Safeguards single points of failure at the DAServer level or AOS redundancy.	Expected failover: 10 to 60 seconds
Level 2 High Availability (HA)	<ul style="list-style-type: none"> <li>● With provision to synchronize in real-time</li> <li>● Uses virtualization techniques</li> <li>● Can be 1-<i>n</i> levels of hot standby</li> <li>● Can be geographically diverse (DR)</li> <li>● Uses standard OS and nonproprietary hardware</li> </ul>	Expected failover: Uncontrolled 30 seconds to 2 minutes, DR 2 - 7 minutes

<b>Level</b>	<b>Description</b>	<b>Comments</b>
Level 3 Hot Redundancy:	Redundancy at the application level typically provided by Invensys controllers. For example, hot backup of Invensys software such as Alarm System.	Expected failover: Next cycle or single digit seconds
Level 4 Lock-step Fault Tolerance (FT)	Provides lock-step failover	Expected failover: Next cycle or without loss of data.  For ArcestrA System Platform, this would be a Marathon-type solution, which also can be a virtualized system.

## High Availability

### About HA

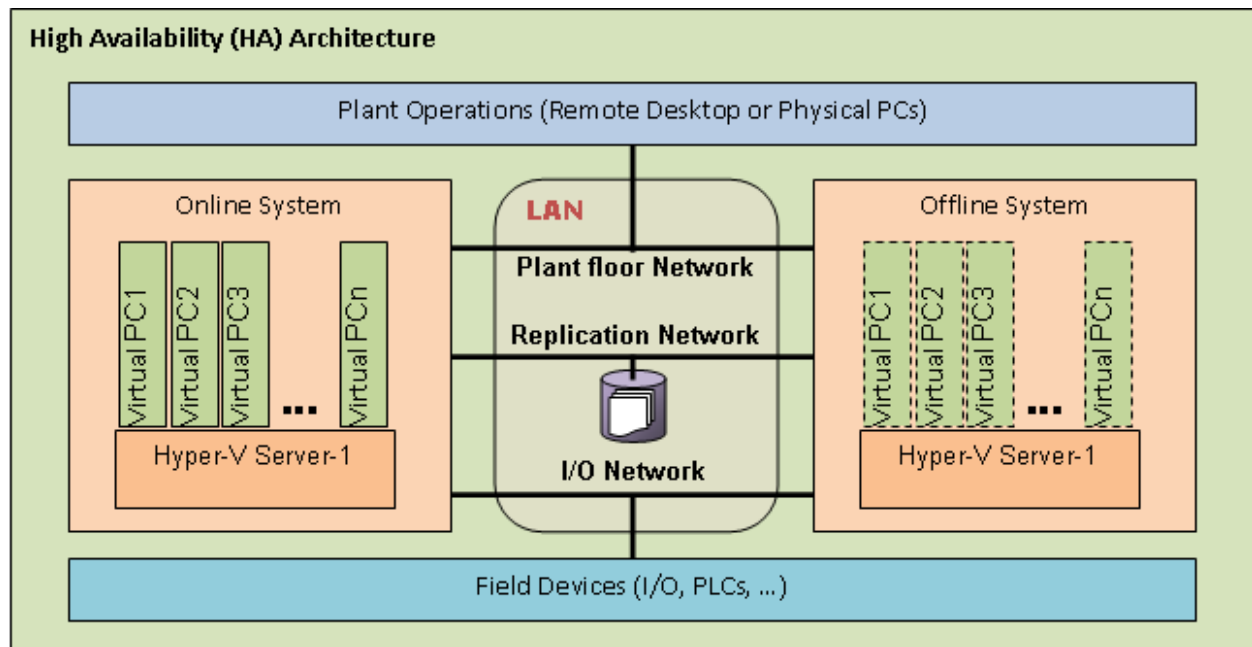
High Availability refers to the availability of resources in a computer system following the failure or shutdown of one or more components of that system.

At one end of the spectrum, traditional HA has been achieved through custom-designed and redundant hardware. This solution produces High Availability, but has proven to be very expensive.

At the other end of the spectrum are software solutions designed to function with off-the-shelf hardware. This type of solution typically results in significant cost reduction, and has proven to survive single points of failure in the system.

## High Availability Scenarios

The basic HA architecture implementation described in this guide consists of an online system including a Hyper-V Server and a number of virtual PCs, linked by a LAN to an offline duplicate system. The LAN accommodates a number of networks including a plant floor network linked to plant operations, an I/O network linked to field devices, and a replication network linked to storage.





This basic architecture permits a number of common scenarios.

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**IT maintains a virtual server.**

- A system engineer fails over all virtual nodes hosting ArcestrA System Platform software to back up the virtualization server over the LAN.
- For a distributed system, the system engineer fails over all virtual nodes to back up the virtualization server over a WAN.
- IT performs the required maintenance, requiring a restart of the primary virtualization server.

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**Virtualization server hardware fails.**

- The primary virtualization server hardware fails with a backup virtualization server on the same LAN.
- For a distributed system, the virtualization server hardware fails with a backup virtualization server over WAN.

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**Note:** This scenario is a hardware failure, not software. A program that crashes or hangs is a failure of software within a given OS.

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**A network fails on a virtual server.**

- Any of the primary virtualization server network components fail with a backup virtualization server on the same LAN, triggering a backup of virtual nodes to the backup virtualization server.
  - Any of the primary virtualization server network components fail with a backup virtualization server connected via WAN, triggering a backup of virtual nodes to the backup virtualization server over WAN.
-

For these scenarios, the following expectations apply:

- For the maintenance scenario, all virtual images are up and running from the last state of execution prior to failover.
- For the hardware and network failure scenarios, the virtual images restart following failover.
- For LAN operations, you should see operational disruptions for approximately 2-15 seconds (LAN operations assumes recommended speeds and bandwidth. For more information refer to "Networks" on page 31).
- For WAN operations, you should see operational disruptions for approximately 2 minutes (WAN operations assumes recommended speeds and bandwidth. For more information refer to "Networks" on page 31).

---

**Note:** The disruption spans described here are general and approximate. For specific metrics under a variety of scenarios, see the relevant Recovery Time Objective (RTO) and Recovery Point Objective (RPO) sections in chapters 2, 3, and 4.

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## Disaster Recovery

### About DR

Disaster Recovery planning typically involves policies, processes, and planning at the enterprise level, which is well outside the scope of this implementation guide.

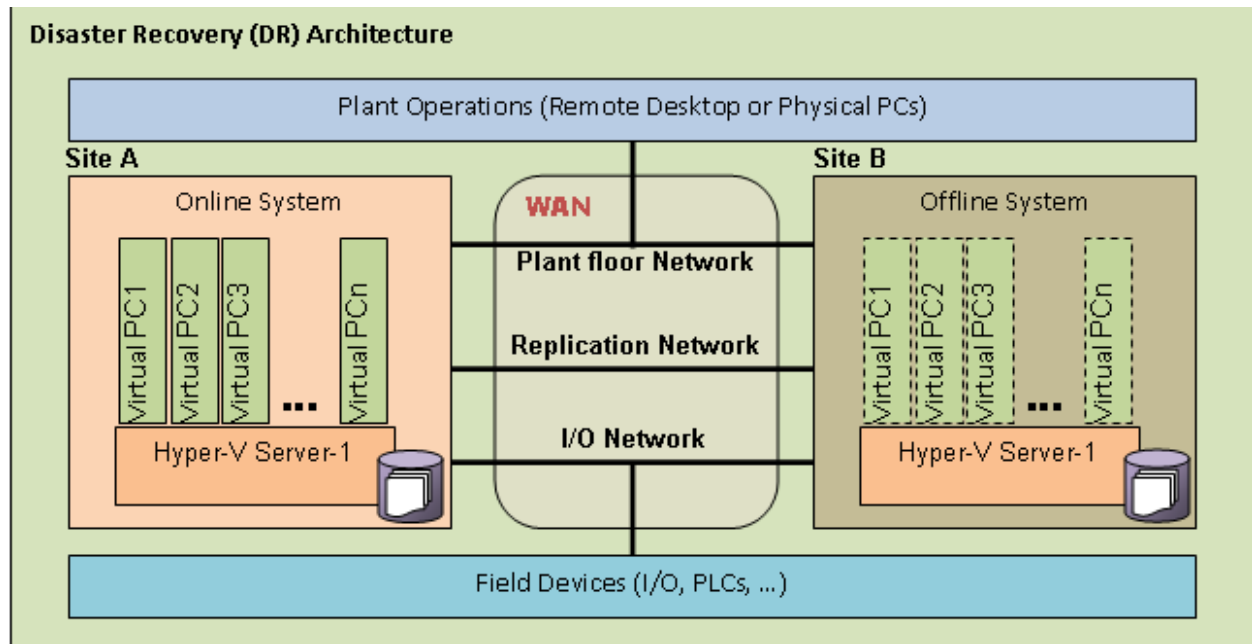
DR, at its most basic, is all about data protection. The most common strategies for data protection include the following:

- Backups made to tape and sent off-site at regular intervals, typically daily.
- For the hardware and network failure scenarios, the virtual images restart following failover
- For the hardware and network failure scenarios, the virtual images restart following failover
- Backups made to disk on-site, automatically copied to an off-site disk, or made directly to an off-site disk.
- Replication of data to an off-site location, making use of storage area network (SAN) technology. This strategy eliminates the need to restore the data. Only the systems need to be restored or synced.
- High availability systems which replicate both data and system off-site. This strategy enables continuous access to systems and data.

The ArcestrA System Platform virtualized environment implements the fourth strategy—building DR on an HA implementation.

## Disaster Recovery Scenarios

The basic DR architecture implementation described in this guide builds on the HA architecture by moving storage to each Hyper-V server, and moving the offline system to an off-site location.



The DR scenarios duplicate those described in "High Availability Scenarios" on page 24, with the variation that all failovers and backups occur over WAN.

## High Availability with Disaster Recovery

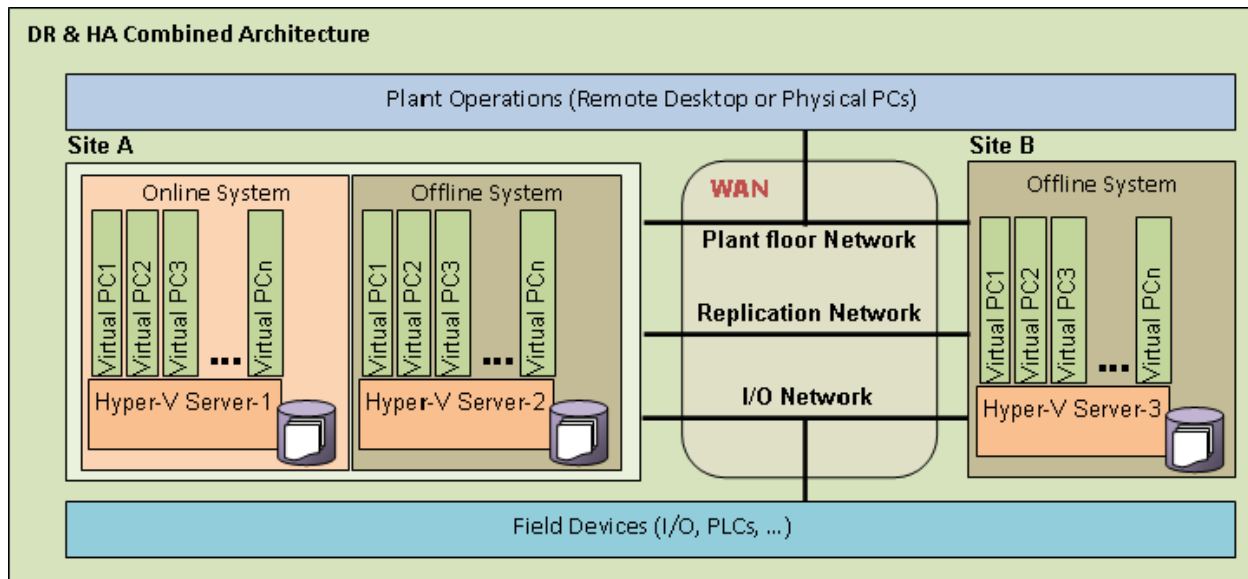
### About HADR

The goal of a High Availability and Disaster Recovery (HADR) solution is to provide a means to shift data processing and retrieval to a standby system in the event of a primary system failure.

Typically, HA and DR are considered as individual architectures. HA and DR combined treat these concepts as a continuum. If your system is geographically distributed, for example, HA combined with DR can make it both highly available and quickly able to recover from a disaster.

## HADR Scenarios

The basic HADR architecture implementation described in this guide builds on both the HA and DR architectures adding an offline system plus storage at "Site A". This creates a complete basic HA implementation at "Site A" plus a DR implementation at "Site B" when combined with distributed storage.



The scenarios and basic performance metrics described in "High Availability Scenarios" on page 24 also apply to HADR.

## Planning the Virtualized System

Planning an ArcestrA System Platform virtualization implementation is a three-step process:

- 1** Assess your existing System Platform installation
- 2** Assess virtualization requirements
- 3** Extend your assessment to define HA, DR, or HADR

For more information about configuring HA, DR, and HADR, see the following chapters:

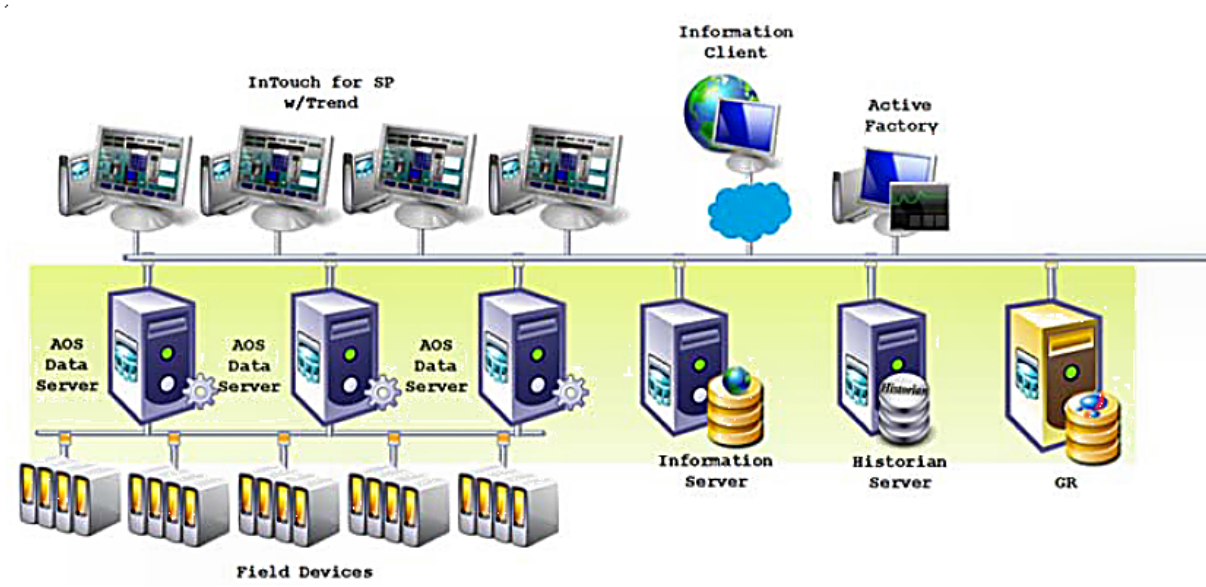
Chapter 2, "Working with High Availability,"

Chapter 3, "Working with Disaster Recovery,"

Chapter 4, "Working with High Availability and Disaster Recovery,"

## Assessing Your System Platform Installation

In most cases, a System Platform installation already exists. You will need to create an assessment of the current architecture. You can start with a basic topology diagram, similar to the following:



Once you have diagramed your topology, you can build a detailed inventory of the system hardware and software.

Microsoft offers tools to assist with virtualization assessment and planning.

- Microsoft Assessment and Planning Toolkit (MAP)

The MAP toolkit is useful for a variety of migration projects, including virtualization. The component package for this automated tool is available for download from Microsoft at the following address:

<http://www.microsoft.com/downloads/en/details.aspx?FamilyID=67240b76-3148-4e49-943d-4d9ea7f77730&displaylang=en>

- Infrastructure Planning and Design Guides for Virtualization (IPD)

The IPD Guides from Microsoft provide a series of guides specifically geared to assist with virtualization planning. They are available for download from Microsoft at the following address:

<http://technet.microsoft.com/en-us/solutionaccelerators/ee395429>

## Sizing Recommendations for Virtualization

This section provides sizing guidelines and recommended minimums for ArcestrA System Platform installations.

For a virtualization-only implementation, you can use these minimums and guidelines to size the virtualization server or servers that will host your System Platform configuration.

### Cores and Memory

#### **Spare Resources**

The host server should always have spare resources of 25% above what the guest machines require.

For example, if a configuration with five nodes requires 20GB of RAM and 10 CPUs, the host system should have 25GB of RAM and 13 CPUs. If this is not feasible, choose the alternative closest to the 25% figure, but round up so the host server has 32GB of RAM and 16 cores.

#### **Hyper-Threading**

Hyper-Threading Technology can be used to extend the amount of cores, but it does impact performance. An 8-core CPU will perform better than a 4-core CPU that is Hyper-Threading.

### Storage

It is always important to plan for proper Storage. A best practice is to dedicate a local drive or virtual drive on a Logical Unit Number (LUN) to each of the VMs being hosted. We recommend SATA or higher interfaces.

#### **Recommended Storage Topology**

To gain maximum performance, the host OS also should have a dedicated storage drive. A basic storage topology would include:

- Host storage
- VM storage for each VM
- A general disk

This disk should be large enough to hold snapshots, backups, and other content. It should not be used by the host or by a VM.

## Recommended Storage Speed

Boot times and VM performance are impacted both by storage bandwidth and storage speed. Faster is always better. Drives rated at 7200 rpm perform better than those rated at 5400 rpm. Solid-state drives (SSDs) perform better than 7200-rpm drives.

Keep in mind that multiple VMs attempting to boot from one hard drive will be slow, and your performance will experience a significant degrade. Attempting to save on storage could well become more costly in the end.

## Networks

Networking is as important as any other component for the overall performance of the system.

### Recommended Networking for Virtualization

If virtualization is your only requirement, your network topology could include the following elements:

- Plant network
- Storage network
- Hyper-V network.

A best practice is to establish, on every node, an internal-only Static Virtual Network. In the event that the host and the guest VMs become disconnected from the outside world, you will still be able to communicate through an RDP session independent of external network connectivity.

### Recommended Networking for HA

If HA is your requirement, then we recommend using fast, dedicated drives for local use. In the case of a Storage Area Network (SAN), we recommend using iSCSI 1GB/s as a minimum configuration.

A higher-performance configuration would be an FO connection to the storage at 10GB/s. For HA, we recommend a dedicated network for Hyper-V at 1GB/s. This will ensure fast transfers when using Quick Migration and Live Migration.

## Recommended Minimums for System Platform

Following are approximate numbers of nodes to define small, medium, and large systems.

- Small: 1–3 nodes
- Medium: 4–8 nodes
- Large: More than 8 nodes

The following table provides recommended minimums for System Platform configurations.

	<b>Cores</b>	<b>RAM</b>	<b>Storage</b>
<b>Small Systems</b>			
GR Node	2	2	100
Historian	2	2	250
Application Server	2	2	100
RDS Servers	2	2	100
Information Servers	2	2	100
Historian Clients	2	2	100
<b>Medium and Large Systems</b>			
GR Node	4	4	250
Historian	4	4	500
Application Server	2–4	4	100
RDS Servers	4–8	4–8	100
Information Server	4	4	100
Historian Clients	2	4	100

After installation of the server, you will start from scratch, or you can use the existing installation. A free tool on Microsoft TechNet called Disk2vhd supports extracting a physical machine to a VHD file. The Disk2vhd tool is available for download from Microsoft at the following address:

<http://technet.microsoft.com/en-us/sysinternals/ee656415>

Another tool you can use to migrate physical machines into to a virtual environment is VMM2008. This tool is available for purchase from Microsoft. For more information, see the following Microsoft address:

<http://www.microsoft.com/systemcenter/en/us/virtual-machine-manager.aspx>



## Defining High Availability

To define a High Availability implementation, you need to plan for the following requirements:

- Server specification doubles

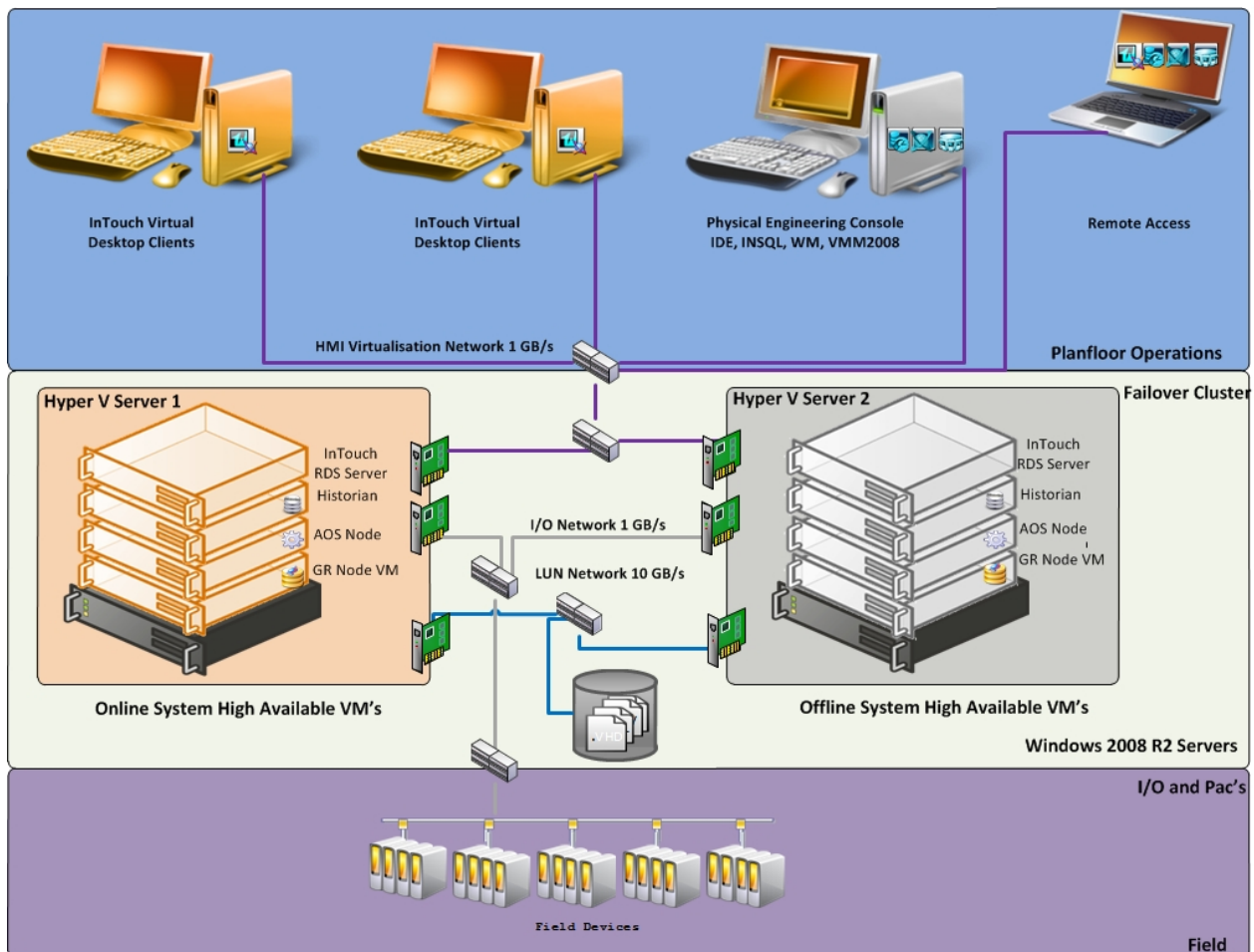
Double the baseline configuration is required for shadow nodes in the Failover Cluster.

- Minimum OS requirements increase

Failover is supported only on Windows Server 2008 R2 Enterprise and higher operating system editions.

Also, live migration, remote applications, and other features are available only if the host machines are Windows Server 2008 R2 editions.

The following shows a System Platform HA implementation.



To implement HA, we strongly recommend the use of a SAN configured with the sizing guidelines and recommendations outlined in the preceding section.

## Defining Disaster Recovery

To define a Disaster Recovery implementation, you need to plan for the following requirements:

- Adding a second server set with the same specifications as the first

The second server set moves to the off-site location and connects over LAN or (more likely) WAN.

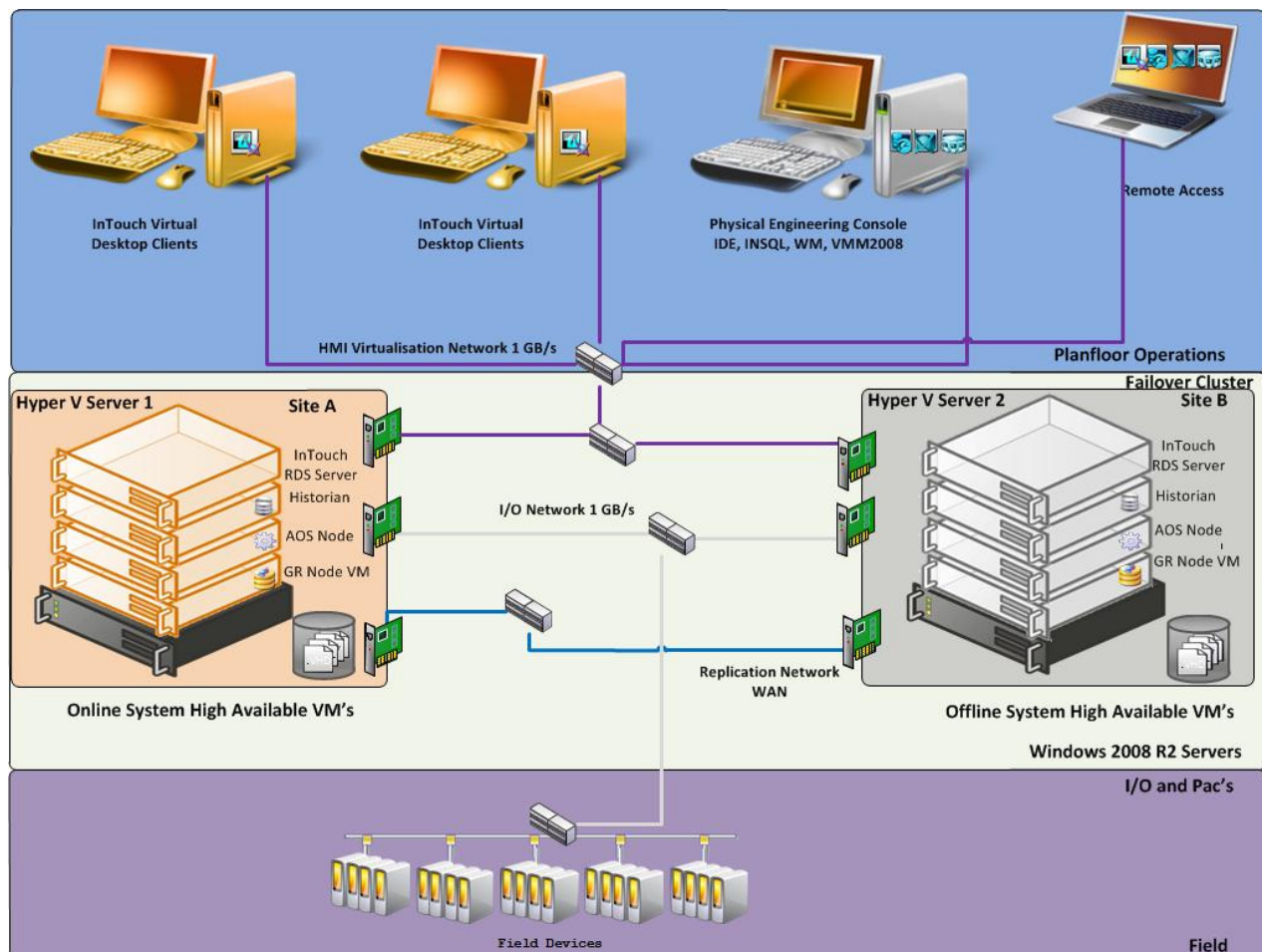
- Configuring minimum bandwidth

The minimum network bandwidth is 100MB/sec. Recovery times improve with higher network speeds.

- Installing and configuring third-party software

Third party software from SIOS (SteelEye) mirrors the drives from site A to site B. The replication can be done on a SAN system or as shown in the illustration, with regular local hard drives.

**Important:** Mirrored partitions must have identical drive letters and sizes.



# Defining High Availability and Disaster Recovery Combined

An important advantage from implementing HA and DR in the same scenario is that a local HA set can quickly resume functionality upon failure. In the event that site A is offline, the system can resume at site B without intervention from site A.

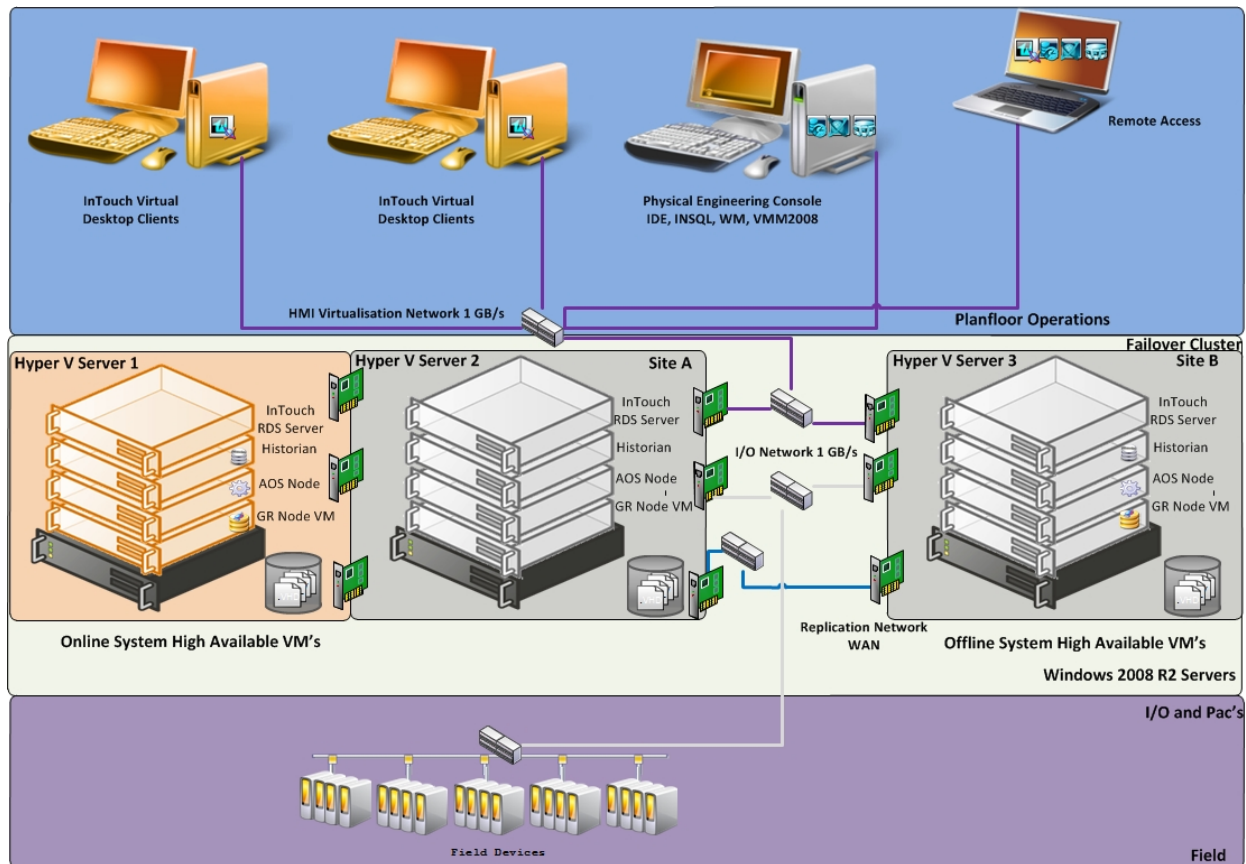
To define a HADR implementation, you need to plan for the following requirements:

- Sizing

You'll need to triple the size of the estimated baseline server.

- SANs

Two SANs are required—one local and one remote—to host the storage. In HADR implementation, the local configuration uses the failover cluster configuration and the set of VMs are replicated to a remote site.





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## Chapter 2

# Working with High Availability

This section introduces virtualization high-availability solutions that improve the availability of System Platform Products. A high-availability solution masks the effects of a hardware or software failure, and maintains the availability of applications so that the perceived downtime for users is minimized.

The set-up and configuration procedures, expected Recovery Time Objective (RTO) observations, Recovery Point Objective (RPO) observations, and data trend snapshots are presented first for small-scale virtualization environment, and are then repeated for medium-scale virtualization environment.

## Recommendations and Best Practices

- Ensure that auto log on is set up for all Hyper-V virtual machines running the System Platform products. This is to ensure that these Hyper-V virtual machines start up automatically after the failover.
- Ensure the time on all the Hyper-V host servers, the virtual machines and all other nodes which are part of the High Availability Environment are continuously synchronized. Otherwise, the Hyper-V virtual machines running on the host experience time drifts and results in discarding of data. You can add the time synchronization utility in the Start Up programs so that this utility starts automatically whenever the Hyper V machine reboots.

- On the host servers disable all the network cards which are not utilized by the System Platform Environment. This is to avoid any confusion during the network selections while setting up the cluster.
- Ensure the Virtual Networks created in Hyper-V Manager have the same name across all the nodes which are participating in the Cluster. Otherwise, migration/failover of Hyper-V virtual machines will fail.

### **System Platform Product-specific Recommendations and Observations**

- During the preparation for Live and Quick migrations it is observed that the network freezes intermittently and then at the time of actual migration connectivity to the VM is lost. As a result, the System Platform node under migration experiences intermittent data loss during the preparation for Live and Quick migrations, and then has a data gap for the duration of actual migration.

### **Historian**

- In case of Live and Quick migration of Historian, you may notice that Historian logs values with quality detail 448 and there may be values logged twice with same timestamps. This is because the suspended Historian VM starts on the other cluster node with the system time it was suspended at before the migration. As a result, some of the data points it is receiving with the current time seem to be in the future to the Historian. This results in Historian modifying the timestamps to its system time and updating the QD to 448. This happens until the system time of the Historian node catches up with the real current time using the TimeSync utility, after which the problem goes away. So, it is recommended to stop the historian before the migration and restart it after the VM is migrated and its system time is synced up with the current time.
- Live and Quick migration of Historian should not be done when the block change over is in progress on the Historian node.
- If a failover happens (for example, due to a network disconnect on the source Host Virtualization Server) while the Historian status is still “Starting”, the Historian node fails over to the target Host Virtualization Server. In the target host, Historian fails to start. To recover from this state, kill the Historian services that failed to start and then start the Historian by launching the SMC.

## InTouch

- Ensure that InTouch Window Viewer is added to the Start Up programs so that the view is started automatically when the virtual machine reboots.

## Application Server

- If a failover happens (for example, due to a network disconnect on the source Host Virtualization Server) while the Galaxy Migration is in progress, the GR node fails over to the target Host Virtualization Server. In the target host, on opening the IDE for the galaxy, the templates do not appear in the Template toolbox and in Graphic toolbox. To recover from this state, delete the galaxy and create new Galaxy. Initiate the migration process once again.
- If a failover happens (for example, due to an abrupt power-off on the source Host Virtualization Server) while a platform deploy is in progress, the Platform node fails over to the target Host Virtualization Server. In the target host, some objects will be in deployed state and the rest will be in undeployed state. To recover from this state, redeploy the whole Platform once again.
- If a failover happens (for example, due to an abrupt power-off on the source Host Virtualization Server) while a platform undeploy is in progress, the Platform node fails over to the target Host Virtualization Server. In the target host, some objects will be in undeployed state and the rest will be in deployed state. To recover from this state, undeploy the whole Platform once again.

## Data Access Server

- In case of Live and Quick migration of I/O Server node (for example, DASSIDirect), InTouch I/O Tags acquiring data from that I/O server needs to be reinitialized after the I/O server node is migrated. To automatically acquire the data for these tags from the I/O server after migration, it is recommended to have an InTouch script which monitors the quality status of any of those tags and triggers reinitialize I/O once the quality goes to bad. Execute this script every 3 to 5 seconds until the tag quality becomes good.

## Working with a Small Scale Virtualization Environment

This section contains the following topics:

- Setting Up Small Scale Virtualization Environment
- Configuration of System Platform Products in a Typical Small Scale Virtualization
- Expected Recovery Time Objective and Recovery Point Objective
- Snapshots of Data Trends and Observations

### Setting Up Small Scale Virtualization Environment

The following procedures help you to set up and implement a small scale virtualization environment.

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**Note:** In the event that the private network becomes disabled, you may need to add a script to enable a failover. For more information, see "Failover of the Virtual Machine if the Domain/ Private Network is disabled" on page 80

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### Planning for Small Scale Virtualization Environment

The following table lists the minimum and recommended hardware and software requirements for the machines used for a small scale virtualization environment:

#### Hyper-V Hosts

Processor:	Two - 2.66 GHz Intel Xeon with - 8 Cores
Operating System	Windows Server 2008 R2 Enterprise with Hyper-V Enabled
Memory	12GB
Storage	Local Volume with Capacity of 500 GB

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**Note:** For the Hyper-V Host to function optimally, the server should have the same processor, RAM, storage and service pack level. Preferably the servers should be purchased in pairs to avoid hardware discrepancies. Though the differences are supported, it will impact the performance during failovers.

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## Virtual Machines

Using the above Specified Hyper-V Host, three virtual machines can be created with the following Configuration.

### Virtual Machine 1: DAS SI, Historian, and Application Server (GR) node

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Historian, Arcestra, DAS SI

### Virtual Machine 2: Application Server Runtime node 1

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	2 GB
Storage	40 GB
System Platform Products Installed	Application Server Runtime only, and InTouch

### Virtual Machine 3: Information Server node, InTouch, and Historian Client

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 Standard
Memory	4 GB
Storage	40 GB
System Platform Products Installed	Information Server , InTouch, Historian Client

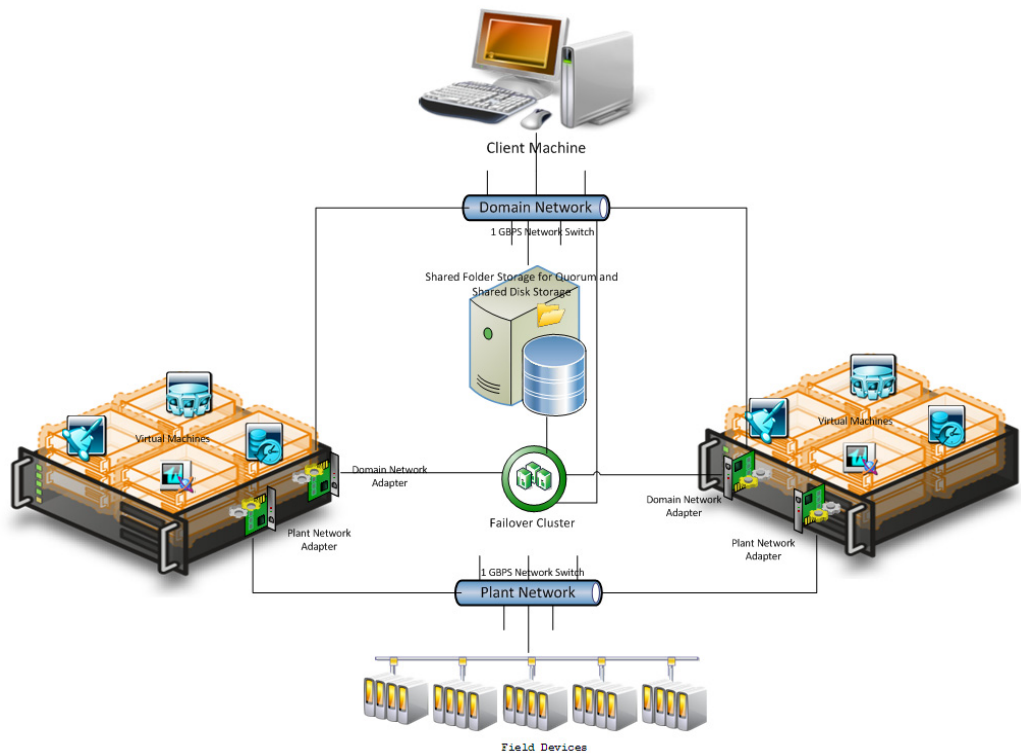
**Note:** There should be a minimum of two Hyper-V hosts to configure the failover cluster.

### Network Requirements

For this high availability architecture, you can use two physical network cards that need to be installed on a host computer and configured, to separate the domain network and the process network.

## Configuring Failover Cluster

The following is the recommended topology of the failover cluster for a small scale virtualization environment.



This setup requires a minimum of two host servers. Another independent node is used for configuring the quorum. For more information on configuring the quorum, refer to "Configuring Cluster Quorum Settings" on page 59. In this setup, the same or a different node can be used for the storage of virtual machines.

The following procedures help you to install and configure a failover cluster, that has two nodes, to set up on a small scale virtualization environment.

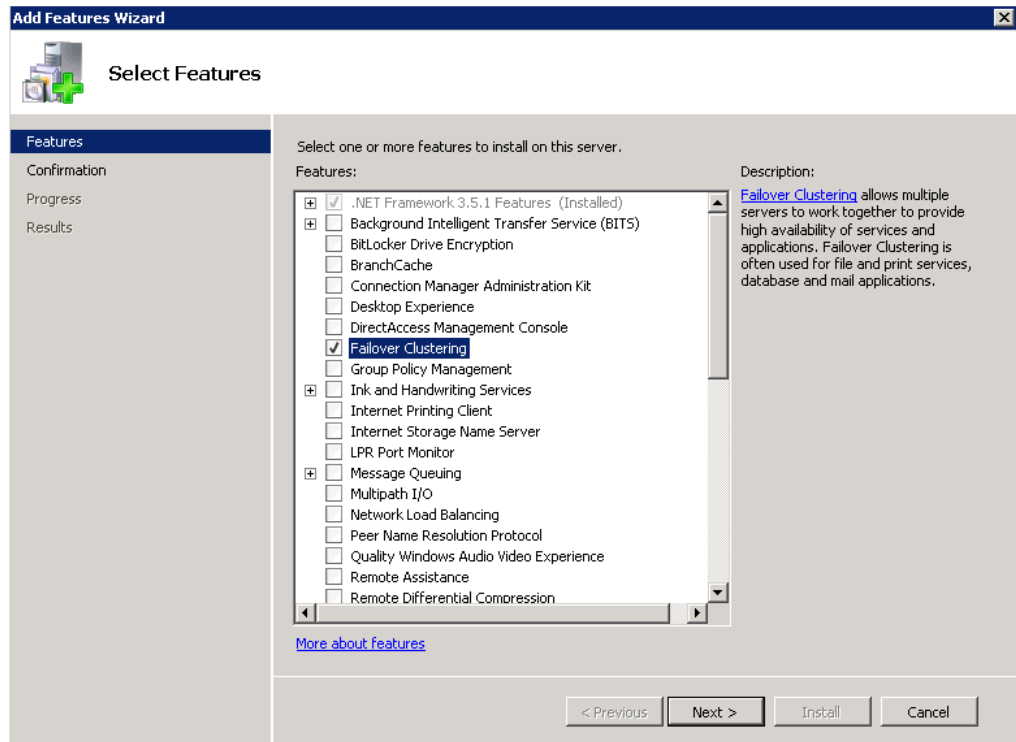
### Installing Failover Cluster

To install the failover cluster feature, you need to run Windows Server 2008 R2 Enterprise Edition on your server.

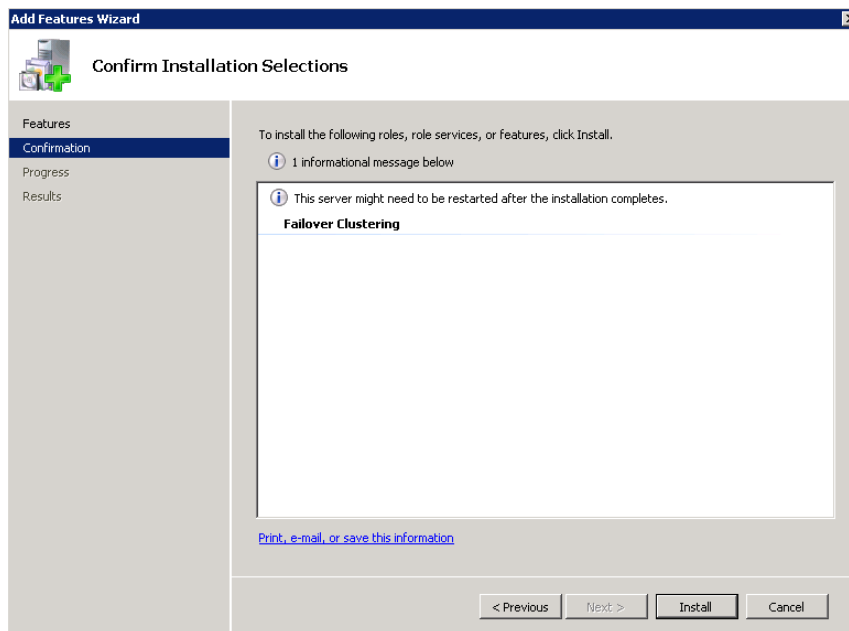
## To install the failover cluster feature on a server

- 1 On the **Initial Configuration Tasks** window, under **Customize This Server**, click **Add features**. The **Add Features Wizard** window appears.

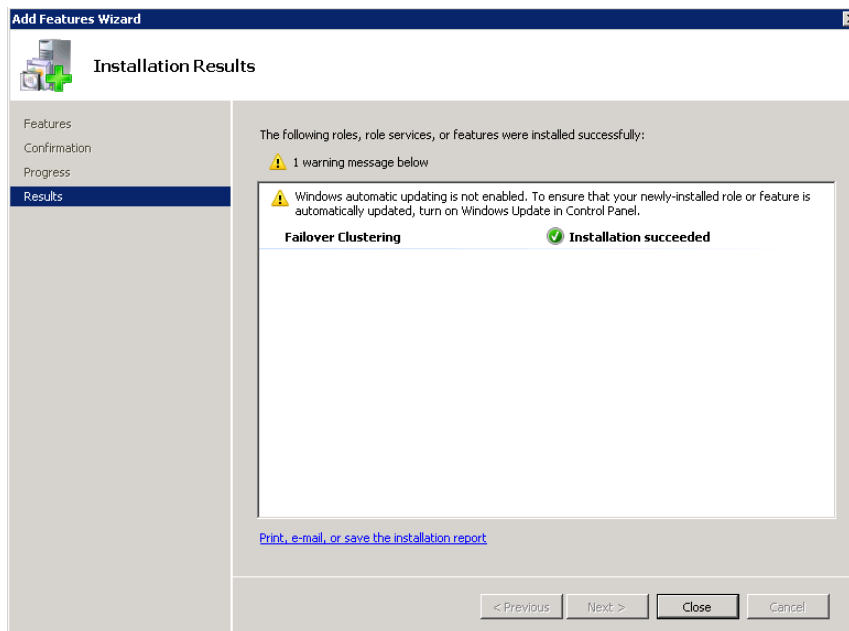
**Note:** The **Initial Configuration Tasks** window appears if you have already installed Windows Server 2008 R2. If it does not appear, open the **Server Manager** window, right-click **Features** and click **Add Features**. For information on accessing the **Server Manager** window, refer to step 1 of "To validate failover cluster configuration" on page 141.



- In the **Add Features Wizard** window, select the **Failover Clustering** check box and click **Next**. The **Confirm Installation Selections** area appears.



- To complete the installation, view the instructions on the wizard and click **Install**. The **Installation Results** area appears with the installation confirmation message.



- Click **Close** to close the **Add Features Wizard** window.

**Note:** Repeat the above procedure to include all the other nodes that are part of the Cluster configuration process.

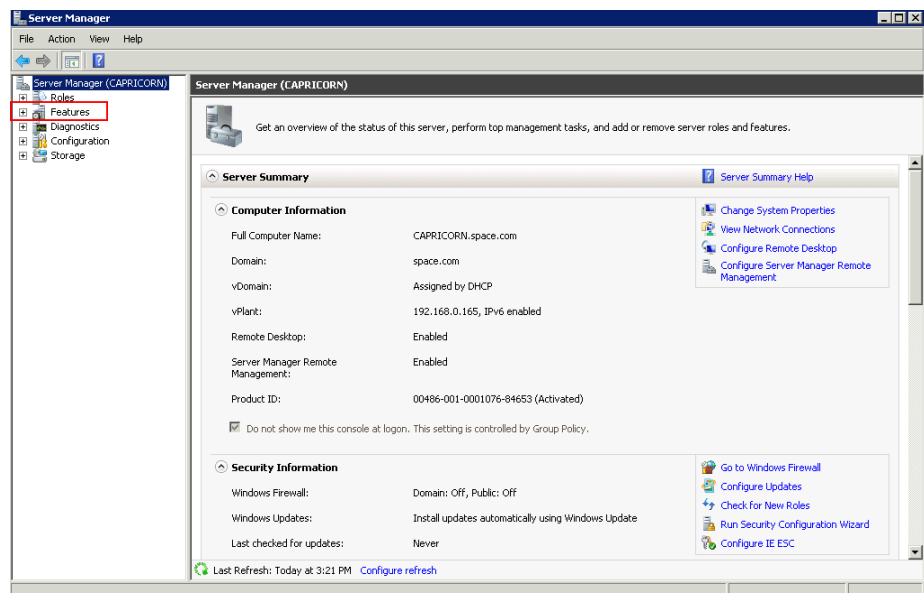
## Validating Failover Cluster Configuration

You must validate your configuration before you create a cluster. Validation helps you to confirm the configuration of your servers, network, and to storage meets the specific requirements for failover clusters.

### To validate failover cluster configuration

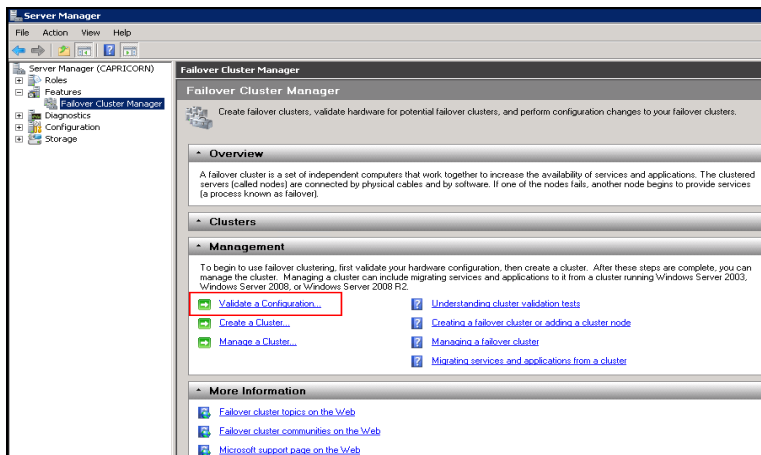
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

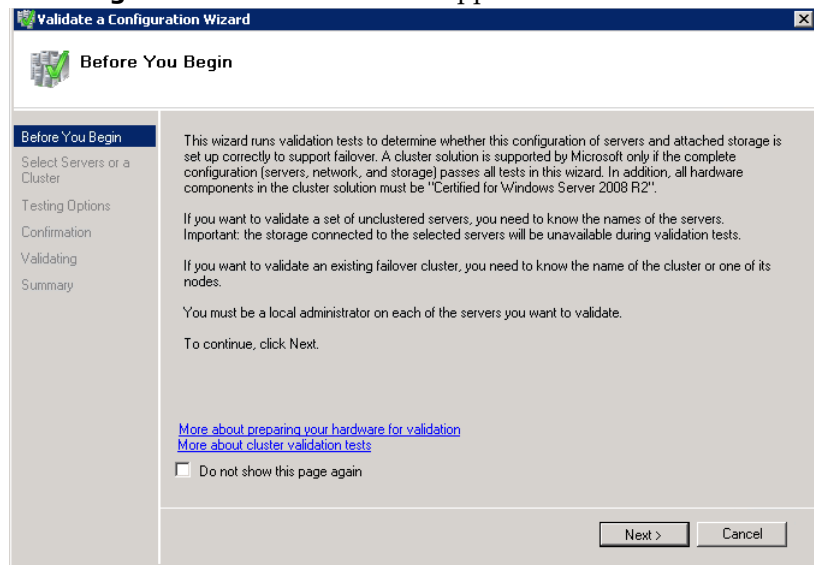


2 Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** area appears.

**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



- 3 Under **Management**, click **Validate a Configuration**. The **Validate a Configuration Wizard** window appears. Click **Next**.

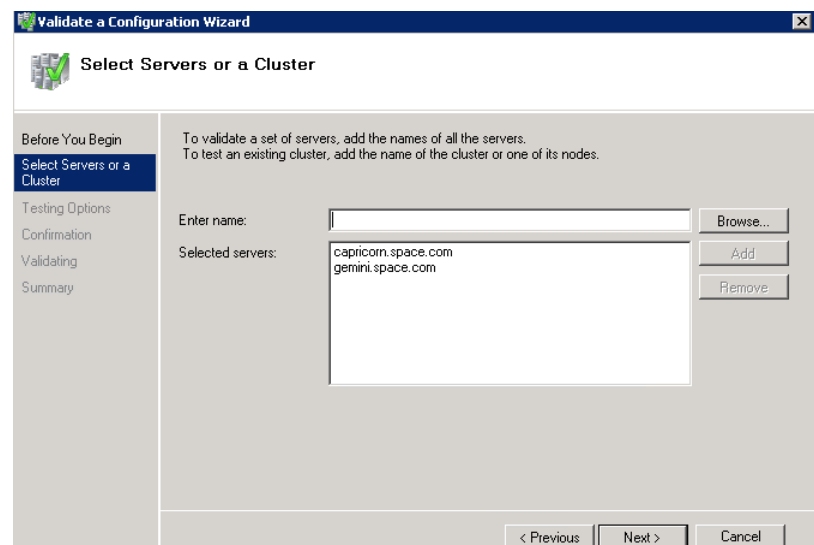


- 4 In the **Select Servers or a Cluster** area, do the following:
- Click **Browse** or enter next to the **Enter name** box and select the relevant server name.

**Note:** You can either enter the server name or click **Browse** and select the relevant server name.

- In the **Selected Servers** list, click the required servers, and then click **Add**.
- Click **Next**. The **Testing Options** area appears.

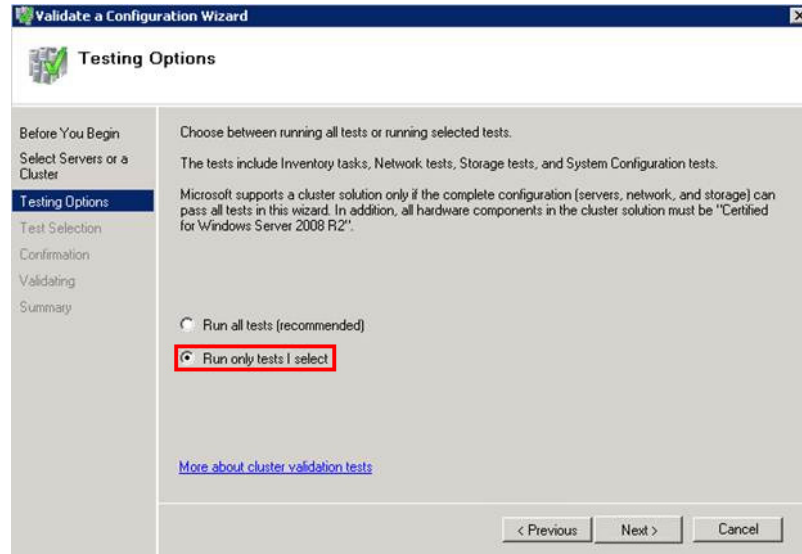
**Note:** You can add one or more server names. To remove a server from the **Selected servers** list, select the server and click **Remove**.





**d** Click **Next**. The **Testing Options** area appears.

**Note:** You can add one or more server names. To remove a server from the **Selected servers** list, select the server and click **Remove**.

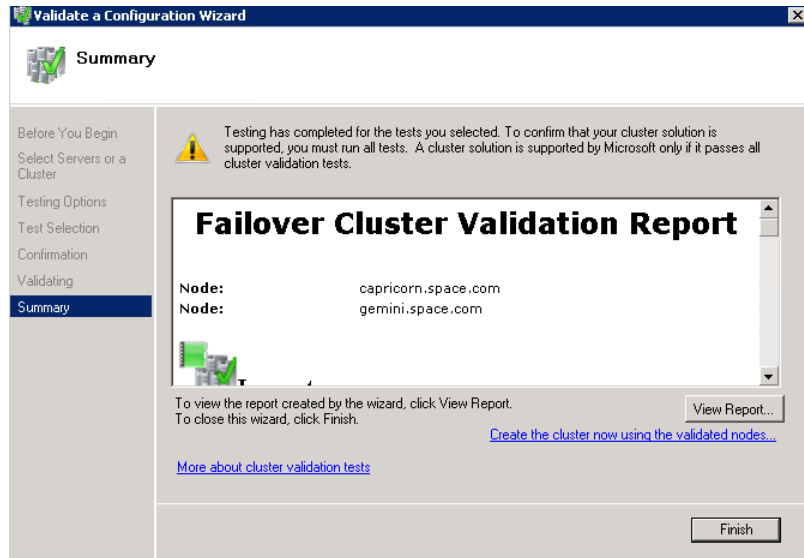


**5** Click the **Run only tests I select** option to skip storage validation process, and then click **Next**. The **Test Selection** area appears.

**Note:** Click the **Run all tests (recommended)** option to validate the default selection of tests.



- 6 Clear the **Storage** check box, and then click **Next**. The **Summary** screen appears.



- 7 Click **View Report** to view the test results or click **Finish** to close the **Validate a Configuration Wizard** window.

A warning message appears indicating that all tests have not been run. This usually happens in a multisite cluster where storage tests are skipped. You can proceed if there is no other error message. If the report indicates any other error, you need to fix the problem and rerun the tests before you continue. You can view the results of the tests after you close the wizard in *SystemRoot \ Cluster \ Reports \ Validation Report date and time.html* where SystemRoot is the folder in which the operating system is installed (for example, C:\Windows).

To know more about cluster validation tests, click **More about cluster validation tests** on **Validate a Configuration Wizard** window.

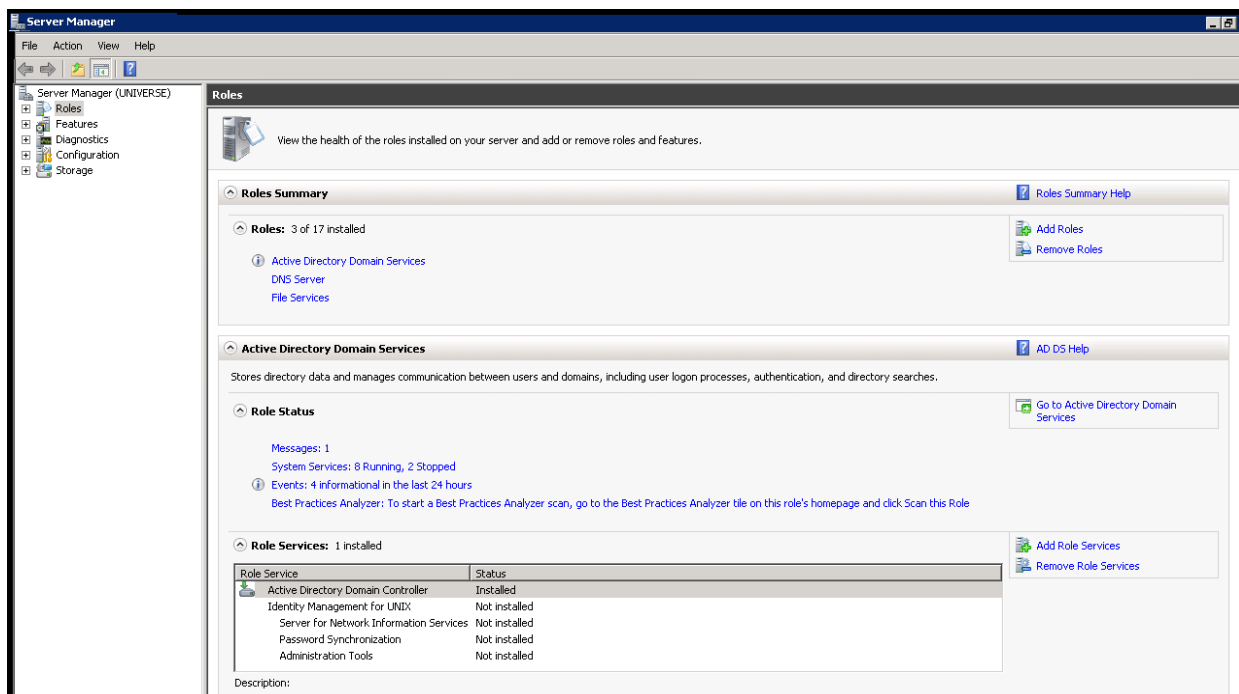
## Creating a Cluster

To create a cluster, you need to run the Create Cluster wizard.

### To create a cluster

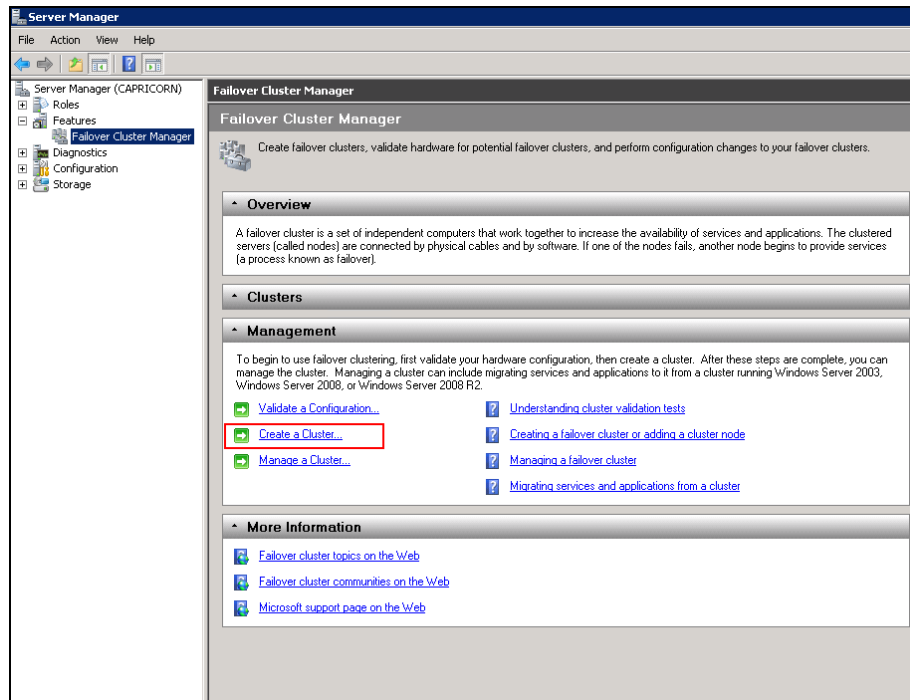
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

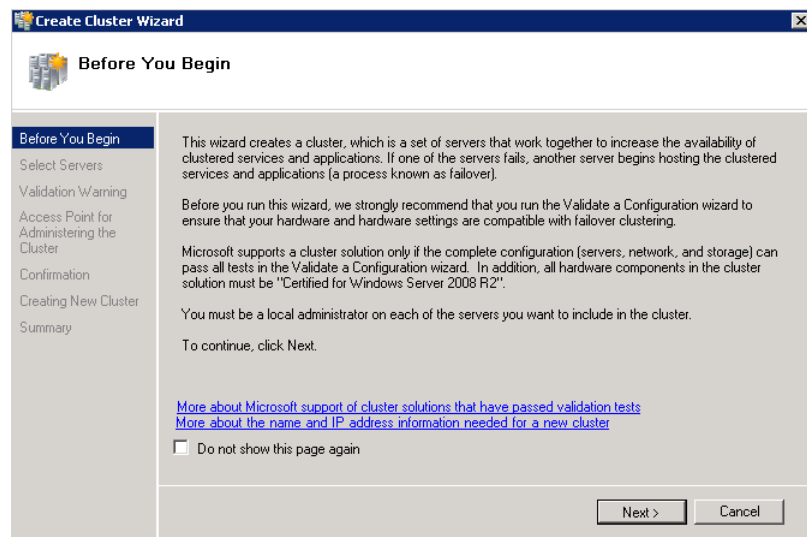


2 Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

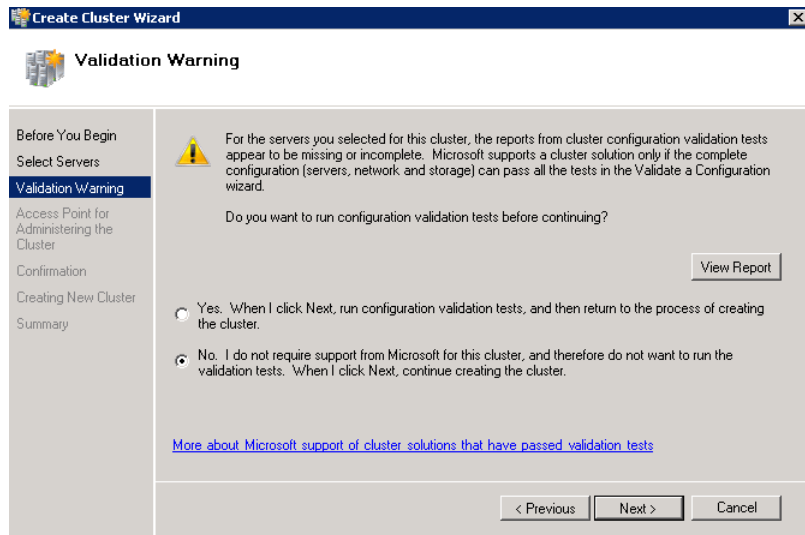
**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



3 Under **Management**, click **Create a cluster**. The **Create Cluster Wizard** window appears.

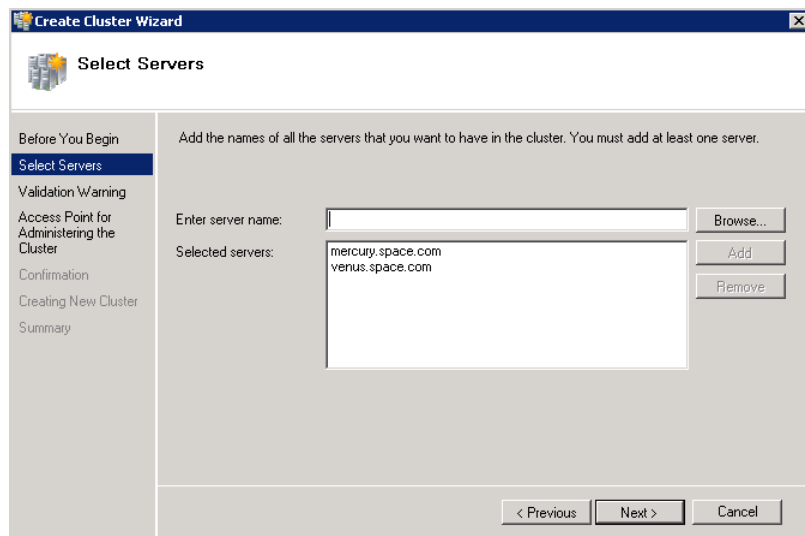


- 4 View the instructions and click **Next**. The **Validation Warning** area appears.



- 5 Click **No. I do not require support from Microsoft for this cluster, and therefore do not want to run the validation tests. When I click Next, continue creating the cluster** option and click **Next**. The **Select Servers** area appears.

**Note:** Click **Yes. When I click Next, run configuration validation tests, and then return to the process of creating the cluster** if you want to run the configuration validation tests. Click **View Report** to view the cluster operation report.

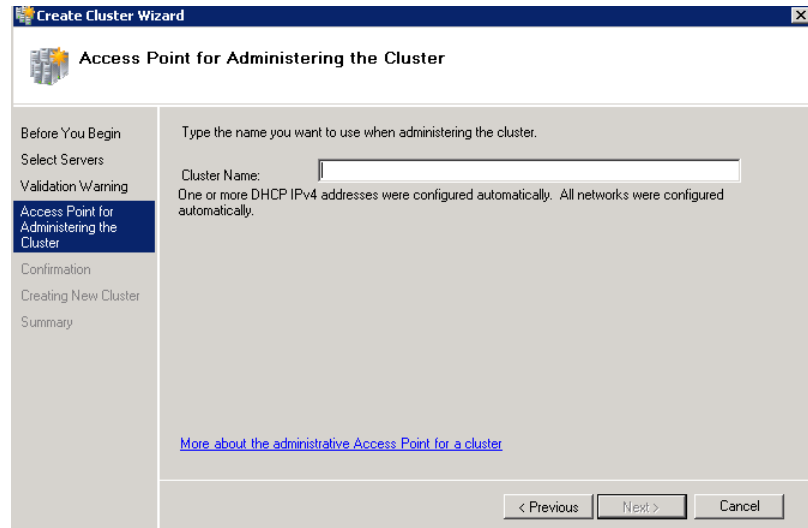


- 6 In the **Select Servers** screen, do the following:

- a** In the **Enter server name** field, enter the relevant server name and click **Add**. The server name gets added in the **Selected servers** box.

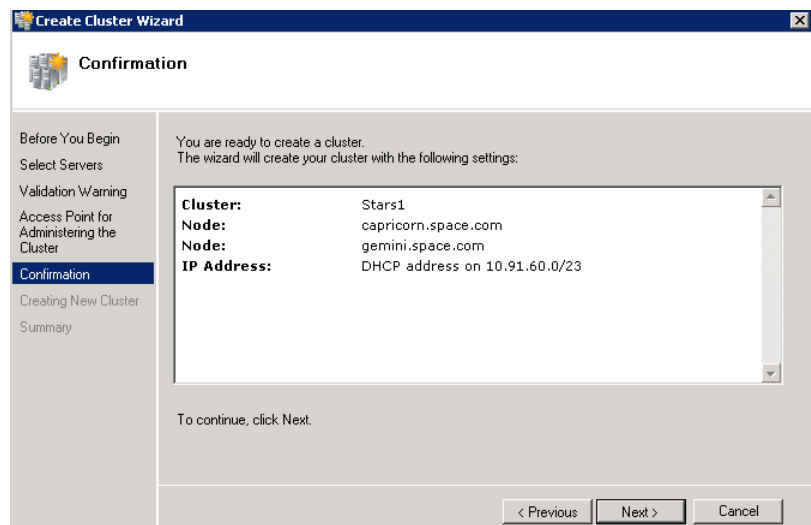
**Note:** You can either enter the server name or click **Browse** to select the relevant server name.

- b** Click **Next**. The **Access Point for Administering the Cluster** area appears.

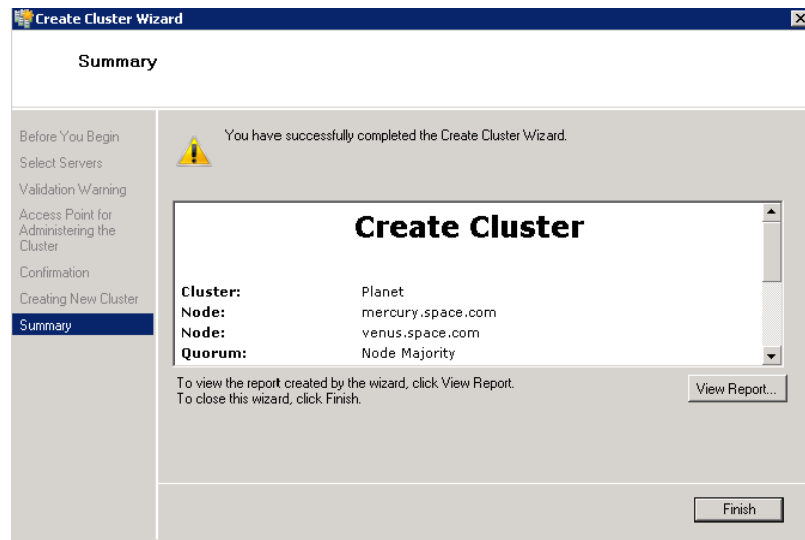


- 7** In the **Cluster Name** field, enter the name of the cluster and click **Next**. The **Confirmation** area appears.

**Note:** Enter a valid IP address for the cluster to be created if the IP address is not configured through Dynamic Host Configuration Protocol (DHCP).



- 8 Click **Next**. The cluster is created and the **Summary** area appears.



- 9 Click **View Report** to view the cluster report created by the wizard or click **Finish** to close the **Create Cluster Wizard** window.

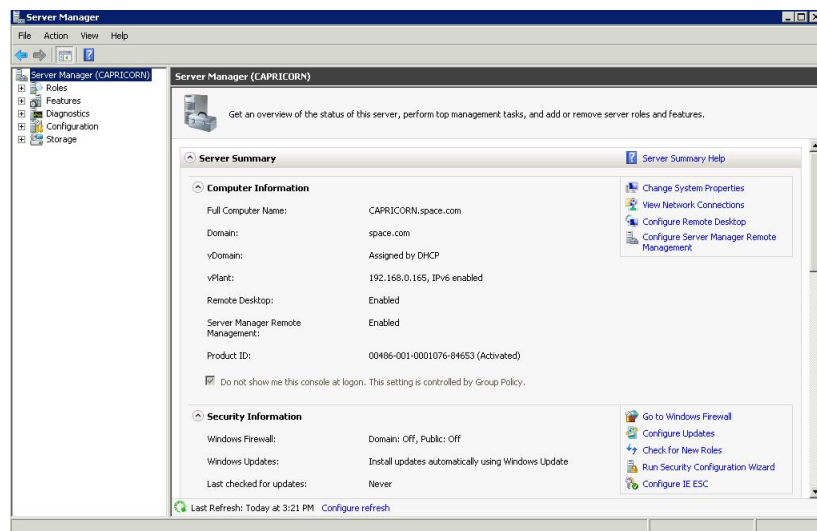
## Disabling the Plant Network for the Cluster Communication

After creating the failover cluster using two or more enabled network cards, make sure only the primary network card which is used for the communication between the Hyper-V nodes is enabled for the Failover Communication. You must disable the remaining cluster networks.

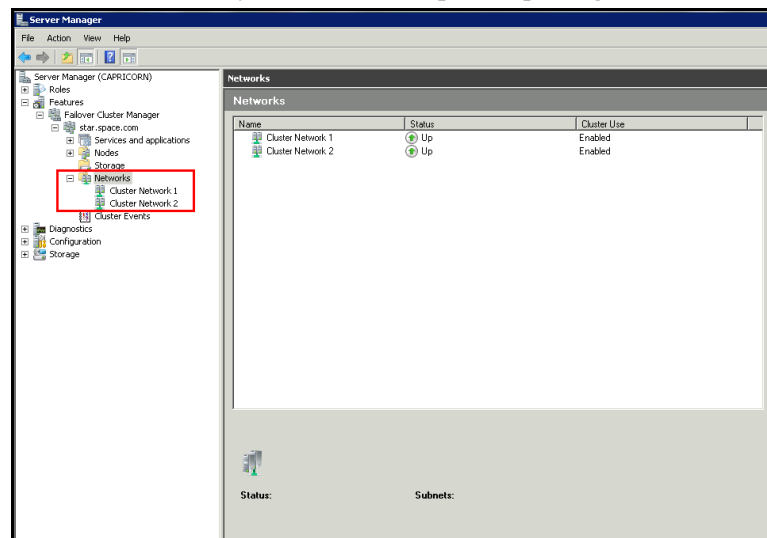
### To disable the plant network for the Cluster Communication

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the Administrative Tools window or the Start menu.

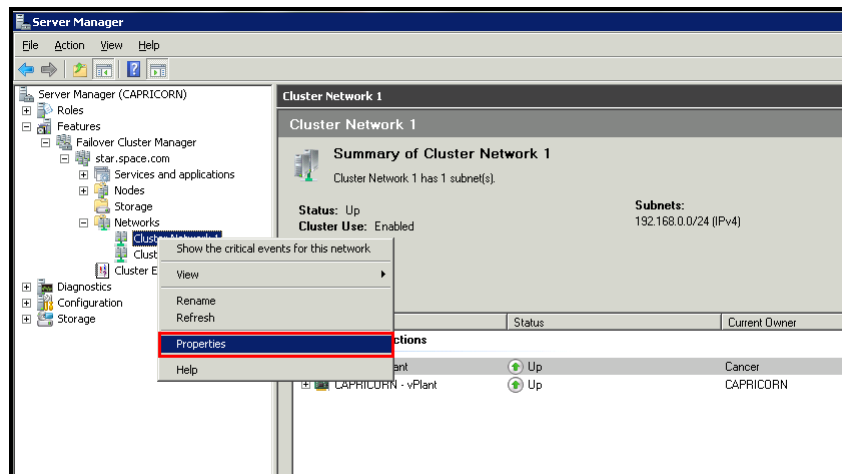


- 2 Expand the **Failover Cluster Manager** and select **Networks** to check how many networks are participating in the cluster.

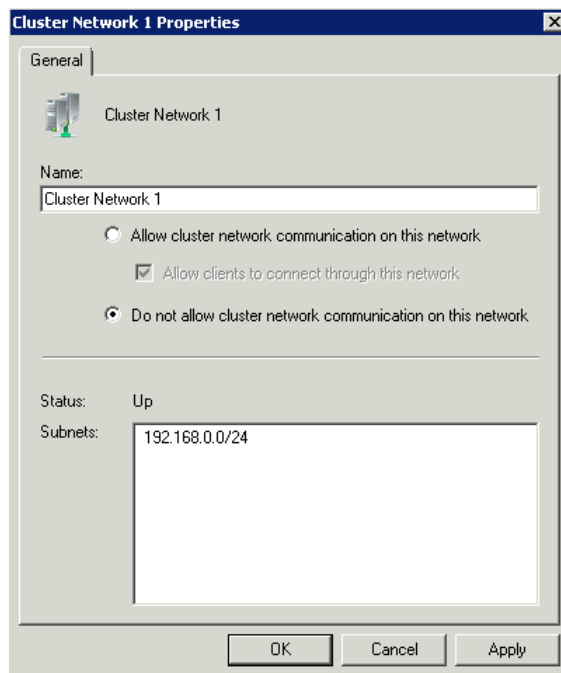




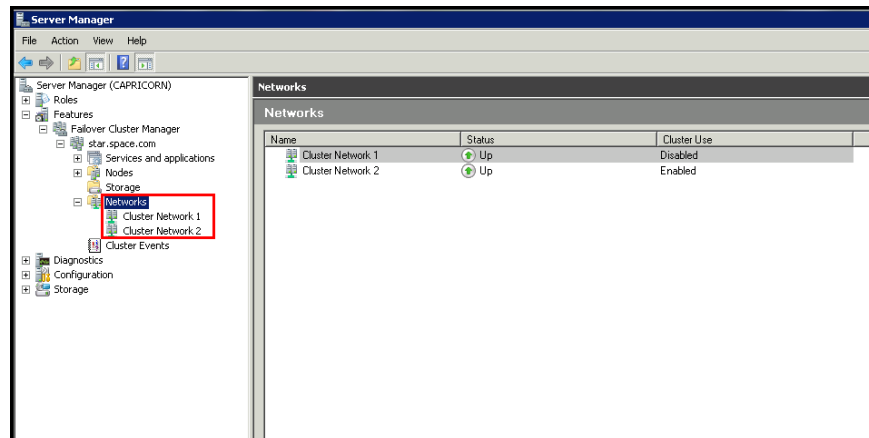
- 3 Select the network that is not required to be part of the Cluster Communication (for example, Private Network ), and right-click and then select **Properties**. The **Cluster Network Properties** dialog box appears.



- 4 Select the **Do not Allow cluster communication on this network** option from the **Properties** dialog box and click **OK** to apply the changes.



- 5 Check the summary pane of the networks and ensure **Cluster Use** is disabled for the network which is not required for cluster communication.



**Note:** Repeat the above process if more than two networks, which are not required for cluster communication, are involved in the Cluster Setup.

## Configuring Cluster Quorum Settings

After both nodes have been added to the cluster, and the cluster networking components have been configured, you must configure the failover cluster quorum.

The File Share to be used for the node and File Share Majority quorum must be created and secured before configuring the failover cluster quorum. If the file share has not been created or correctly secured, the following procedure to configure a cluster quorum will fail. The file share can be hosted on any computer running a Windows operating system.

To configure the cluster quorum, you need to perform the following procedures:

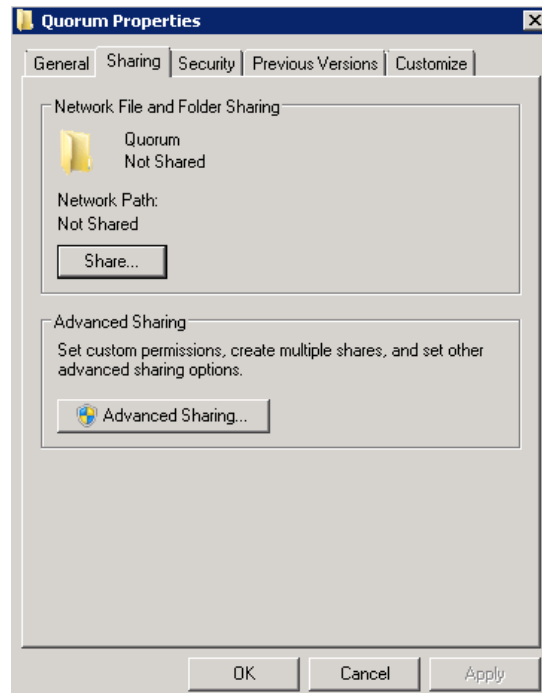
- Create and secure a file share for the node, and file share majority quorum
- Use the failover cluster management tool to configure a node, and file share majority quorum

### To create and secure a file share for the node and file share majority quorum

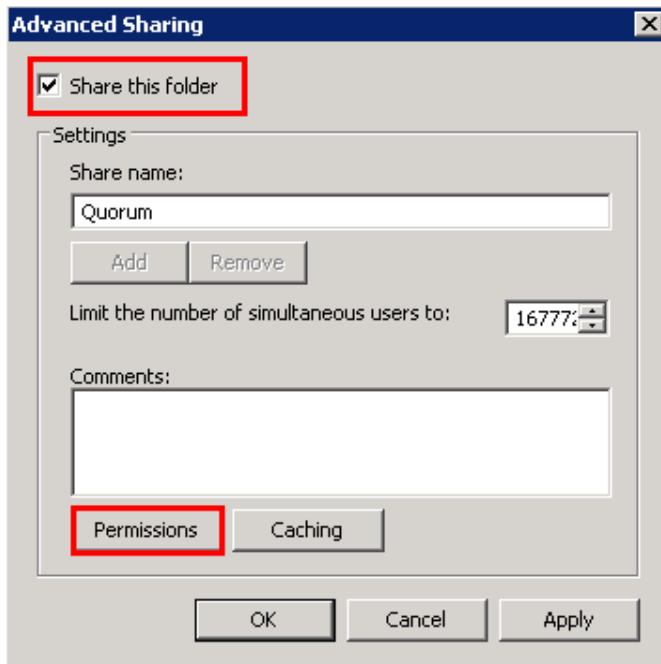
- 1** Create a new folder on the system that will host the share directory.

- 2 Right-click the folder that you created and click **Properties**. The **Quorum Properties** window for the folder that you created appears.

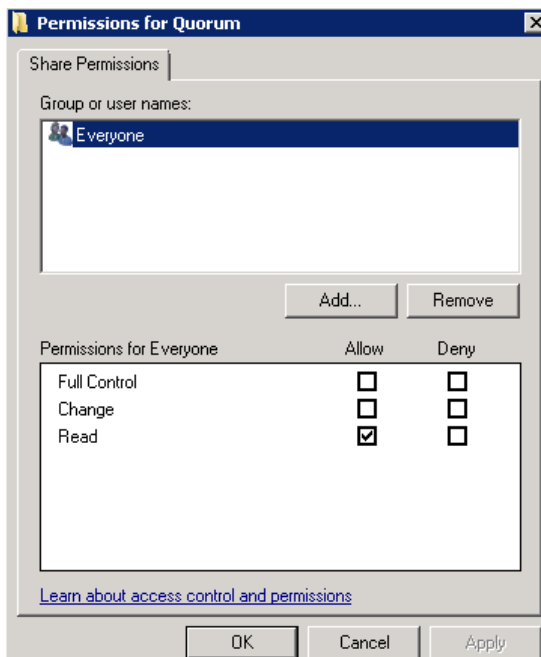
**Note:** In the following procedure, Quorum is the name of the folder.



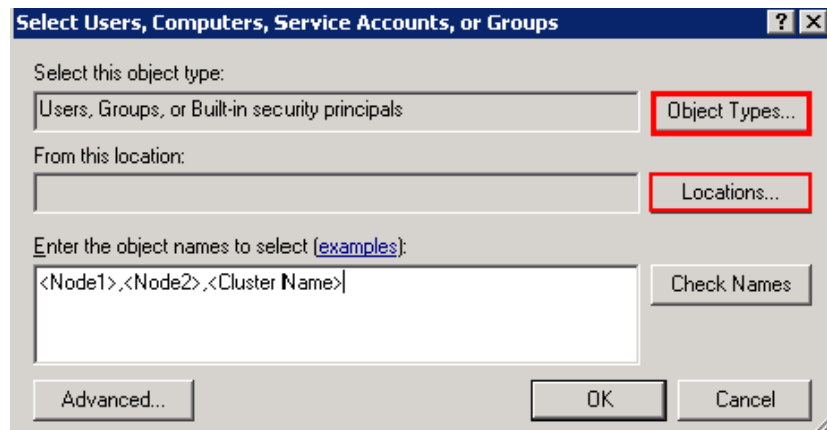
- Click the **Sharing** tab, and then click **Advanced Sharing**. The **Advanced Sharing** window appears.



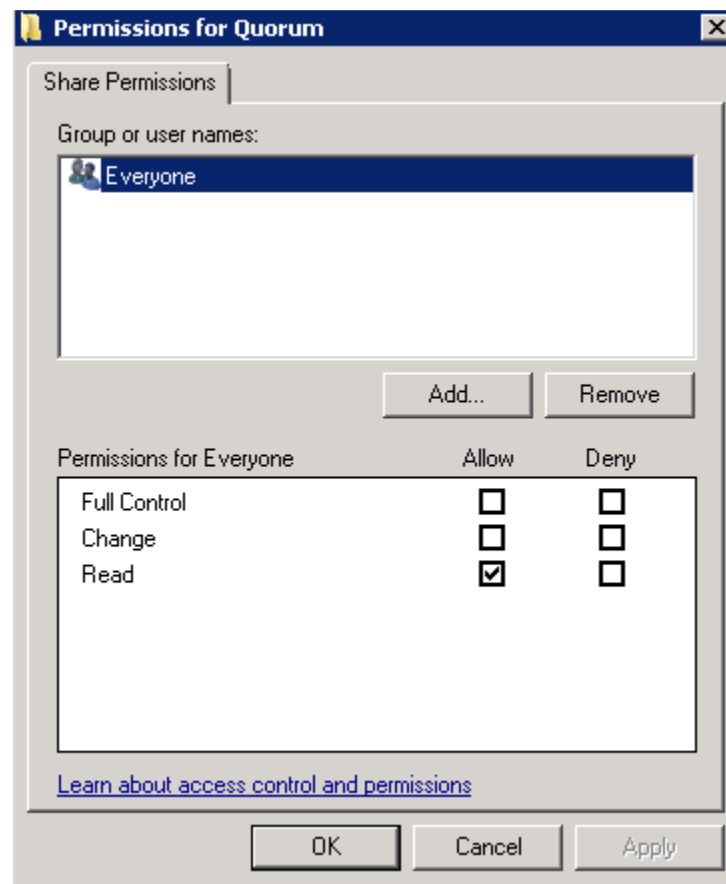
- Select the **Share this folder** check box and click **Permissions**. The **Permissions for Quorum** window appears.



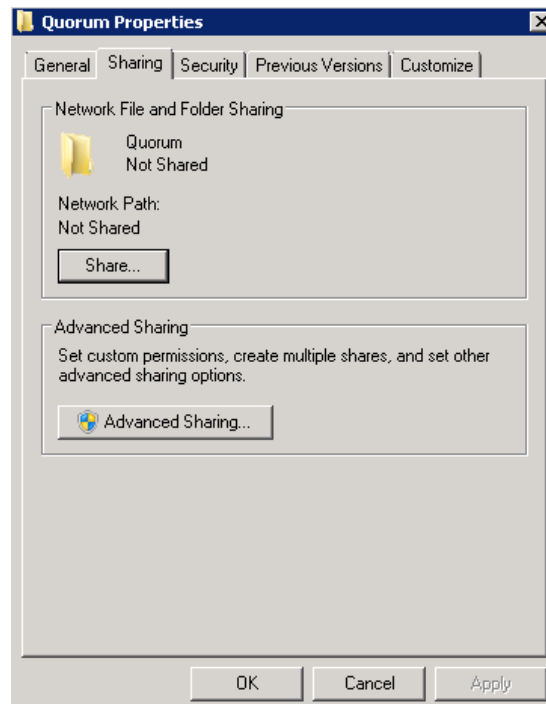
- 5 Click **Add**. The **Select Users, Computers, Service Accounts, or Groups** window appears.



- 6 In the **Enter the object name to select** box, enter the two node names used for the cluster in the small node configuration and click **OK**. The node names are added and the **Permissions for Quorum** window appears.



- 7 Select the **Full Control**, **Change**, and **Read** check boxes and click **OK**. The **Properties** window appears.

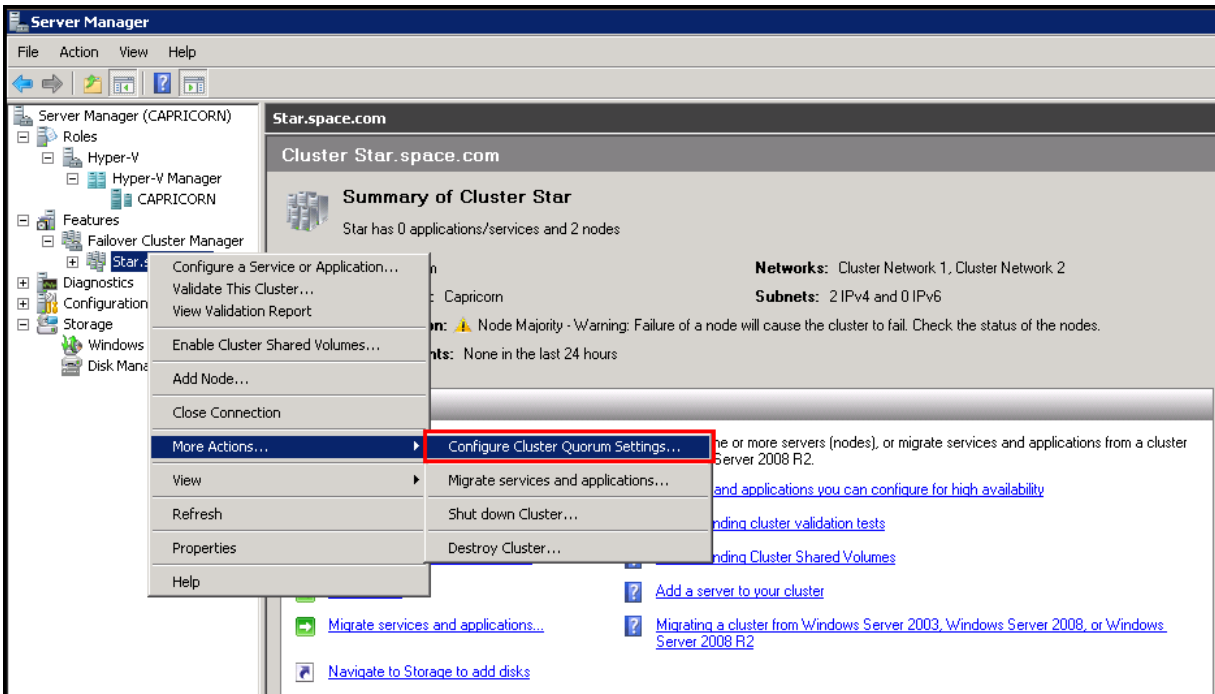


- 8 Click **Ok**. The folder is shared and can be used to create virtual machines.

## To configure a node and file share majority quorum using the failover cluster management tool

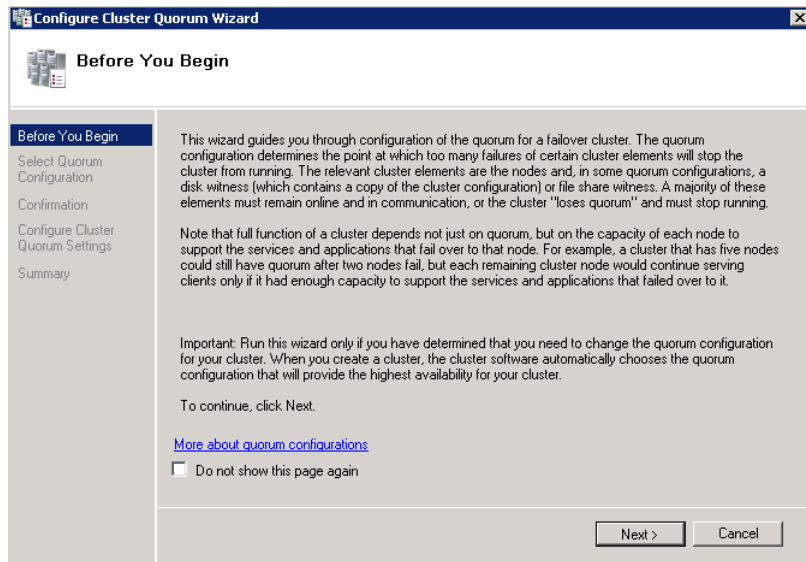
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.



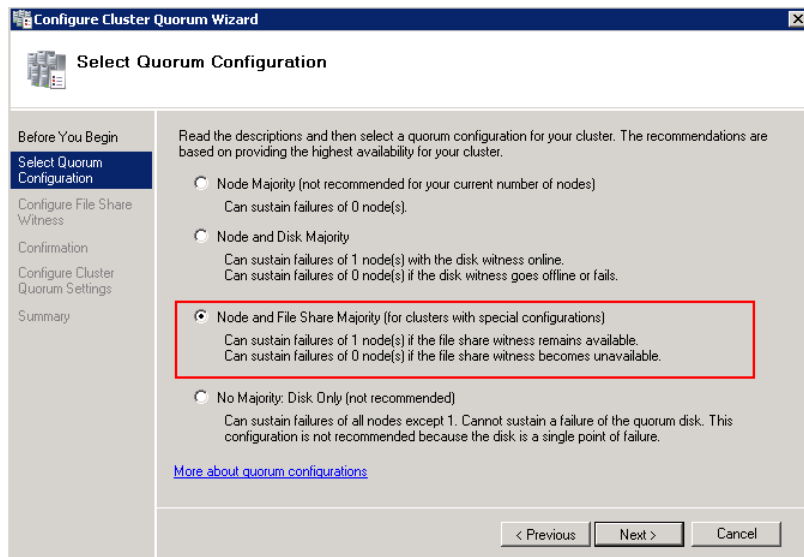


- Right-click the name of the cluster you created and click **More Actions**. Click **Configure Cluster Quorum Settings**. The **Configure Cluster Quorum Wizard** window appears.



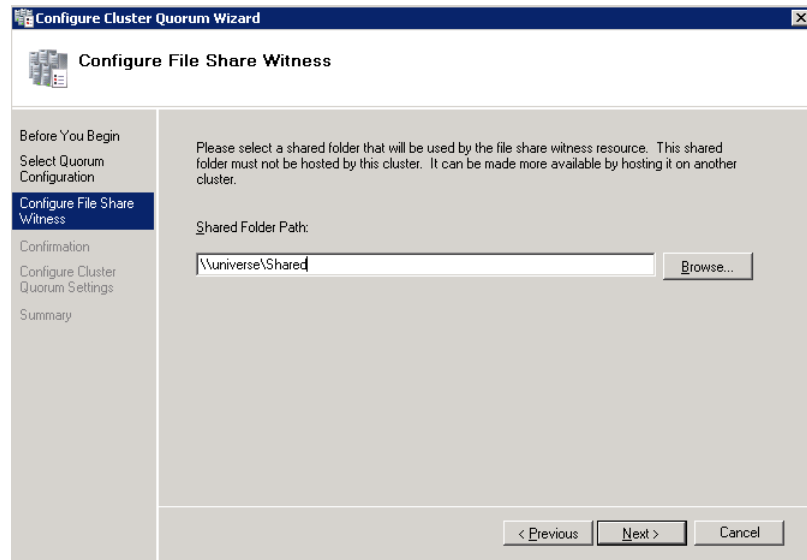
- View the instructions on the wizard and click **Next**. The **Select Quorum Configuration** area appears.

**Note:** The **Before you Begin** screen appears the first time you run the wizard. You can hide this screen on subsequent uses of the wizard.



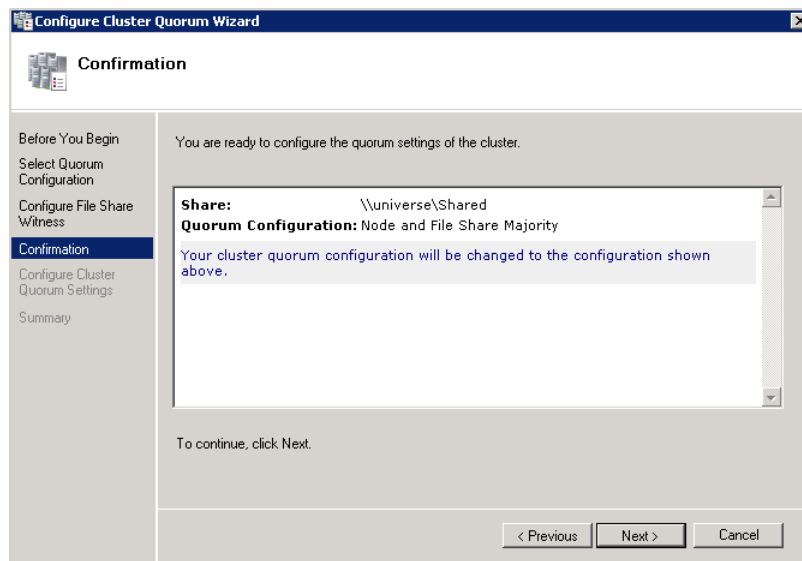
- 4 You need to select the relevant quorum node. For special configuration, click the **Node and File Share Majority** option and click **Next**. The **Configure File Share Witness** area appears.

**Note:** Click the **Node Majority** option if the cluster is configured for node majority or a single quorum resource. Click the **Node and Disk Majority** option if the number of nodes is even and not part of a multisite cluster. Click the **No Majority: Disk Only** option if the disk being used is only for the quorum.

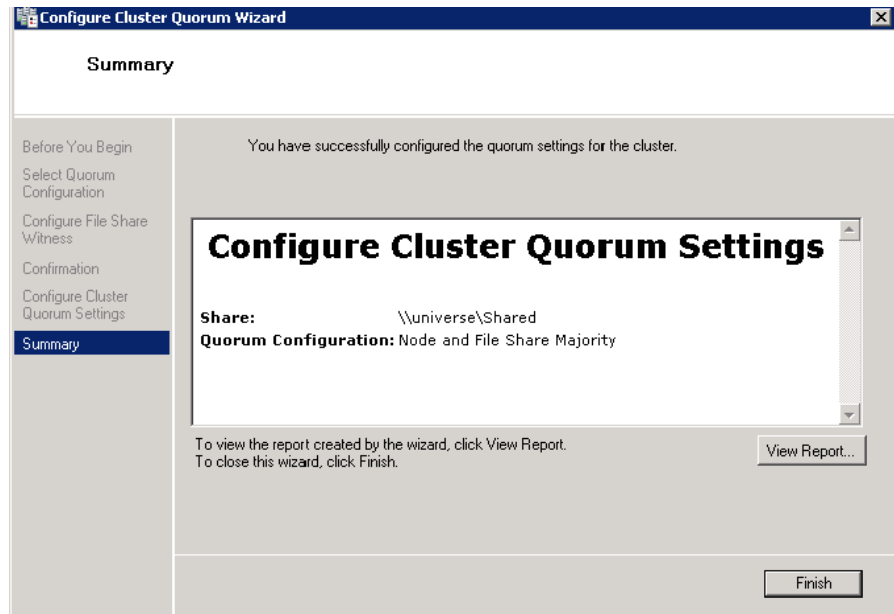


- 5 In the **Shared Folder Path** box, enter the Universal Naming Convention (UNC) path to the file share that you created in the Shared Folder Path field, and then click **Next**. Permissions to the share are verified. If there are no problems with the access to the share, the **Confirmation** screen appears.

**Note:** You can either enter the server name or click **Browse** to select the relevant shared path.



- 6 The details you have selected are displayed. To confirm the details click **Next**. The **Summary** area appears and the configuration details of the quorum settings are displayed.



- 7 Click **View Report** to view a report of the tasks performed, or click **Finish** to close the window.

After you configure the cluster quorum, you must validate the cluster. For more information, refer to [http://technet.microsoft.com/en-us/library/bb676379\(EXCHG.80\).aspx](http://technet.microsoft.com/en-us/library/bb676379(EXCHG.80).aspx).

## Configuring Storage

For a smaller virtualization environment, storage is one of the central barriers to implementing a good virtualization strategy. But with Hyper-V, VM storage is kept on a Windows file system. Users can put VMs on any file system that a Hyper-V server can access. As a result, HA can be built into the virtualization platform and storage for the virtual machines. This configuration can accommodate a host failure by making storage accessible to all Hyper-V hosts so that any host can run VMs from the same path on the shared folder. The back-end part of this storage can be a local or storage area network, iSCSI or whatever is available to fit the implementation.

For this architecture, the Shared Folder is used. The process of how to use the Shared Folder in the Failover Cluster for the High Availability is described in the section "Configuring Virtual Machines" on page 171.

The following table lists the minimum storage recommendations to configure storage for each VM:

<b>System</b>	<b>Processor</b>
Historian and Application Server (GR node) Virtual Machine	80 GB
Application Engine (Runtime node) Virtual Machine	40 GB
InTouch and Information Server Virtual Machine	40 GB

The recommended total storage capacity should be minimum 1TB.

## Configuring Hyper-V

Microsoft Hyper-V Server 2008 R2 helps in creating a virtual environment that improves server utilization. It enhances patching, provisioning, management, support tools, processes, and skills. Microsoft Hyper-V Server 2008 R2 provides live migration, cluster shared volume support, expanded processor, and memory support for host systems.

Hyper-V is available in x64-based versions of Windows Server 2008 R2 operating system, specifically the x64-based versions of Windows Server 2008 R2 Standard, Windows Server 2008 R2 Enterprise, and Windows Server 2008 Datacenter.

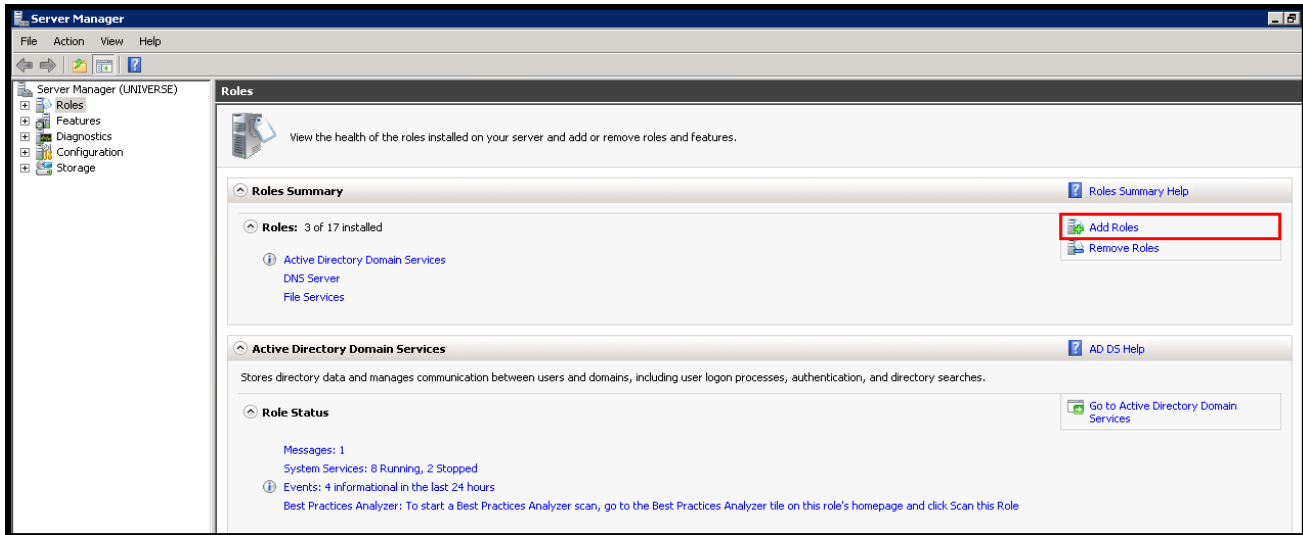
The following are the prerequisites to set up Hyper-V:

- x64-based processor
- Hardware-assisted virtualization
- Hardware Data Execution Prevention (DEP)

## To configure Hyper-V on Windows Server 2008 R2

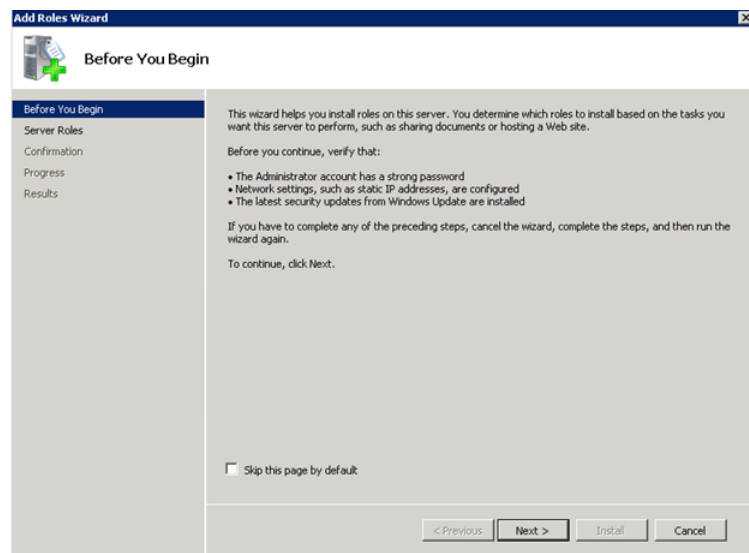
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

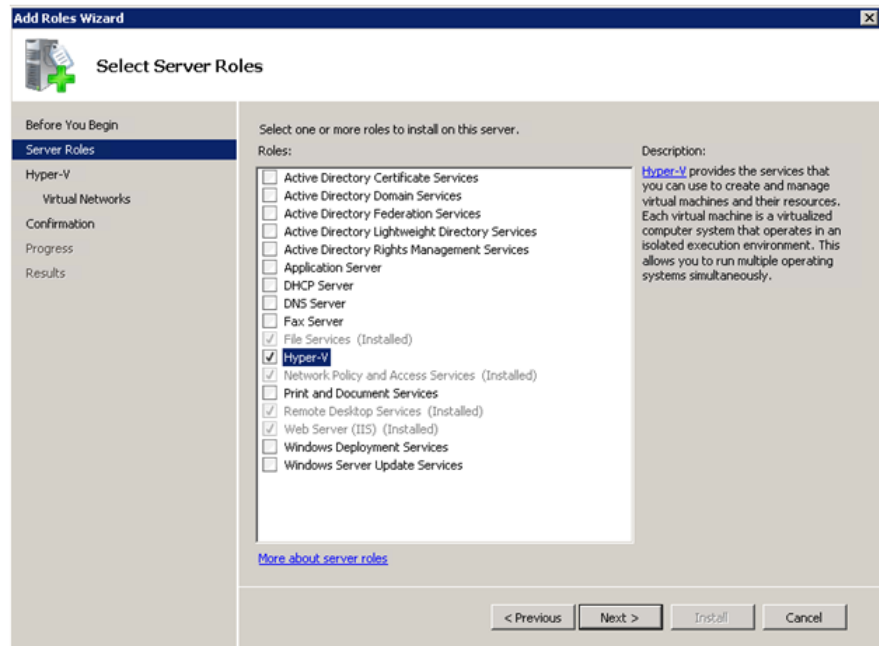


- 2 In the Roles pane, under **Roles Summary** area, click **Add Roles**. The **Add Roles Wizard** window appears.

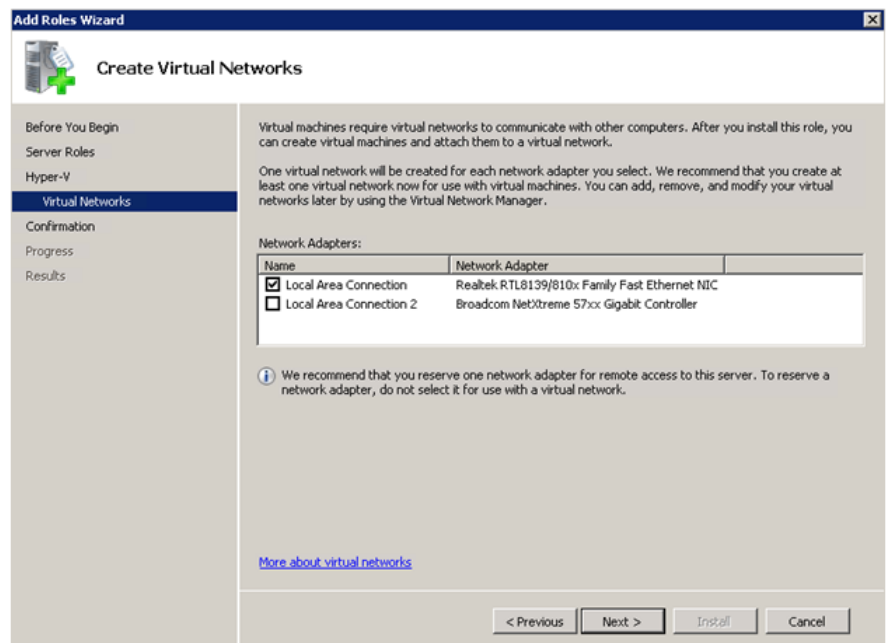
**Note:** You can also right-click **Roles**, and then click **Add Roles Wizard** to open the **Add Roles Wizard** window.



- View the instructions on the wizard and click **Next**. The **Select Server Roles** area appears.

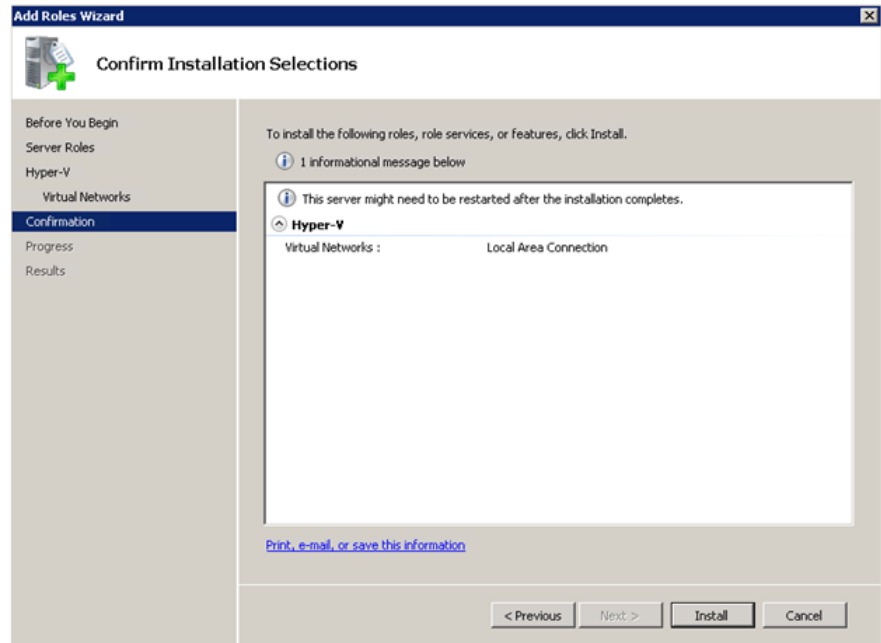


- Select the **Hyper-V** check box and click **Next**. The **Create Virtual Networks** area appears.

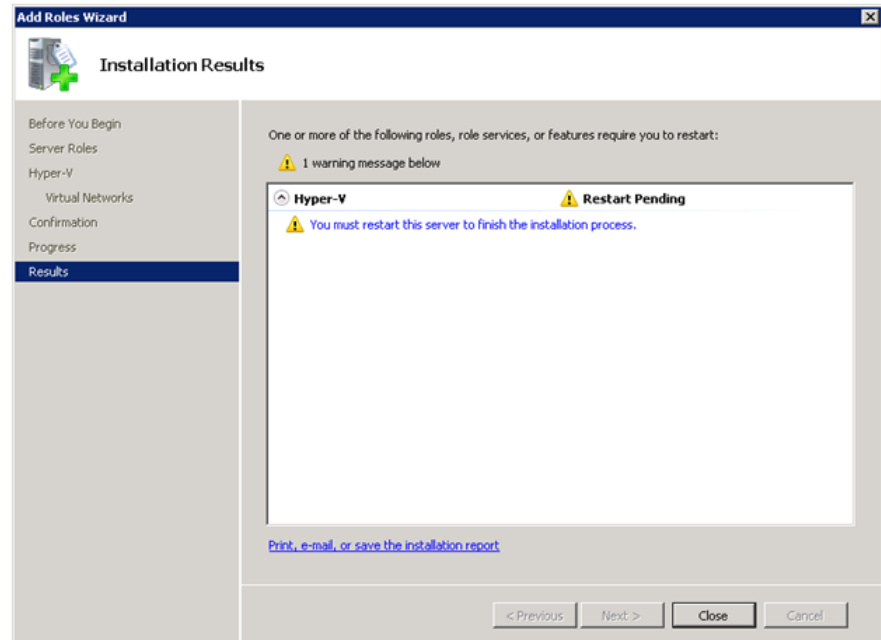


- Select the check box next to the required network adapter to make the connection available to virtual machines. Click **Next**. The **Confirm Installation Selections** area appears.

**Note:** You can select one or more network adapters.

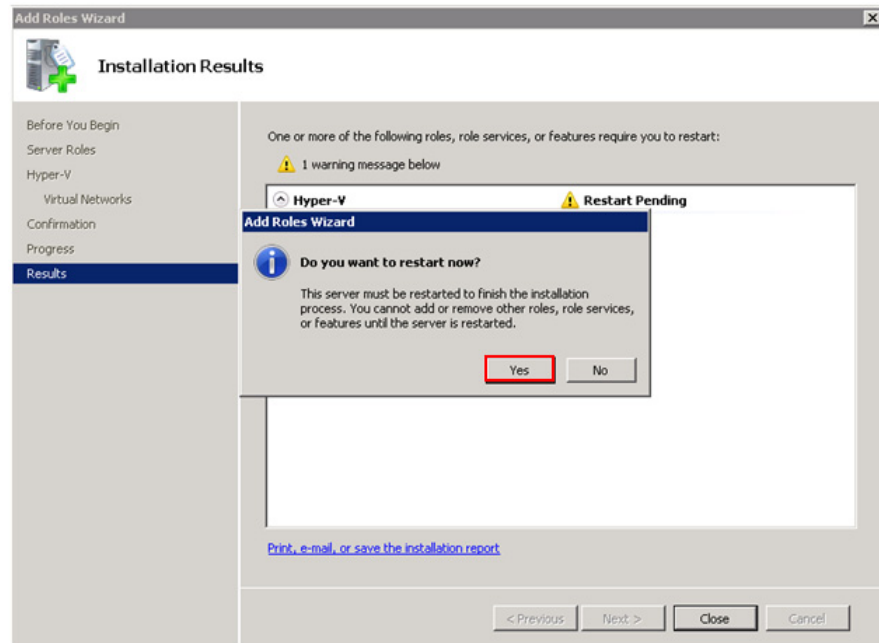


6 Click **Install**. The **Installation Results** area appears.

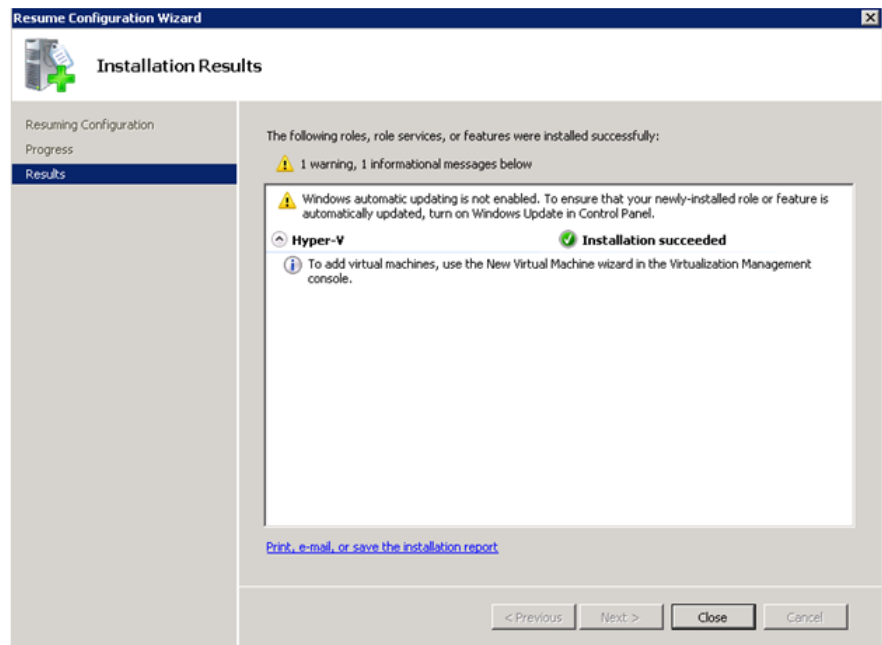




- 7 A message appears prompting you to restart the computer. Click **Close**. The **Add Roles Wizard** pop-up window appears.



- 8 Click **Yes** to restart the computer.
- 9 After you restart the computer, log on with the same ID and password you used to install the Hyper V role. The installation is completed and the **Resume Configuration Wizard** window appears with the installation results.



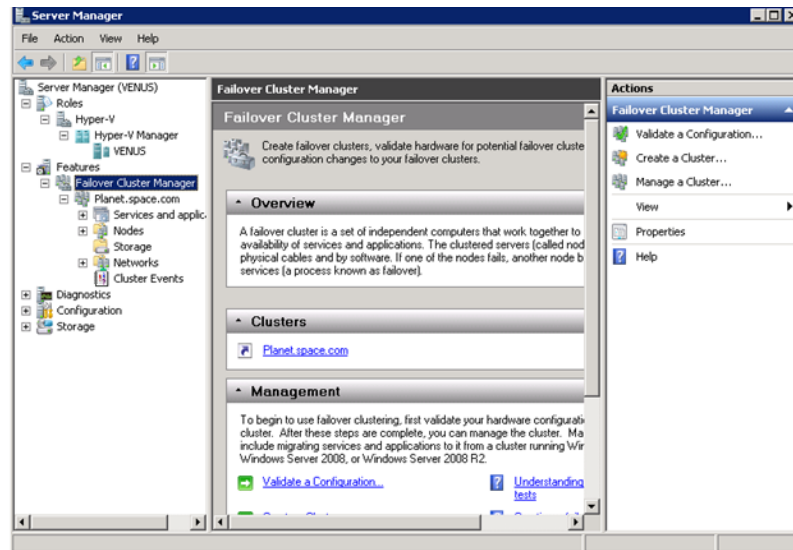
- 10 Click **Close** to close the **Resume Configuration Wizard** window.

## Configuring Virtual Machines

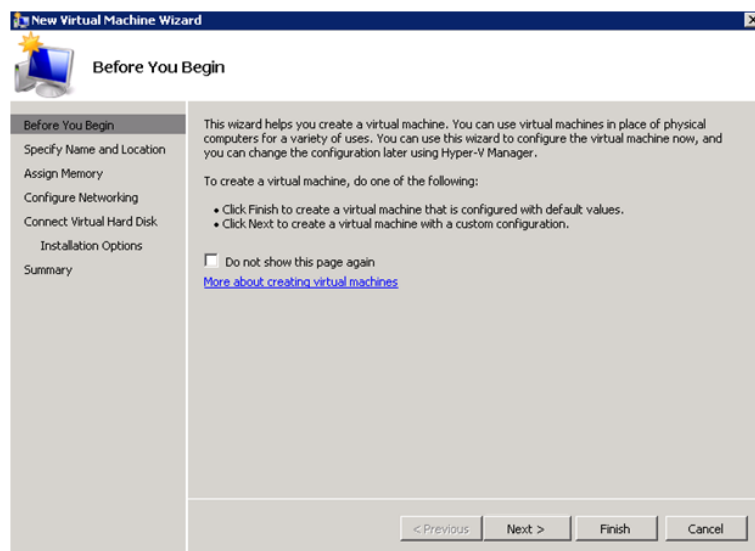
After installing Hyper-V, you need to create a virtual machine.

### To configure a virtual machine

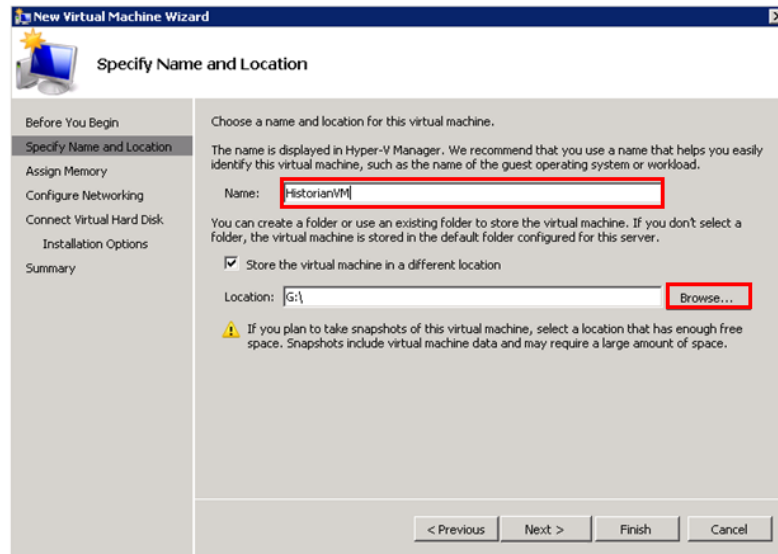
- 1 In the **Server Manager** window, right-click **Features**, and then click **Failover Cluster Manager**. The **Failover Cluster Manager** tree expands.



- 2 Right-click **Services and applications**, click **Virtual Machines**, and then click **New Virtual Machine**. The **New Virtual Machine Wizard** window appears.



- 3 View the instructions in the **Before You Begin** area and click **Next**. The **Specify Name and Location** area appears.

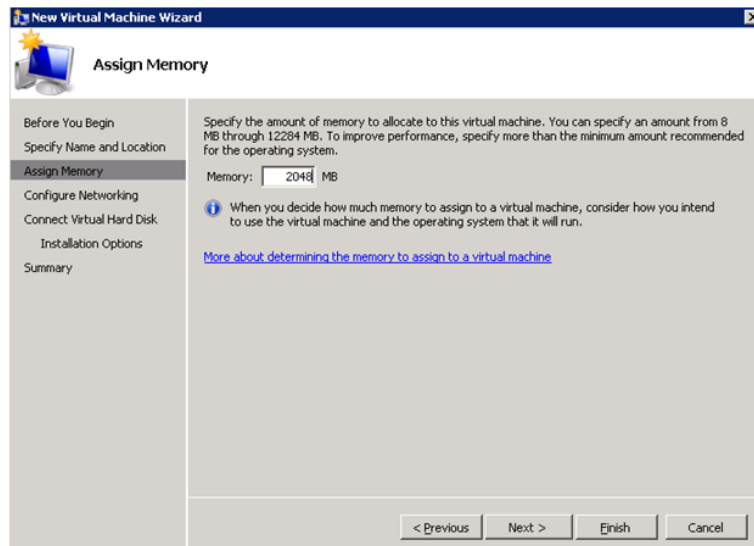


- 4 In the **Specify Name and Location** area, do the following:
  - a In the **Name** box, enter a name for the virtual machine.
  - b Select the **Store the virtual machine in a different location** check box to be able to indicate the location of the virtual machine.

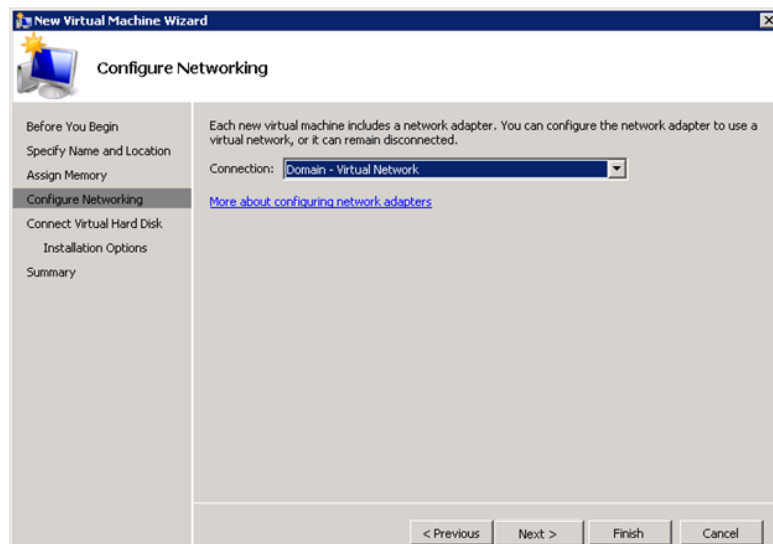
- c In the **Location** box, enter the location where you want to store the virtual machine.

**Note:** You can either enter the path to the filename or click **Browse** to select the relevant server name.

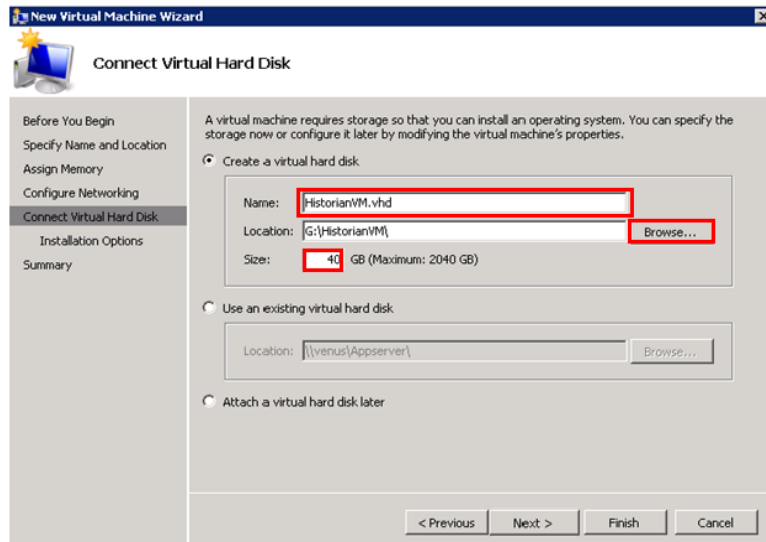
- d Click **Next**. The **Assign Memory** area appears.



- 5 Enter the recommended amount of memory in the **Memory** box and click **Next**. The **Configure Networking** area appears.



- 6 Select the network to be used for the virtual machine and click **Next**. The **Connect Virtual Hard Disk** area appears.

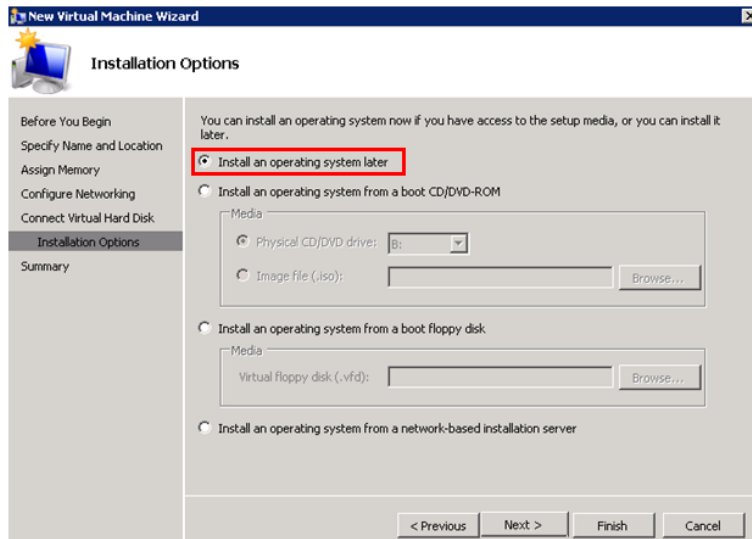


- 7 Click the **Create a virtual hard disk** option and then do the following:
  - a In the **Name** box, enter the name of the virtual machine.
  - b In the **Location** box, enter the location of the virtual machine.

**Note:** You can either enter the location or click **Browse** to select the location of the virtual machine and click Next.

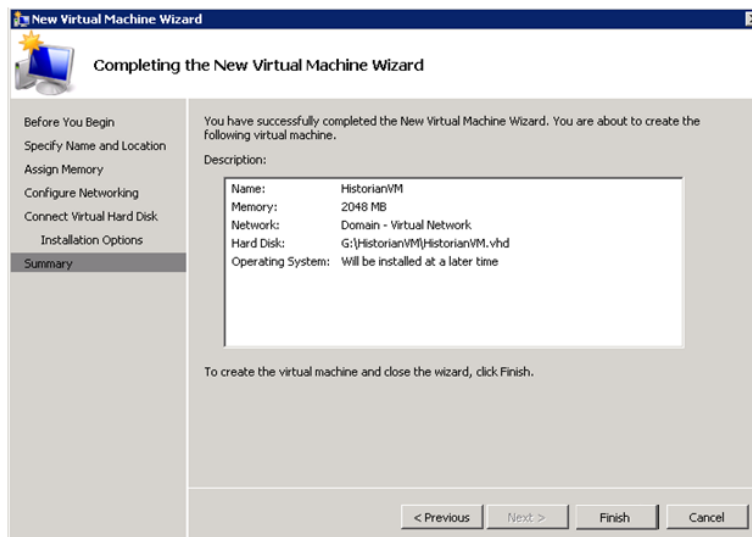
- c In the **Size** box, enter the size of the virtual machine and then click **Next**. The **Installation Options** area appears.

**Note:** You need to click either the **Use an existing virtual hard disk** or the **Attach a virtual hard disk later** option, only if you are using an existing virtual hard disk, or you want to attach a virtual disk later.

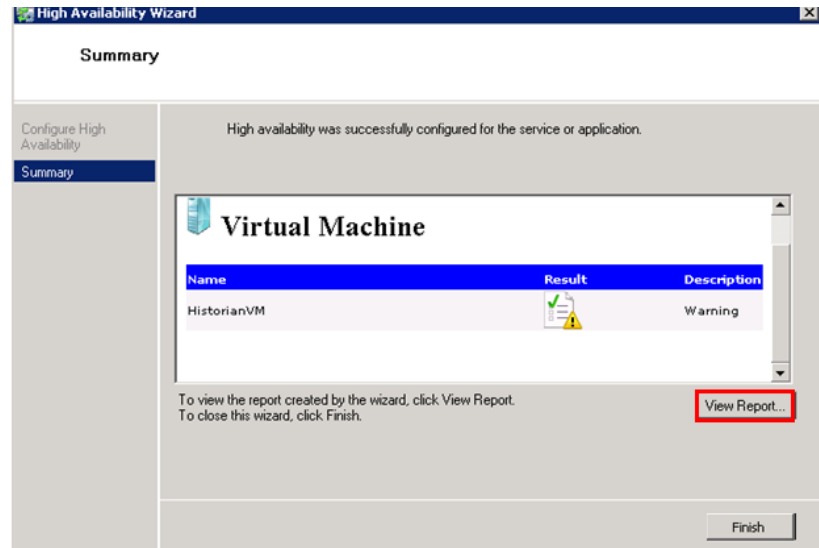


- Click the **Install an operating system later** option and click **Next**. The **Completing the New Virtual Machine Window** area appears.

**Note:** If you want to install an operating system from a boot CD/DVD-ROM or a boot floppy disk or a network-based installation server, click the relevant option.



- 9 Click **Finish**. The virtual machine is created with the details you provided. As we have started this process from the Failover Cluster Manager, after completing the process of creating a virtual machine, the **High Availability Wizard** window appears.



- 10 Click **View Report** to view the report or click **Finish** to close the **High Availability Wizard** window.

**Note:** You can use the above procedure to create multiple virtual machines with appropriate names and configuration.

### **Failover of the Virtual Machine if the Domain/Private Network is disabled**

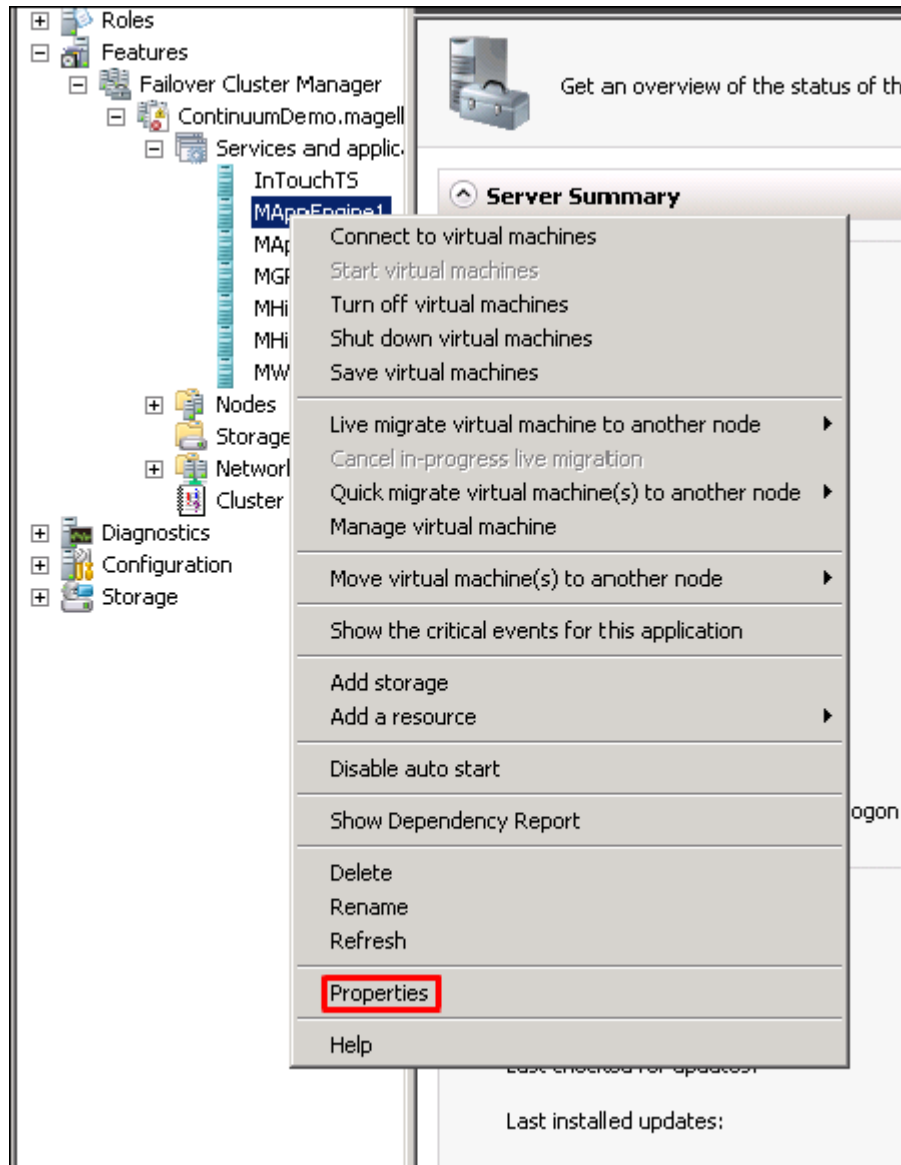
Whenever public network is disconnected on the node where the virtual machines are running, Failover Cluster Manager force failover of all the Virtual Machine Services and application to the other host node in the cluster. If the private network which is not participating in the cluster communication fails, Failover Cluster Manager does not failover any Cluster Service or Application.

To overcome this, we need to add a script which detects the private network failure as a dependency to the Virtual Machine. This results in failover of the Virtual Machine when the script fails.

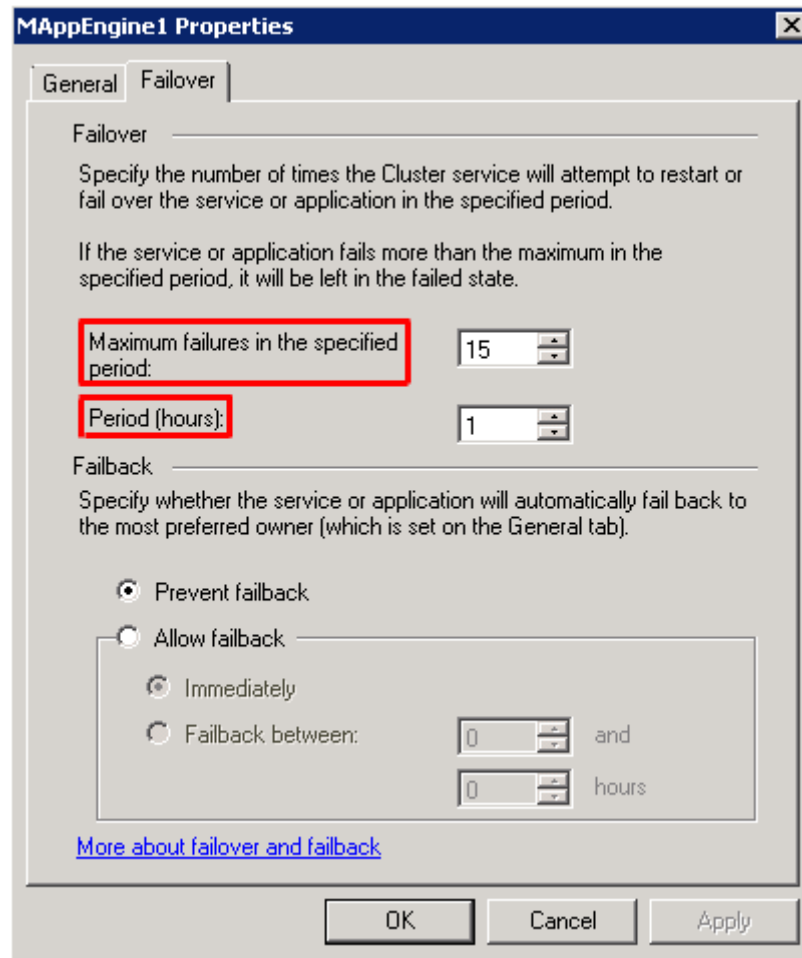


### To add a script which enables the failover of the virtual machine if the private network is disabled

- 1 Add a script to the virtual machine. Follow the process mentioned in the following URL to add the script:  
<http://gallery.technet.microsoft.com/ScriptCenter/5f7b4df3-af02-47bf-b275-154e5edf17e6/>
- 2 After the script is added, select the virtual machine and right-click. Click **Properties**. The **Properties** dialog box appears.



- 3 Navigate to the **Failover** tab and change **Maximum failures in the specified period** to 15 and **Period (hours)** to 1 and Click **OK**.



**Note:** If the Script fails when Domain/Private network is disabled, Virtual machine also fails and moves to the backup node.

## Configuration of System Platform Products in a Typical Small Scale Virtualization

To record the expected Recovery Time Objective (RTO) and Recovery Point Objective (RPO) trends and various observations in a small scale virtualization environment, tests are performed with System Platform Product configuration shown below.

The virtualization host server used for small scale configuration consists of three virtual machines listed below.

Node 1: GR , Historian and DAS SI Direct - Windows 2008 R2 Standard edition (64bit) OS with SQL Server 2008 SP1 32 bit

Node 2 (AppEngine): Bootstrap , IDE and InTouch (Managed App) - Windows 2008 R2 Standard edition (64bit) OS

Node 3: Information Server , Bootstrap and IDE, InTouch Terminal Service and Historian Client - Windows Server 2008 SP2 (32bit) with SQL Server 2008 SP1 and Office 2007

<b>Virtual Node</b>	<b>IO tags (Approx.)</b>	<b>Historized tags (Approx.)</b>
GR	10000	2500
AppEngine	10000	5000

### Historized tags and their Update Rates for this Configuration

The following table shows historized tags and their update rates for this configuration:

#### Real Time data from DAS SI Direct

Topic Name	Update Rate	Device Items	Active Items
Topic 13	1000	480	144
Topic 1	10000	1	1
Topic 2	10000	1880	796
Topic 3	30000	1880	796
Topic 4	60000	1880	796
Topic 5	3600000	1880	796
Topic 7	600000	40	16
Topic 8	10000	1480	596
Topic 9	30000	520	352
Topic 6	1800000	1480	676
Topic 39	1000	4	4
Topic 16	1800000	1000	350

#### Late tags and buffered tags from DAS test Server

Topic Name	Update Rate	Device Items	Active Items
Late Data (1 hour)	1000	246	112
Buffered Data	1000	132	79

### **Application Server Configuration Details**

Total No of Engines: 14

#### **Number of objects under each Engine**

- Engine 1 : 9
- Engine 2 : 13
- Engine 3 : 13
- Engine 4 : 225
- Engine 5 : 118
- Engine 6 : 118
- Engine 7 : 195
- Engine 8 : 225
- Engine 9 : 102
- Engine 10: 2
- Engine 11: 3
- Engine 12: 21
- Engine 13: 1
- Engine 14: 1

The total number of DI objects is 6.

## Expected Recovery Time Objective and Recovery Point Objective

This section provides the indicative Recovery Time Objectives (RTO) and Recovery Point Objective (RPO) for the load of IO and Attributes historized shown above and with the configuration of Host Virtualization Servers and Hyper-V virtual machines explained in the Setup instructions of Small Scale Virtualization. In addition to these factors, the exact RTO and RPO depend on factors like storage I/O performance, CPU utilization, memory usage, and network usage at the time of failover/migration activity.

### RTO and RPO Observations—HA Small Configuration

Scenarios and observations in this section:

Scenario	Observation
Scenario 1: IT provides maintenance on Virtualization Server	"Live Migration" on page 87
	"Quick Migration" on page 88
	"Quick Migration of all nodes simultaneously" on page 89
	"Shut down" on page 90
Scenario 2: Virtualization Server hardware fails	"Scenario 2: Virtualization Server hardware fails" on page 92
Scenario 3: Network fails on Virtualization Server	"Failover due to network disconnect (private)" on page 96
Scenario 4: Virtualization Server becomes unresponsive	"Scenario 4: Virtualization Server becomes unresponsive" on page 97

The following tables display RTO and RPO observations with approximately 20000 IO points with approximately 7500 attributes being historized:

### Scenario 1: IT provides maintenance on Virtualization Server

#### Live Migration

Primary Node	Products	RTO	RPO	
			Tags	Data Loss Duration
GR	IAS	2 sec	IAS tag (Script)	8 sec
			IAS IO Tag (DASSiDirect)	13 sec
	Historian	2 sec	Historian Local tag	0 sec
			InTouch Tag \$Second	4 sec
			IAS IO Tag (DASSiDirect)	20 sec
			IAS tag (Script)	0 sec
	DAS	5 sec	N/A	N/A

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>WIS Node</b>	InTouch	5 sec		5 sec
	WIS	5 sec	N/A	N/A
	Historian Client	5 sec	N/A	N/A
<b>AppEngine</b>	AppEngine	1 sec	IAS IO tag (DASSiDirect)	3 sec
			IAS tag (Script)	6 sec

### Quick Migration

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>GR</b>	IAS	134 sec	IAS Tag (Script)	183 sec
			IAS IO Tag (DASSiDirect)	184 sec
	Historian	145 sec	Historian Local tag	148 sec
			InTouch tag \$Second	152 sec
			IAS IO Tag (DASSiDirect)	165 sec
			IAS tag (Script)	0 sec
	DAS	146 sec	N/A	N/A



Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>WIS Node</b>	InTouch	79 sec		89 sec
	WIS	79 sec	N/A	N/A
	Historian Client	79 sec	N/A	N/A
<b>AppEngine</b>	AppEngine	59 sec	IAS IO tag (DASSiDirect)	105 sec
			IAS Tag (Script)	104 sec

### Quick Migration of all nodes simultaneously

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>GR</b>	IAS	188 sec	IAS tag (Script)	222 sec
			IAS IO tag (DASSiDirect)	227 sec
	Historian	220 sec	Historian Local tag	221 sec
			InTouch tag \$Second	228 sec
			IAS IO tag (DASSiDirect)	238 sec
			IAS tag (Script)	135 sec
	DAS	221 sec	N/A	

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>WIS Node</b>	InTouch	183 sec		228 sec
	WIS	183 sec	N/A	N/A
	Historian Client	183 sec	N/A	N/A
<b>AppEngine</b>	AppEngine	100 sec	IAS IO tag (DASSiDirect)	238 sec
			IAS tag (Script)	135 sec

### Shut down

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>GR</b>	IAS	160 sec	IAS tag (Script)	3 min 36 sec
			IAS IO tag (DASSiDirect)	3 min 43 sec
	Historian	211 sec	Historian Local tag	3 min 25 sec
			InTouch tag \$Second	3 min 32 sec
			IAS IO tag (DASSiDirect)	3 min 50 sec
			IAS tag (Script)	2 min 46 sec
	DAS	212 sec	N/A	N/A

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>WIS Node</b>	InTouch	202 sec		212 sec
	WIS	202 sec	N/A	N/A
	Historian Client	202 sec	N/A	N/A
<b>AppEngine</b>	AppEngine	114 sec	IAS IO tag (DASSiDirect)	3 min 50 sec
			IAS tag (Script)	2 min 46 sec

**Scenario 2: Virtualization Server hardware fails**

The failover occurs due to hardware failure, and it is simulated with power-off on the host server.

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
GR	IAS	497 sec	IAS Tag (Script)	9min
			IAS IO tag (DASSiDirect)	9 min
	Historian	532 sec	Historian local tag	9 min 23 sec
			InTouch tag \$Second	10 min + time taken to start viewer
			<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
			IAS IO tag (DASSiDirect)	8 min 23 sec
			IAS tag (Script)	7 min 1 sec

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
	DAS	269 sec	N/A	N/A
<b>WIS Node</b>	InTouch	601 sec + time taken by the user to start the InTouchView		611 sec
			<p><b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.</p>	
	WIS	601 sec + time taken by the user to start the Information Server	N/A	N/A
	Historian Client	601 sec+ time taken by the user to start the Hist Client	N/A	N/A
<b>AppEngine</b>	AppEngine	366 sec	IAS IO Tag (DASSiDirect)	8 min 23 sec
			IAS tag (Script)	7 min 1 sec

**Scenario 3: Network fails on Virtualization Server**

The failover occurs due to network disconnect (public). In this case, the VMs restart, after moving to the other host server.

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
GR	IAS	535 sec	IAS Tag (Script)	9 min 8 sec
			IAS IO Tag (DASSiDirect)	8 min 53 sec
	Historian	544 sec	Historian Local Tag	9 min 35 sec
			InTouch Tag \$Second	9 min 16 sec
			<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
			IAS IO Tag (DASSiDirect)	8 min 57 sec
			IAS Tag (Script)	7 min 52 sec
	DAS	457sec	N/A	N/A
WIS Node	InTouch	415 sec + time taken by the user to start the InTouchView	N/A	556 sec + Time taken to run viewer)
			<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
	WIS	415 sec + time taken by the user to start the Information Server	N/A	N/A
	Historian Client	415 sec + time taken by the user to start the Hist Client	N/A	N/A
<b>AppEngine</b>	AppEngine	463 sec	N/A	8 min 57 sec
			N/A	7 min 52 sec

**Failover due to network disconnect (private)**

In this case, the private network disconnects on GR, VM will be moved to the other host server.

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
GR	IAS	118 sec	IAS Tag (Script)	132 sec
			IAS IO Tag (DASSiDirect)	140 sec
	Historian	128 sec	Historian Local Tag	132 sec
			InTouch Tag \$Second	147 sec
			<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
			IAS IO Tag (DASSiDirect)	145 sec
			IAS Tag (Script)	0 (Sfed)
DAS	134 sec			
<b>WIS Node</b>	InTouch	N/A	N/A	
	WIS	N/A	N/A	
	Historian Client	N/A	N/A	N/A



Primary node	Products	RTO (sec)	RPO	
			Tags	Data Loss Duration
<b>AppEngine</b>	AppEngine	N/A	IAS IO Tag (DASSiDirect)	
			IAS Tag (Script)	

#### Scenario 4: Virtualization Server becomes unresponsive

There is no failover of VMs to the other host server when the CPU utilization on the host server is 100%.

Primary node	Products	RTO (sec)	RPO	
			Tags	Data Loss Duration
<b>GR</b>	IAS	N/A		N/A
	Historian	N/A		N/A
<b>WIS Node</b>	InTouch	N/A		N/A
	WIS	N/A		N/A
	Historian Client	N/A	N/A	N/A

<b>Primary node</b>	<b>Products</b>	<b>RTO (sec)</b>	<b>RPO</b>	
			<b>Tags</b>	<b>Data Loss Duration</b>
<b>AppEngine</b>	AppEngine	N/A	N/A	
	InTouch	N/A		N/A
<b>WIS Node</b>	InTouch	N/A		N/A

## Snapshots of Data Trends and Observations

Scenarios and observations in this section:

Scenario	Observation
Scenario 1: IT provides maintenance on Virtualization Server	"Live Migration of GR, Historian" on page 99
	"Live Migration of AppEngine" on page 102
	"Live Migration of WIS, InTouch, HistorianClient" on page 104
	"Quick Migration of GR, Historian" on page 106
	"Quick Migration of all nodes" on page 114
Scenario 2: Virtualization Server hardware fails	"Shut down of Source Host Virtualization Server" on page 118
	"Failover Due to Hardware Failure" on page 121
Scenario 3: Network fails on Virtualization Server	"Failover Due to Network Disconnect (Public)" on page 124
Scenario 4: Virtualization Server becomes unresponsive	"Hyper-V Virtual Machines with Static RAM and Reservations for Processors" on page 127

### Scenario 1: IT provides Maintenance on Virtualization Server

#### Live Migration of GR, Historian

##### Trend

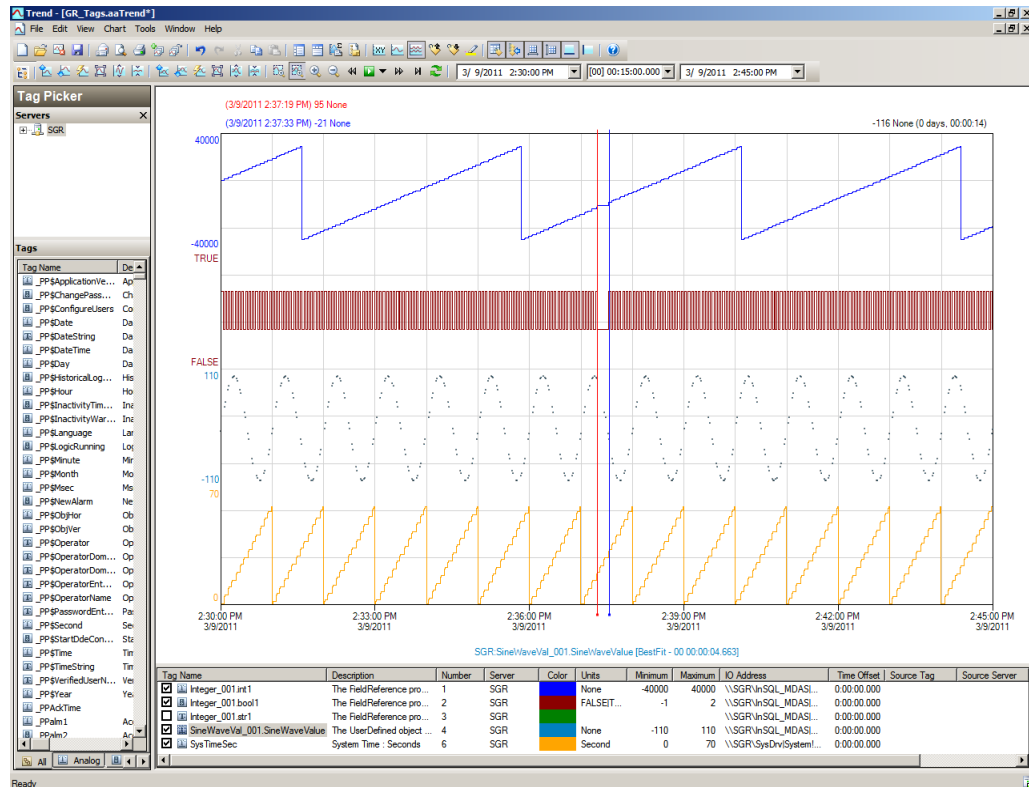
In the Historian Trend below, the GR node tags are:

Tag1: SystemTimeSec tag of Historian

Tag2: I/O Tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O Tag (Integer\_001.bool1) getting data from DESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue) of GR node.



In the Historian Trend below the, the AppEngine node tags are:

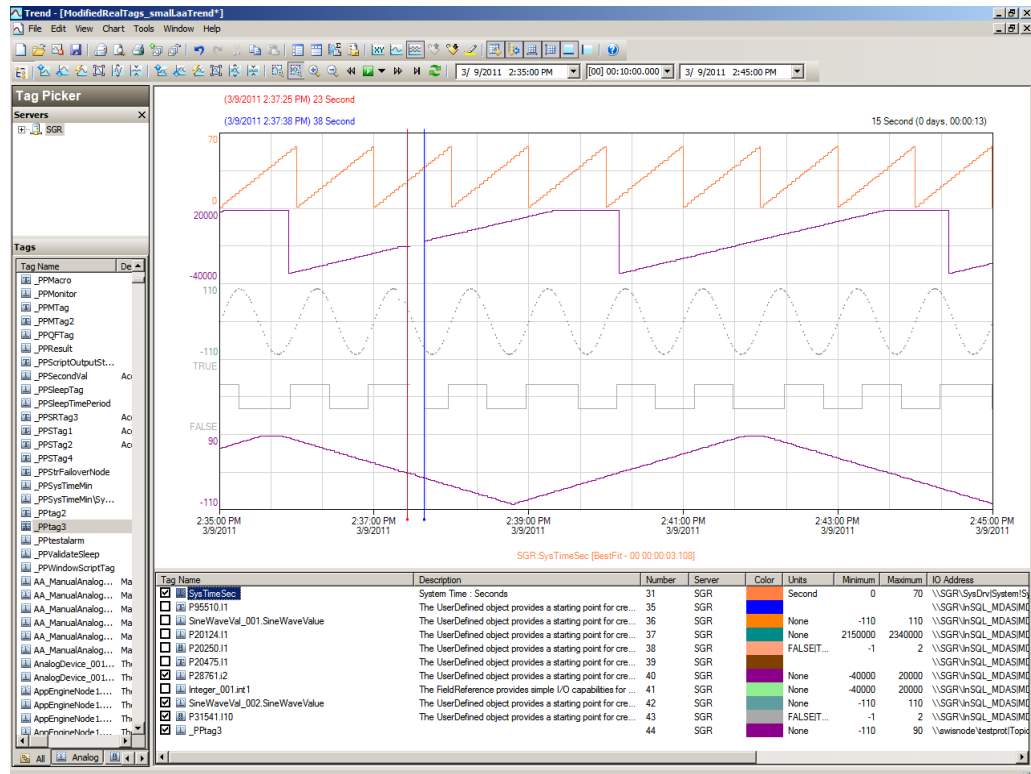
Tag1: SystemTimeSec tag of Historian local tag

Tag2: I/O Tag (P31541.I10) getting data from DASSI of GR node

Tag3: InTouch Tag (\_PP\$Second) from WIS node historizing to GR node

Tag4: Script Tag (Sinewaveval\_002.SineWaveValue) of AppEngine node

The IAS tag (script) does not have any data loss as the data is stored in the SF folder in the AppEngine node. This data is later forwarded after Live Migration.



## Observations

GR is Platform1 in the Galaxy deployed. During Live Migration of the GR, it is obvious that there will be an instance during Live Migration when the following occurs:

- GR, Historian will not be able to connect to the other deployed nodes (Platforms 2, 3, and 4).
- Other nodes will not be able to connect to GR (Platform1)
- Some data sent from GR will be discarded till the TimeSync utility is executed and system time of GR is synchronized.
- AppEngine node is in the Store Forward mode.
- Historian Client trend will not be able to connect to Historian, so the warning message is expected.
- Historian machine's time is not synchronized during Live Migration of Historian, so the "Attempt to store values in the future" message is expected.

After Live Migration, Historian's time needs to be synchronized. Therefore the server shifting warning message is expected.

After the Live Migration of GR, Historian node, the stored data is forwarded from the AppEngine node. As a result, you see the following warnings on each of the VM nodes.

### GR node

```
368064482/7/20117:39:13 PM23962556WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
368064492/7/20117:39:13 PM23962556WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
368064502/7/20117:39:13 PM23962556WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
368064532/7/20117:39:24 PM15442248WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (02/07/11,19:39:23,070, 02/07/11,19:39:09,503) [SGR;
  Config.cpp; 2040]
```

### AppEngine node

```
220263132/7/20117:39:08 PM25642580WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
220264202/7/20117:39:19 PM27203000WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
220264462/7/20117:39:50 PM27203000WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.
```

### WIS node

```
17174702/7/20117:39:07 PM37683684WarningNmxSvcPlatform 1 exceed
  maximum heartbeats timeout of 8000 ms
```

## Live Migration of AppEngine

### Trends:

In the Historian Trend shown below, the first three tags receive data from DDESuiteLinkClient in Industrial Application Server (IAS) from the PLC and are historized from Platform AppEngine. There is a data loss for 27 seconds.

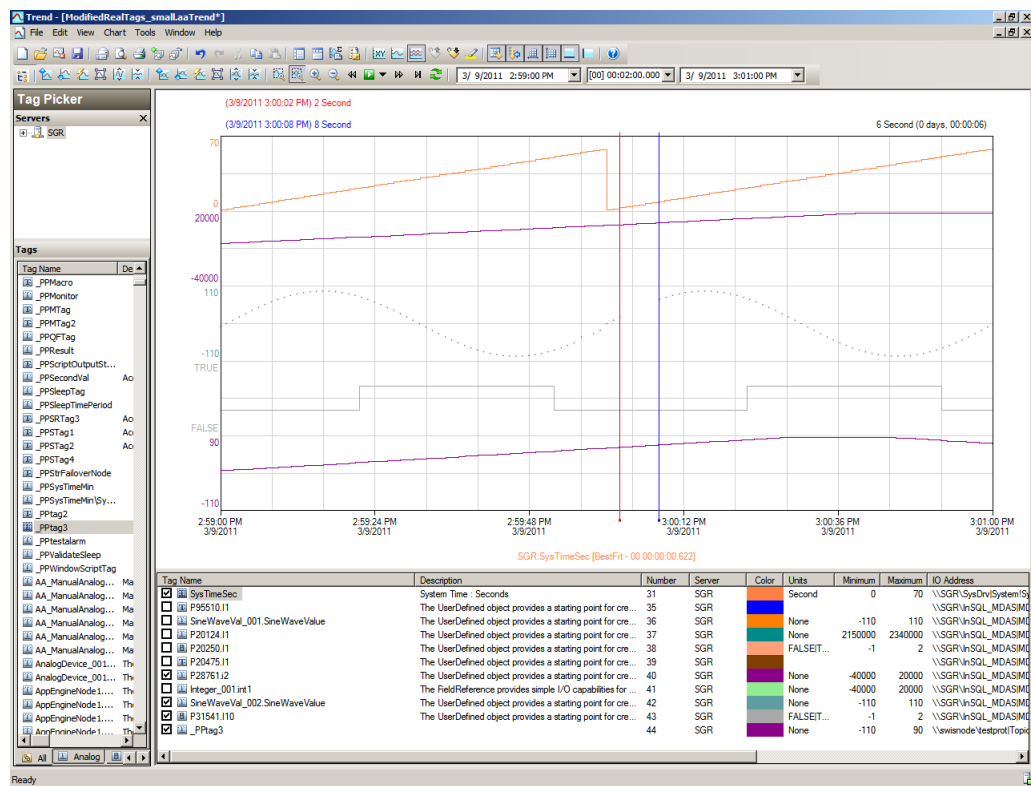
In the Historian Trend below, the AppEngine node tags are:

Tag1: SystemTimeSec tag of Historian local tag

Tag2: I/O Tag (P31541.I10) getting data from DASSI of GR node

Tag3: Script Tag (Sinewaveval\_002.SineWaveValue)

The RPO value is captured in the RPO table of Live Migration of the AppEngine node. For AppEngine node Script tag and Intouch tag there is no data loss.



## Observations

AppEngine is Platform2 in the Galaxy deployed. During Live Migration of the AppEngine, it is obvious that there will be an instance during Live Migration when the following occurs:

- AppEngine will not be able to connect to the other deployed nodes (Platforms 1, 3, and 4).
- Other nodes will not be able to connect to AppEngine (Platform2)
- Some data sent from AppEngine will be discarded till the TimeSync utility is executed and system time of AppEngine is synchronized. So Historian is bound to discard data from the AppEngine node.

As a result, you see the following warnings on each of the VM nodes.

### GR node

```
368058502/7/20115:19:02 PM23962556WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
```

### AppEngine

```
220261792/7/20115:19:05 PM25642580WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
220261802/7/20115:19:05 PM25642580WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
```

220261812/7/20115:19:05 PM25642580WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.

### WIS node

17134351/27/20117:52:59 PM40642196WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

## Live Migration of WIS, InTouch, HistorianClient

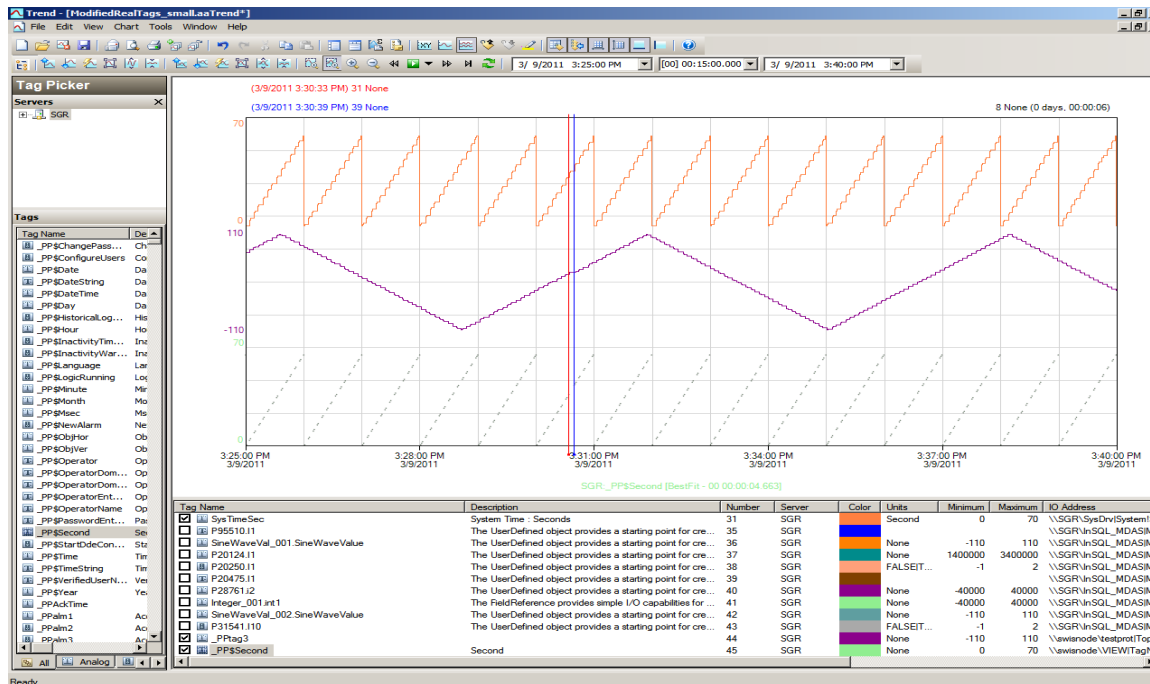
### Trends:

In the Historian Trend below, the last tag \$Second receives data from InTouch and is historized.

Tag1: SystemTimeSec tag of Historian local tag

Tag2\_PP\$Second Intouch tag

Tag3:\_P\$tag3 InTouch tag



### Observations

WIS node is Platform4 in the Galaxy deployed. During Live Migration of the WIS node, it is obvious that there will be an instance during Live Migration when the following occurs:

- Other nodes will not be able to connect to WIS (Platform4)
- Historian Client trend will not be able to connect to Historian, so warning is expected.



- Historian machine's time is not synchronized during Live Migration of WIS node, so the "Attempt to store values in the future" message is expected.

As a result, you see the following warnings on each of the VM nodes.

**GR node**

None

**AppEngine node**

```
220255672/7/20113:07:40 PM25082696WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.
```

```
220255682/7/20113:10:24 PM25082696WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
```

```
220255692/7/20113:11:42 PM25082696WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.
```

**WIS node**

None

## Quick Migration of GR, Historian

### Trends:

GR node hosts the DDESuiteLinkObjects. Therefore, during quick migration of the GR node, there is data loss for tags that receive data from DAS Server/PLC.

In the Historian Trend below, the GR node tags are:

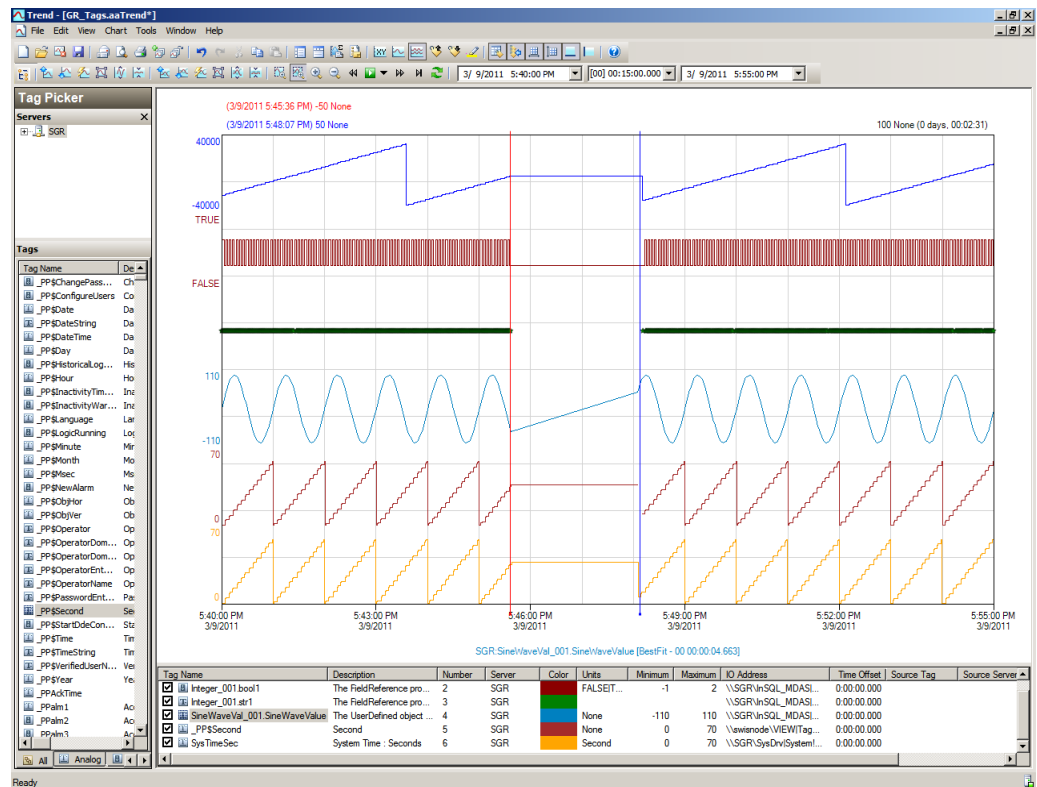
Tag1: SystemTimeSec tag of Historian.

Tag2: I/O Tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O Tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue)

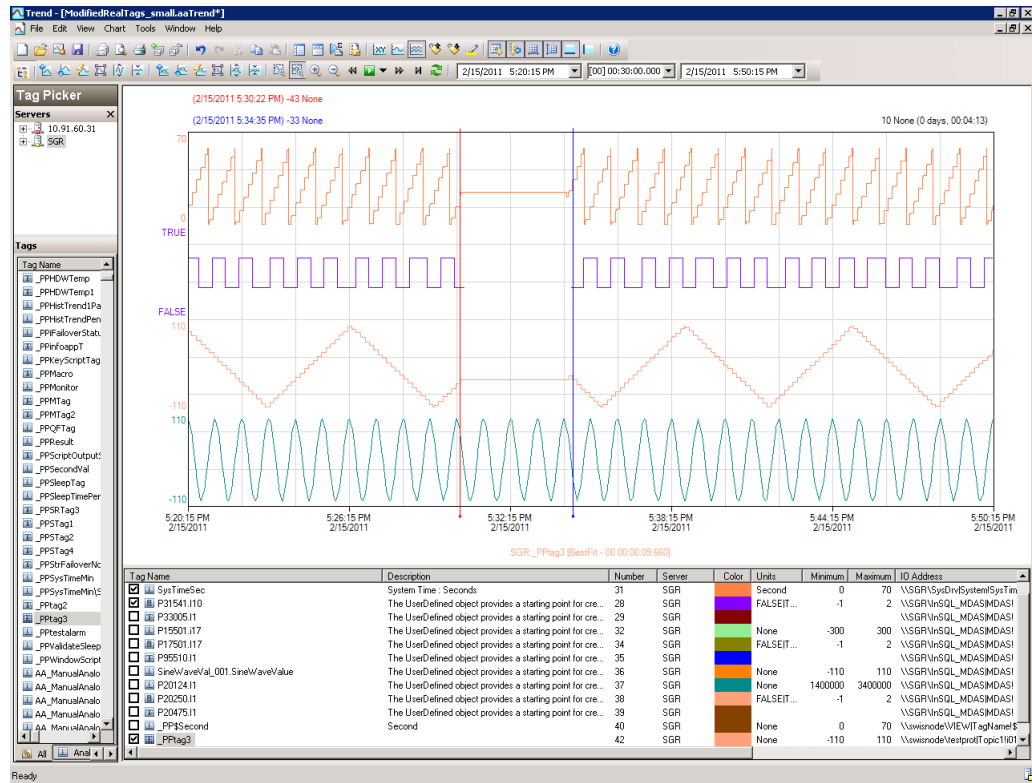
These are captured in the RPO table for Quick Migration of the GR node.



In the following Historian Trend, the AppEngine node tags are:

- Tag1: SystemTimeSec tag of Historian local tag
- Tag2: I/O Tag (P31541.I10) getting data from DASSI of GR node
- Tag3: InTouch Tag (\_PP\$Second) from WIS node historizing to GR node
- Tag4: Script Tag (Sinewaveval\_002.SineWaveValue)

The Industrial Application Server (IAS) tag (script) does not have any data loss as the data is stored in the SF folder in the AppEngine node. This data is later forwarded after Quick Migration.



### Observations

GR is Platform1 in the Galaxy deployed. During Quick Migration of the GR, it is obvious that there will be an instance during Quick Migration when the following occurs:

- GR, Historian will not be able to connect to the other deployed nodes (Platforms 2, 3, and 4).
- Other nodes will not be able to connect to GR (Platform1).
- Some data sent from GR will be discarded till the TimeSync utility is executed and system time of GR is synchronized.
- AppEngine node is in the Store Forward mode.
- Historian Client trend will not be able to connect to Historian, so warning message is expected.
- Historian machine's time is not synchronized during Live
- Migration of the Historian, so the "Attempt to store values in the future" message is expected.
- After Live Migration, Historian's time needs to be synchronized. Therefore, the server shifting warning message is expected.

After the Quick Migration of GR, Historian Node, the stored data is forwarded from AppEngine node.

As a result, you see the following warnings on each of the VM nodes.

#### GR node

```
372973352/15/20115:34:19 PM7202748WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
```

```
372973362/15/20115:34:19 PM7202748WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
```

```
372973902/15/20115:34:25 PM12844968WarningDDESuiteLinkClient
  CTopic::RemoveItems didn't get executed...: connection handle
  m_hConn=0x00000000, connection status m_bConnected=false,
  host handle m_pHost=0x0038eb80
```

```
372974562/15/20115:38:35 PM58683864WarningaaEngine0:6EC Values
  in the past did not fit within the realtime window; discarding
  data (260, 2011/02/15 12:00:25.440, 2011/02/15 12:04:22.490)
  [aahMDASSF.cpp; 3722; 36]
```

#### AppEngine node

```
220482942/15/20115:30:33 PM26482672WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
220484332/15/20115:34:28 PM42764372WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.
```

**WIS node**

```
17199092/15/20115:30:33 PM29443380WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.

17199232/15/20115:31:29 PM49323684WarningaaAFCommonTypesUnable
  to create dataview: Server must be logged on before executing
  SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
  aaIQ=Quality, aaQD=QualityDetail, aaS=0

  FROM History

  WHERE TagName IN ('..
```

## Quick Migration of AppEngine

### Trends:

In the Historian Trend below, the first three tags receive data from DDESuiteLinkClient in Industrial Application Server (IAS) from the PLC and are historized from Platform AppEngine. There is a data loss for 81 seconds.

In the Historian Trend below, the AppEngine node tags are:

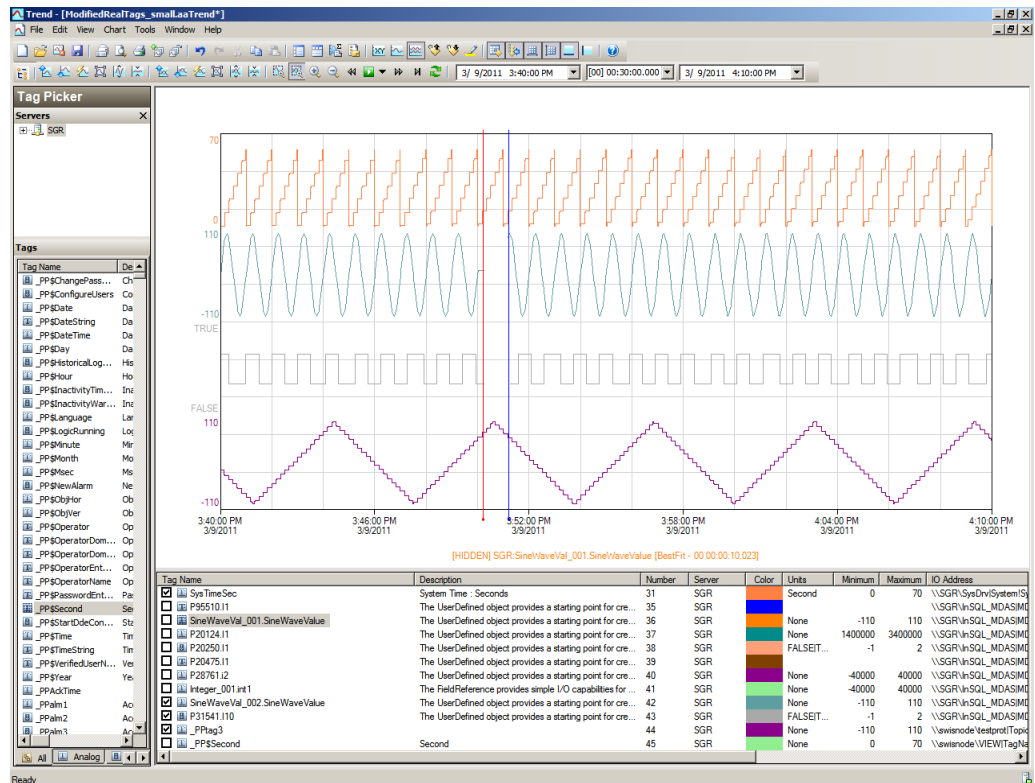
Tag1: SystemTimeSec tag of Historian local tag

Tag2: I/O tag (P31541.I10) getting data from DASSI of GR node

Tag3: (\_PPTag3) is a InTouch tag of Wis node

Tag4: Script Tag (Sinewaveval\_002.SineWaveValue)

RPO value are been captured in RPO table of QuickMigration of AppEngine Node.



## Observations

AppEngine is Platform2 in the Galaxy deployed. During Quick Migration of the AppEngine, it is obvious that there will be an instance during Quick Migration when

- AppEngine will not be able to connect to the other deployed nodes (Platforms 1, 3, and 4).
- Other nodes will not be able to connect to AppEngine (Platform2)
- Some data sent from AppEngine will be discarded till the TimeSync utility is executed and system time of AppEngine is synchronized. So Historian is bound to discard data from AppEngine node.
- AppEngine is not synchronized during quick migration and a message “Values in the past did not fit within the realtime window” is expected on AppEngine.

As a result, you see the following warnings on each of the VM nodes.

### GR node

```
413214162/16/20113:58:23 PM23962780WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms
```

### AppEngine

```
220563372/16/20114:00:28 PM25162532WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
220563382/16/20114:00:28 PM25162532WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
```

```
220563392/16/20114:00:28 PM25162532WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
```

```
220564742/16/20114:01:06 PM31563160WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
```

```
220565732/16/20114:04:42 PM32364488WarningaaEngine0:9B8 Values
  in the past did not fit within the realtime window; discarding
  data (1385, 2011/02/16 10:28:13.968, 2011/02/16 10:30:30.426)
  [aahMDASSF.cpp; 3709; 121]
```

```
220565772/16/20114:04:45 PM33044556WarningaaEngine0:A04 Values
  in the past did not fit within the realtime window; discarding
  data (445, 2011/02/16 10:28:14.827, 2011/02/16 10:30:32.067)
  [aahMDASSF.cpp; 3709; 2]
```

### WIS node

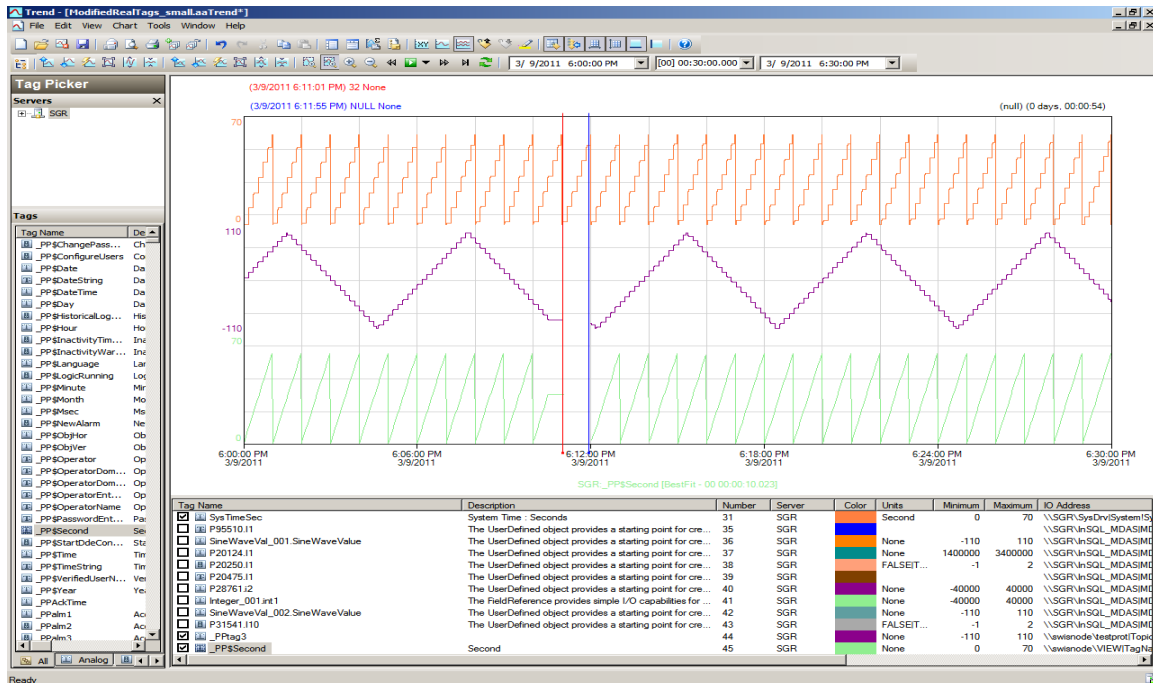
```
17204112/16/20113:58:21 PM36523428WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
```

## Quick Migration of WIS, InTouch, HistorianClient Trends:

In the Historian Trend below, the last tag \$Second receives data from InTouch and is historized.

Tag1: SysTimeSec

Tag2: \$Second Intouch tag



### Observations

WIS node is Platform4 in the Galaxy deployed. During Quick Migration of the WIS node, it is obvious that there will be an instance during Quick Migration when

- WIS will not be able to connect to the other deployed nodes (Platforms 1, 2, and 3).
- Other nodes will not be able to connect to WIS (Platform4)
- Historian Client trend will not be able to connect to Historian, so warning is expected.
- Historian machine's time is not synchronized during Quick Migration of WIS node, so "Attempt to store values in the future" is expected.

As a result, you see the following warnings on each of the VM nodes.



### **GR node**

```
413215532/16/20114:19:13 PM23962780WarningNmxSvcPlatform 4  
  exceed maximum heartbeats timeout of 8000 ms.
```

### **AppEngine node**

```
220566142/16/20114:19:13 PM25162532WarningNmxSvcPlatform 4  
  exceed maximum heartbeats timeout of 8000 ms.
```

### **WIS node**

```
17204172/16/20114:21:30 PM36523428WarningNmxSvcPlatform 1  
  exceed maximum heartbeats timeout of 8000 ms.
```

```
17204182/16/20114:21:30 PM36523428WarningNmxSvcPlatform 2  
  exceed maximum heartbeats timeout of 8000 ms
```

## Quick Migration of all nodes

### Trends:

GR node hosts the DDESuiteLinkObjects. Therefore during Quick Migration of GR node, there is data loss for tags that does receive data from DAS Server/PLC.

In the Historian Trend below, GR node tags are:

Tag1: I/O Tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

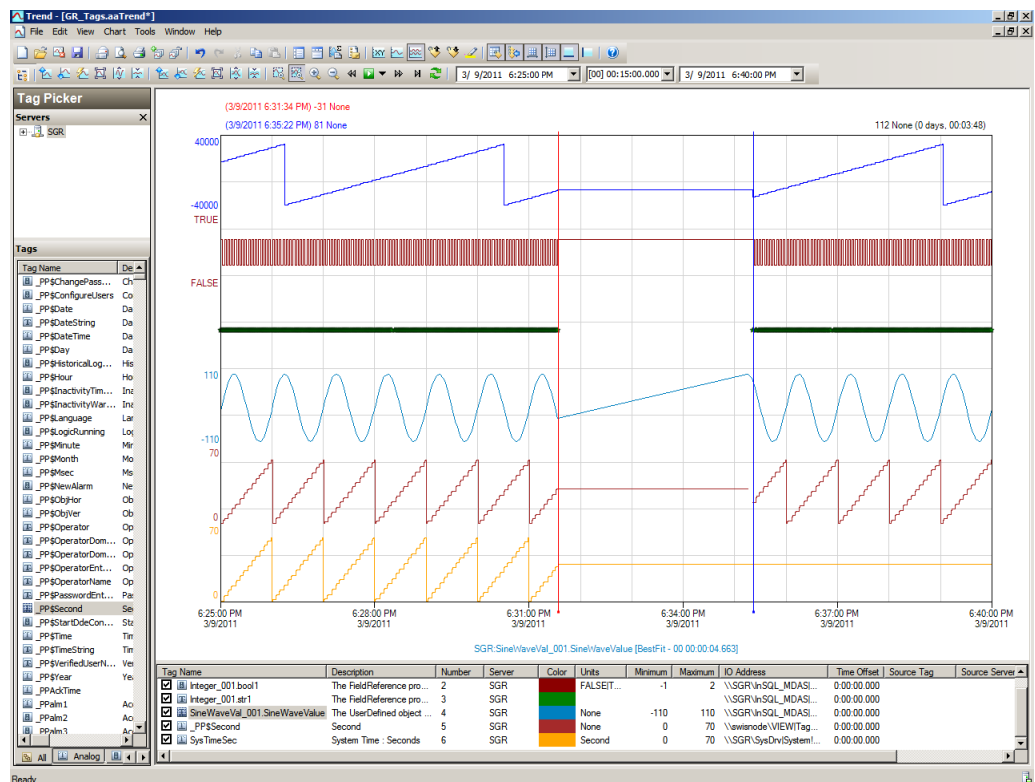
Tag2: I/O Tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O Tag (Integer\_001.str1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue)

Tag5: InTouch tag (\_PP\$Second) from WIS node Historising to GR node.

Tag6: SystemTimeSec tag of Historian.



In the Historian Trend below, the AppEngine tags are:

Tag: I/O Tag (P28762.i15) getting data from DASSI on GR

Tag: I/O Tag (P31541.i10) getting data from DASSI on GR

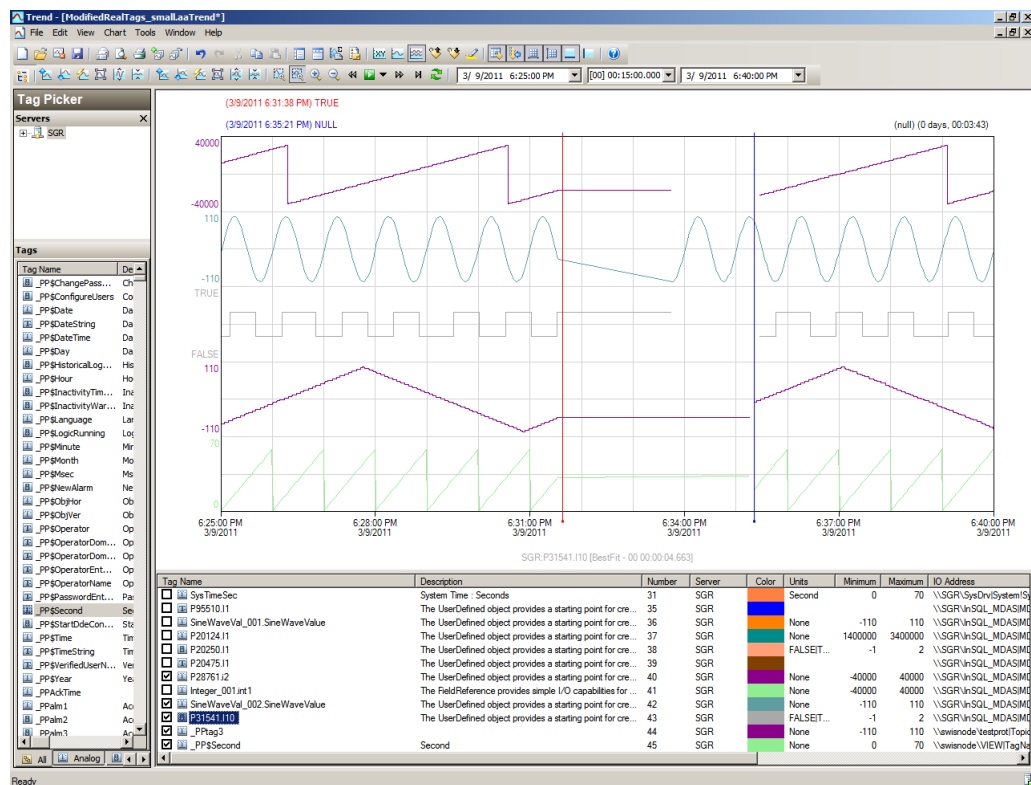
Tag: I/O Tag (P20124.i1) Buffer data tag getting data from DASSI on GR

Tag: I/O Tag (P20475.i1) Buffer data tag getting data from DASSI on GR

Tag: Script Tag (SineWaveVal\_001.SineWaveValue) of GR

Tag: Script Tag (SineWaveVal\_002.SineWaveValue) of AppEngine

Tag: SystemTimeSec tag of Historian.



## Observations

The following warning are observed.

### GR node

372976552/15/20116:09:39 PM7202748WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

372976562/15/20116:09:46 PM7202748WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.

372976572/15/20116:17:21 PM7202748WarningNmxSvcPlatform 3  
exceed maximum heartbeats timeout of 8000 ms.

```
372977172/15/20116:17:22 PM12846136WarningaaEngine0:B40 Values
  in the past did not fit within the realtime window; discarding
  data (392, 2011/02/15 12:39:47.662, 2011/02/15 12:47:22.031)
  [aahMDASSF.cpp; 3722; 1]

372977192/15/20116:17:22 PM12844968WarningScanGroupRuntime2
  Can't convert Var data type to MxDataType

372977662/15/20116:17:25 PM58683864WarningaaEngine0:6EC Values
  in the past did not fit within the realtime window; discarding
  data (260, 2011/02/15 12:39:47.405, 2011/02/15 12:47:23.232)
  [aahMDASSF.cpp; 3722; 1]

372977692/15/20116:17:27 PM50685780WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (02/15/11,18:17:26,562, 02/15/11,18:09:53,900) [SGR;
  Config.cpp; 2040]

372978322/15/20116:21:35 PM49123852WarningaaEngine0:EB8 Values
  in the past did not fit within the realtime window; discarding
  data (391, 2011/02/15 12:39:47.369, 2011/02/15 12:47:21.779)
  [aahMDASSF.cpp; 3722; 64]

372978342/15/20116:21:35 PM58683864WarningaaEngine0:6EC Values
  in the past did not fit within the realtime window; discarding
  data (260, 2011/02/15 12:39:47.405, 2011/02/15 12:47:23.232)
  [aahMDASSF.cpp; 3722; 57]
```

## AppEngine

```
220485882/15/20116:13:36 PM26482672WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.

220485892/15/20116:13:36 PM26482672WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.

220485902/15/20116:13:36 PM26482672WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.

220485912/15/20116:13:36 PM26482744WarningMessageChannelSGR
  address was not resolved. Error = 10022

220486792/15/20116:13:40 PM5352524WarningaaEngine0:988 Values
  in the past did not fit within the realtime window; discarding
  data (6245, 2011/02/15 12:39:32.687, 2011/02/15 12:43:39.655)
  [aahMDASSF.cpp; 3709; 1]

220486832/15/20116:13:40 PM68606540WarningaaEngine0:A80 Values
  in the past did not fit within the realtime window; discarding
  data (4500, 2011/02/15 12:39:32.936, 2011/02/15 12:43:39.093)
  [aahMDASSF.cpp; 3709; 1]

220486942/15/20116:14:35 PM42764372WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.

220487542/15/20116:17:51 PM68606540WarningaaEngine0:A80 Values
  in the past did not fit within the realtime window; discarding
```

```
data (4500, 2011/02/15 12:39:32.936, 2011/02/15 12:43:39.093)
[aahMDASSF.cpp; 3709; 6]
```

```
220487582/15/20116:17:53 PM42763452WarningaaEngine0:CEC Values
in the past did not fit within the realtime window; discarding
data (458, 2011/02/15 12:39:32.796, 2011/02/15 12:43:39.655)
[aahMDASSF.cpp; 3709; 15]
```

### **WIS node**

```
17199362/15/20116:15:44 PM29443380WarningNmxSvcPlatform 1
exceed maximum heartbeats timeout of 8000 ms.
```

```
17199372/15/20116:15:44 PM29443380WarningNmxSvcPlatform 2
exceed maximum heartbeats timeout of 8000 ms.
```

```
17199442/15/20116:16:36 PM49324412WarningaaAFCommonTypesUnable
to create dataview: Server must be logged on before executing
SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
aaIQ=Quality, aaQD=QualityDetail, aaS=0
FROM History
WHERE TagName IN ('...
```

## Shut down of Source Host Virtualization Server

### Trends:

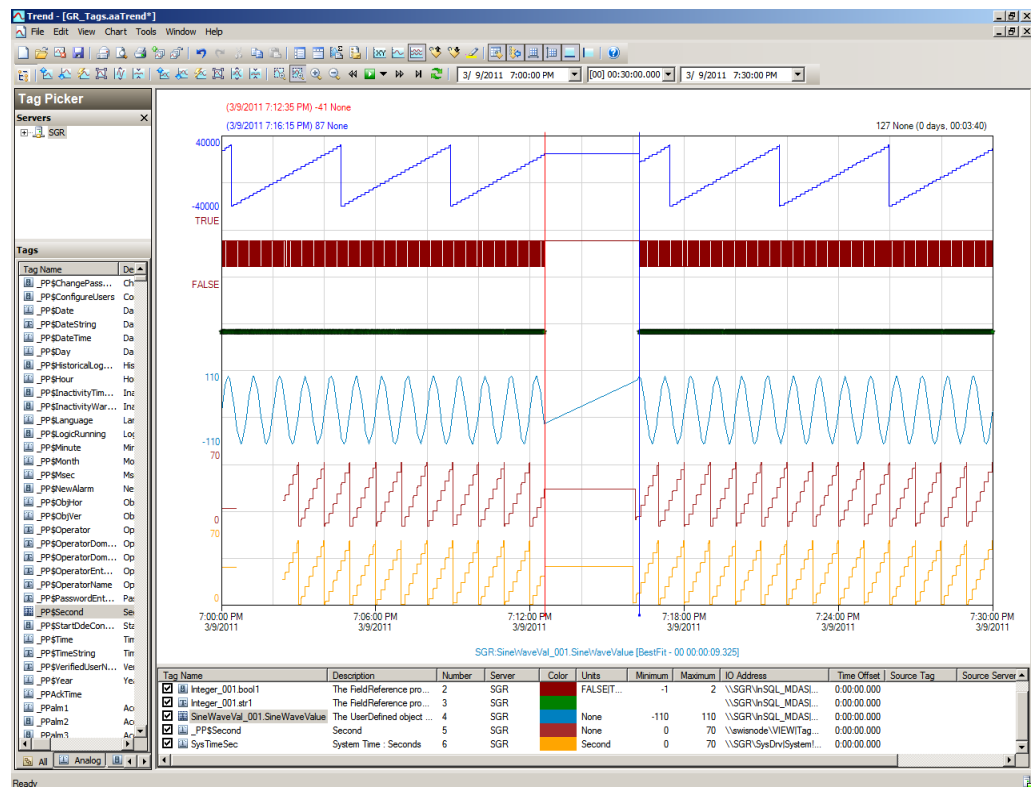
In the following Historian Trend, the GR node tags are:

Tag1: SystemTimeSec tag of Historian.

Tag2: I/O tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script tag (SineWaveVal\_001.SineWaveValue)

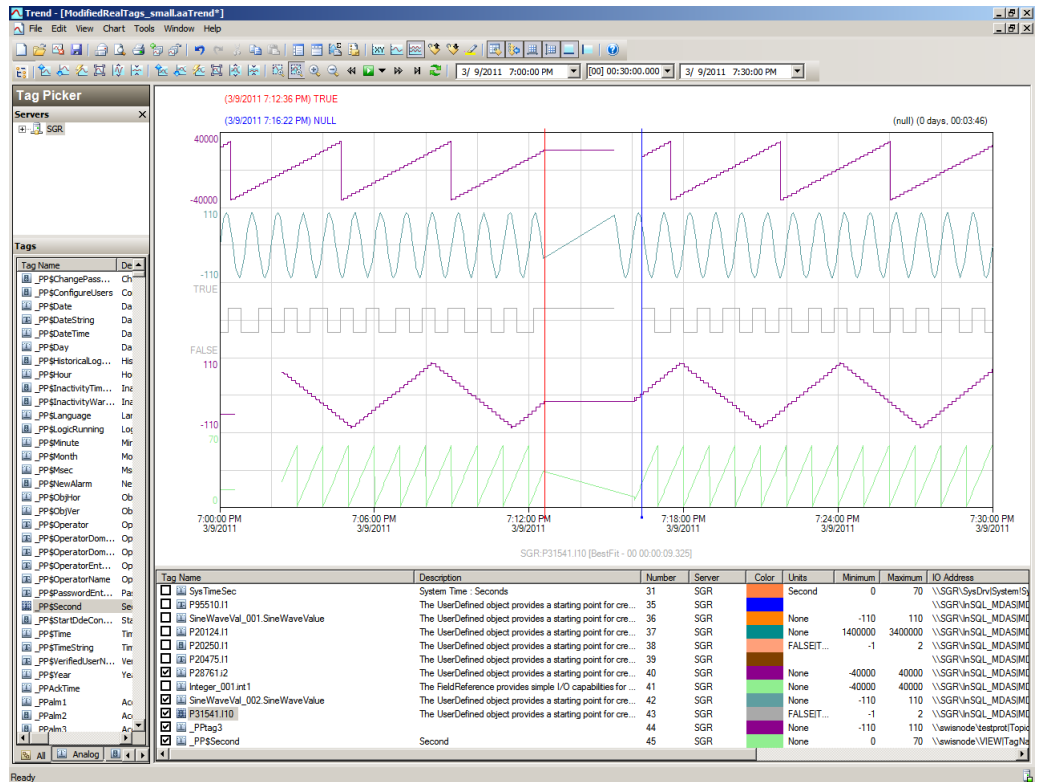


In the Historian Trend below, the AppEngine node tags are:

Tag1: I/O tag (P31541.I10) getting data from DASSI of GR node

Tag2: I/O tag (P15501.I17) getting data.

Tag3: Script tag (Sinewaveval\_002.SineWaveValue)



## Observations

The following warnings are observed.

### GR node

The following warnings are observed on the GR node during Power off of Host Server.

```
369044912/14/201111:48:53 PM3040892WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
```

```
369044922/14/201111:48:53 PM3040892WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
```

```
369044932/14/201111:48:53 PM3040892WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
```

```
369045602/14/201111:48:59 PM24084444WarningaaEngine0:6F0 Values
  in the past did not fit within the realtime window; discarding
  data (260, 2011/02/14 18:10:39.969, 2011/02/14 18:18:57.850)
  [aahMDASSF.cpp; 3722; 1]
```

```
369045682/14/201111:49:00 PM42964300WarningScriptRuntime
  DDESuiteLinkClient_Buffered.reconnect: Script timed out.
```

```
369045692/14/201111:49:00 PM42964300WarningDDESuiteLinkClient
  CTopic::RemoveItems didn't get executed...: connection handle
  m_hConn=0x00000000, connection status m_bConnected=false,
  host handle m_pHost=0x01d6eec8
```

**AppEngine node**

```
220418642/14/201111:47:02 PM24562476WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.

220418652/14/201111:47:02 PM24562476WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.

220418662/14/201111:47:02 PM24562476WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.

220419262/14/201111:47:04 PM27323912WarningaaEngine0:9C0 Values
  in the past did not fit within the realtime window; discarding
  data (846, 2011/02/14 18:10:39.025, 2011/02/14 18:17:03.548)
  [aahMDASSF.cpp; 3709; 1]

220419762/14/201111:49:41 PM15842492WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.

220420922/14/201111:51:16 PM29804064WarningaaEngine0:8A8 Values
  in the past did not fit within the realtime window; discarding
  data (1870, 2011/02/14 18:10:40.010, 2011/02/14 18:17:03.329)
  [aahMDASSF.cpp; 3709; 144]

220420962/14/201111:51:18 PM24123836WarningaaEngine0:BD0 Values
  in the past did not fit within the realtime window; discarding
  data (324, 2011/02/14 18:10:39.838, 2011/02/14 18:17:05.094)
  [aahMDASSF.cpp; 3709; 57]
```

**WIS node**

```
17187672/14/201111:48:49 PM24443064WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.

17187682/14/201111:48:49 PM24443064WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms
```



## Scenario 2: Virtualization Server Hardware Fails

### Failover Due to Hardware Failure

The failover occurs due to hardware failure, and it is simulated with power-off on the host server.

#### Trends:

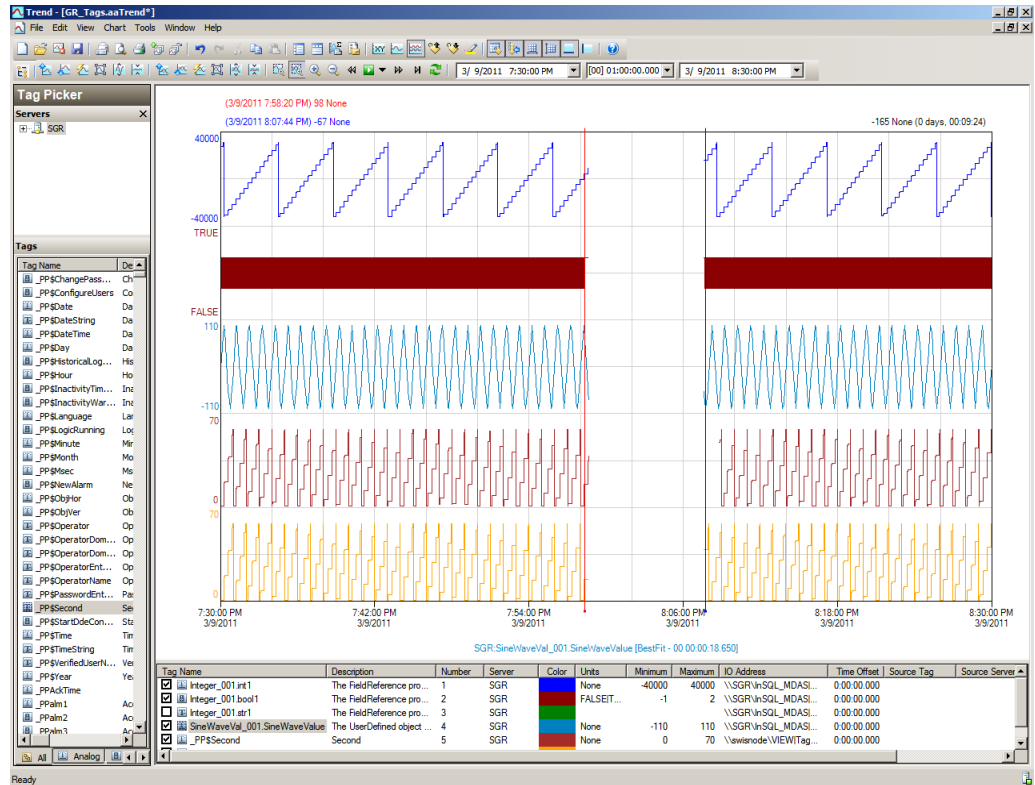
In the Historian Trend below, the GR node tags are:

Tag1: SystemTimeSec tag of Historian.

Tag2: I/O tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script tag (SineWaveVal\_001.SineWaveValue)



In the Historian Trend below, the, AppEngine node tags are:

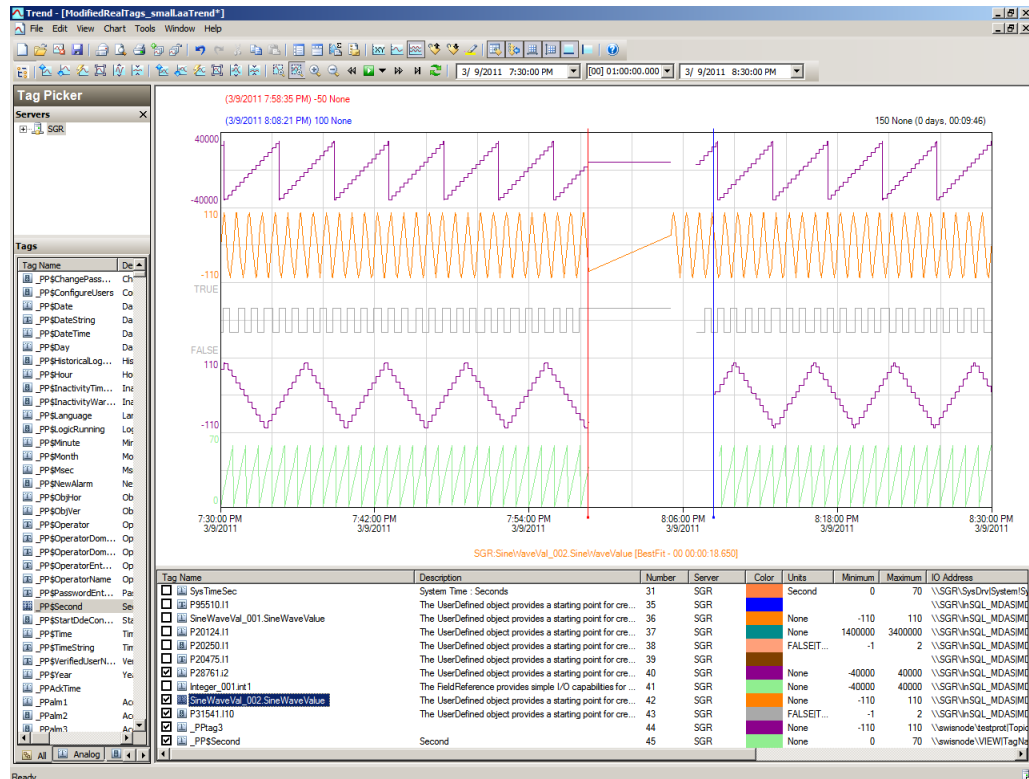
Tag1: SystemTimeSec tag of Historian.

Tag2: I/O tag (P31541.I10) getting data from DASSI of GR node

Tag3: I/O tag (\_PP\$Second) InTouch tag

Tag4: I/O tag (\_PPtag3) InTouch tag

Tag5: Script tag (Sinewaveval\_002.SineWaveValue)



## Observations

### GR node

The following warnings are observed on the GR node during Power off of Host Server.

```
369049522/15/201112:13:55 AM22722288WarningScriptRuntime
GR.privatebytes: Script timed out.
```

```
369053872/15/201112:14:44 AM17285332WarningaaEngine0:C9C Values
in the past did not fit within the realtime window; discarding
data (318, 2011/02/14 18:44:07.128, 2011/02/14 18:44:43.444)
[aahMDASSF.cpp; 3722; 1]
```

```
369123252/15/201112:18:56 AM17285332WarningaaEngine0:C9C Values
in the past did not fit within the realtime window; discarding
data (318, 2011/02/14 18:44:07.128, 2011/02/14 18:44:43.444)
[aahMDASSF.cpp; 3722; 21]
```

**AppEngine node**

```
220423732/15/201112:15:17 AM21002104WarningScriptRuntime
  AppEngineNode1.privatembytes: Script timed out.
```

```
220425602/15/201112:16:10 AM24964832WarningDCMConnectionMgr
  Open() of DCMConnection failed: 'A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...
```

```
220425612/15/201112:16:11 AM24964832WarningSQLDataRuntime3
  SQLTestResults Command Failure - A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...
```

**WIS node**

None

## Scenario 3: Network Fails on Virtualization Server

### Failover Due to Network Disconnect (Public)

#### Trends:

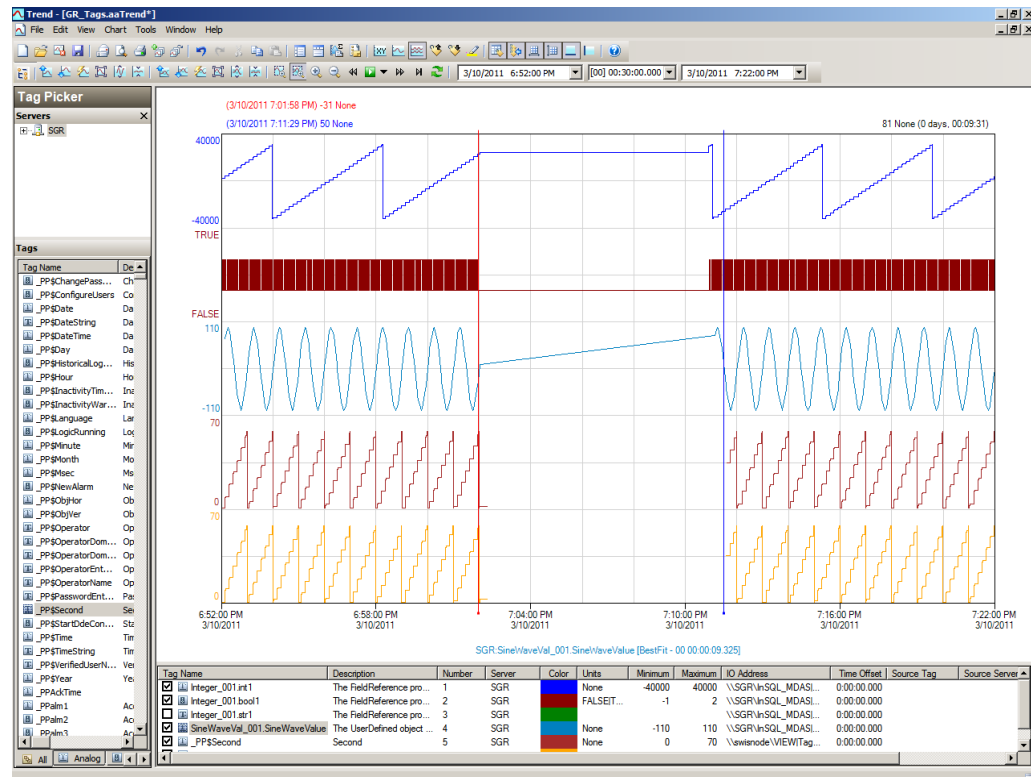
In the Historian Trend below, the GR node tags are:

Tag1: SystemTimeSec tag of Historian.

Tag2: I/O tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script tag (SineWaveVal\_001.SineWaveValue)



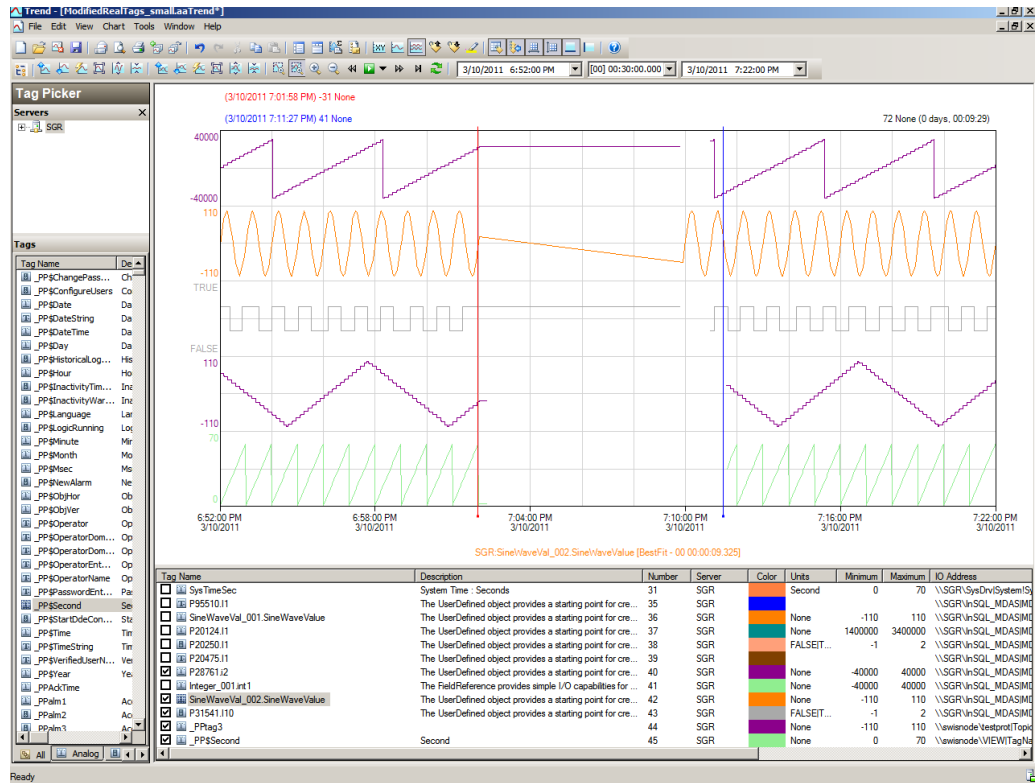
In the Historian Trend below AppEngine node tags are:

Tag2: I/O tag (P31541.I10) getting data from DASSI of GR node

Tag3: I/O tag (\_PP\$Secound) InTouch tag

Tag4: I/O tag (\_PPTag3) InTouch tag

Tag5: Script Tag (Sinewaveval\_002.SineWaveValue)



## Observations

During network disconnect of host server all the nodes will be moved to other Host server and all the VM's in the Host Server will get restarted.

## GR node

The following warnings are observed on the GR node during network disconnect of host server.

```
372991772/15/20117:07:43 PM18522652WarningScriptRuntime
GR.privatembytes: Script timed out.
```

```
372993942/15/20117:08:03 PM18524540WarningaaEngine0:6FC Values
in the past did not fit within the realtime window; discarding
data (303, 2011/02/15 13:37:15.000, 2011/02/15 13:38:02.332)
[aahMDASSF.cpp; 3722; 1]
```

```
373063772/15/20117:08:26 PM16683064WarningaaStoreSvcAttempt to
store value prior to disconnect time. Value discarded -
```

```
possible loss of data (SGR_mdas, 4504, 2011/02/15
13:38:25.428, 2011/02/15 13:38:24.868) [SGR; pipeserver.cpp;
958]
```

```
373065202/15/20117:12:14 PM18524540WarningaaEngine0:6FC Values
in the past did not fit within the realtime window; discarding
data (303, 2011/02/15 13:37:15.000, 2011/02/15 13:38:02.332)
[aahMDASSF.cpp; 3722; 33]
```

```
373065242/15/20117:12:38 PM16683064WarningaahStoreSvcAttempt to
store value prior to disconnect time. Value discarded -
possible loss of data (SGR_mdas, 4504, 2011/02/15
13:38:25.428, 2011/02/15 13:38:24.868) [SGR; pipeserver.cpp;
958; 3031]
```

### **AppEngine node**

```
220493472/15/20117:07:15 PM23482352WarningScriptRuntime
AppEngineNode1.privatembytes: Script timed out.
```

```
220495942/15/20117:07:59 PM29765016WarningDCMConnectionMgr
Open() of DCMConnection failed: 'A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
accessible. Verify that the instance name is correct and that
SQL Server is configured...
```

```
220495952/15/20117:08:00 PM29764200WarningSQLDataRuntime3
SQLTestResults Command Failure - A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
accessible. Verify that the instance name is correct and that
SQL Server is configured...
```

```
220497602/15/20117:08:55 PM27281088WarningInTouchProxyFailed to
reconecnt to data source
```

```
220498382/15/20117:13:19 PM29762980WarningScriptRuntime
Insert.InsertValueWF: Script timed out.
```

### **WIS node**

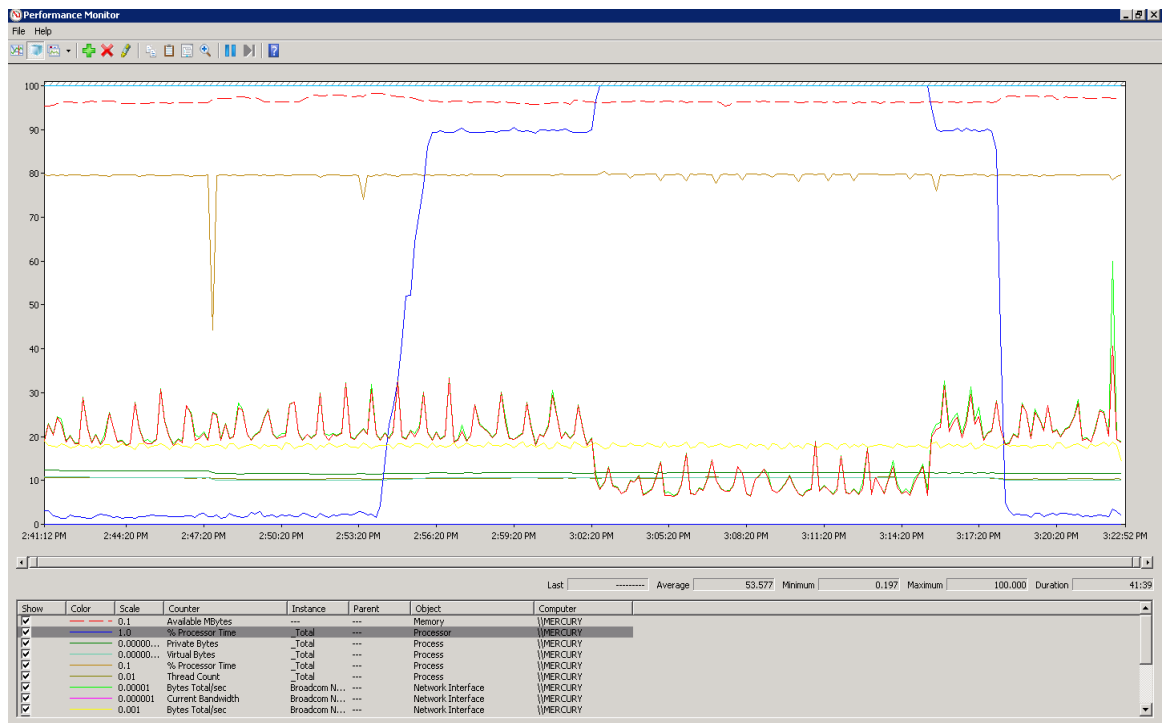
None

## Scenario 4: Virtualization Server Becomes Unresponsive

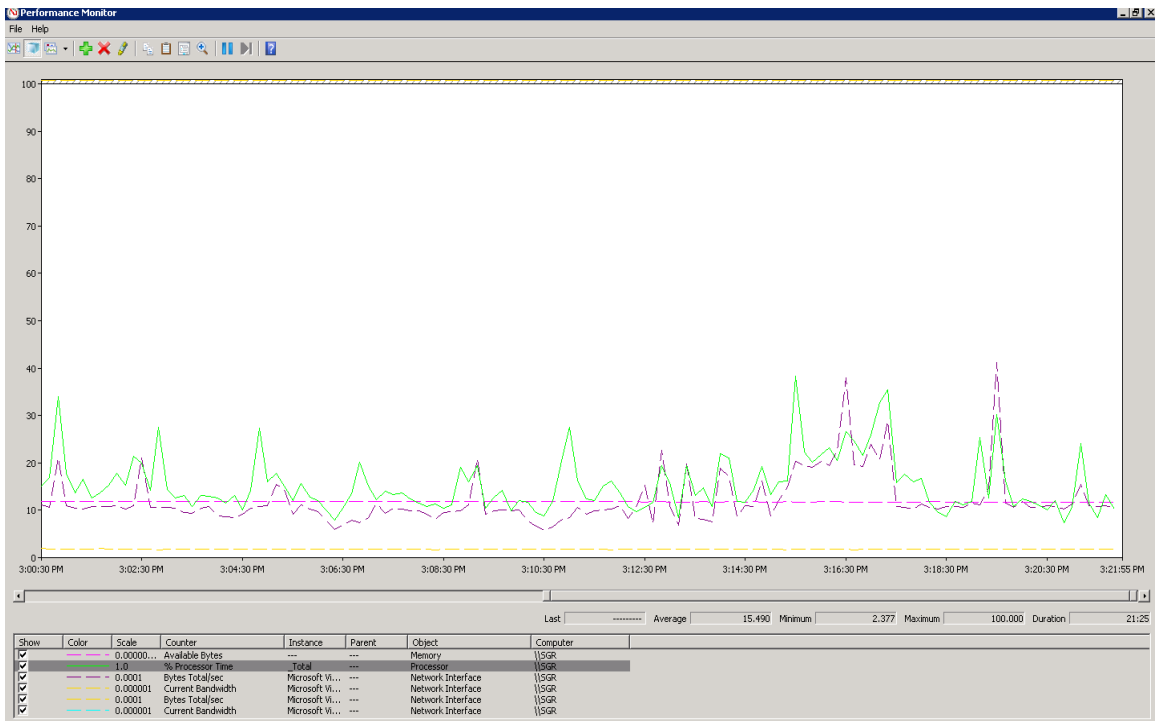
### Hyper-V Virtual Machines with Static RAM and Reservations for Processors

It has been observed that even when the Host Virtualization Server reaches 100% CPU utilization, there is no failover of the Hyper-V virtual machines running on it to the other Host Virtualization Server. However, the host server running at 100% CPU utilization fails to process all the network requirements of the Hyper-V virtual machines running on it. As a result, network disruptions on the Hyper-V virtual machines are observed that result in data loss.

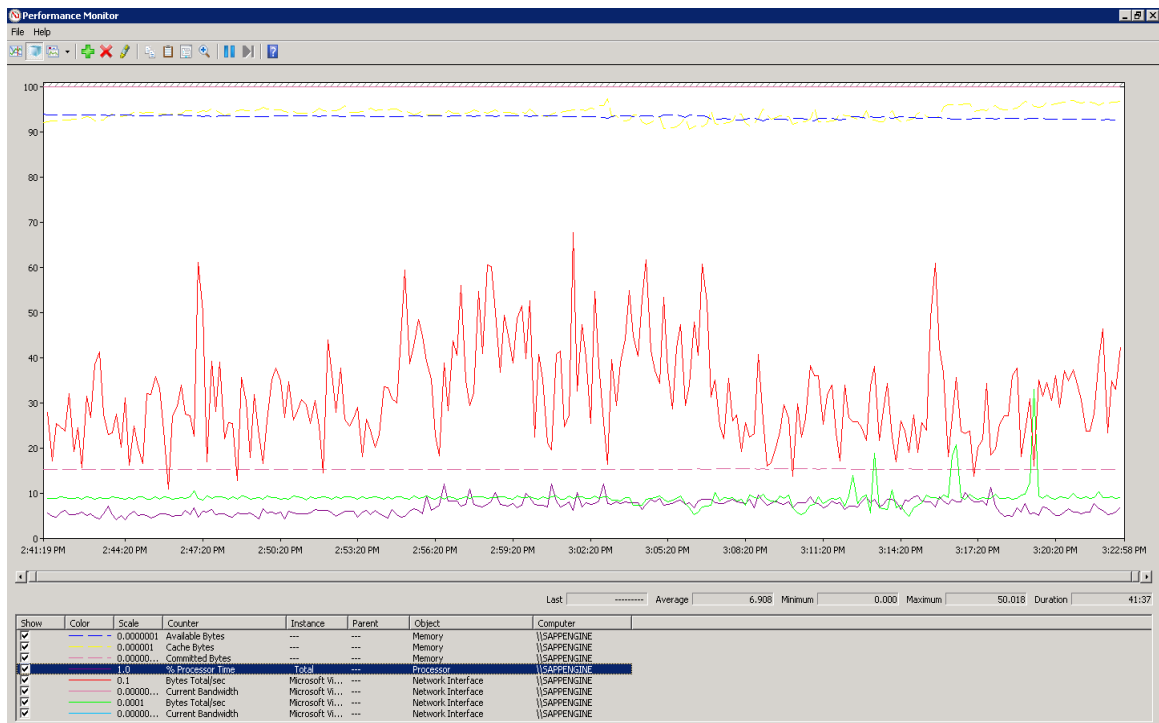
### Host Virtualization Server Performance with CPU Load at 100%



### Performance of GR node when the CPU load on host is at 100%



### Performance of AppEngine node when the CPU load on host is at 100%





## Observations When CPU Load is 100% on Host Virtualization Server

The virtual machines do not failover when CPU load stays at 100%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is at 100%.

The messages "Snapshot write operation took longer than 10 seconds" are expected when the virtual machines are running at high Processor time % (Historian at 100% and AppEngine node at 50%).

The execution of time sync utility is impacted and the time is not synchronized on the Historian, AppEngine nodes and GR node. As a result, the message "Values in the past did not fit within the realtime window" is observed.

### GR node

```
413126932/16/20113:08:02 PM15202136WarningaahStoreSvcSnapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (1024, 3, 0,
52004273, 2137401, 10) [SGR; deltastore.cpp; 2669]
```

```
413127142/16/20113:10:04 PM15202136WarningaahStoreSvcSnapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (1024, 3, 0,
52004273, 2200899, 11) [SGR; deltastore.cpp; 2669]
```

```
413127432/16/20113:10:47 PM15202136WarningaahStoreSvcValues in
the past did not fit within the realtime window; discarding
data (SGR_mdas, 4500, 2011/02/16 09:40:14.558, 2011/02/16
09:40:46.643) [SGR; pipeserver.cpp; 2388]
```

```
413127472/16/20113:10:49 PM15644892WarningaaEngine0:AF0 Values
in the past did not fit within the realtime window; discarding
data (392, 2011/02/16 09:40:13.767, 2011/02/16 09:40:49.195)
[aahMDASSF.cpp; 3722; 1]
```

### AppEngine

```
220548592/16/20113:06:44 PM22364432WarningaaEngine0:9E8 Values
in the past did not fit within the realtime window; discarding
data (2790, 2011/02/16 09:36:13.631, 2011/02/16 09:36:44.035)
[aahMDASSF.cpp; 3709; 1]
```

```
220548852/16/20113:06:47 PM14764744WarningaaEngine0:A28 Values
in the past did not fit within the realtime window; discarding
data (444, 2011/02/16 09:36:14.506, 2011/02/16 09:36:45.534)
[aahMDASSF.cpp; 3709; 1]
```

```
220548922/16/20113:06:47 PM22804524WarningaaEngine0:9E8 Values
in the past did not fit within the realtime window; discarding
```

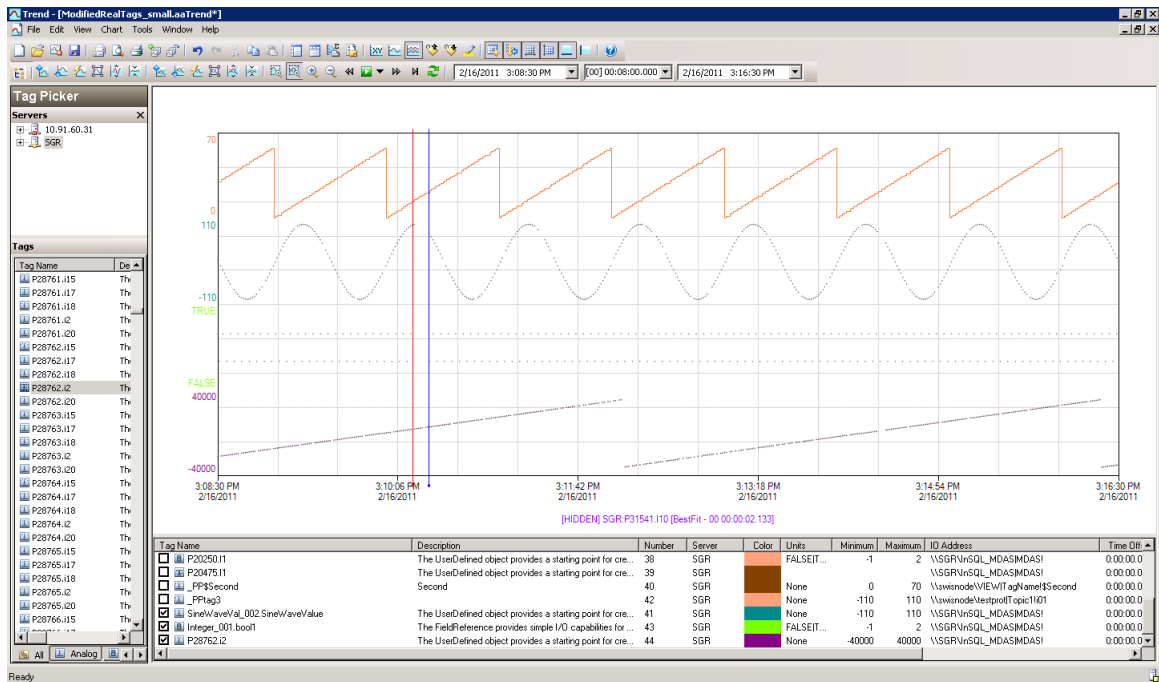
```
data (846, 2011/02/16 09:36:14.677, 2011/02/16 09:36:45.908)
[aahMDASSF.cpp; 3709; 1]
```

```
220550432/16/20113:10:27 PM22321496WarningScriptRuntime
Insert.InsertValueWF: Script timed out.
```

### WIS node:

None

### Trend when CPU utilization is 100%



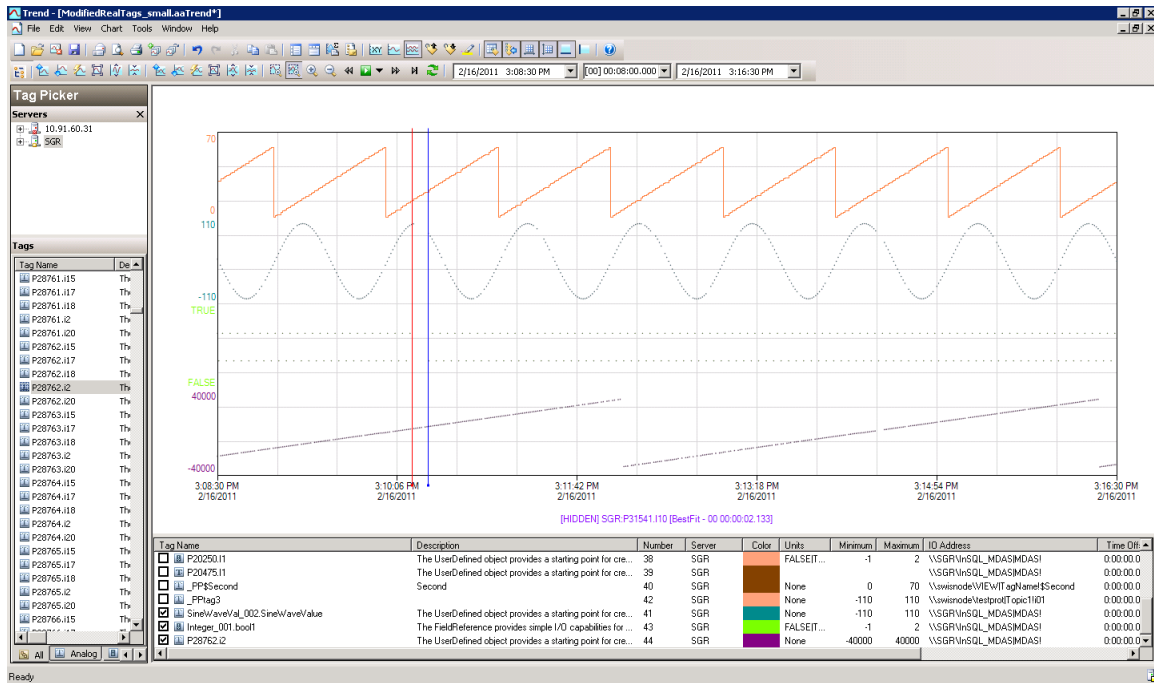
From the above trend it can be noticed that there are frequent data losses for all types tags IO and Script generated from GR and AppEngine nodes.

### Observations When CPU Load is 89% on Host Virtualization Server

The virtual machines do not failover when CPU load stays at 89%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is high.

No warning messages are observed when CPU load of host is 89%.

## Trend when CPU Load is 89% on Host Virtualization Server



From the above trend it can be noticed that there is data loss for Script tags of AppEngine node.

## Working with a Medium Scale Virtualization Environment

This section contains the following topics:

- Setting Up Medium Scale Virtualization Environment
- Configuration of System Platform Products in a Typical Medium Scale Virtualization
- Expected Recovery Time Objective and Recovery Point Objective
- Snapshots of Data Trends and Observations

## Setting Up Medium Scale Virtualization Environment

The following procedures help you to set up and implement the medium scale virtualization high availability environment.

**Note:** In the event that the private network becomes disabled, you may need to add a script to enable a failover. For more information, see "Failover of the Virtual Machine if the Domain/ Private Network is disabled" on page 80

## Planning for Medium Scale Virtualization Environment

The minimum recommended hardware and software requirements for the Host and Virtual machines used for medium virtualization environment are provided in the table below:

### Hyper-V Host

Processor	Two 2.79 GHz Intel Xeon with 24 Cores
Operating System	Windows Server 2008 R2 Enterprise with Hyper-V enabled
Memory	48 GB
Storage	SAN with 1TB storage disk

**Note:** For the Hyper-V Host to function optimally, the server should have the same processor, RAM, storage and service pack level. Preferably the servers should be purchased in pairs to avoid hardware discrepancies. Though the differences are supported, it will impact the performance during failovers.

### Virtual Machines

Using the Hyper-V host specified above, seven virtual machines can be created in the environment with the configuration given below.

#### Virtual Machine 1: Historian node

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	8 GB

Storage	200 GB
System Platform Products Installed	Historian

**Virtual Machine 2: Application Server node, DAS SI**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	8 GB
Storage	100 GB
System Platform Products Installed	ArchestrA-Runtime, DAS SI

**Virtual Machine 3: InTouch TS node**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	InTouch with TS enabled

**Virtual Machine 4: Application Server Runtime node 1**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Application Server Runtime only and InTouch

**Virtual Machine 5: Application Server Runtime node 2**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Application Server Runtime only



### Virtual Machine 6: Information Server node

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Information Server

### Virtual Machine 7: Historian Client node

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows 7 Enterprise
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Historian Client

---

**Note:** There should be a minimum of two Hyper-V hosts to configure the failover cluster.

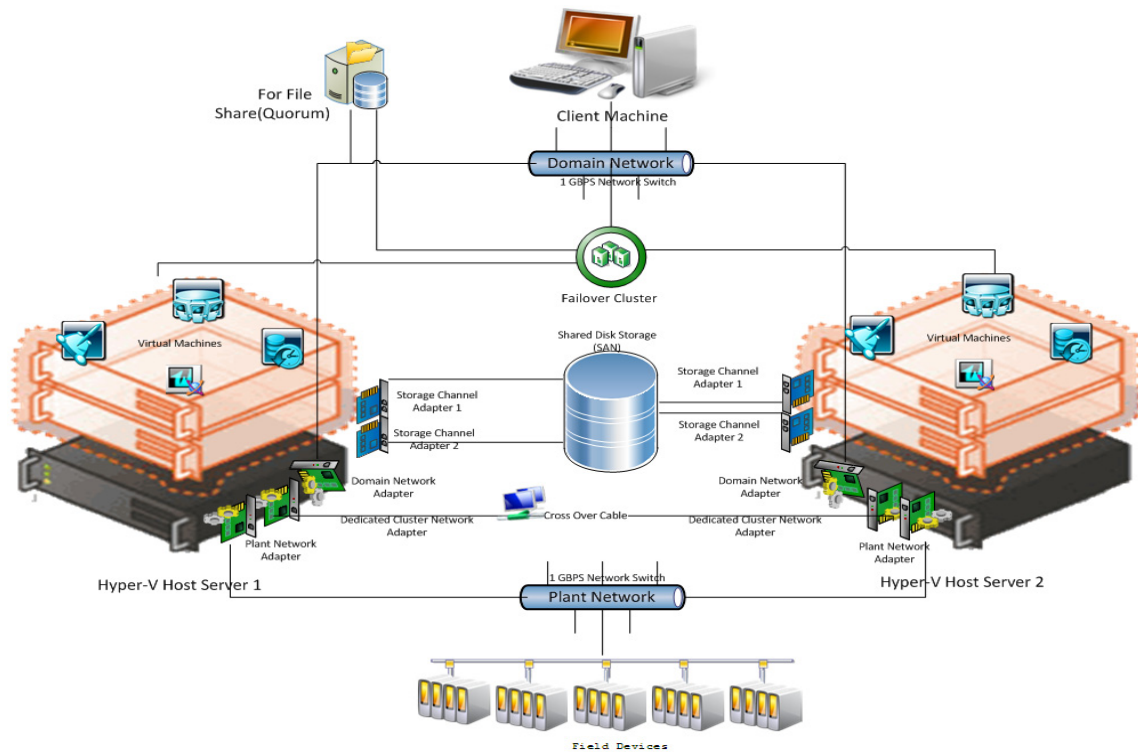
---

### Network Requirements

For this high availability architecture, you can use two physical network cards that need to be installed on a host computer and configured to separate the domain network and the process network.

## Configuring Failover Cluster

The following is the recommended topology of the failover cluster for a medium scale virtualization high availability environment.



This setup requires a minimum of two host servers and one storage server shared across two hosts. Another independent node is used for configuring the quorum. For more information on configuring the quorum, refer to "Configure Cluster Quorum Settings" on page 154.

The following procedures help you install and configure a failover cluster that has two nodes to set up on a medium scale virtualization high availability environment.

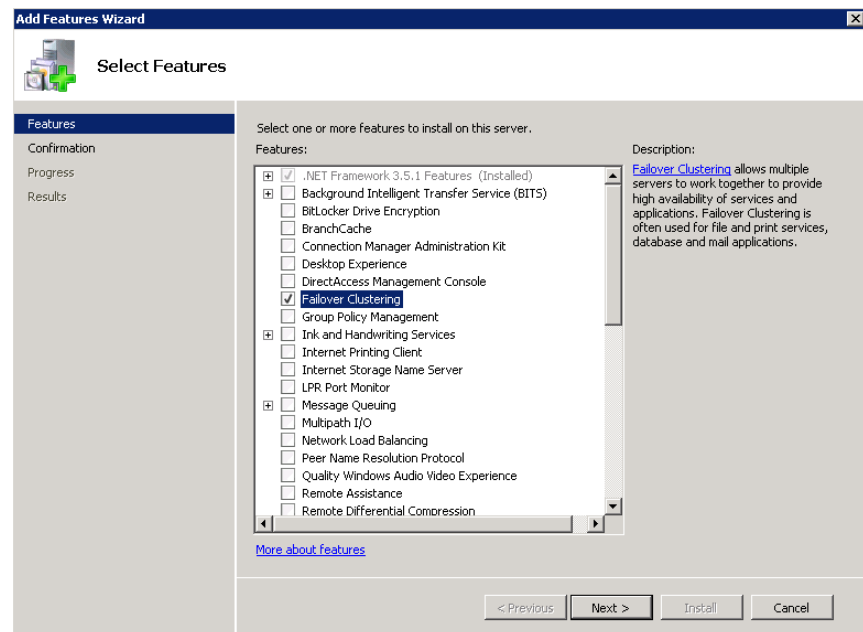
## Installing Failover Cluster

To install the failover cluster feature, you need to run Windows Server 2008 R2 Enterprise Edition on your server.

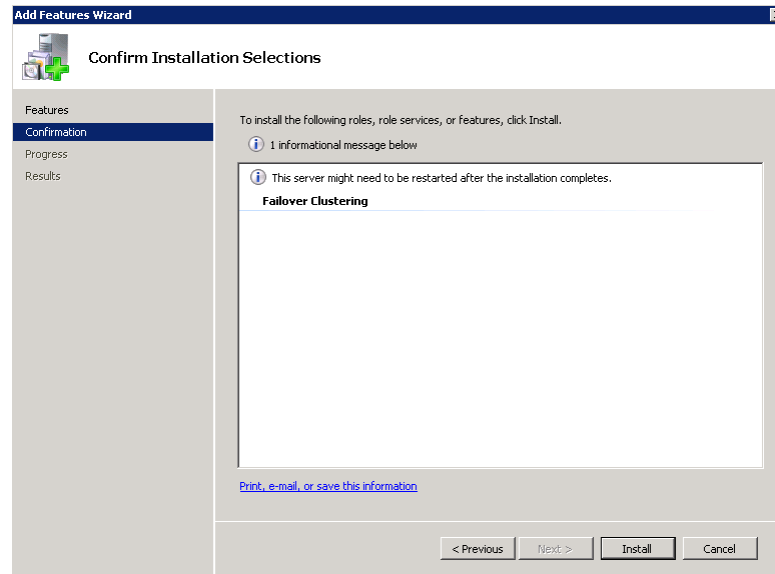
### To install the failover cluster feature on a server

- 1 On the **Initial Configuration Tasks** window, under **Customize This Server**, click **Add features**. The **Add Features Wizard** window appears.

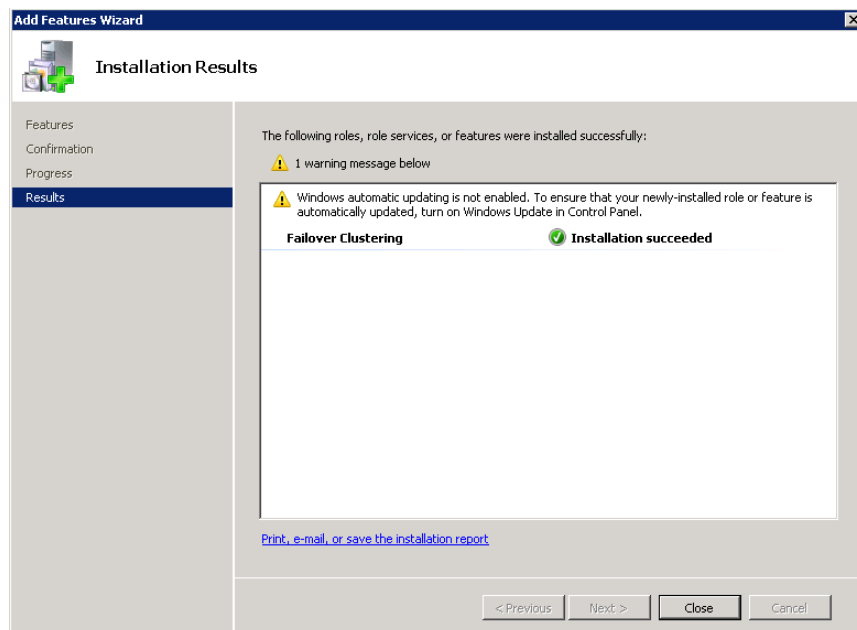
**Note:** The **Initial Configuration Tasks** window appears if you have already installed Windows Server 2008 R2. If it does not appear, open the **Server Manager** window, right-click **Features** and click **Add Features**. For information on accessing the **Server Manager** window, refer to step 1 of "To validate failover cluster configuration" on page 141.



- In the **Add Features Wizard** window, select the **Failover Clustering** check box and click **Next**. The **Confirm Installation Selections** area appears.



- To complete the installation, view the instructions on the wizard and click **Install**. The **Installation Results** area appears with the installation confirmation message.



- Click **Close** to close the **Add Features Wizard** window.

**Note:** Repeat the above procedure to include all the other nodes that will be part of the Cluster configuration process.

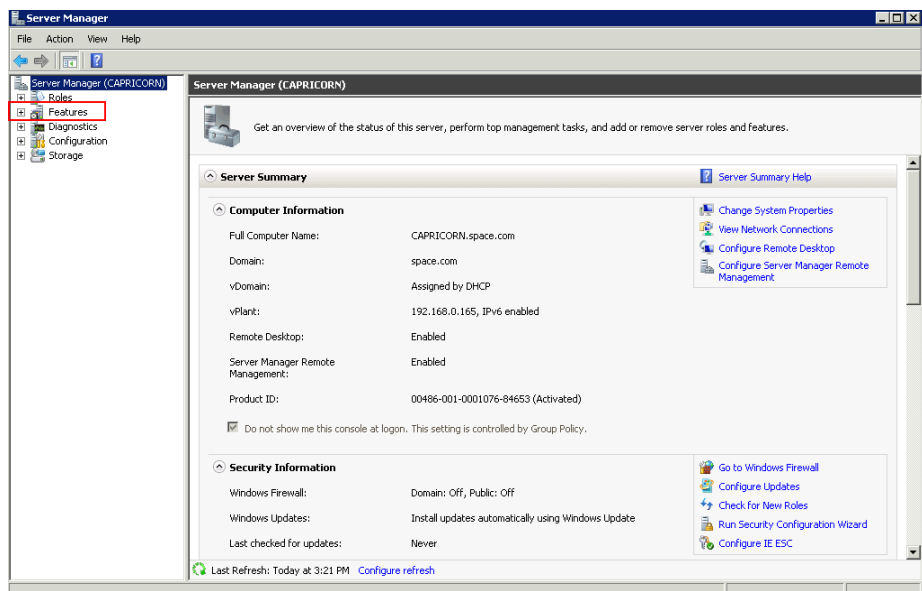
## Validating Failover Cluster Configuration

You must validate your configuration before you create a cluster. Validation helps you confirm the configuration of your servers, network, and storage meets the specific requirements for failover clusters.

### To validate failover cluster configuration

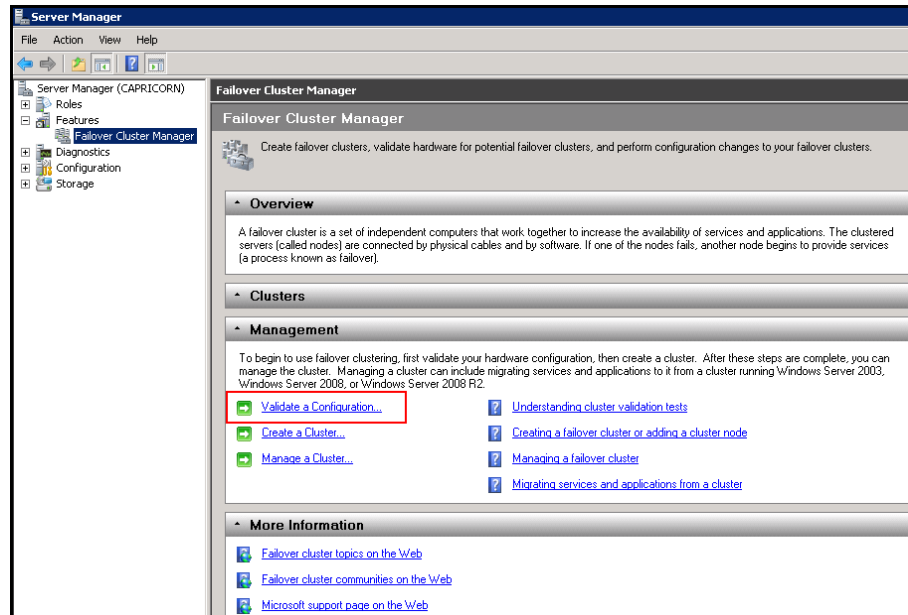
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

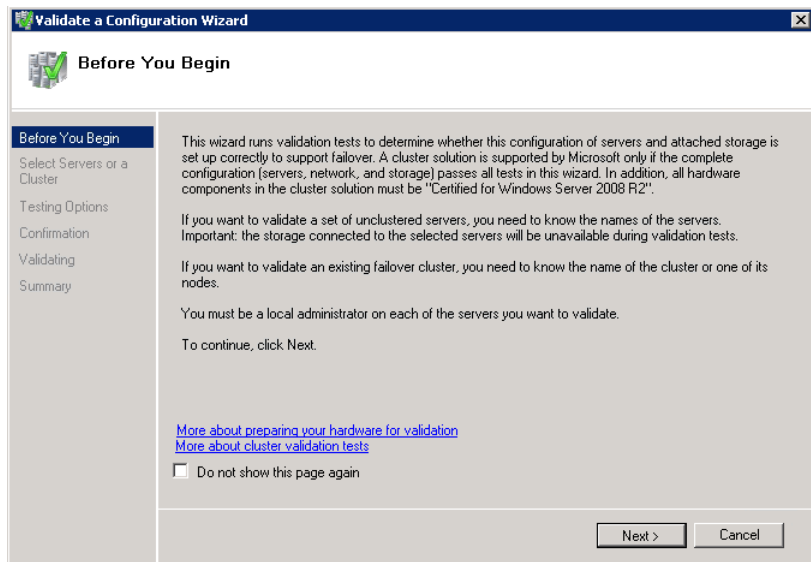


- Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** area appears.

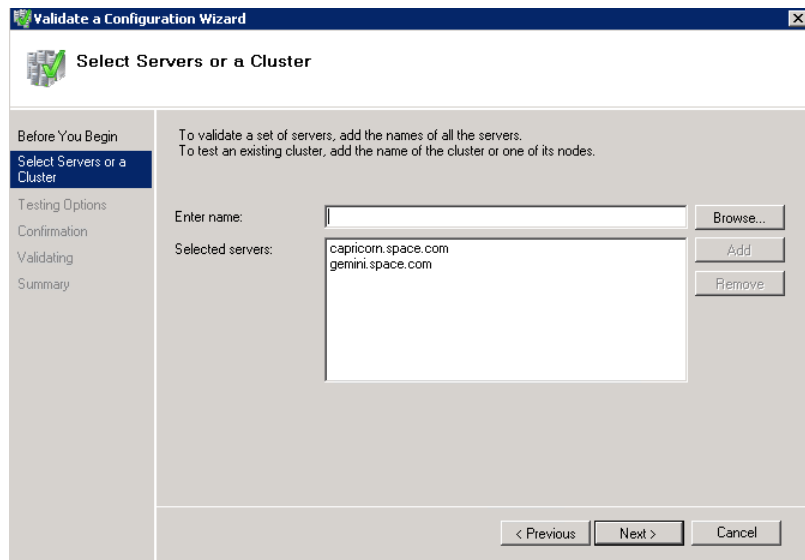
**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



- Under **Management**, click **Validate a Configuration**. The **Validate a Configuration Wizard** window appears.



- 4 View the instructions on the wizard and click **Next**. The **Select Servers or a Cluster** area appears.

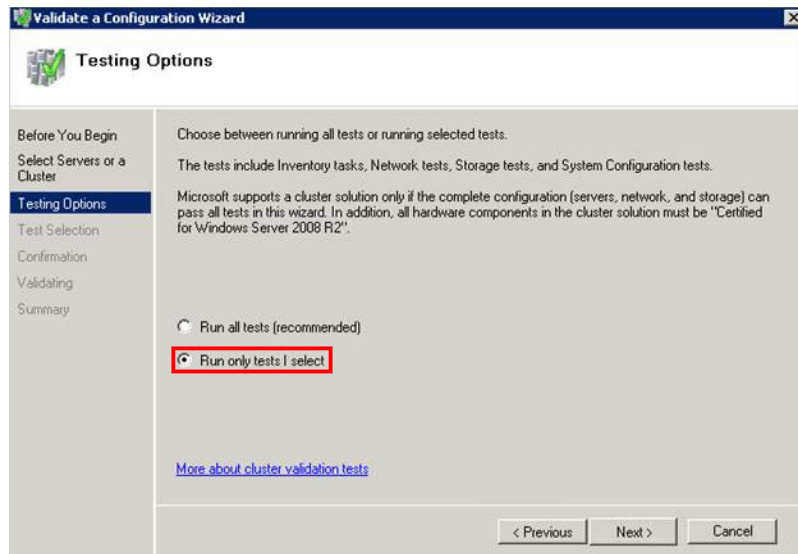


- 5 In the **Select Servers or a Cluster** area, do the following:
  - a In the **Enter name** list, enter the relevant server name.

**Note:** You can either enter the server name or click **Browse** to select the relevant server name.

- b** In the **Selected servers** list, click the required servers, and then click **Add**.
- c** Click **Next**. The **Testing Options** area appears.

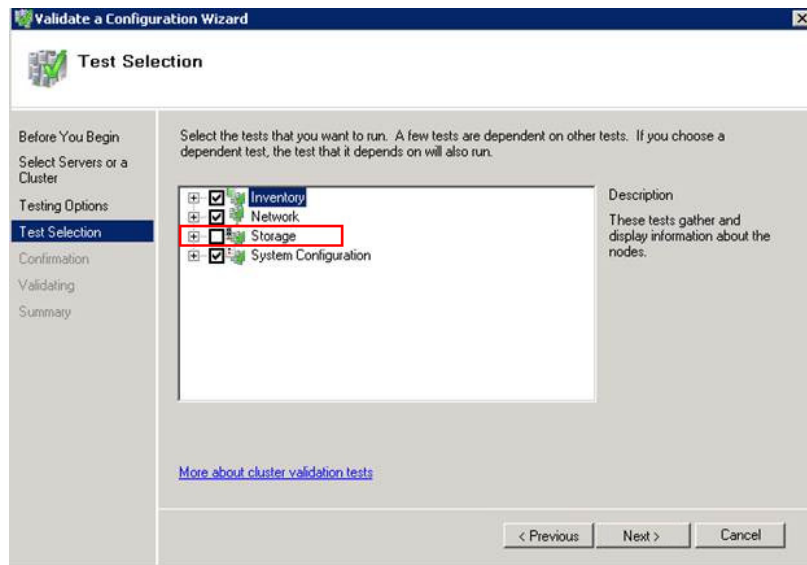
**Note:** You can add one or more server names. To remove a server from the **Selected servers** list, select the server and click **Remove**.



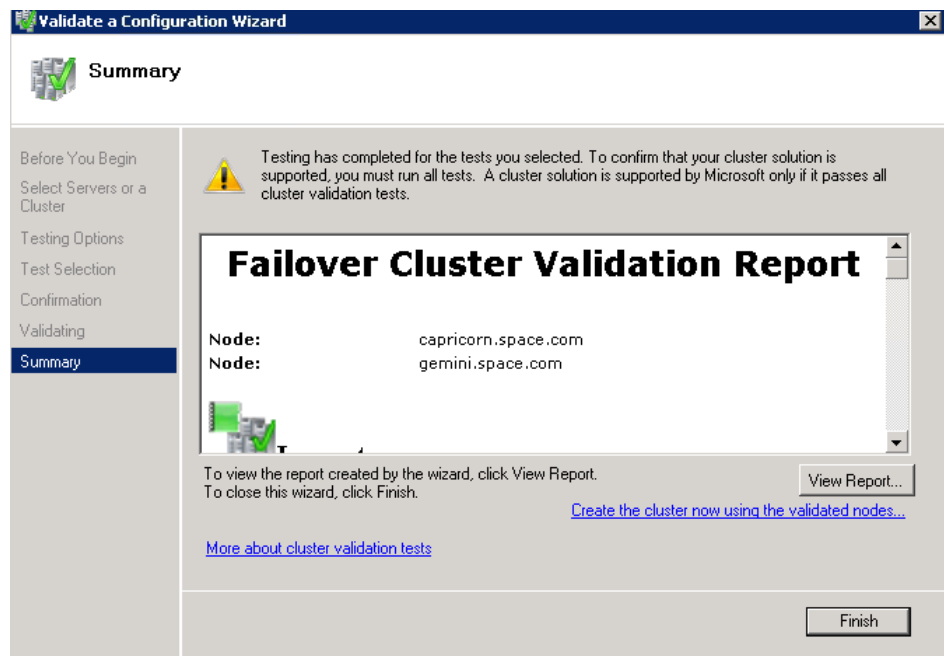


- 6 Click the **Run only tests I select** option to skip storage validation process, and then click **Next**. The **Test Selection** screen appears.

**Note:** Click the **Run all tests (recommended)** option to validate the default selection of tests.



- 7 Clear the **Storage** check box, and then click **Next**. The **Summary** screen appears.



- 8 Click **View Report** to view the test results or click **Finish** to close the **Validate a Configuration Wizard** window.

A warning message appears indicating that all tests have not been run. This usually happens in a multisite cluster where storage tests are skipped. You can proceed if there is no other error message. If the report indicates any other error, you need to fix the problem and rerun the tests before you continue. You can view the results of the tests after you close the wizard in `SystemRoot\Cluster\Reports\Validation Report date and time.html` where `SystemRoot` is the folder in which the operating system is installed (for example, `C:\Windows`).

To know more about cluster validation tests, click **More about cluster validation tests** on **Validate a Configuration Wizard** window.

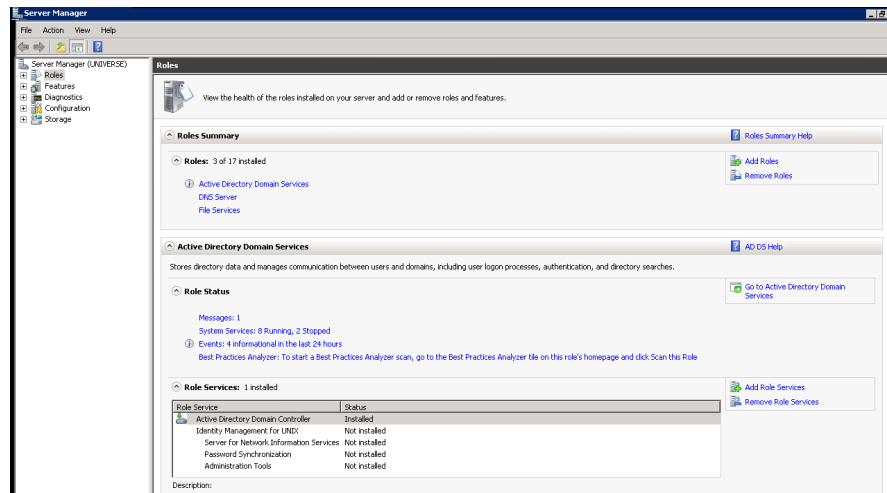
## Creating a Cluster

To create a cluster, you need to run the Create Cluster wizard.

### To create a cluster

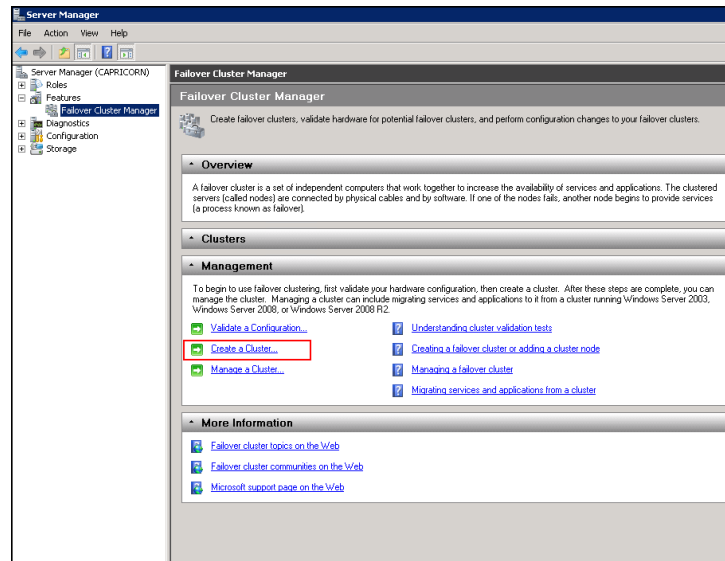
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

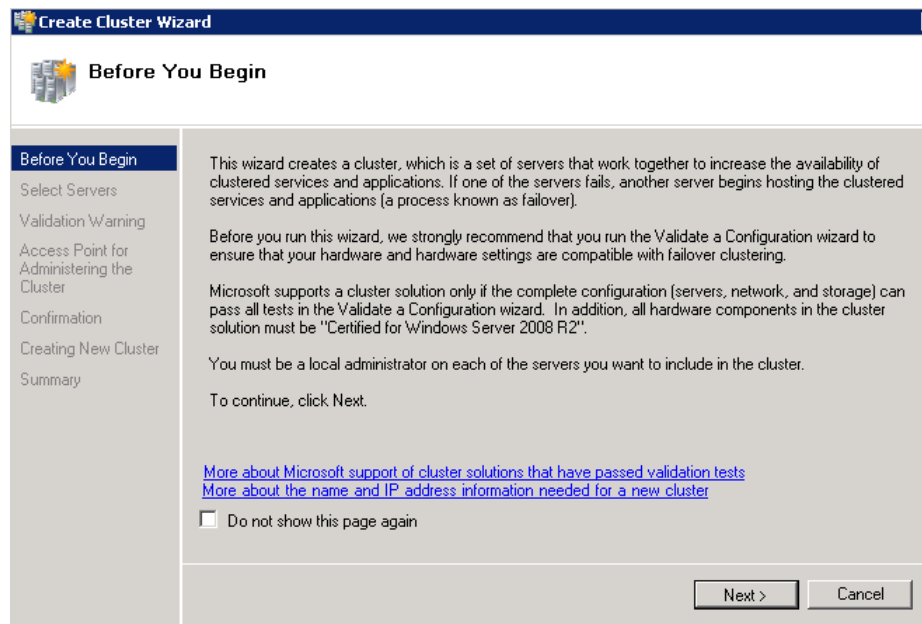


- Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

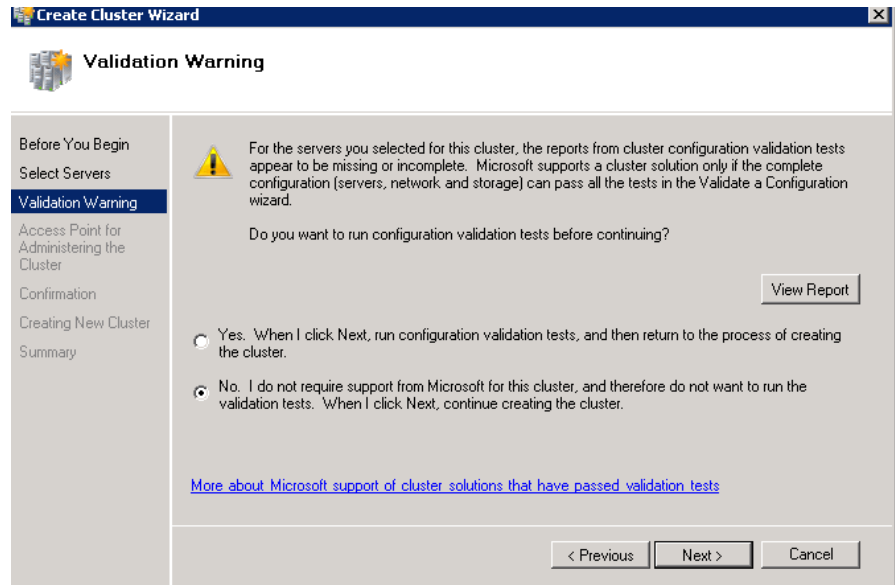
**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



- Under **Management**, click **Create a cluster**. The **Create Cluster Wizard** window appears.

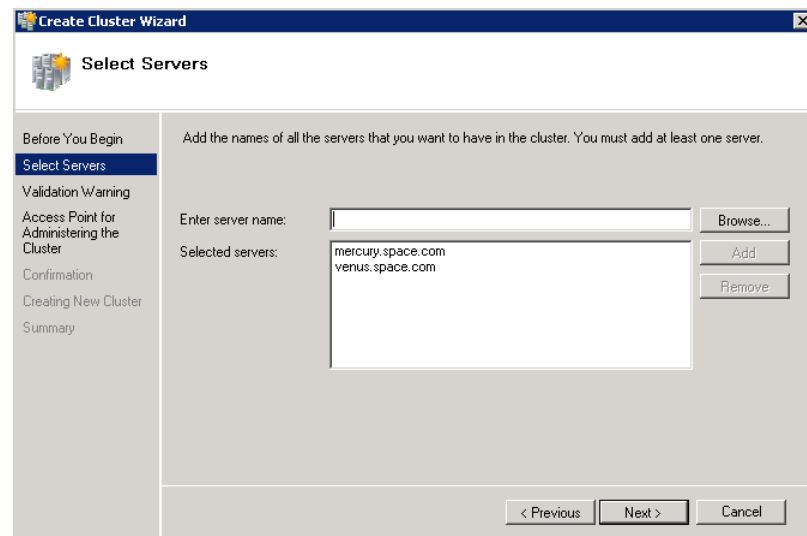


- View the instructions and click **Next**. The **Validation Warning** area appears.



- 5** Click **No. I do not require support from Microsoft for this cluster, and therefore do not want to run the validation tests. When I click Next, continue creating the cluster** option and click **Next**. The **Select Servers** area appears.

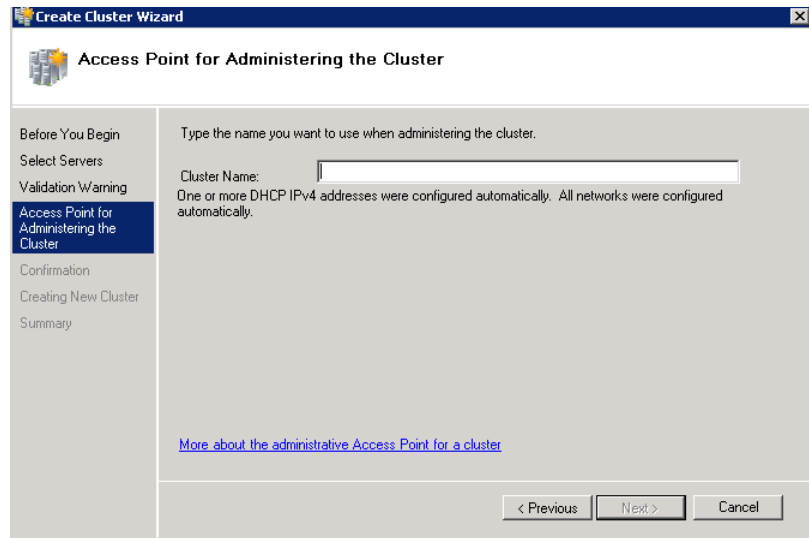
**Note:** Click **Click Yes. When I click Next, run configuration validation tests, and then return to the process of creating the cluster** option if you want to run the configuration validation tests. Click **View Report** to view the cluster operation report.



- 6** In the **Select Servers** screen, do the following:
- a** In the **Enter server name** box, enter the relevant server name and click **Add**. The server name gets added in the **Selected servers** box.

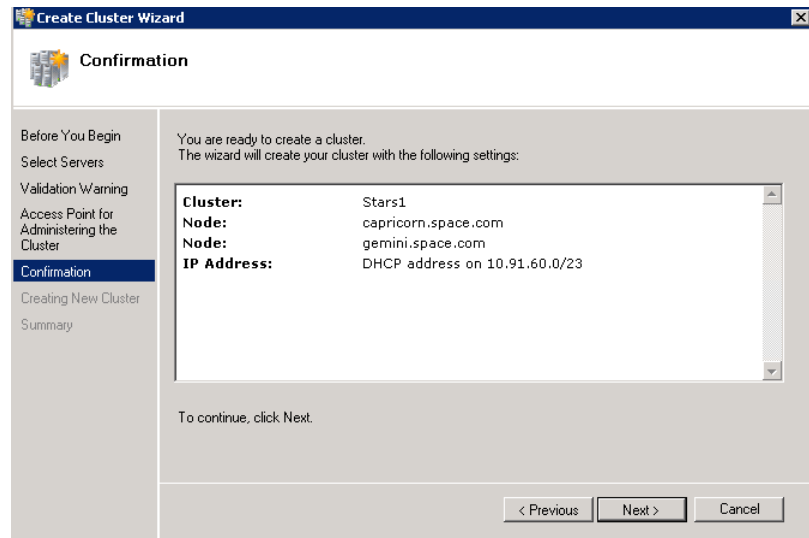
**Note:** You can either enter the server name or click **Browse** to select the relevant server name.

- b** Click **Next**. The **Access Point for Administering the Cluster** area appears.

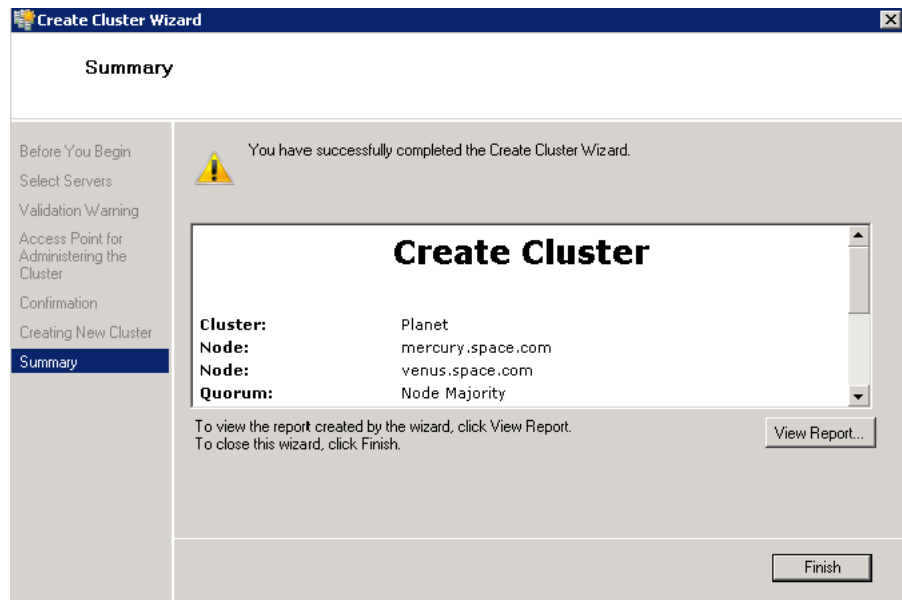


- 7 In the **Cluster Name** box, enter the name of the cluster and click **Next**. The **Confirmation** area appears.

**Note:** Enter a valid IP address for the cluster to be created if the IP address is not configured through Dynamic Host Configuration Protocol (DHCP).



- 8 Click **Next**. The cluster is created and the **Summary** area appears.



- 9 Click **View Report** to view the cluster report created by the wizard or click **Finish** to close the **Create Cluster Wizard** window

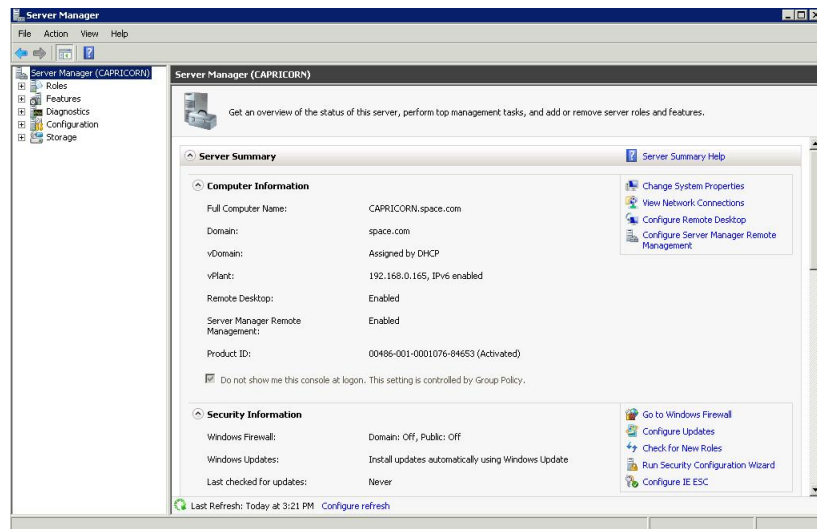
## Disabling the Plant Network for the Cluster Communication

After creating the Failover cluster using two or more Network Cards enabled, Make sure only Primary Network card which is used for the Communication between the Hyper-V nodes is enabled for the Failover Communication Disable the remaining Cluster Networks

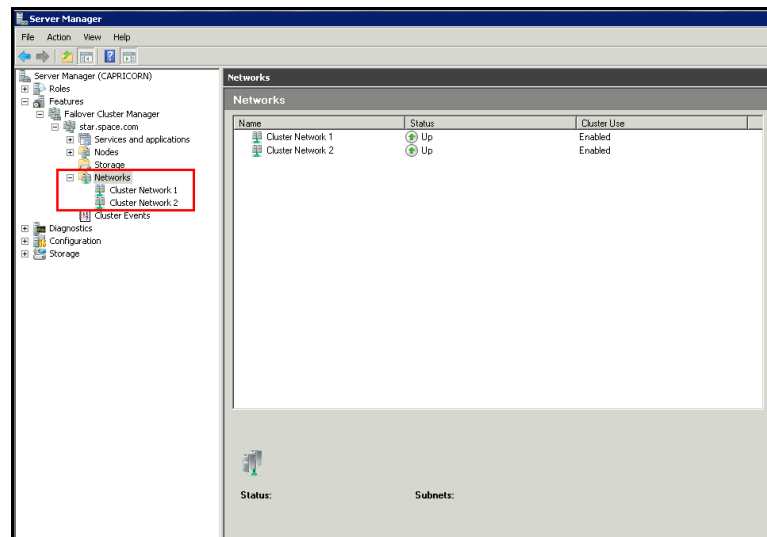
### To disable the plant network for the Cluster Communication

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

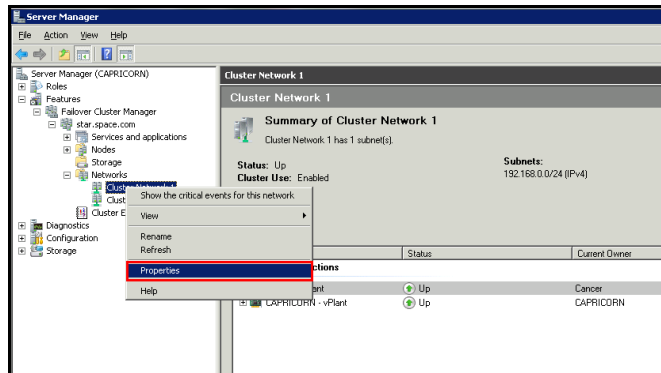
**Note:** You can also access the **Server Manager** window from the Administrative Tools window or the Start menu.



- 2 Expand the **Failover Cluster Manager** and select **Networks** to check how many networks are participating in the cluster.

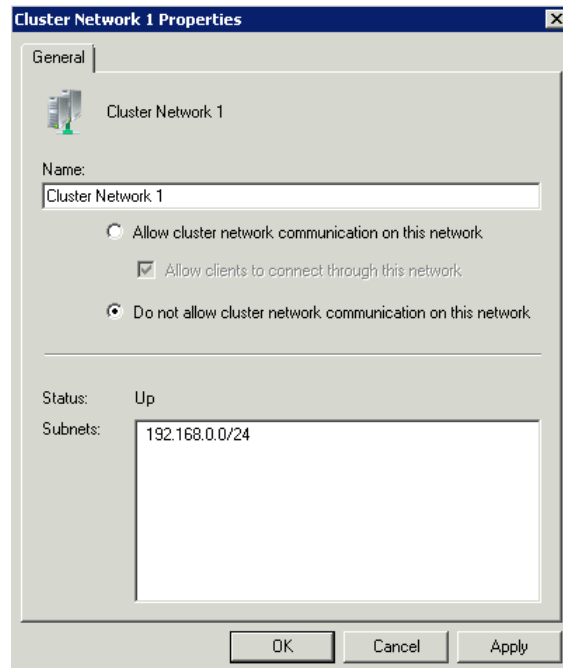


- 3 Select Network of which is not required to be part of the Cluster Communication (for example, Private Network ) and right click to select **Properties**. The Cluster Network Properties menu dialog box appears

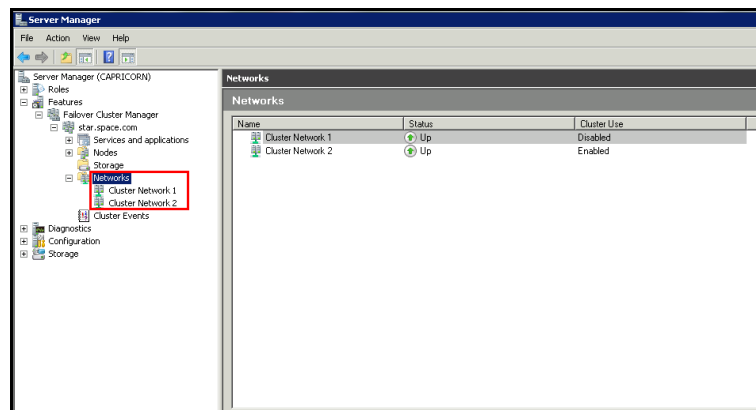




- 4 Select the **Do not Allow cluster communication on this network** option from the **Properties** dialog box and click **OK** to apply the changes.



- 5 Check the summary pane of the networks and ensure **Cluster Use** is disabled for the network which is not required for cluster communication



**Note:** Repeat the above process if more than two networks which are not required for cluster communication are involved in the Cluster Setup.

## Configure Cluster Quorum Settings

Quorum is the number of elements that need to be online to enable continuous running of a cluster. In most instances, the elements are nodes. In some cases, the elements also consist of disk or file share witnesses. Each of these elements determines whether the cluster should continue to run.

All elements, except the file share witnesses, have a copy of the cluster configuration. The cluster service ensures that the copies are always synchronized. The cluster should stop running if there are multiple failures or if there is a communication error between the cluster nodes.

After both nodes have been added to the cluster, and the cluster networking components have been configured, you must configure the failover cluster quorum.

The file share to be used for the node and File Share Majority quorum must be created and secured before configuring the failover cluster quorum. If the file share has not been created or correctly secured, the following procedure to configure a cluster quorum will fail. The file share can be hosted on any computer running a Windows operating system.

To configure the cluster quorum, you need to perform the following procedures:

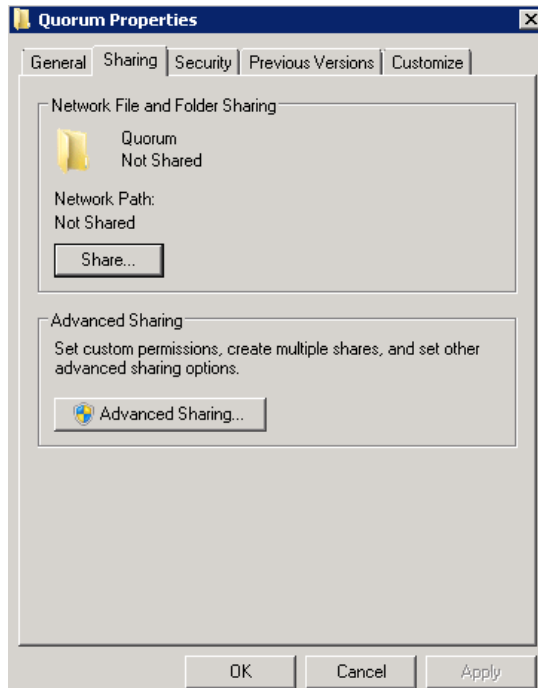
- Create and secure a file share for the node and file share majority quorum
- Use the failover cluster management tool to configure a node and file share majority quorum

### To create and secure a file share for the node and file share majority quorum

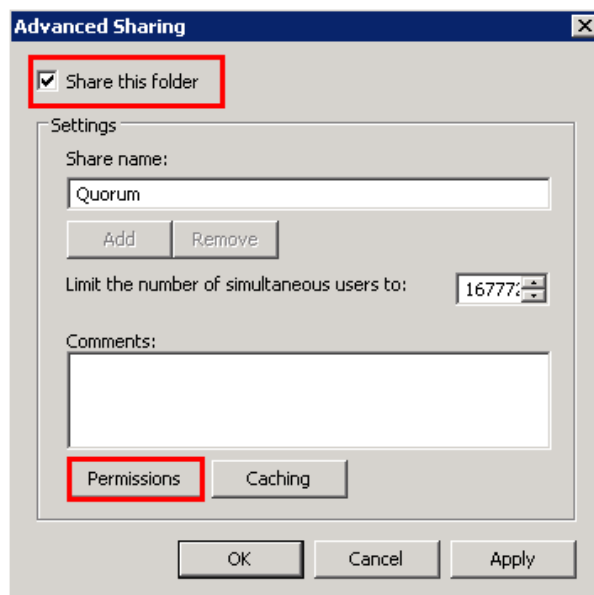
- 1 Create a new folder on the system that will host the share directory.

- 2 Right-click the folder that you created and click **Properties**. The **Quorum Properties** window for the folder you created appears.

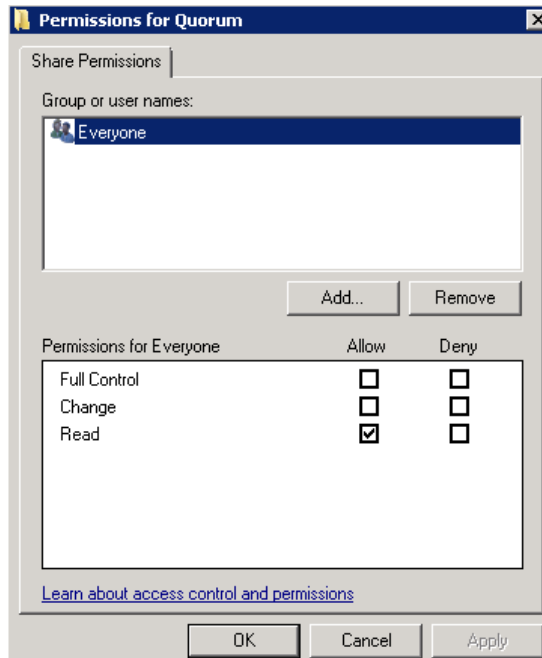
**Note:** In the following procedure, Quorum is the name of the folder.



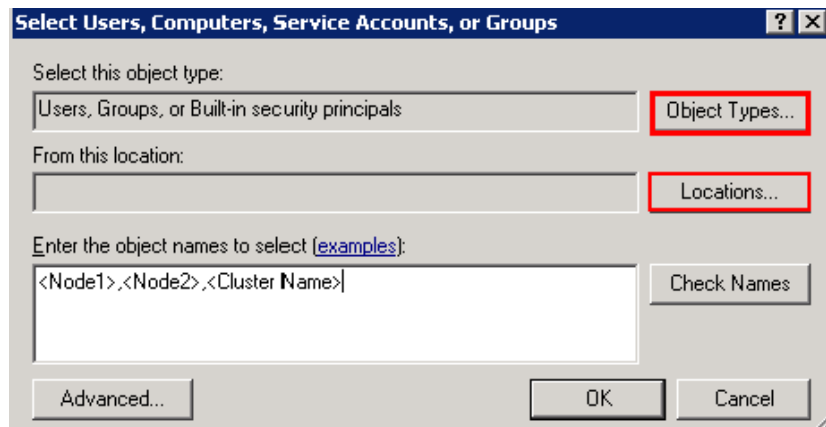
- 3 Click the **Sharing** tab, and then click **Advanced Sharing**. The **Advanced Sharing** window appears.



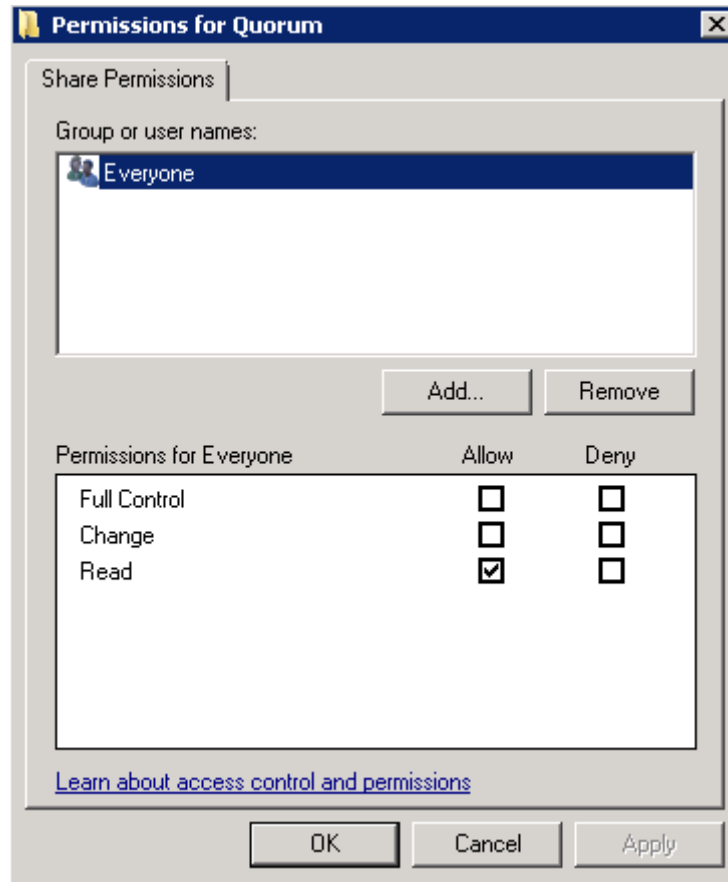
- 4 Select the **Share this folder** check box and click **Permissions**. The **Permissions for Quorum** window appears.



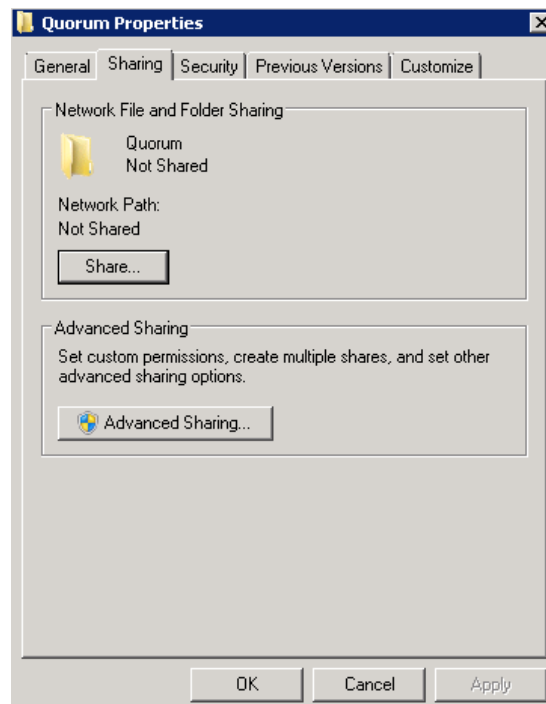
- 5 Click **Add**. The **Select Users, Computers, Service Accounts, or Groups** window appears.



- 6 In the **Enter the object name to select** box, enter the two node names used for the cluster in the medium node configuration and click **OK**. The node names are added and the **Permissions for Quorum** window appears.



- 7 Select the **Full Control**, **Change**, and **Read** check boxes and click **OK**. The **Properties** window appears.

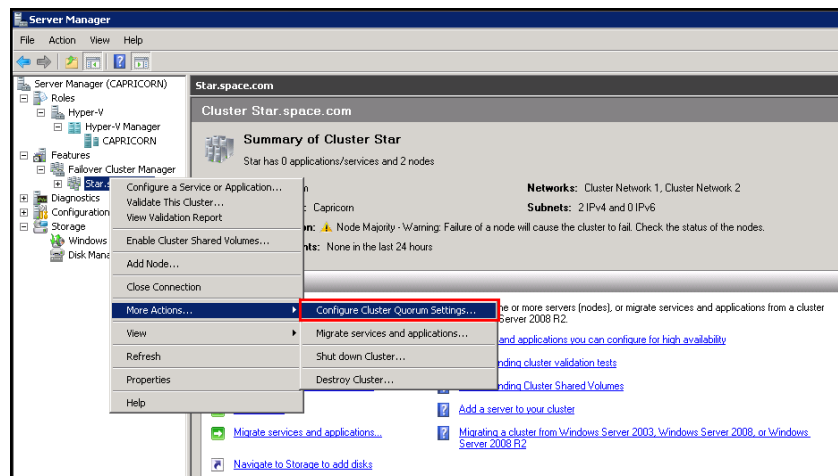


- 8 Click **Ok**. The folder is shared and can be used to create virtual machines.

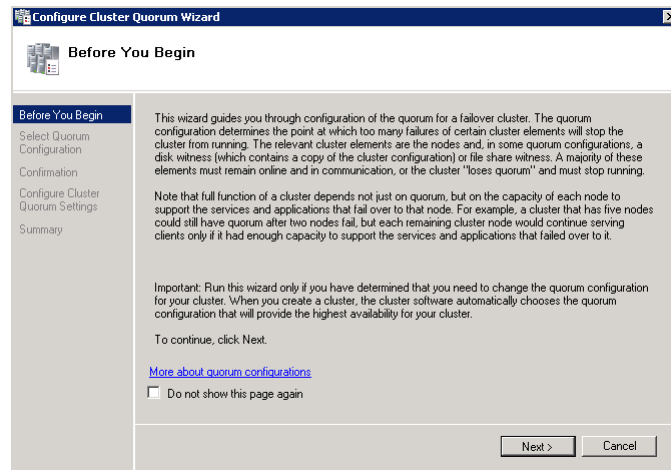
### To configure a node and file share majority quorum using the failover cluster management tool

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

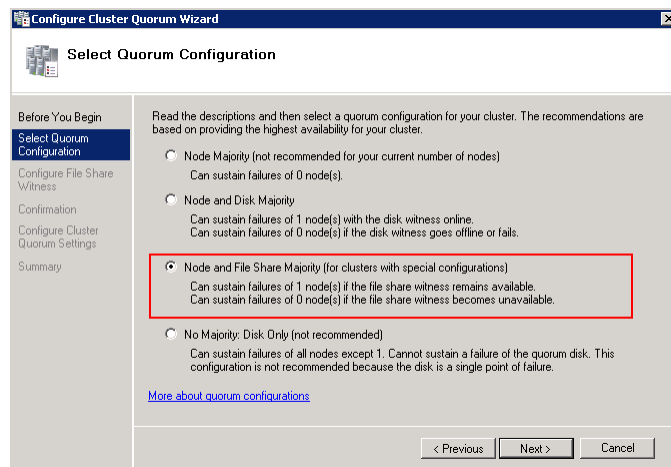


- Right-click the name of the cluster you created and click **More Actions**. Click **Configure Cluster Quorum Settings**. The **Configure Cluster Quorum Wizard** window appears.



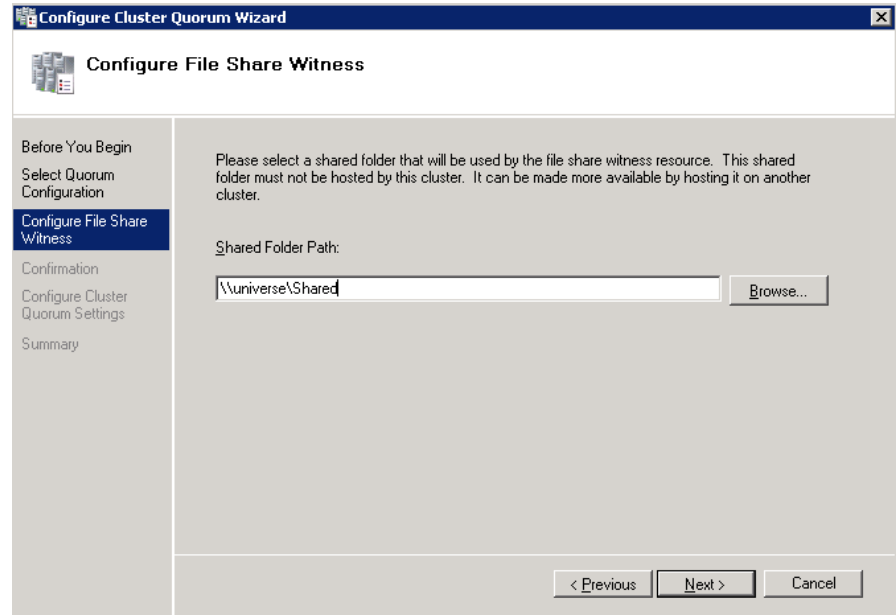
- View the instructions on the wizard and click **Next**. The **Select Quorum Configuration** area appears.

**Note:** The **Before you Begin** screen appears the first time you run the wizard. You can hide this screen on subsequent uses of the wizard.



- 4 You need to select the relevant quorum node. For special configurations, click the **Node and File Share Majority** option and click **Next**. The **Configure File Share Witness** area appears.

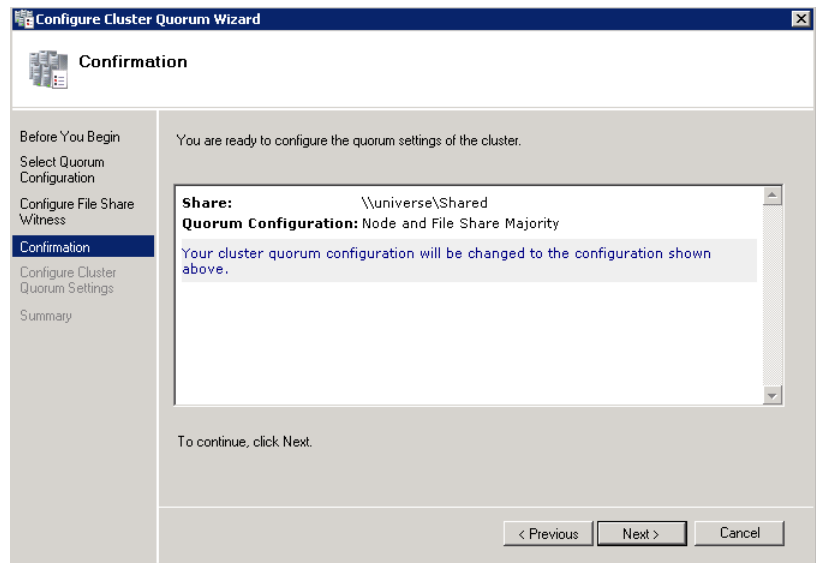
**Note:** Click the **Node Majority** option if the cluster is configured for node majority or a single quorum resource. Click the **Node and Disk Majority** option if the number of nodes is even and not part of a multisite cluster. Click the **No Majority: Disk Only** option if the disk being used is only for the quorum.



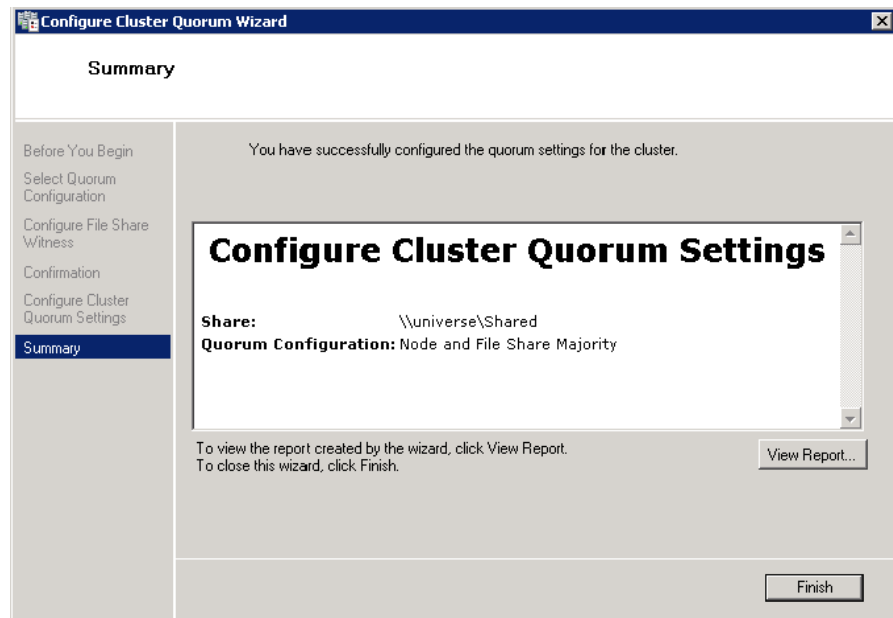


- 5 In the **Shared Folder Path** box, enter the Universal Naming Convention (UNC) path to the file share that you created in the Shared Folder Path field, and then click **Next**. Permissions to the share are verified. If there are no problems with the access to the share, the **Confirmation** screen appears.

**Note:** You can either enter the server name or click **Browse** to select the relevant shared path.



- 6 The details you selected are displayed. To confirm the details click **Next**. The **Summary** screen appears and the configuration details of the quorum settings are displayed.



- 7 Click **View Report** to view a report of the tasks performed, or click **Finish** to close the window.

After you configure the cluster quorum, you must validate the cluster. For more information, refer to [http://technet.microsoft.com/en-us/library/bb676379\(EXCHG.80\).aspx](http://technet.microsoft.com/en-us/library/bb676379(EXCHG.80).aspx).

## Configuring Storage

For any virtualization environment, storage is one of the central barriers to implementing a good virtualization strategy. But with Hyper-V, VM storage is kept on a Windows file system. Users can put VMs on any file system that a Hyper-V server can access. As a result, you can build HA into the virtualization platform and storage for the virtual machines. This configuration can accommodate a host failure by making storage accessible to all Hyper-V hosts so that any host can run VMs from the same path on the shared folder. The back-end part of this storage can be a local storage area network, iSCSI or whatever is available to fit the implementation.

The following table lists the minimum storage recommendations for each VM :

<b>System</b>	<b>Processor</b>
Historian Virtual Machine	200 GB
Application Server (GR node) Virtual Machine	100 GB
Application Engine 1(Runtime node) Virtual Machine	80 GB
Application Engine 2 (Runtime node) Virtual Machine	80 GB
InTouch Virtual Machine	80 GB
Information Server Virtual Machine	80 GB
Historian Client	80 GB

The recommended total storage capacity should be minimum 1TB.

## Configuring Hyper-V

Microsoft Hyper-V Server 2008 R2 helps in creating virtual environment that improves server utilization. It enhances patching, provisioning, management, support tools, processes, and skills. Microsoft Hyper-V Server 2008 R2 provides live migration, cluster shared volume support, expanded processor, and memory support for host systems.

Hyper-V is available in x64-based versions of Windows Server 2008 R2 operating system, specifically the x64-based versions of Windows Server 2008 R2 Standard, Windows Server 2008 R2 Enterprise, and Windows Server 2008 Datacenter.

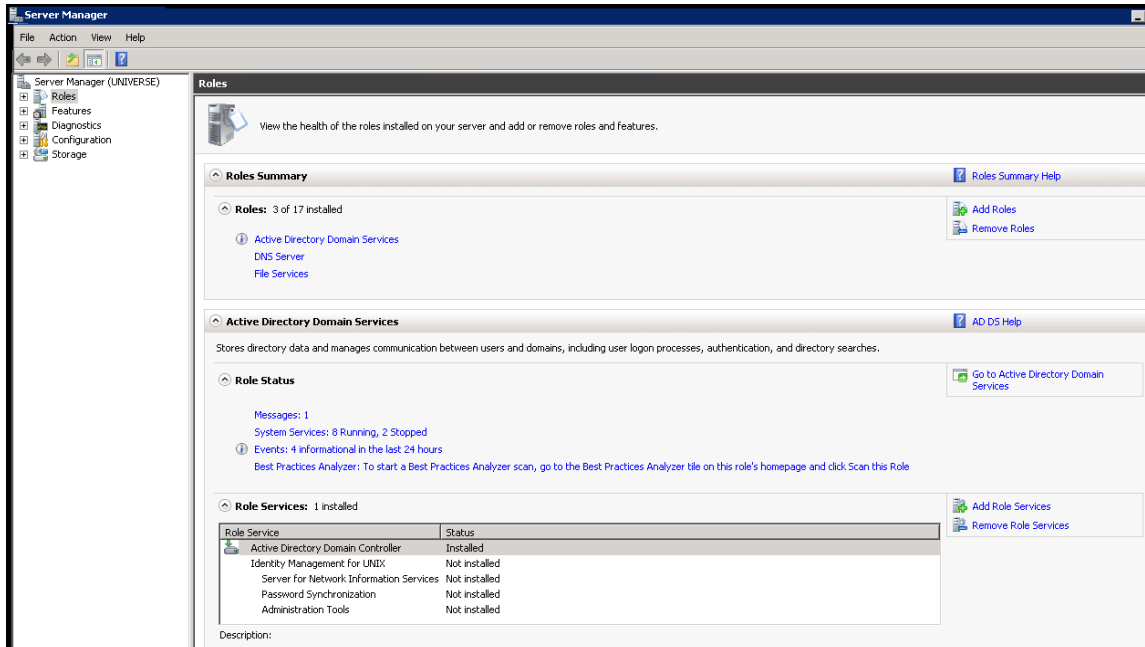
The following are the pre-requisites to set up Hyper-V:

- x64-based processor
- Hardware-assisted virtualization
- Hardware Data Execution Prevention (DEP)

## To configure Hyper-V

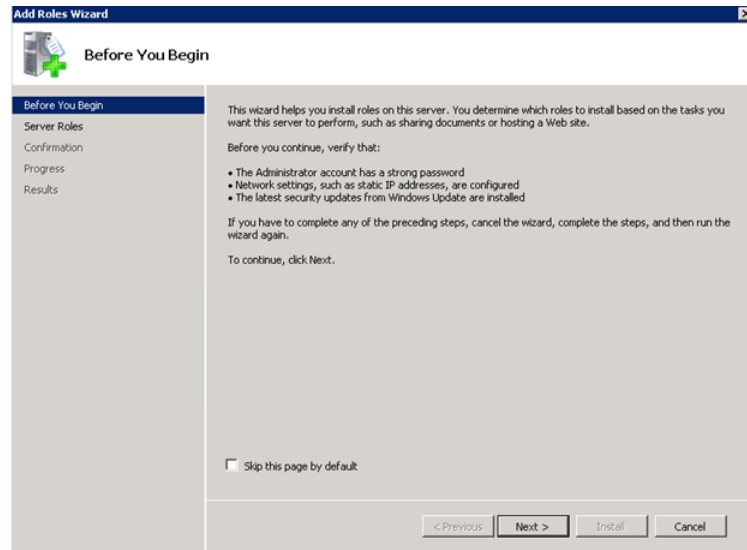
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

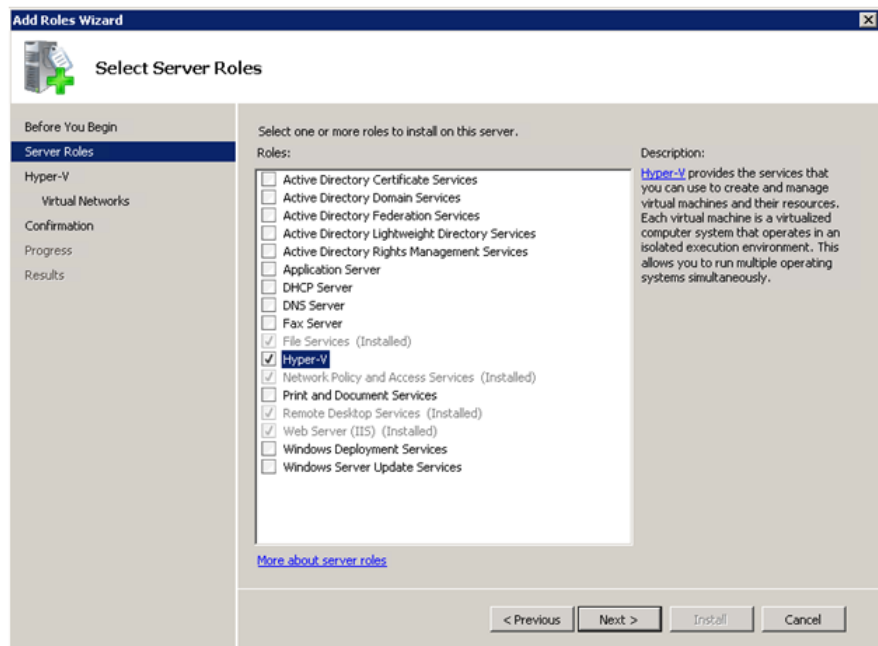


2 In the **Roles Summary** area, click **Add Roles**. The **Add Roles Wizard** window appears.

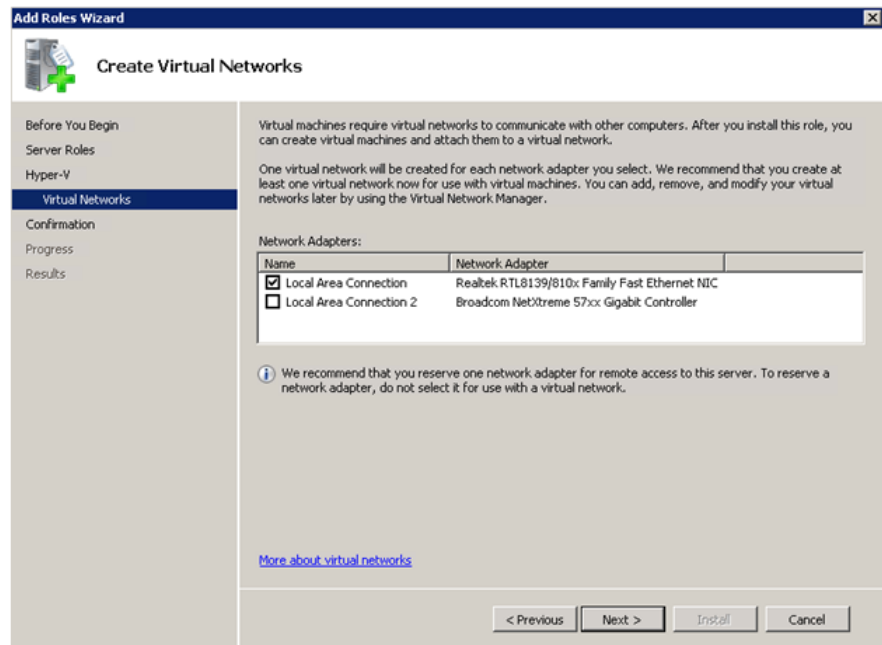
**Note:** You can also right-click **Roles**, and then click **Add Roles Wizard** to open the **Add Roles Wizard** window.



- 3 View the instructions on the wizard and click **Next**. The **Select Server Roles** area appears.

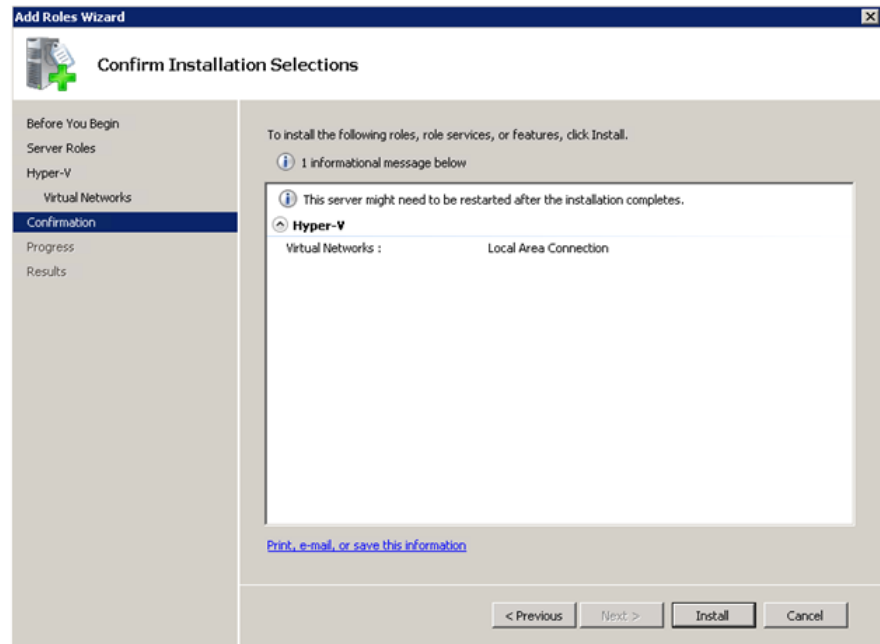


- 4 Select the **Hyper-V** check box and click **Next**. The **Create Virtual Networks** area appears.

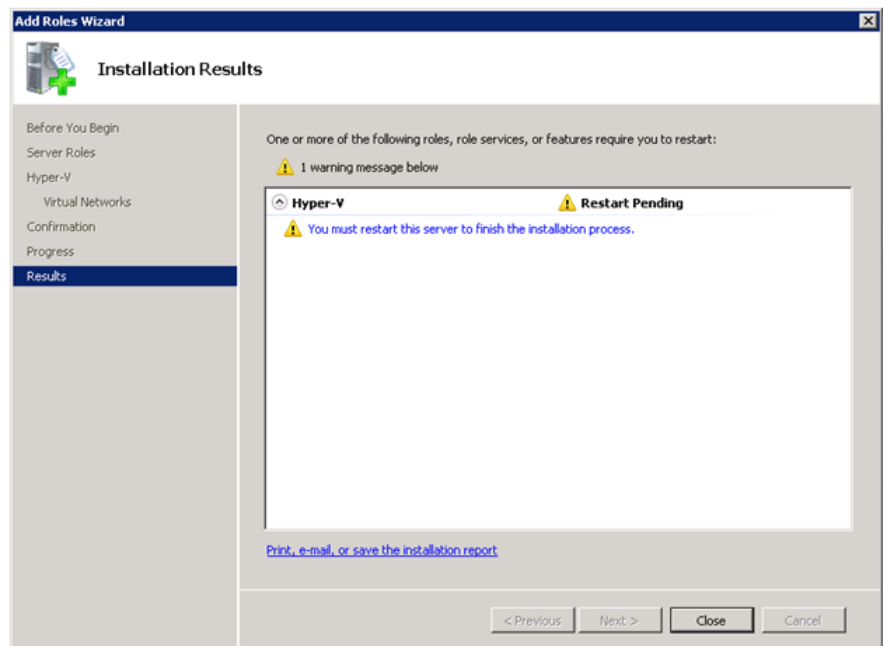


- 5 Select the check box next to the required network adapter to make the connection available to virtual machines. Click **Next**. The **Confirmation Installation Selections** area appears.

**Note:** You can select one or more network adapters.

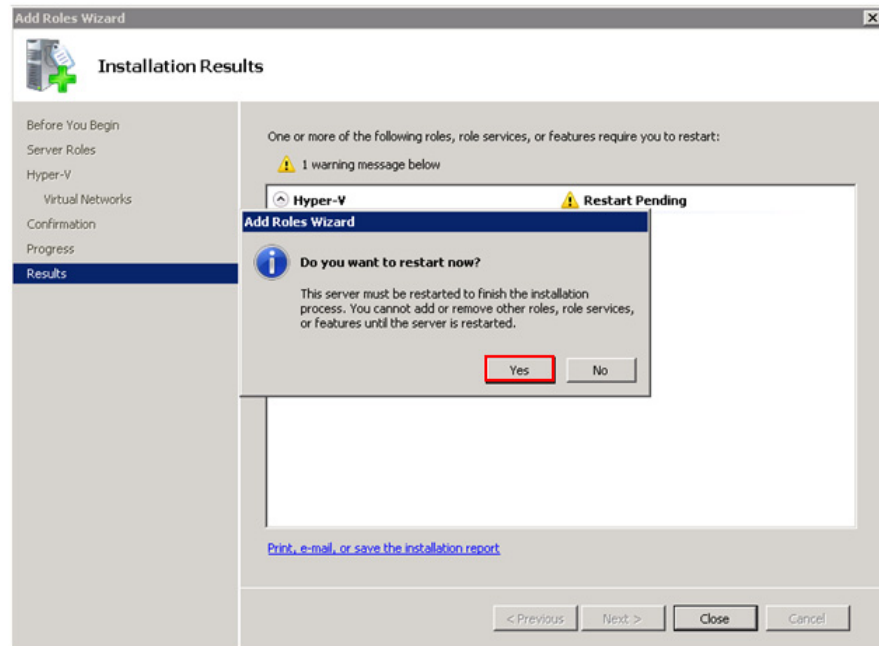


- 6 Click **Install**. The **Installation Results** area appears.

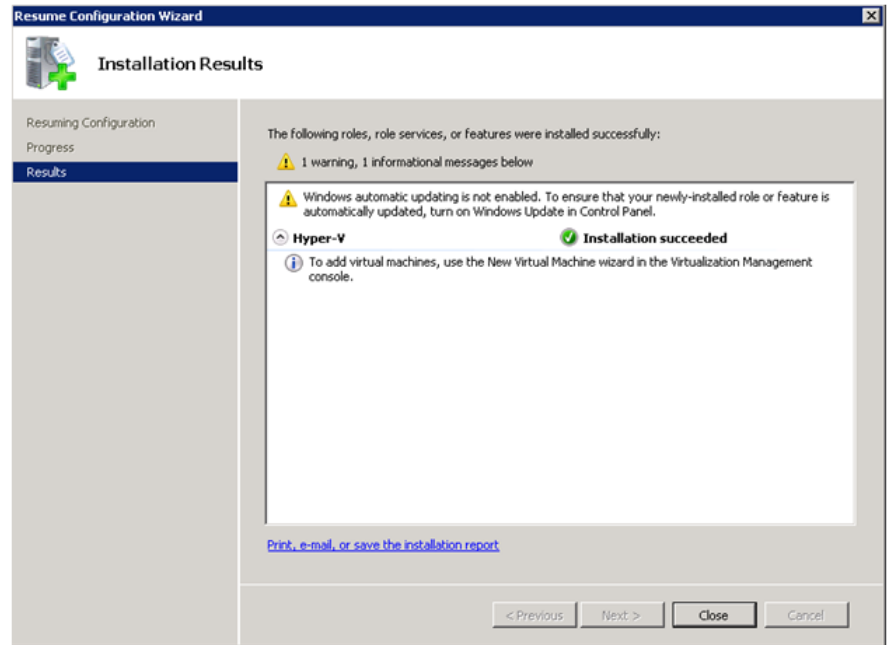




- 7 A message appears prompting you to restart the computer. Click **Close**. The **Add Roles Wizard** pop-up window appears.



- 8 Click **Yes** to restart the computer.
- 9 After you restart the computer, log on with the same ID and password you used to install the Hyper V role. The installation is completed and the **Resume Configuration Wizard** window appears with the installation results.



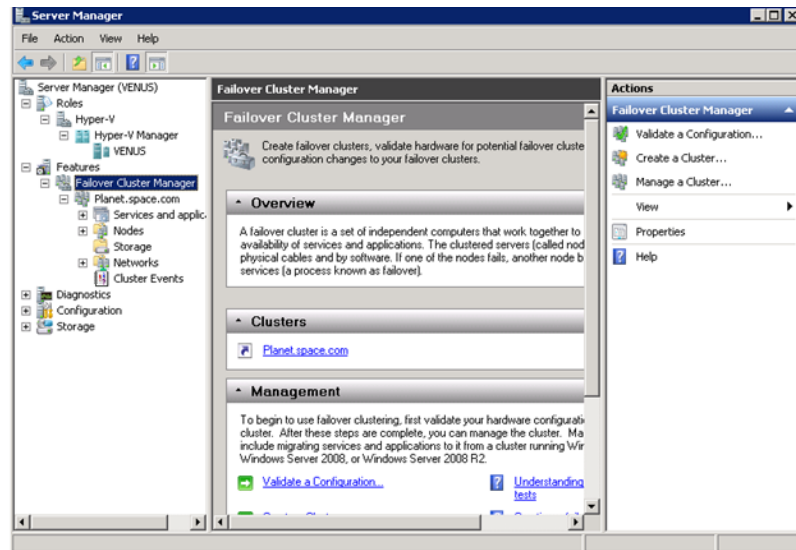
- 10 Click **Close** to close the **Resume Configuration Wizard** window.

## Configuring Virtual Machines

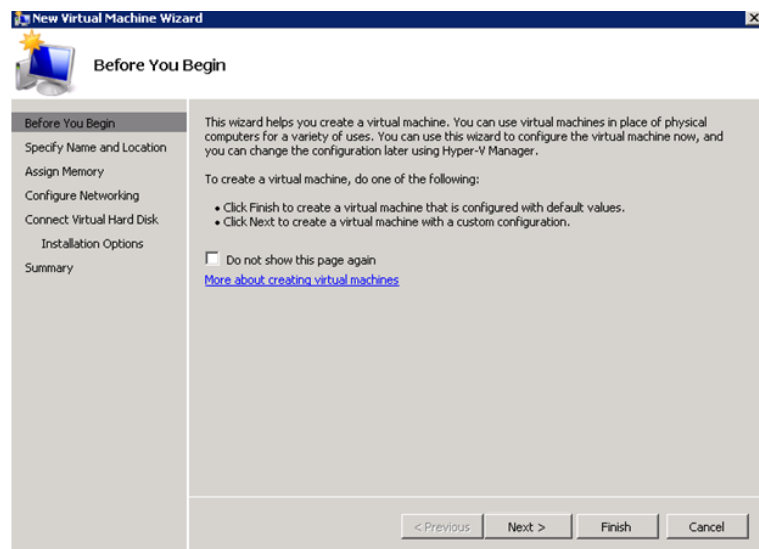
After installing Hyper-V, you need to create a virtual machine.

### To configure a virtual machine in the disk

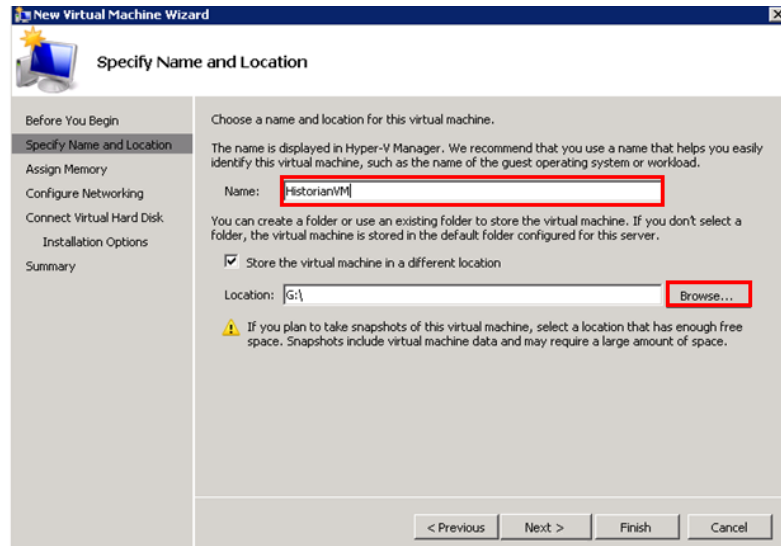
- 1 In the **Server Manager** window, right-click **Features**, and then click **Failover Cluster Manager**. The **Failover Cluster Manager** tree expands.



- 2 Right-click **Services and applications**, click **Virtual Machines**, and then click **New Virtual Machine**. The **New Virtual Machine Wizard** window appears.



- 3 View the instructions in the **Before You Begin** area and click **Next**. The **Specify Name and Location** area appears.



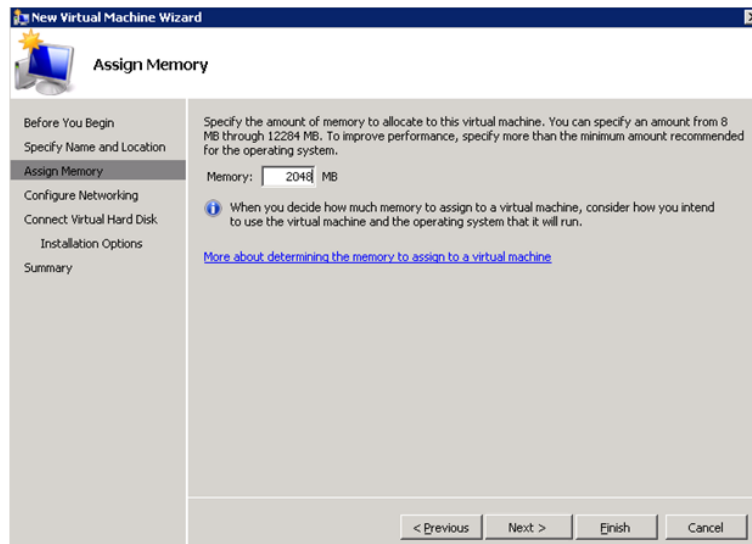
- 4 In the **Specify Name and Location** area, do the following:
  - a In the **Name** box, enter a name for the virtual machine.
  - b Select the **Store the virtual machine in a different location** check box to be able to indicate the location of the virtual machine.

- c In the **Location** box, enter the location where you want to store the virtual machine.

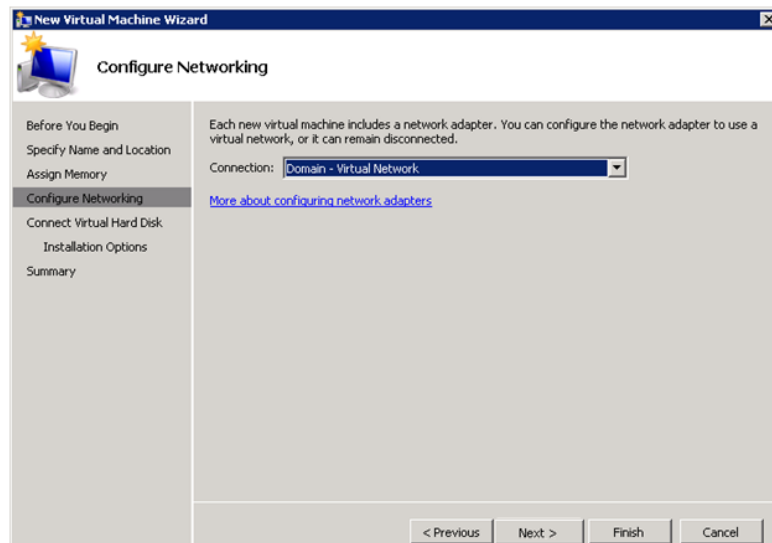
**Note:** In the medium scale virtualization environment, SAN storage disk can be used for creating virtual machines.

**Note:** You can either enter the path to the filename or click **Browse** to select the relevant server name.

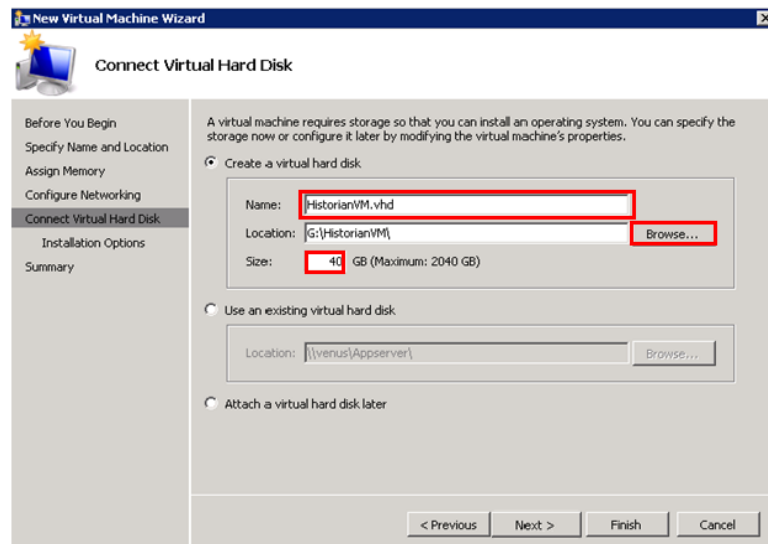
- d Click **Next**. The **Assign Memory** area appears.



- 5 Enter the recommended amount of memory in the **Memory** box and click **Next**. The **Configure Networking** area appears.



- 6 Select the network to be used for the virtual machine and click **Next**. The **Connect Virtual Hard Disk** area appears.

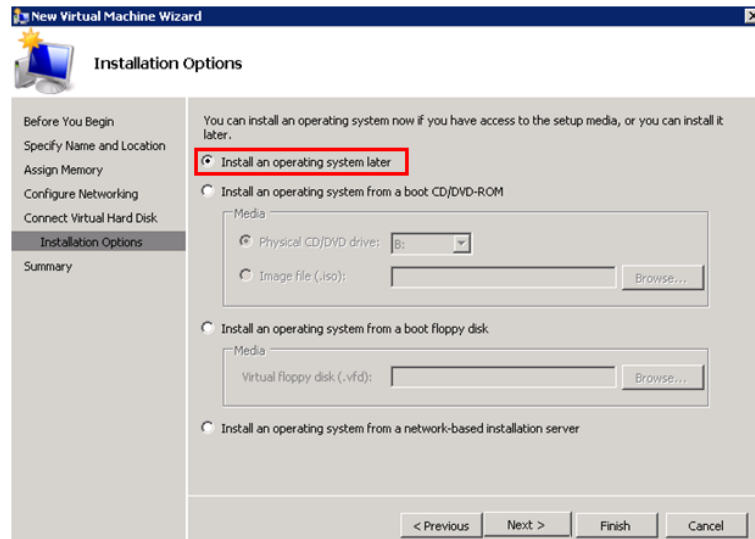


- 7 Click the **Create a virtual hard disk** option and then do the following:
  - a In the **Name** box, enter the name of the virtual machine.
  - b In the **Location** box, enter the location of the virtual machine.

**Note:** You can either enter the location or click **Browse** to select the location of the virtual machine and click **Next**.

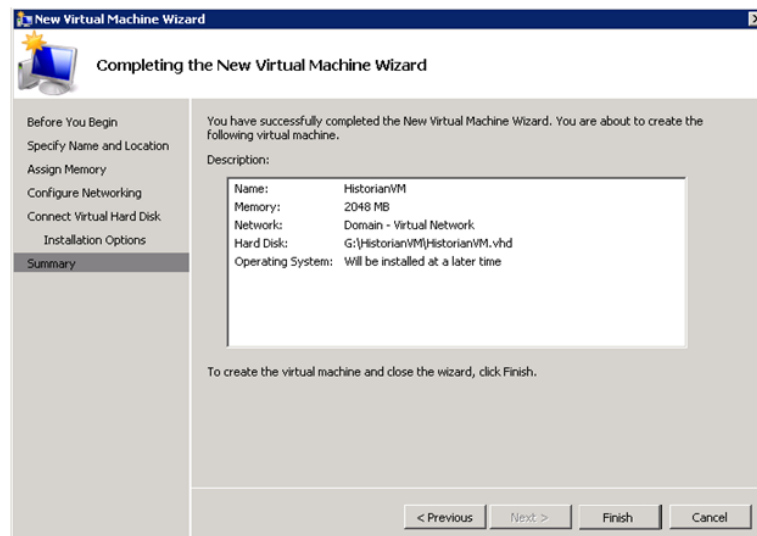
- c In the **Size** box, enter the size of the virtual machine and then click **Next**. The **Installation Options** area appears.

**Note:** You need to click either the **Use an existing virtual hard disk** or the **Attach a virtual hard disk later** option, only if you are using an existing virtual hard disk, or you want to attach a virtual disk later.

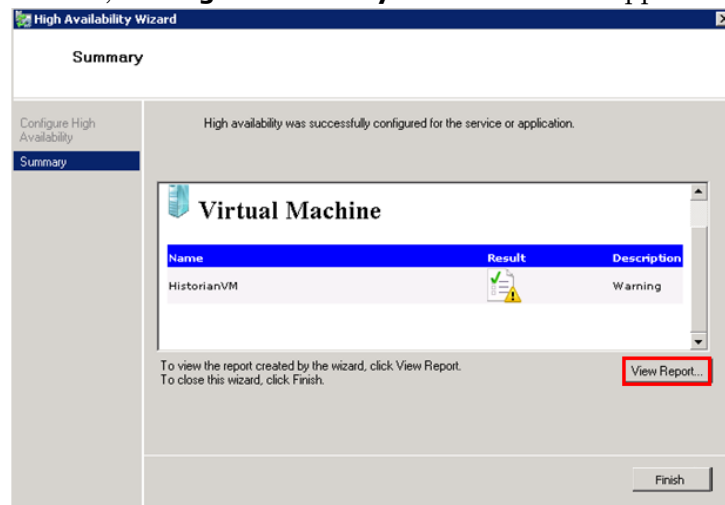


- 8 Click the **Install an operating system later** option and click **Next**. The **Completing the New Virtual Machine Window** area appears.

**Note:** If you want to install an operating system from a boot CD/DVD-ROM or a boot floppy disk or a network-based installation server, click the relevant option.



- 9 Click **Finish**. The virtual machine is created with the details you provided. As we have started this process from the Failover Cluster Manager, after completing the process of creating a virtual machine, the **High Availability Wizard** window appears



- 10 Click **View Report** to view the report or click **Finish** to close the **High Availability Wizard** window.

**Note:** You can use the above procedure to create multiple virtual machines with appropriate names and configuration.

## Failover of the Virtual Machine if the Private Network is Disabled

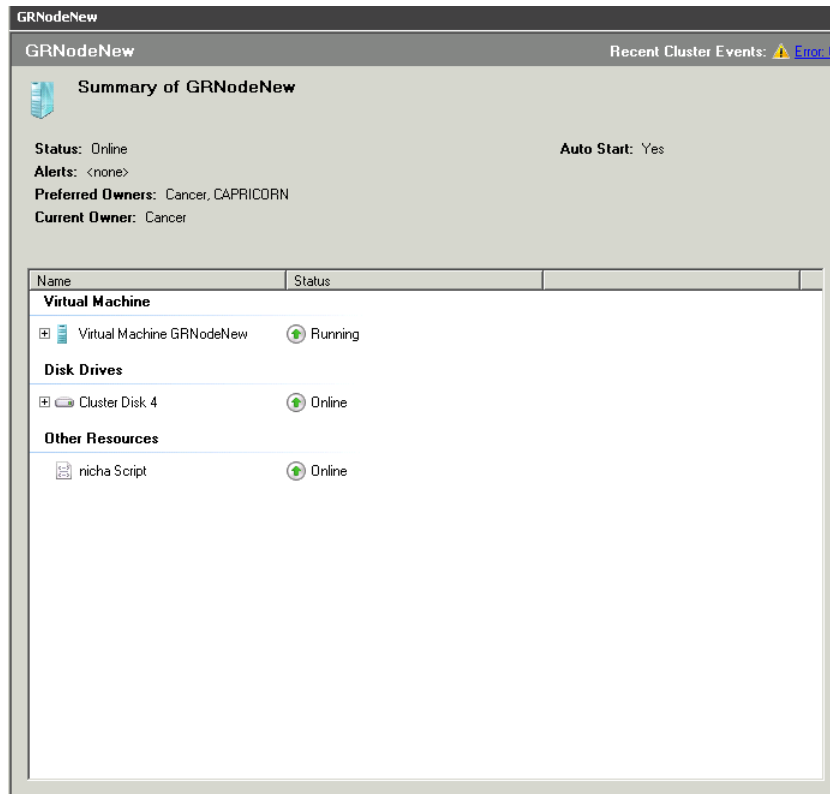
Whenever public network is disconnected on the node where the virtual machines are running, Failover Cluster Manager force failover of all the Virtual Machine Services and application to the other host node in the cluster. If the private network which is not participating in the cluster communication fails, Failover Cluster Manager does not failover any Cluster Service or Application.

To overcome this, we need to add a script which detects the private network failure as a dependency to the Virtual Machine. This results in failover of the Virtual Machine when the script fails.

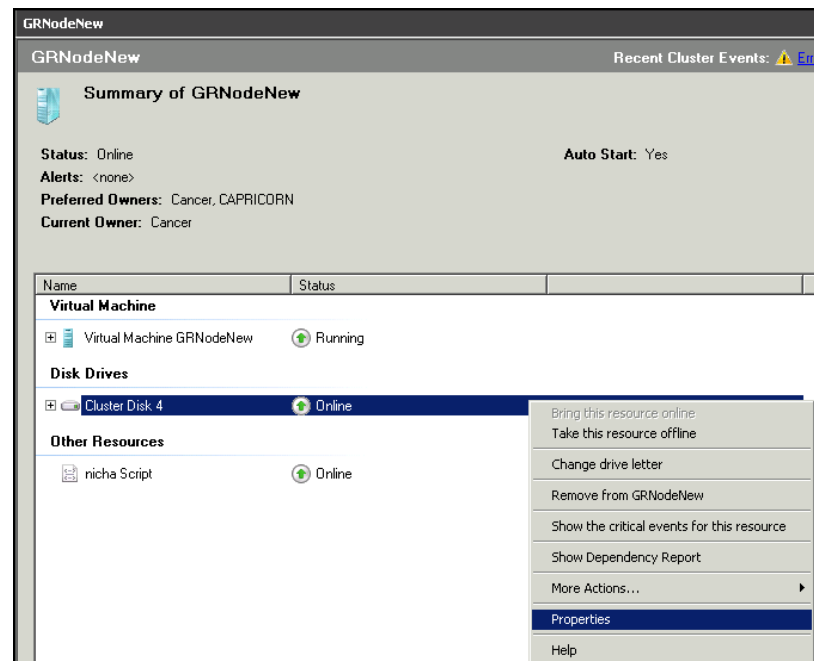
### To add a script which enables the failover of the virtual machine if the private network is disabled

- 1 Add a script to the virtual machine. Follow the process mentioned in the following URL to add the script:  
<http://gallery.technet.microsoft.com/ScriptCenter/5f7b4df3-af02-47bf-b275-154e5edf17e6/>
- 2 After adding the Script to a Virtual Machine, the summary pane of the Virtual Machine will be displayed as below.

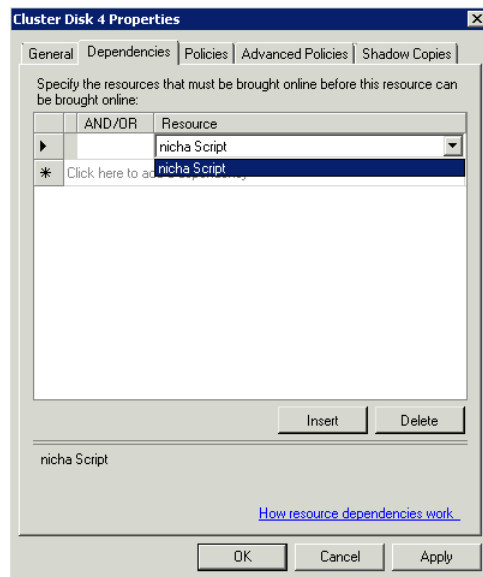




- Right click on the **Disk Resource** and click on **Properties** menu which opens **Disk Properties Dialog** box.



- Navigate to the **Dependencies** tab and select the **nicha Script** from the **Resource** Combo box and press **OK**.



**Note:** By adding this, if the Script fails when Private network is disabled, Disk Resource will also fail and try to move the Virtual Machine service to the backup node.

## Configuration of System Platform Products in a Typical Medium Scale Virtualization

To record the expected Recovery Time Objective (RPO) and Recovery Point Objective (RPO), trends and various observations in a medium scale virtualization environment, tests are performed with System Platform Product configuration shown below.

The virtualization host server used for medium scale configuration consists of seven virtual machines listed below.

Node 1 (GR): GR , InTouch and DAS SI Direct – Windows 2008 R2 Standard edition (64bit) OS with SQL Server 2008 SP1 32 bit

Node 2 (AppEngine1): Bootstrap , IDE and InTouch (Managed App) – Windows 2008 R2 Standard edition (64bit) OS

Node 3 (AppEngine2): Bootstrap , IDE – Windows 2008 R2 Standard edition (64bit) OS

Node 4: Historian – Windows 2008 R2 Standard edition (64bit) OS with SQL Server 2008 SP1 32 bit

Node 5: Information Server , Bootstrap and IDE – Windows Server 2008 SP2 (32bit) with SQL Server 2008 SP1 and Office 2007

Node 6: InTouch Terminal Service – Windows 2008 R2 Standard edition (64bit) OS enabled with Terminal Service

Node 7: Historian Client and InTouch – Windows 7 Professional Edition (64bit) OS with SQL Server 2008 SP1 32 bit

---

<b>Virtual Node</b>	<b>IO tags (Approx.)</b>	<b>Historized tags(Approx.)</b>
AppEngine1	25000	10000
AppEngine2	25000	10000

---

### Historized tags and their Update Rates for this Configuration

The following table shows historized tags and their update rates for this configuration:

#### Real Time data from DAS SI Direct

Topic Name	Update Rate	Device Items	Active Items
Topic 13	1000	1241	374
Topic 0	500	14	5
Topic 1	1000	1	1
Topic 2	10000	5002	2126
Topic 3	30000	5002	2126
Topic 4	60000	5002	2126
Topic 5	3600000	5001	2125
Topic 7	600000	5001	2589
Topic 8	10000	3841	1545
Topic 9	30000	1281	885
Topic 6	18000000	2504	1002
Topic 39	1000	4	4
Topic 16	180000	1000	350

#### Late tags and buffered tags from DAS test Server

Topic Name	Update Rate	Device Items	Active Items
Late Data (1 hour)	1000	465	208
Buffered Data	1000	198	119

### **Application Server Configuration Details**

Total No of Engines: 15

#### **Number of objects under each Engine**

- Engine 1 : 9
- Engine 2 : 2
- Engine 3 : 492
- Engine 4 : 312
- Engine 5 : 507
- Engine 6 : 2
- Engine 7 : 24
- Engine 8 : 24
- Engine 9 : 250
- Engine 10: 508
- Engine 11: 506
- Engine 12: 4
- Engine 13: 22
- Engine 14: 1
- Engine 15: 1

Number of DI objects: 6

## **Expected Recovery Time Objective and Recovery Point Objective**

This section provides the indicative Recovery Time Objectives (RTO) and Recovery Point Objectives (RPO) for the load of IO and Attributes historized shown above and with the configuration of Host Virtualization Servers and Hyper-V virtual machines explained in the Setup instructions of Medium Scale Virtualization. In addition to these factors, the exact RTO and RPO depend on factors like storage I/O performance, CPU utilization, memory usage, and network usage at the time of failover/migration activity.

## RTO and RPO Observations—HA Medium Configuration

Scenarios and observations in this section:

<b>Scenario</b>	<b>Observation</b>
Scenario 1: IT provides maintenance on Virtualization Server	"Scenario 1: IT provides maintenance on Virtualization Server" on page 183  "Quick Migration" on page 184  "Quick Migration of all nodes simultaneously" on page 185
Scenario 2: Virtualization Server hardware fails	"Scenario 2: Virtualization Server hardware fails" on page 186
Scenario 3: Network fails on Virtualization Server	"Scenario 3: Network fails on Virtualization Server" on page 187
Scenario 4: Virtualization Server becomes unresponsive	"Scenario 4: Virtualization Server becomes unresponsive" on page 190

The following tables display RTO and RPO observations with approximately 50000 IO points with approximately 20000 attributes being historized:

### Scenario 1: IT provides maintenance on Virtualization Server

#### Live Migration

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	13 sec	Data Loss for \$Second tag (Imported to Historian)	13 sec
GR	10 sec	IAS Tag (Script)	12 sec
		IAS IO Tag (DASSiDirect)	59 sec
AppEngine1	15 sec	IAS Tag (Script)	22 sec
		IAS IO Tag (DASSiDirect)	57 sec
AppEngine2	7 sec	IAS Tag (Script)	11 sec
		IAS IO Tag (DASSiDirect)	57 sec
Historian	9 sec	SysTimeSec (Historian)	0 sec
		\$Second (InTouch)	2 sec
		IAS Tag (Script)	0 (Data is SFed)
		IAS IO Tag (DASSiDirect)	0 (Data is SFed)
DAS SIDirect	14 sec	N/A	N/A
Historian Client	0 sec	N/A	N/A
Information Server	5 sec	N/A	N/A

### Quick Migration

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	31 sec	Data Loss for \$Second tag (Imported to Historian)	27 sec
GR	50 sec	IAS Tag (Script)	50 sec
		IAS IO Tag (DASSiDirect)	1 Min 51 Sec
AppEngine1	35 sec	IAS Tag (Script)	35 sec
		IAS IO Tag (DASSiDirect)	54 sec
AppEngine2	41 sec	IAS Tag (Script)	44 sec
		IAS IO Tag (DASSiDirect)	1 Min 14 Sec
Historian	84 sec	SysTimeSec (Historian)	1 Min 25 Sec
		\$Second (InTouch)	1 Min 51 Sec
		IAS Tag (Script)	0 (data is SFed)
		IAS IO Tag (DASSiDirect)	0 (data is SFed)
DAS SIDirect	50 sec	N/A	N/A
Historian Client	1 Min 32 Sec	N/A	N/A
Information Server	33 sec	N/A	N/A



**Quick Migration of all nodes simultaneously**

The following table displays the data for Quick Migration of all nodes.

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	28 Sec	Data Loss for \$Second tag (Imported to Historian)	1 Min 40 Sec
GR	104 Sec	IAS Tag (Script)	1 Min 36 Sec
		IAS IO Tag (DASSiDirect)	4 Min 14 Sec
AppEngine1	67 Sec	IAS Tag (Script)	1 Min 20 Sec
		IAS IO Tag (DASSiDirect)	4 Min 11 Sec
AppEngine2	54 Sec	IAS Tag (Script)	52 Sec
		IAS IO Tag (DASSiDirect)	4 Min 28 Sec
Historian	73 Sec	SysTimeSec (Historian)	1 Min 14 Sec
		\$Second (InTouch)	1 Min 40 Sec
		IAS Tag (Script)	1 Min 36 Sec
		IAS IO Tag (DASSiDirect)	4 Min 14 Sec
DAS SIDirect	107 Sec	N/A	
Historian Client	38 Sec	N/A	
Information Server	36 Sec	N/A	

**Scenario 2: Virtualization Server hardware fails**

The Virtualization Server hardware failure results in failover that is simulated with power-off on the host server. In this case, the VMs restart, after moving to the other host server.

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	335 Sec + time taken by the user to start the InTouchView	Data Loss for \$Second tag (Imported to Historian)	6 Min 47 Sec.
		<hr/> <b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag. <hr/>	
GR	313 Sec	IAS Tag (Script)	5 Min 44 Sec
		IAS IO Tag (DASSiDirect)	7 Min 28 Sec
AppEngine1	365 Sec	IAS Tag (Script)	6 Min 35 Sec
		IAS IO Tag (DASSiDirect)	7 Min 29 Sec
AppEngine2	372 Sec	IAS Tag (Script)	6 Min 41 Sec
		IAS IO Tag (DASSiDirect)	7 Min 20 Sec
Historian	381 Sec	SysTimeSec (Historian)	6 Min 33 Sec
		\$Second (InTouch)	6 Min 47 Sec
		<hr/> <b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag. <hr/>	
		IAS Tag (Script)	5 Min 45 Sec
		IAS IO Tag (DASSiDirect)	7 Min 30 Sec

Products	RTO	RPO	
		Tags	Data Loss Duration
DAS SIDirect	265 Sec	N/A	N/A
Historian Client	214 Sec + time taken by the user to start the Historian Client	N/A	N/A
Information Server	255 Sec + time taken by the user to start the Information Server	N/A	N/A

### Scenario 3: Network fails on Virtualization Server

#### Failover due to Network Disconnect (Public)

In this case, after the VMs move to the other host server, the VMs restart.

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	150 sec + time taken by the user to start the InTouchView	Data Loss for \$Second tag (Imported to Historian)	4 Min 14 Sec
		<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
GR	197 sec	IAS Tag (Script)	3 Min 41 Sec
		IAS IO Tag (DASSiDirect)	3 Min 50 Sec

Products	RTO	RPO	
		Tags	Data Loss Duration
AppEngine1	188 sec	IAS Tag (Script)	3 Min 31 Sec
		IAS IO Tag (DASSiDirect)	4 Min 2 Sec
AppEngine2	200 sec	IAS Tag (Script)	3 Min 41 Sec
		IAS IO Tag (DASSiDirect)	4 Min 08 Sec
Historian	236 sec	SysTimeSec (Historian)	3 Min 55 Sec
		\$Second (InTouch)	4 Min 14 Sec
		<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
		IAS Tag (Script)	3 Min 41 Sec
		IAS IO Tag (DASSiDirect)	3 Min 50 Sec
DAS SIDirect	174 sec	N/A	N/A
Historian Client	163 sec + time taken by the user to start the Historian Client	N/A	N/A
Information Server	66 sec + time taken by the user to start the Information Server	N/A	N/A

**Failover due to network disconnect (plant)**

In this case, only the GR Node moves to other host server and restarts. Only GR has data acquisition through Plant network and disconnected Plant network results in failover of GR alone.

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	N/A	Data Loss for \$Second tag (Imported to Historian)	N/A
GR	97 Sec	IAS Tag (Script)	1 Min 43 Sec
		IAS IO Tag (DASSiDirect)	1 Min 46 Sec
AppEngine1	N/A	IAS Tag (Script)	N/A
		IAS IO Tag (DASSiDirect)	1 Min 50 Sec
AppEngine2	N/A	IAS Tag (Script)	N/A
		IAS IO Tag (DASSiDirect)	1 Min 58 Sec
Historian	N/A	SysTimeSec (Historian)	N/A
		\$Second (InTouch)	N/A
		IAS Tag (Script)	1 Min 43 Sec
		IAS IO Tag (DASSiDirect)	1 Min 46 Sec
DAS SIDirect	111 Sec	N/A	N/A
Historian Client	N/A	N/A	N/A
Information Server	N/A	N/A	N/A

**Scenario 4: Virtualization Server becomes unresponsive**

There is no failover of VMs to the other host server when the CPU utilization on the host server is 100%.

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	N/A	N/A	N/A
GR	N/A	N/A	N/A
	N/A	N/A	N/A
AppEngine1	N/A	N/A	N/A
	N/A	N/A	N/A
AppEngine2	N/A	N/A	N/A
Historian	N/A	N/A	N/A
	N/A	N/A	N/A
	N/A	N/A	N/A
	N/A	N/A	N/A
DAS SIDirect	N/A	N/A	N/A
Historian Client	N/A	N/A	N/A
Information Server	N/A	N/A	N/A

## Snapshots of Data Trends and Observations

Scenarios and observations in this section:

<b>Scenario</b>	<b>Observation</b>
Scenario 1: IT provides maintenance on Virtualization Server	"Live Migration of InTouch" on page 192
	"Live Migration of GR" on page 192
	"Live Migration of AppEngine1" on page 195
	"Live Migration of AppEngine2" on page 198
	"Live Migration of Historian" on page 202
	"Quick Migration of InTouch" on page 204
	"Quick Migration of GR" on page 205
	"Quick Migration of AppEngine1" on page 208
	"Quick Migration of AppEngine2" on page 211
Scenario 2: Virtualization Server hardware fails	"Quick Migration of Historian" on page 214
	"Quick Migration of All Nodes" on page 217
	"Failover Due to Hardware failure" on page 221
Scenario 3: Network fails on Virtualization Server	"Failover Due to Network Disconnect (Public)" on page 230
Scenario 4: Virtualization Server becomes unresponsive	"Hyper-V Virtual Machines with Static RAM and Reservations for Processors" on page 239

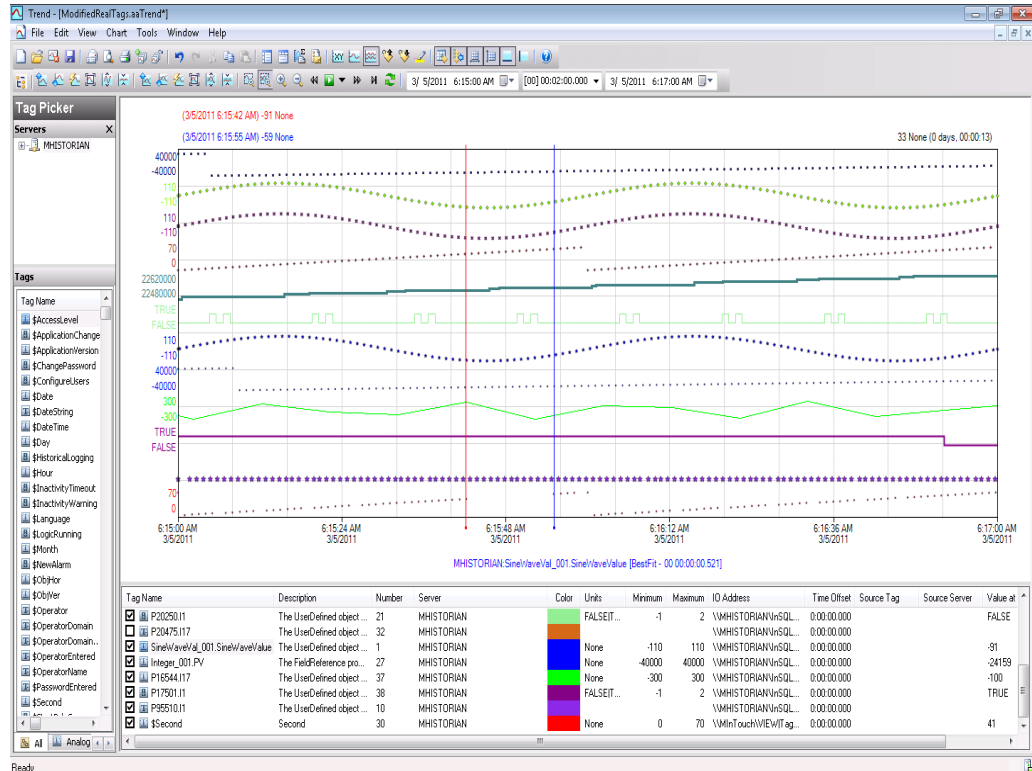
## Scenario 1: IT provides Maintenance on Virtualization Server

### Live Migration of InTouch

#### Trends:

In the Historian Trend, the last tag \$Second receives data from InTouch and is historized.

This is also captured in the RPO for Live Migration of InTouch tag.



#### Observations

There are no errors and warnings observed on all the virtual nodes.

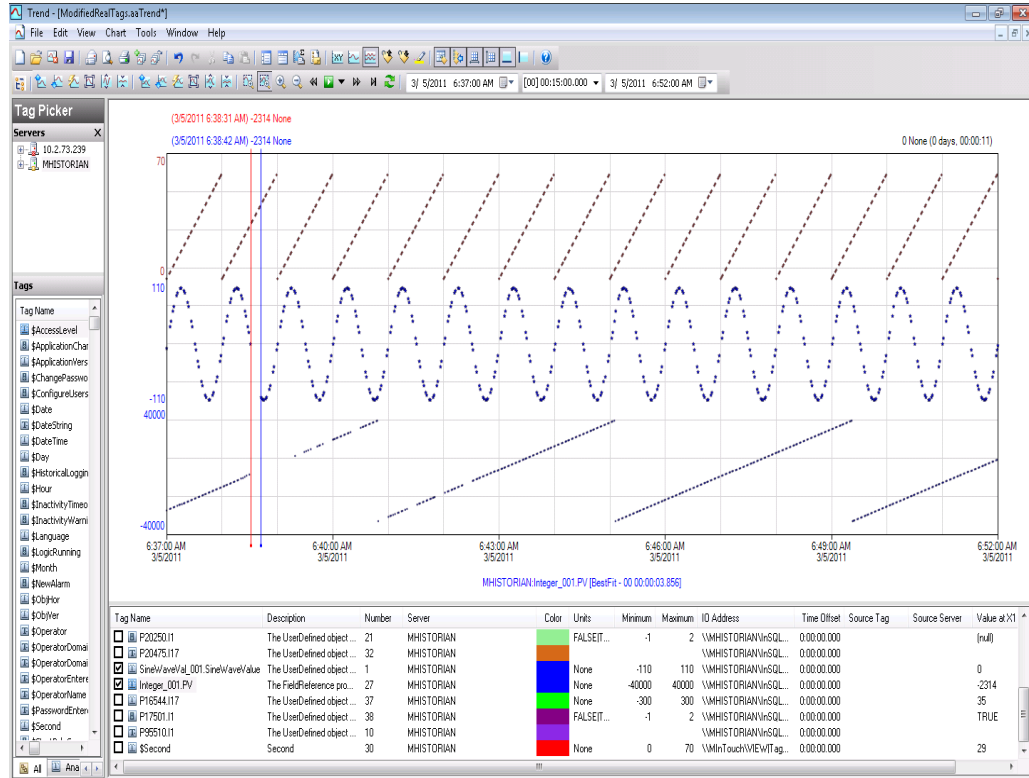
### Live Migration of GR

#### Trends:

In the Historian Trend below, the first tag SineWaveCal\_001.SineWaveValue receives data from scripts on GR node and is historized.

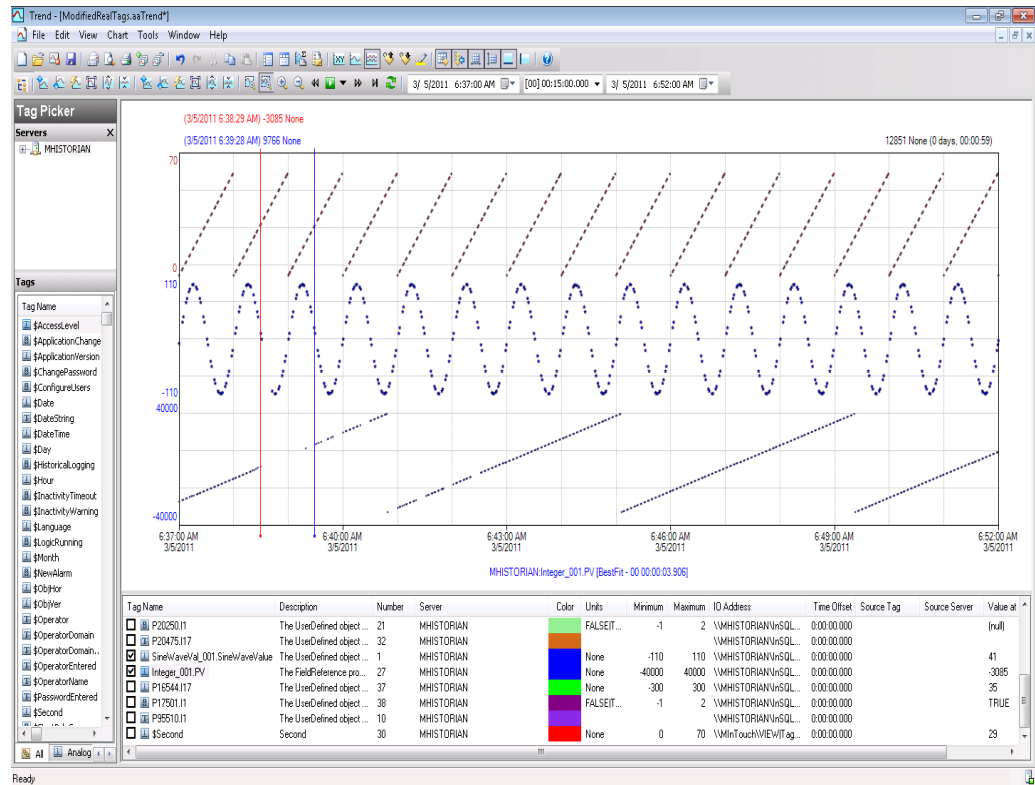


This is also captured in the RPO for Live Migration of GR node for IAS Tag (Script).



In the Historian Trend below, the middle tag Integer\_001.PV receives data from DDESuiteLinkObject on GR node and is historized.

This is also captured in the RPO for Live Migration of GR node for Industrial Application Server (IAS) IO Tag (DASSiDirect).



## Observations

During Live Migration of the GR node, it is expected that

GR node is Platform 1 in the Galaxy deployed. Therefore it is obvious that there will be an instance during Live Migration when the following occurs:

- GR node will not be able to connect to the other deployed nodes (Platforms 2, 3, 4, and 5).
- Rest of virtual machines will not be able to connect to GR node (Platform1)

## GR node

```
530396202/17/20116:16:25 PM2708516WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
530396212/17/20116:16:25 PM2708516WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
530396222/17/20116:16:25 PM2708516WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
530396232/17/20116:16:25 PM2708516WarningNmxSvcPlatform 6  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

### **AppEngine1 node**

```
1134668232/17/20116:16:17 PM29883004WarningNmxSvcPlatform 1  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

### **AppEngine2 node**

```
55437632/17/20116:16:17 PM30602176WarningNmxSvcPlatform 1  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

### **Historian**

None

### **WIS node**

None

### **HistClient**

None

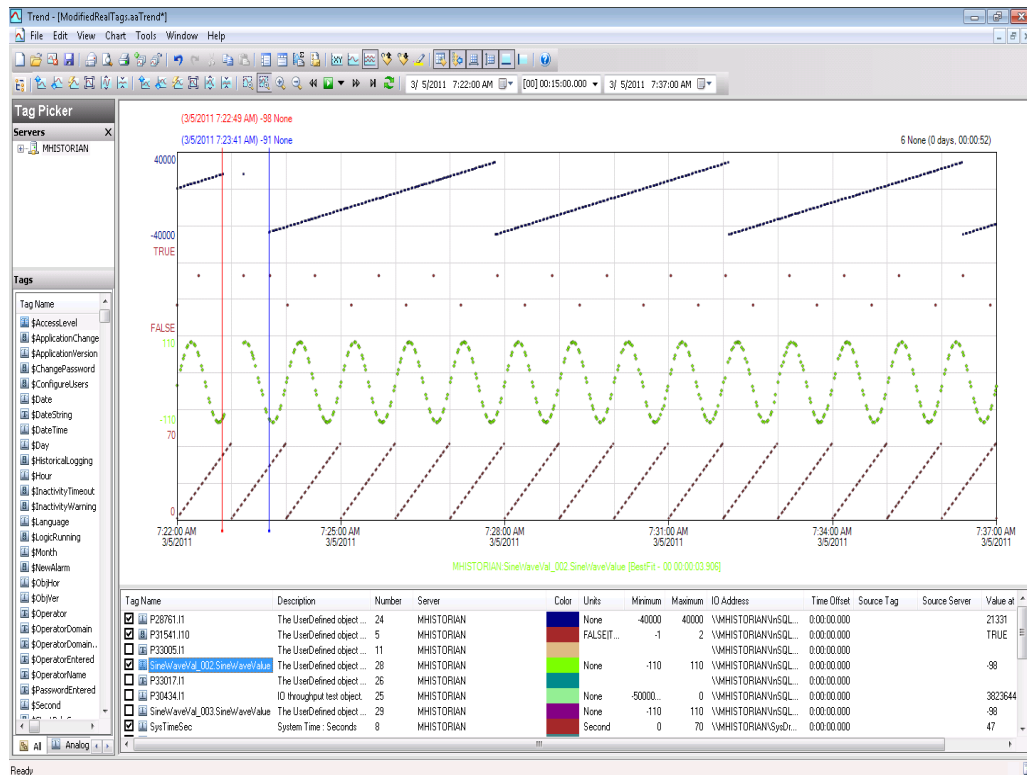
## **Live Migration of AppEngine1**

### **Trends:**

Industrial Application Server (IAS) tags receiving data from IO Server (DAS SI Direct)

In the Historian Trend below, the first two tags receive data from DDESuiteLinkClient in Industrial Application Server (IAS) from the PLC and are historized from Platform AppEngine1.

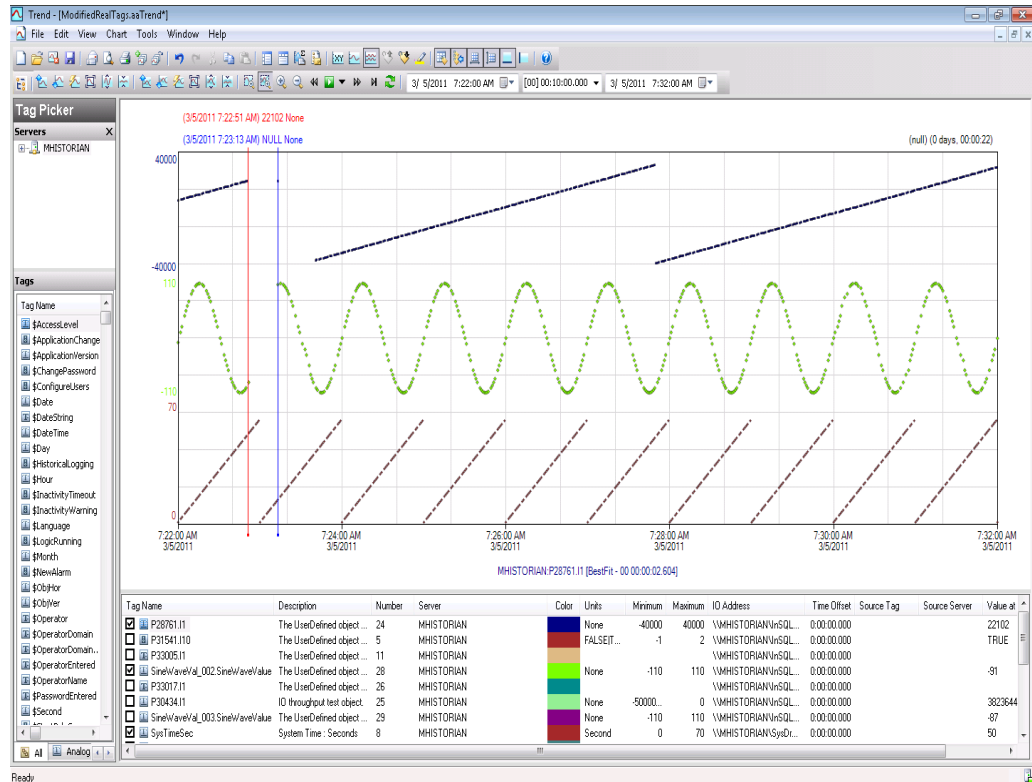
This is also captured in the RPO for Live Migration of AppEngine1 for Industrial Application Server (IAS) IO tag (DASSiDirect).



### Industrial Application Server (IAS)tags (tags fed by scripts)

In the Historian Trend below, the third tag is modified using scripts and is historized from Platform AppEngine1.

This is also captured in the RPO for Live Migration of AppEngine1 for IAS tag (Script).



## Observations

Error log during Live Migration of AppEngine1

During Live Migration, it is expected that

AppEngine1 is Platform2 in the Galaxy deployed. Therefore it is obvious that there will be an instance during Live Migration when the following occurs:

- AppEngine1 will not be able to connect to the other deployed nodes (Platforms 3, 4, and 5).
- Other nodes will not be able to connect to AppEngine1(Platform2)
- Some data sent from AppEngine1 will be discarded till the TimeSync utility is executed and system time of AppEngine1 is synchronized. So Historian is bound to discard data from AppEngine1 node

## GR node

```
529810502/17/20114:09:12 PM2708516WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

### **AppEngine1**

1133382602/17/20114:09:19 PM29883004WarningNmxSvcPlatform 1  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

1133382612/17/20114:09:19 PM29883004WarningNmxSvcPlatform 3  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

1133382622/17/20114:09:19 PM29883004WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

1133382632/17/20114:09:19 PM29883004WarningNmxSvcPlatform 5  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

1133382642/17/20114:09:19 PM29883004WarningNmxSvcPlatform 6  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

### **AppEngine2**

55432652/17/20114:09:12 PM30602176WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

### **Historian**

236000202/17/20114:10:03 PM1928968WarningaahStoreSvcValues in  
the past did not fit within the realtime window; discarding  
data (HISTORIAN\_mdas, 28898, 2011/02/17 10:39:13.246,  
2011/02/17 10:40:02.708) [HISTORIAN; pipeserver.cpp; 2388]  
aahCfgSvc

236000452/17/20114:14:16 PM1928968WarningaahStoreSvcValues in  
the past did not fit within the realtime window; discarding  
data (HISTORIAN\_mdas, 28898, 2011/02/17 10:39:13.246,  
2011/02/17 10:40:02.708) [HISTORIAN; pipeserver.cpp; 2388;  
15135]aahCfgSvc

### **WIS node**

None

### **HistClient**

None

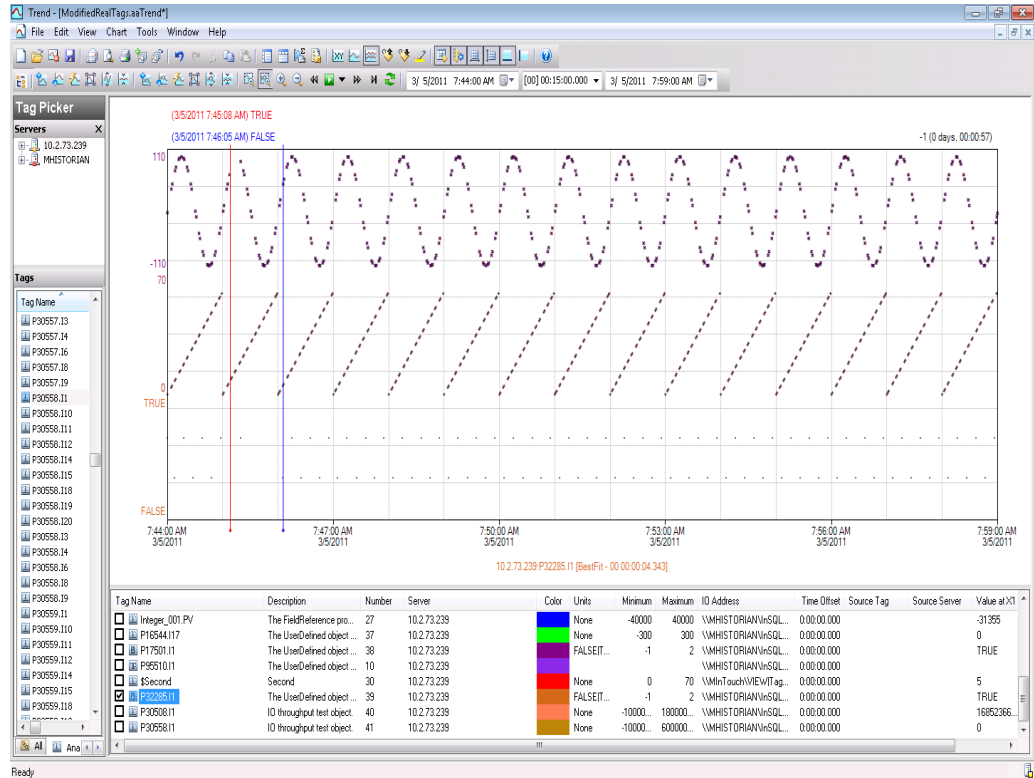
## **Live Migration of AppEngine2**

### **Trends**

IAS tags receiving data from IO Server (DAS SI Direct)

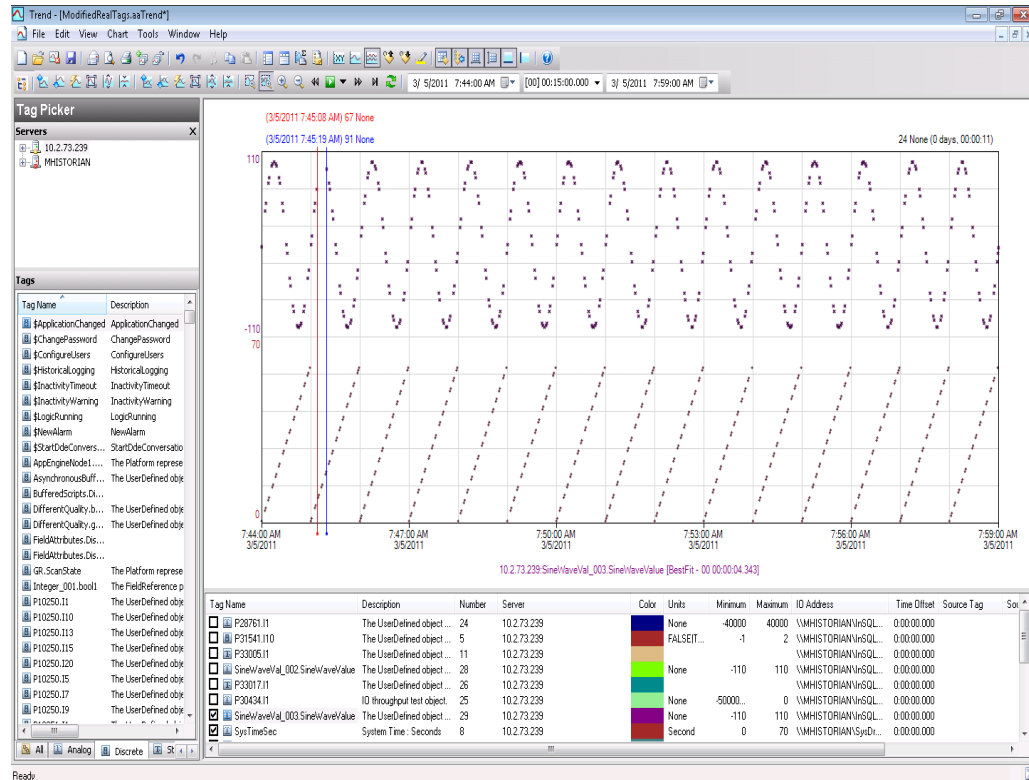
In the Historian Trend below, the second and third tags receive data from DDESuiteLinkClient in Industrial Application Server (IAS) from the PLC and are historized from Platform AppEngine2.

This is also captured in the RPO for Live Migration of AppEngine2 for IAS IO tag (DASSiDirect).



In the Historian Trend below, the first tag is modified using scripts and is historized from Platform AppEngine2.

This is also captured in the RPO for Live Migration of AppEngine2 for IAS Tag tag (Script).



## Observations

Error log during Live Migration of AppEngine2

During Live Migration, it is expected that

- AppEngine2 is Platform4 in the Galaxy deployed, so it is obvious that there will be an instance during Live Migration when
- AppEngine2 will not be able to connect to the other deployed nodes (Platforms 3, 1, and 2).
- Other nodes will not be able to connect to AppEngine2(Platform4)
- Some data sent from AppEngine2 will be discarded till the TimeSync utility is executed and system time of AppEngine2 is synchronized. So Historian is bound to discard data from AppEngine2 node

## GR node

```
529937522/17/20114:43:55 PM2708516WarningNmxSvcPlatform 3
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

## AppEngine1

The below warnings are observed on the AppEngine1 node during the Live Migration of AppEngine2.



```
1133740042/17/20114:43:55 PM29883004WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

## **AppEngine2**

```
55432662/17/20114:44:02 PM30602176WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
55432672/17/20114:44:02 PM30602176WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
55432682/17/20114:44:02 PM30602176WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
55432692/17/20114:44:02 PM30602176WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
55432702/17/20114:44:02 PM30602176WarningNmxSvcPlatform 6
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

## **Historian**

```
236003182/17/20114:44:47 PM1928968WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 20418, 2011/02/17 11:14:00.347,
  2011/02/17 11:14:46.178) [HISTORIAN; pipeserver.cpp; 2388]
  aahCfgSvc
```

```
236003622/17/20114:49:00 PM1928968WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 20418, 2011/02/17 11:14:00.347,
  2011/02/17 11:14:46.178) [HISTORIAN; pipeserver.cpp; 2388;
  1570]aahCfgSvc
```

## **WIS node**

None

## **HistClient**

None

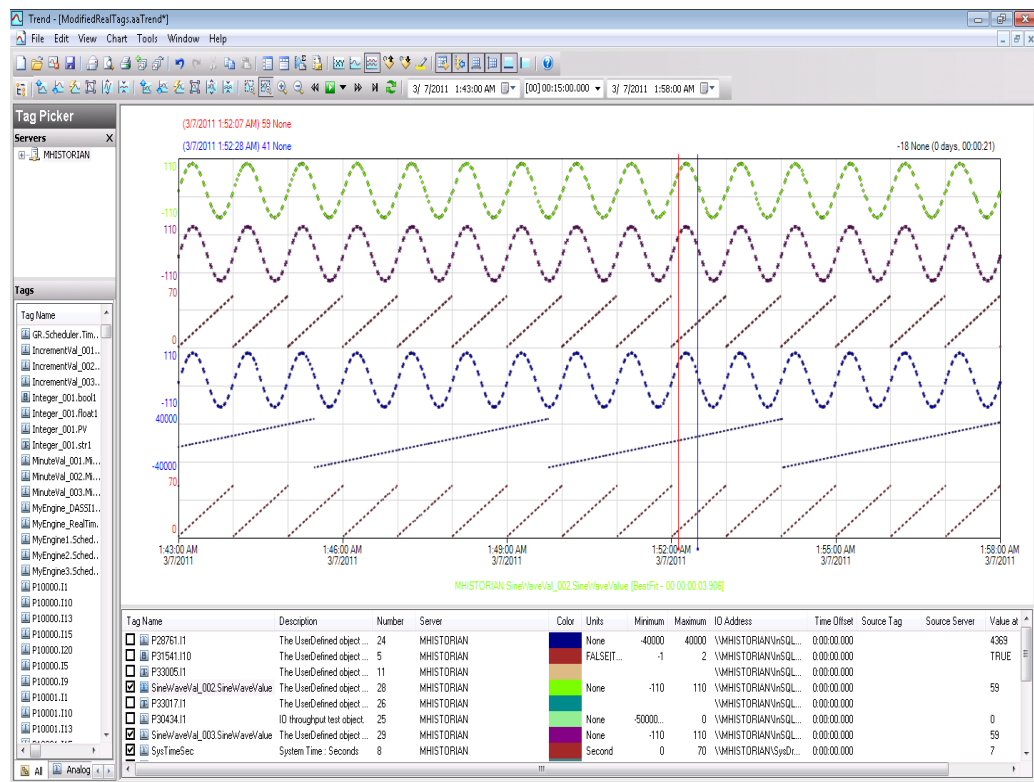
## Live Migration of Historian

### Trends:

In the below Historian Trend, the IAS Tag (Script) and IAS IO Tag (DASSiDirect) do not have any data loss as the data is Stored in SF folder in GR Node, AppEngine1 and AppEngine2 nodes.

This data is later forwarded after Live Migration.

This is also captured in the RPO for Live Migration of IAS IO Tag (DASSiDirect) and IAS Tag (Script) as no data loss as well as no data loss for \$Second tag historized from native InTouch application and Historian system tag (SysTimeSec).



### Observations

When the Historian Node undergoes Live Migration, the following is observed:

- GR and AppEngine nodes are in the Store Forward mode.
- Historian Client Trend will not be able to connect to Historian, so warning is expected.
- Historian's time is not synchronized during the Live Migration of Historian, so the "Attempt to store values in the future" message is expected.

After Live Migration, Historian's time needs to be synchronized. Therefore, the server shifting warning is expected.

After Live Migration of the Historian node, the stored data is forwarded from the GR and AppEngine nodes.

#### **GR node**

```
528410852/17/20119:07:31 AM39202428WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypeeaaEngine
```

#### **AppEngine1**

None

#### **AppEngine2**

None

#### **Historian**

```
235940332/17/20119:07:34 AM37963388WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 19594, 2011/02/17 03:34:41.543,
  2011/02/17 03:37:33.054) [HISTORIAN; pipeserver.cpp; 2388]
```

```
235940522/17/20119:10:28 AM37963388WarningaahStoreSvcAttempt to
  store values in the future; timestamps were overwritten with
  current time (pipe name, TagName, wwTagKey, system time (UTC),
  time difference (sec)) (HISTORIAN_mdas, Integer_001.str1,
  19598, 2011/02/17 03:40:27.073, 1) [HISTORIAN;
  pipeserver.cpp; ...
```

```
235940602/17/20119:11:13 AM37963388WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (02/17/11,09:11:11,829, 02/17/11,09:10:54,775) [HISTORIAN;
  Config.cpp; 2040]
```

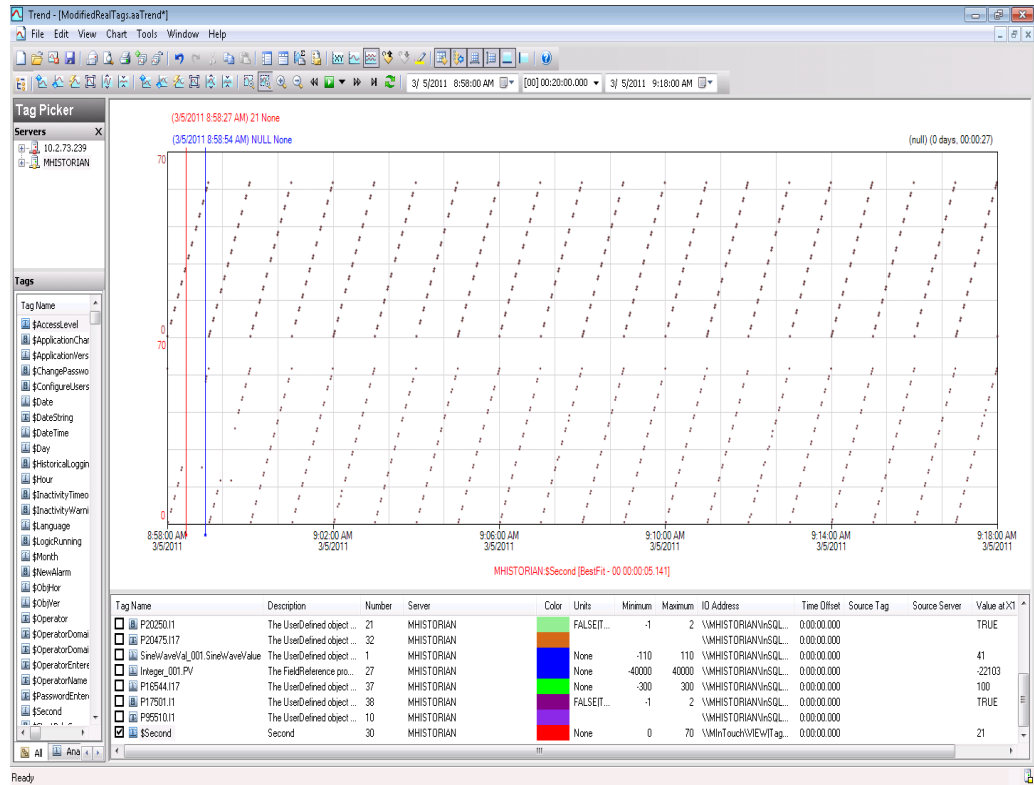
#### **WIS node**

None

#### **HistClient**

None

## Quick Migration of InTouch Trends:



### Observations

No error and warnings observed on the nodes

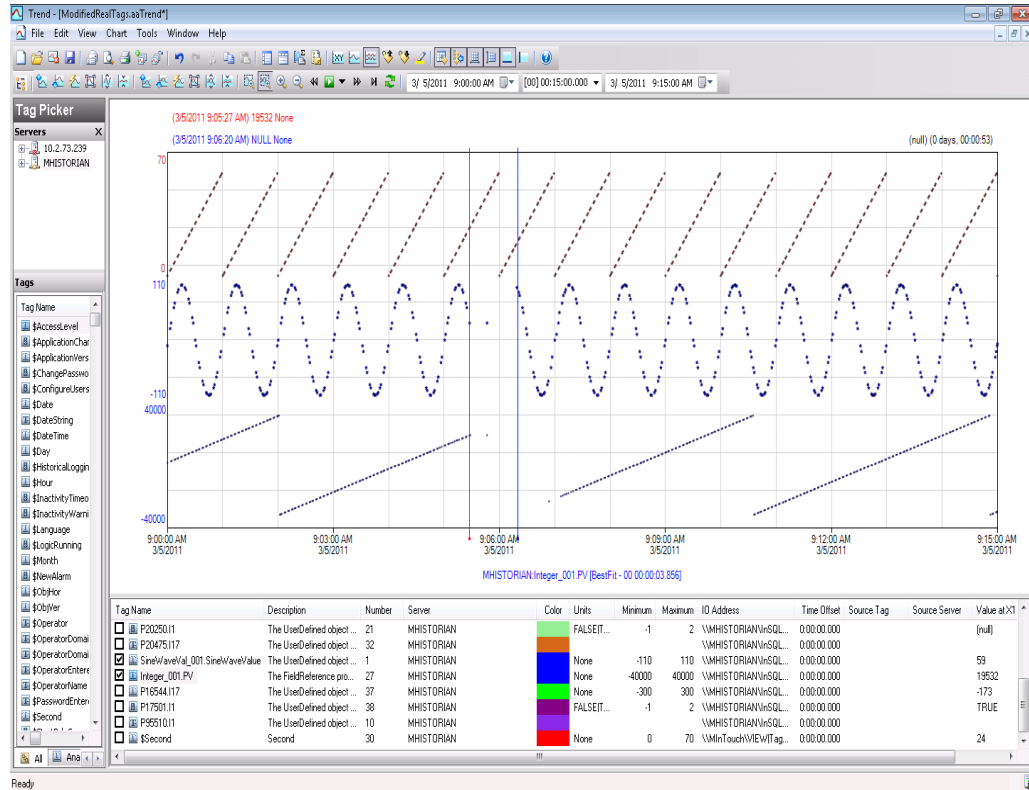
## Quick Migration of GR

### Trends:

### IAS tag (Script)

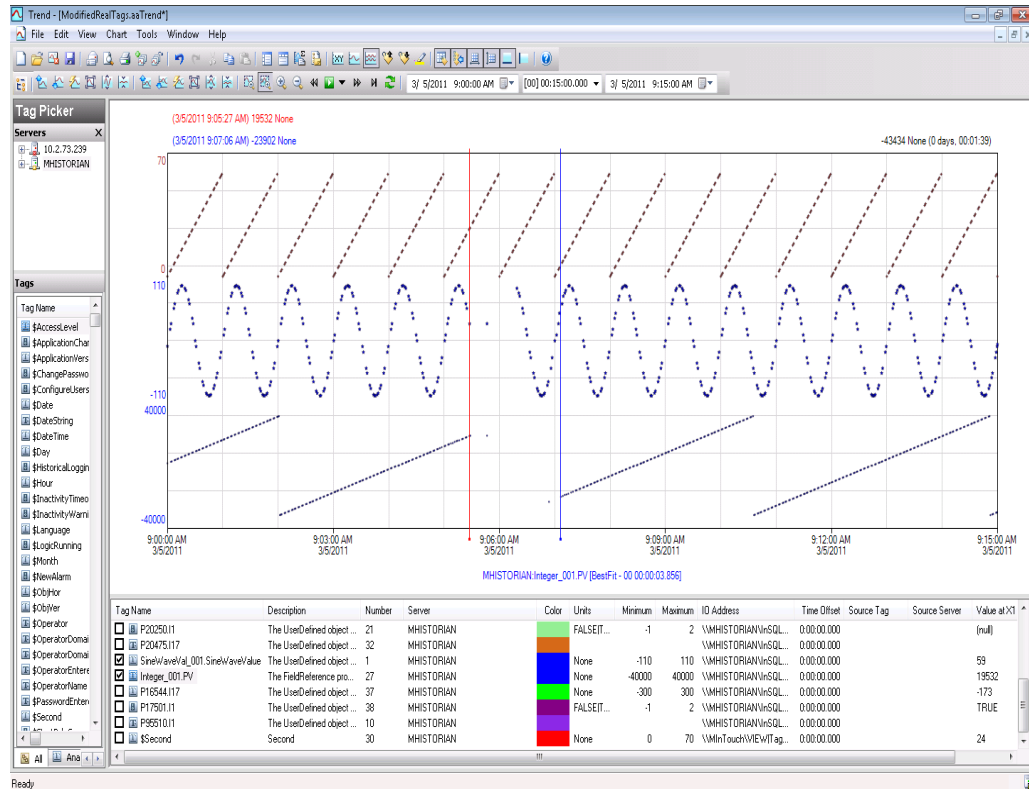
In the Historian Trend below, the second tag SineWaveCal\_001.SinewaveValue receives data from scripts on GR node and is historized.

This is also captured in the RPO for Live Migration of GR node for IAS tag (Script).



## IAS IO Tag (DASSiDirect)

GR node hosts the DDESuiteLinkObjects, so during quick migration of the GR node, there is data loss for tags that's receive data from DAS Server/PLC.



## Observations

During Quick Migration of the GR node, it is expected that

GR node is Platform 1 in the Galaxy deployed. Therefore it is obvious that there will be an instance during Quick Migration when the following occurs:

- GR node will not be able to connect to the other deployed nodes(Platforms 2, 3, 4, and 5).
- Rest of virtual machines will not be able to connect to GR node (Platform1)

Since DAS SI Direct provides data to DDESuiteLinkObject and DAS SI Direct is on the GR Node, a message- "DAServerManager Target node is down" -is expected on AppEngine1 and AppEngine2.

Script involving SDK script library calls timeout during Quick Migration of the GR Node.

## GR node

```
332550721/26/20116:30:35 PM30844484WarningNmxSvcPlatform 4
exceed maximum heartbeats timeout of 8000 ms. 33255074
1/26/20116:30:35 PM30844484WarningNmxSvcPlatform 2 exceed
```

```
maximum heartbeats timeout of 8000 ms. 332552121/26/2011
6:30:54 PM49564952WarningaaEngine Unexpected packet from ND
Area_NonClusteredNode <P3 E2>, structId 938336640, request 0,
start 16103, end 16103, count 1,set 16100, sub 16100, state 1,
commAlarm 0, subStatus <success -1 category0 detectedBy 0
detail 0>, subQual 192, setCnt 118, setResult...aaEngine
332552441/26/20116:33:23 PM30844484WarningNmxSvcPlatform 3
exceed maximum heartbeats timeout of 8000 ms. 33255245
1/26/20116:33:23 PM30844484WarningNmxSvcPlatform 5 exceed
maximum heartbeats timeout of 8000 ms. 332552751/26/2011
6:33:26 PM42163432WarningaaEngine0:F20 Values in the past did
not fit within the realtime window; discarding data (218,
2011/01/26 13:00:59.640, 2011/01/2613:03:24.595)
[aahMDASSF.cpp; 3709; 1]aaEngine
```

```
332552961/26/20116:33:27 PM14881544WarningaaEngine0:C04 Values
in the past did not fit within the realtime window;discarding
data (23576, 2011/01/26 13:00:59.250, 2011/01/26
13:03:26.282)[aahMDASSF.cpp; 3709; 1]aaEngine
```

```
332553151/26/20116:33:28 PM4956412WarningaaEngine0:6BC Values
in the past did not fit within the realtime window; discarding
data (150,2011/01/26 13:00:59.703, 2011/01/26 13:03:26.688)
[aahMDASSF.cpp; 3709; 1] aaEngine
```

```
332553461/26/20116:33:33 PM1488 2816WarningScanGroupRuntime2
Can't convert Var data type to MxDataTypepeaaEngine
```

```
332637691/26/20116:56:57 PM23405200WarningCRLinkServer
CQueue::BroadCastData Ping() hr:0x800706baaaGR
```

## AppEngine1

```
934921901/26/20116:30:27 PM54804996WarningDAServerManagerTarget
node is down. DASCC will stop scanning for Server active
state.mmc
```

```
934922721/26/20116:30:31 PM16522908WarningNmxSvcPlatform 1
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
934933061/26/20116:31:27 PM60966480WarningPackageManagerNet
GalaxyMonitor PollPackageServer Communication failed. A
connection attempt failed because the connected party did not
properly respond after a period of time, or established
connection failed because connected host has failed to respond
10.91.60.33:8090aaIDE
```

```
934963991/26/20116:34:11 PM39043908WarningScriptRuntime
Insert.InsertValuePerodic: Script timed out.aaEngine
```

```
935109161/26/20116:46:52 PM39043908WarningScriptRuntime
Insert.InsertValueWF: Script timed out.aaEngine
```

## AppEngine2

54454601/26/20116:30:27 PM8963888WarningDAServerManagerTarget node is down. DASCC will stop scanning for Server active state.

54454651/26/20116:33:07 PM20882104WarningNmxSvcPlatform 1 exceed maximum heartbeats timeout of 8000 ms.

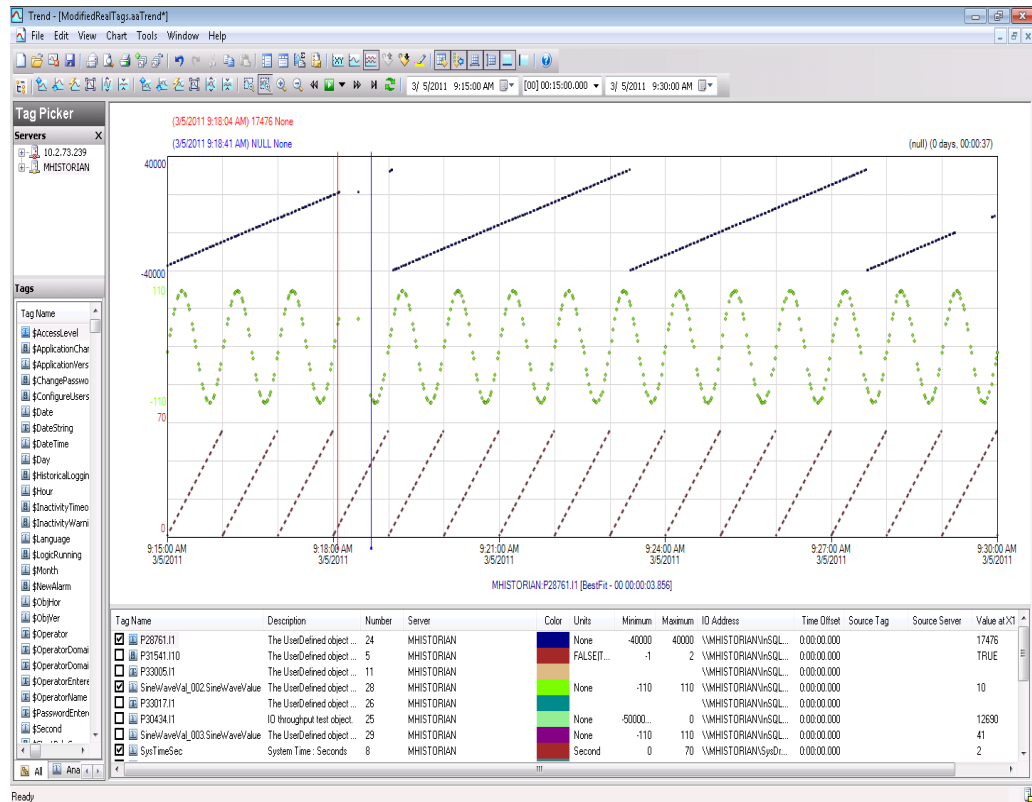
## WIS node

9576531/26/20116:30:30 PM37641516WarningNmxSvcPlatform 1 exceed maximum heartbeats timeout of 8000 ms.NmxSvcHAWISNODE 80.119.175.64

## Quick Migration of AppEngine1

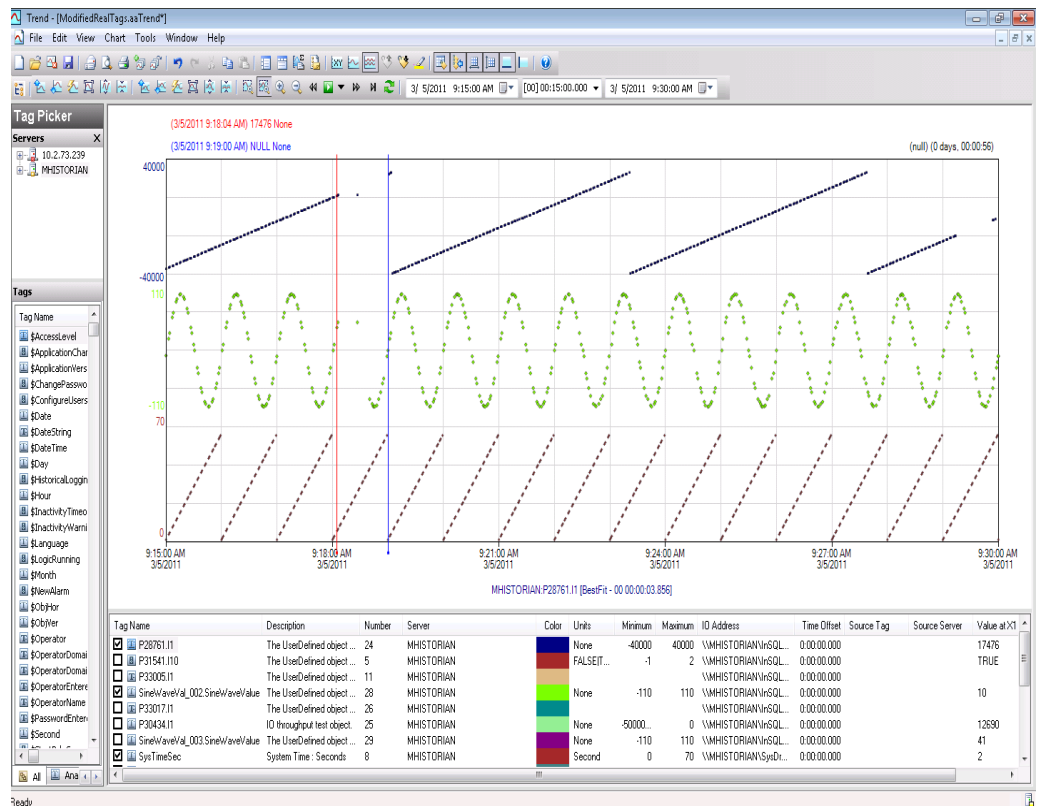
### Trends:

### IAS tag (Script)





## IAS IO Tag (DASSiDirect)



### Observations

During Quick Migration of the AppEngine1 Node, it is expected that:

- AppEngine1 Node is Platform 2 in the Galaxy deployed. Therefore, it is obvious that there will be an instance during Quick Migration when the following occurs:
- AppEngine1 Node will not be able to connect to the other deployed nodes (Platforms 1, 3, 4, and 5).
- Rest of virtual machines will not be able to connect to AppEngine1 (Platform2).
- AppEngine1 is not synchronized during the quick migration and a message -"Values in the past did not fit within the realtime window" -is expected on AppEngine1.
- AppEngine1 is not synchronized during the Quick Migration and a message- "Values in the past did not fit within the realtime window"- is expected on the Historian node.

### GR node

None

**AppEngine1**

1098432442/14/20116:45:15 PM21684544WarningaaEngine0:A8C Values in the past did not fit within the realtime window; discarding data (19713, 2011/02/14 13:09:48.109, 2011/02/14 13:11:02.363) [aahMDASSF.cpp; 3709; 15]aaEngine

1098432792/14/20116:45:16 PM18964392WarningaaEngine0:9AC Values in the past did not fit within the realtime window; discarding data (20421, 2011/02/14 13:09:48.015, 2011/02/14 13:11:03.504) [aahMDASSF.cpp; 3709; 483]aaEngine

1098432802/14/20116:45:16 PM25843712WarningaaEngine0:698 Values in the past did not fit within the realtime window; discarding data (19707, 2011/02/14 13:09:47.765, 2011/02/14 13:11:04.957) [aahMDASSF.cpp; 3709; 21]aaEngine

1098432992/14/20116:45:18 PM30083880WarningaaEngine0:9D4 Values in the past did not fit within the realtime window; discarding data (22042, 2011/02/14 13:09:47.297, 2011/02/14 13:11:05.160) [aahMDASSF.cpp; 3709; 2449]aaEngine

1098433182/14/20116:45:18 PM31364508WarningaaEngine0:9AC Values in the past did not fit within the realtime window; discarding data (19730, 2011/02/14 13:09:48.187, 2011/02/14 13:11:06.050) [aahMDASSF.cpp; 3709; 378]aaEngine

**AppEngine2**

None

**Historian**

None

**HistClient**

None

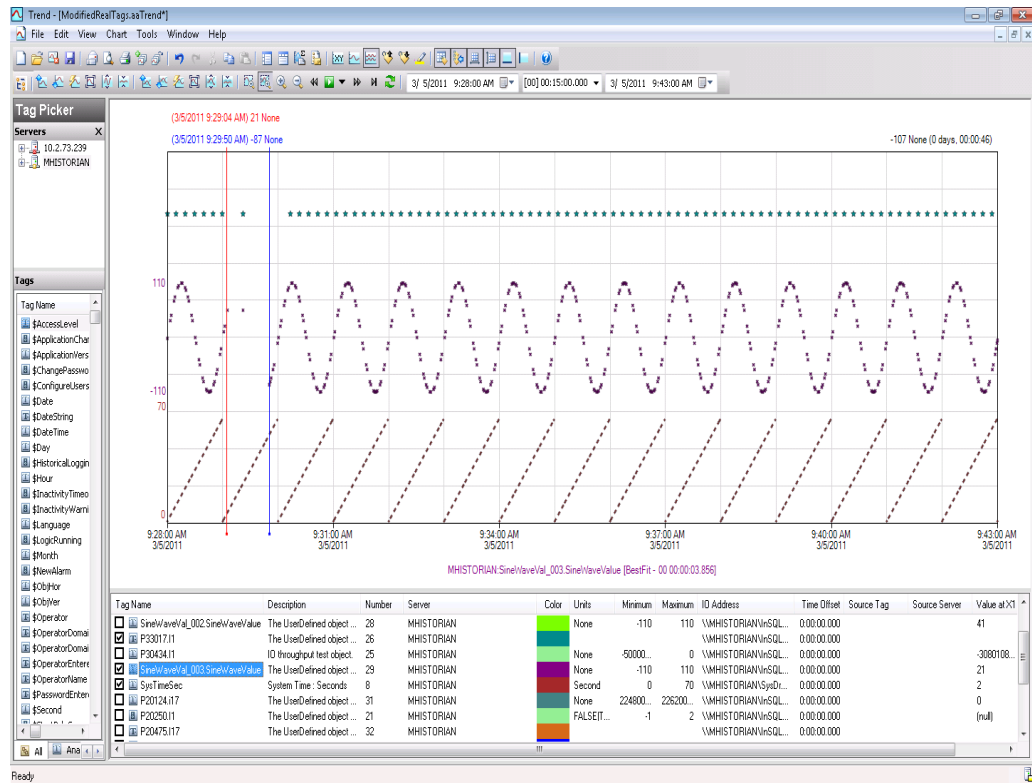
**WIS**

None

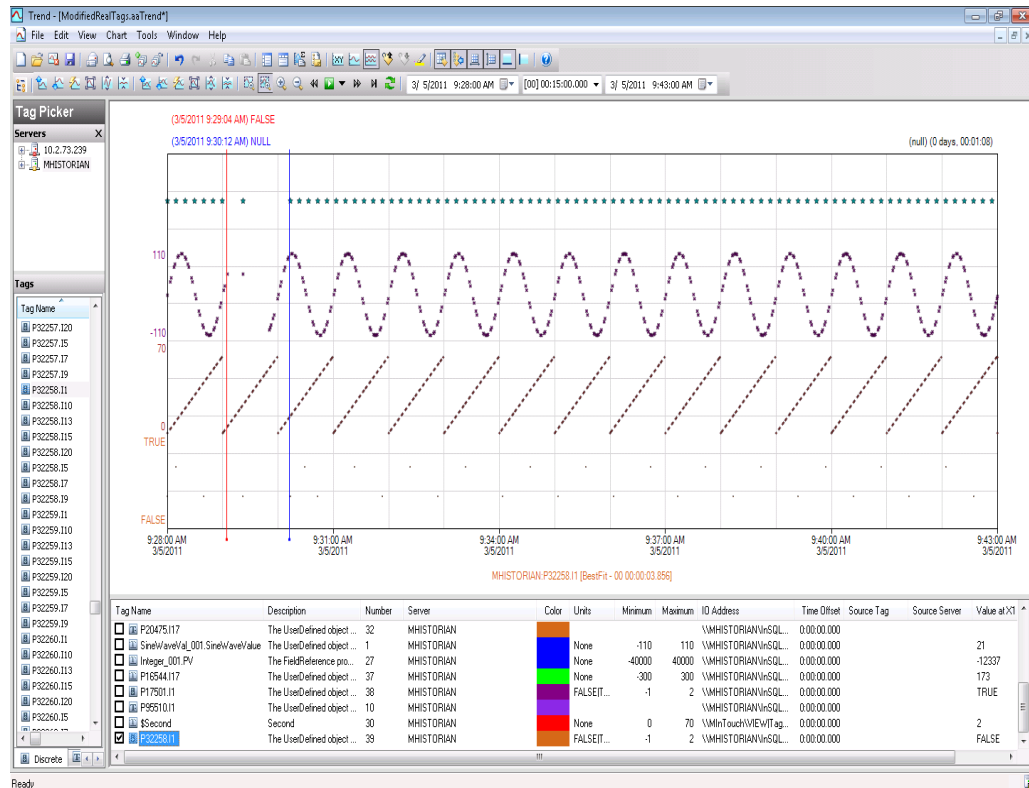
## Quick Migration of AppEngine2

### Trends:

### IAS tag (Script)



## IAS IO Tag (DASSiDirect)



### Observations

During Quick Migration of AppEngine2 Node, it is expected that:

- AppEngine2 Node is Platform 4 in the Galaxy deployed. Therefore, it is obvious that there will be an instance during Quick Migration when the following occurs:
- AppEngine2 Node will not be able to connect to the other deployed nodes (Platforms 1, 3, 2, and 5).
- Rest of Virtual machines will not be able to connect to AppEngine2 (Platform4)
- AppEngine2 is not synchronized during the quick migration and a message- "Values in the past did not fit within the realtime window"- is expected on AppEngine2.
- AppEngine2 is not synchronized during the Quick Migration and a message- "Values in the past did not fit within the realtime window"- is expected on the Historian node.

### GR node

None

### AppEngine1

None

**AppEngine2**

55327542/14/20117:19:02 PM27682308WarningNmxSvcPlatform 1  
exceed maximum heartbeats timeout of 8000 ms.

55327552/14/20117:19:02 PM27682308WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

55327562/14/20117:19:02 PM27682308WarningNmxSvcPlatform 5  
exceed maximum heartbeats timeout of 8000 ms.

55327572/14/20117:19:02 PM27682308WarningNmxSvcPlatform 6  
exceed maximum heartbeats timeout of 8000 ms.

55327892/14/20117:19:06 PM30284124WarningaaEngine0:998 Values  
in the past did not fit within the realtime window; discarding  
data (29347, 2011/02/14 13:47:50.796, 2011/02/14  
13:49:05.836) [aahMDASSF.cpp; 3709; 1]

55327972/14/20117:19:06 PM33644280WarningaaEngine0:994 Values  
in the past did not fit within the realtime window; discarding  
data (34102, 2011/02/14 13:48:00.360, 2011/02/14  
13:49:06.024) [aahMDASSF.cpp; 3709; 1]

55328002/14/20117:19:06 PM3884388WarningaaEngine0:99C Values in  
the past did not fit within the realtime window; discarding  
data (30147, 2011/02/14 13:48:00.798, 2011/02/14  
13:49:06.180) [aahMDASSF.cpp; 3709; 1]

**Historian:**

None

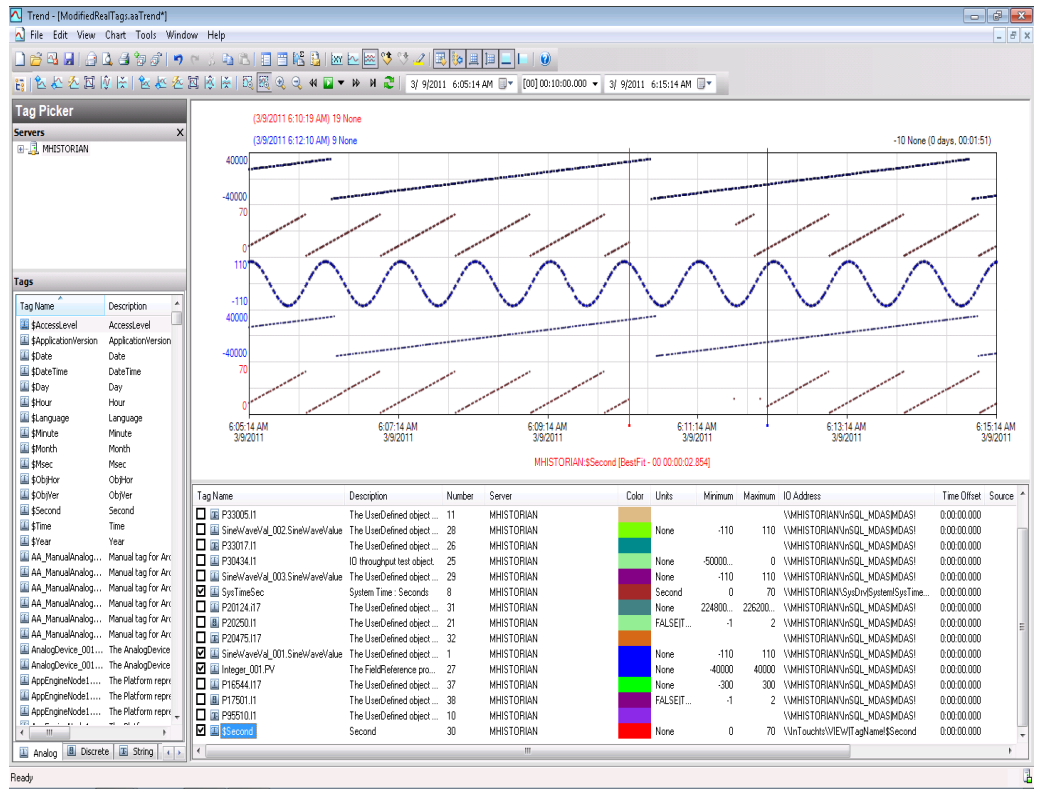
**HistClient**

None

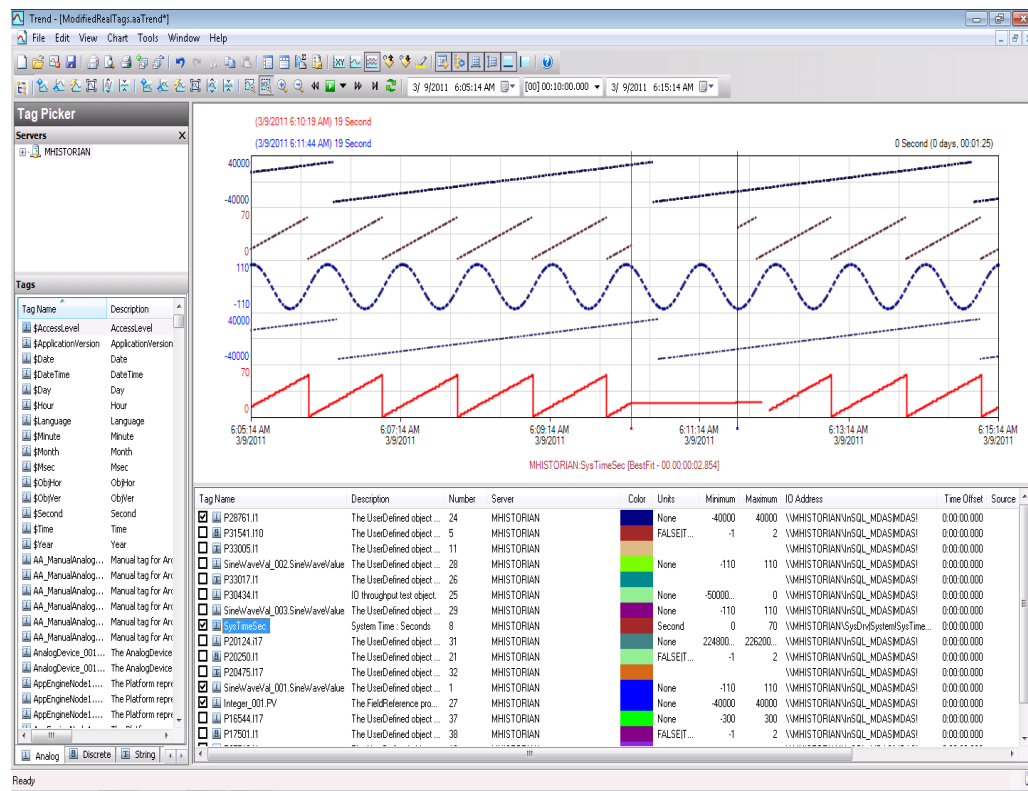
**WIS**

None

## Quick Migration of Historian Trends: \$Second(InTouch)



## SysTimeSec (Historian)



## IAS Tag (Script) and IAS IO Tag (DASSiDirect)

There is no data loss for IAS tag (script) and IAS IO Tag (DASSiDirect) as observed from the tags in the middle, as displayed in the above snapshot.

### Observations

During Quick Migration of the Historian node, it is expected that

- SDK scripts will timeout on the AppEngine1 and the GR Node.
- AppEngine2 fails to connect to Historian
- Historian is not synchronized during the Quick Migration and a message- "Specified time cannot be in the future"- is expected on the Historian node.
- "Historian Client will be unable to connect to Historian.

### GR node

```
511042092/15/20113:56:25 PM38043808WarningScriptRuntime
AsynchronousBuffer.script6: Script timed out.aaEngine

511042682/15/20113:56:35 PM38043808WarningScriptRuntime
AsynchronousBuffer.script2: Script timed out.aaEngine

511044362/15/20113:57:03 PM38043808WarningScriptRuntime
AsynchronousBuffer.script3: Script timed out.aaEngine
```

### AppEngine1

```
1112477922/15/20113:57:53 PM29083924WarningScriptRuntime
  InsertAsync.InsertValueWF: Script timed out.aaEngine

1112477932/15/20113:57:53 PM29083932WarningScriptRuntime
  InsertAsync.InsertValuePeriodic: Script timed out.aaEngine

1112478062/15/20113:57:53 PM29082720WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.aaEngine
```

### AppEngine2

```
55351222/15/20113:56:31 PM24722468WarningHistorianPrimitive
  AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
  ArchestrA user account exist on Historian(InSQL) node or does
  Historian not exist?)aaEngine

55351232/15/20113:57:31 PM24722468WarningHistorianPrimitive
  AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
  ArchestrA user account exist on Historian(InSQL) node or does
  Historian not exist?)aaEngine
```

### Historian

```
235771112/15/20113:57:49 PM23681100WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (02/15/11,15:57:48,174, 02/15/11,15:54:50,984) [HISTORIAN;
  Config.cpp; 2040]aahCfgSvc

Hist Client

6476362/15/20113:55:49 PM20963696WarningaaAFCommonTypesUnable
  to create dataview: Server must be logged on before executing
  SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
  aaIQ=Quality, aaQD=QualityDetail, aaS=0

  FROM History

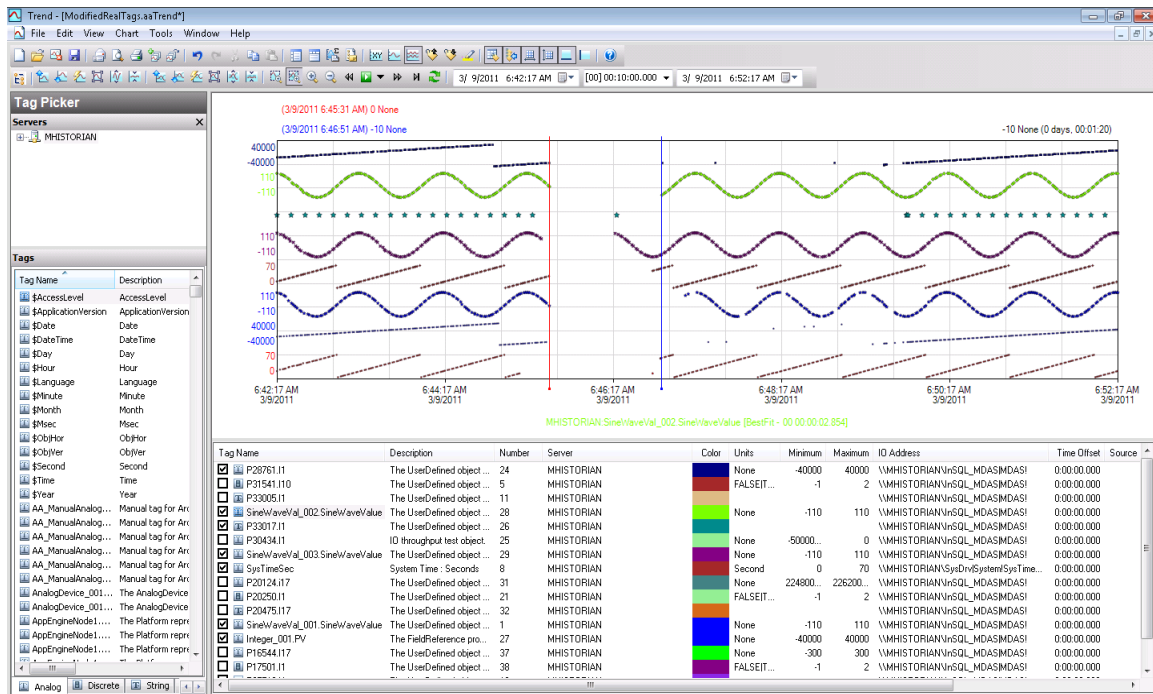
  WHERE TagName IN ('...
```



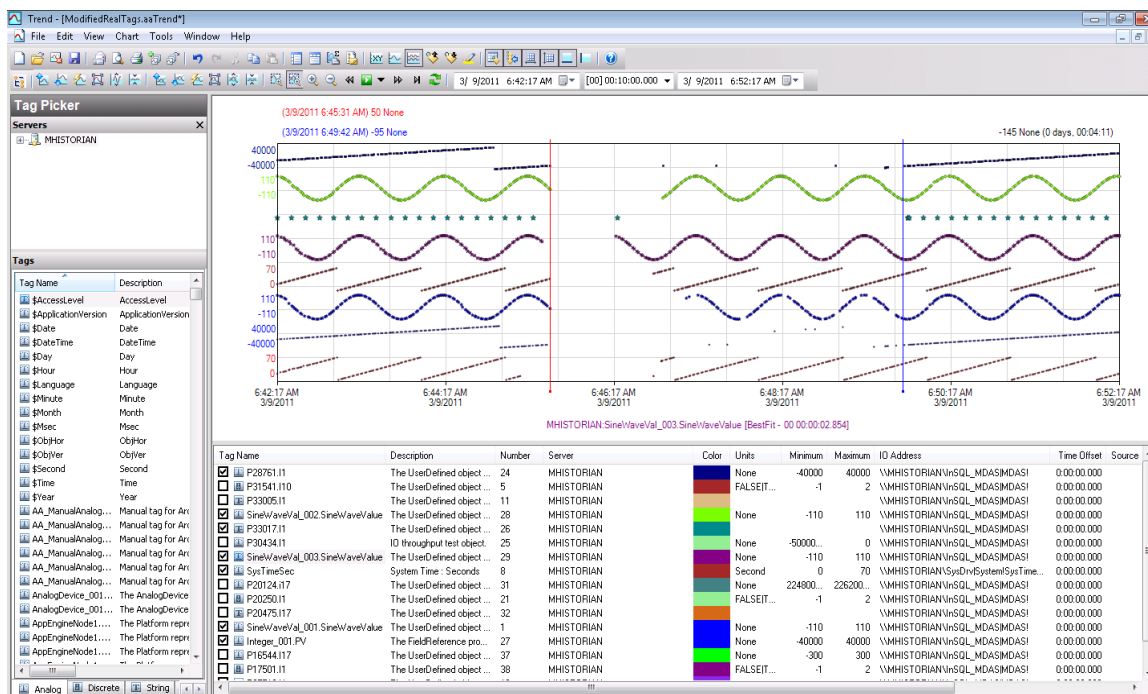
## Quick Migration of All Nodes

Trends:

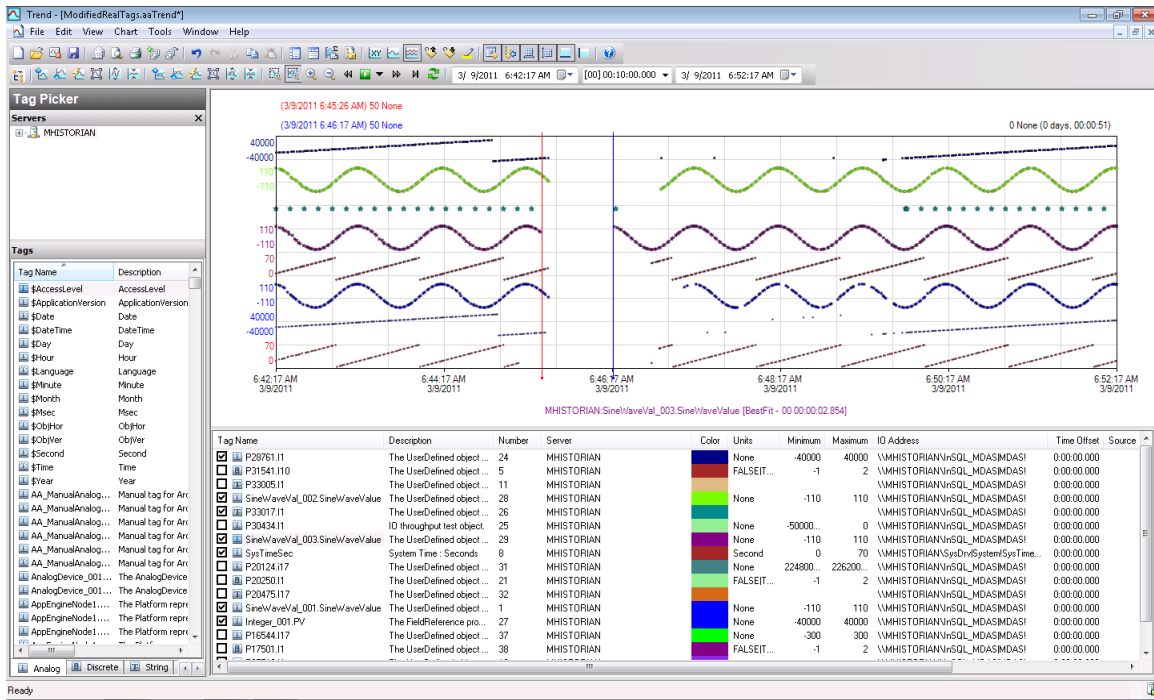
### IAS tag (Script) on AppEngine1 node



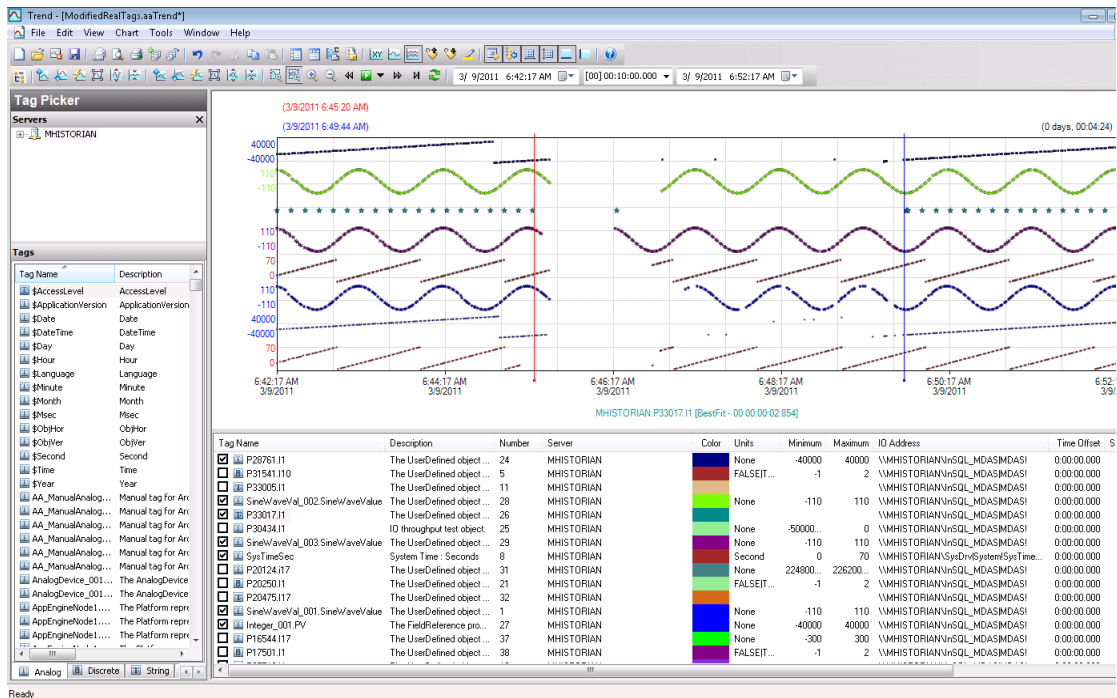
### IAS IO Tag (DASSiDirect) on AppEngine1 node



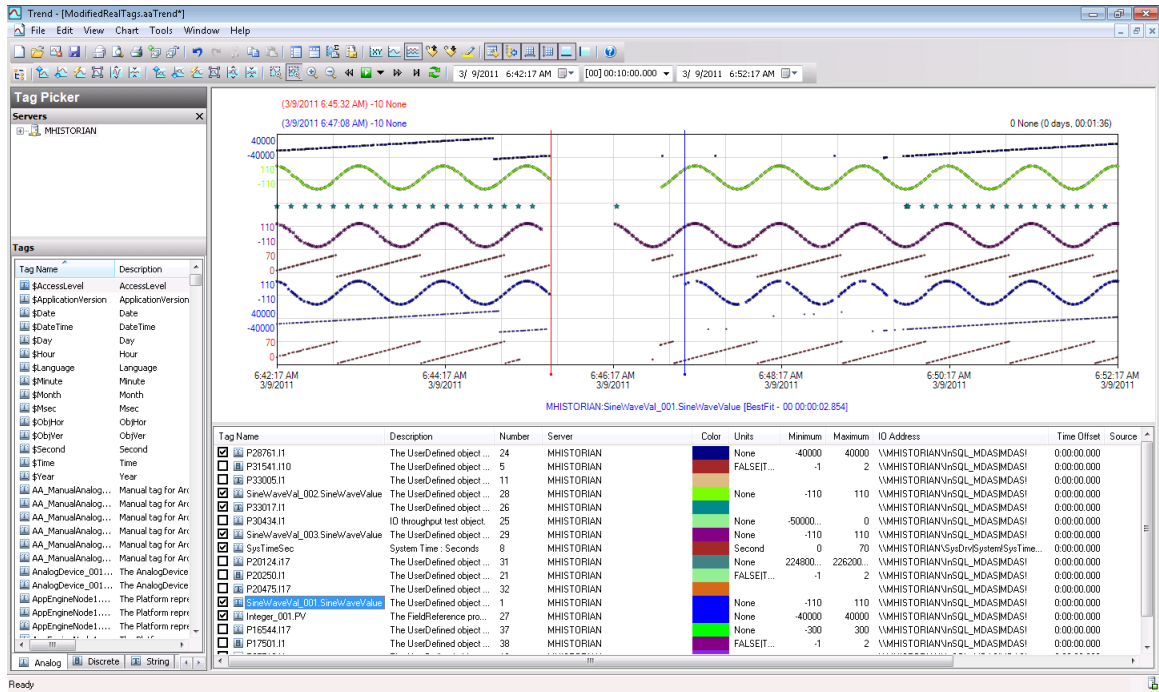
### IAS tag (Script) on AppEngine2



### IAS IO Tag (DASSiDirect) on AppEngine2



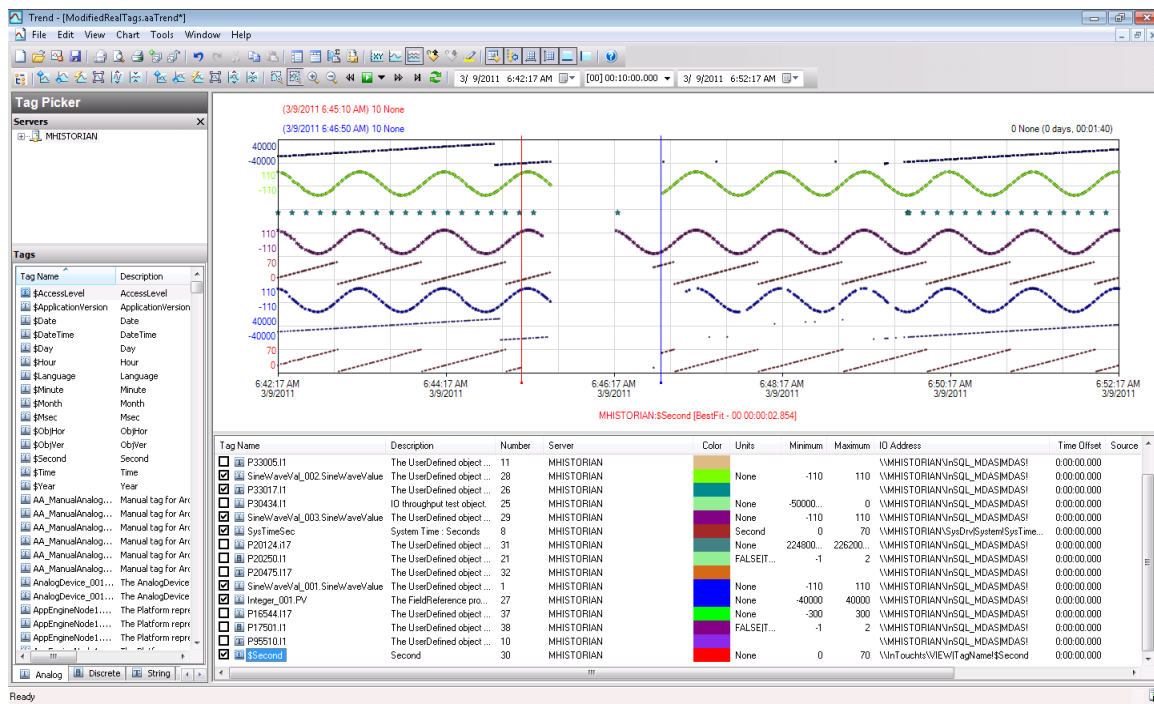
### IAS tag (Script) on GR node.



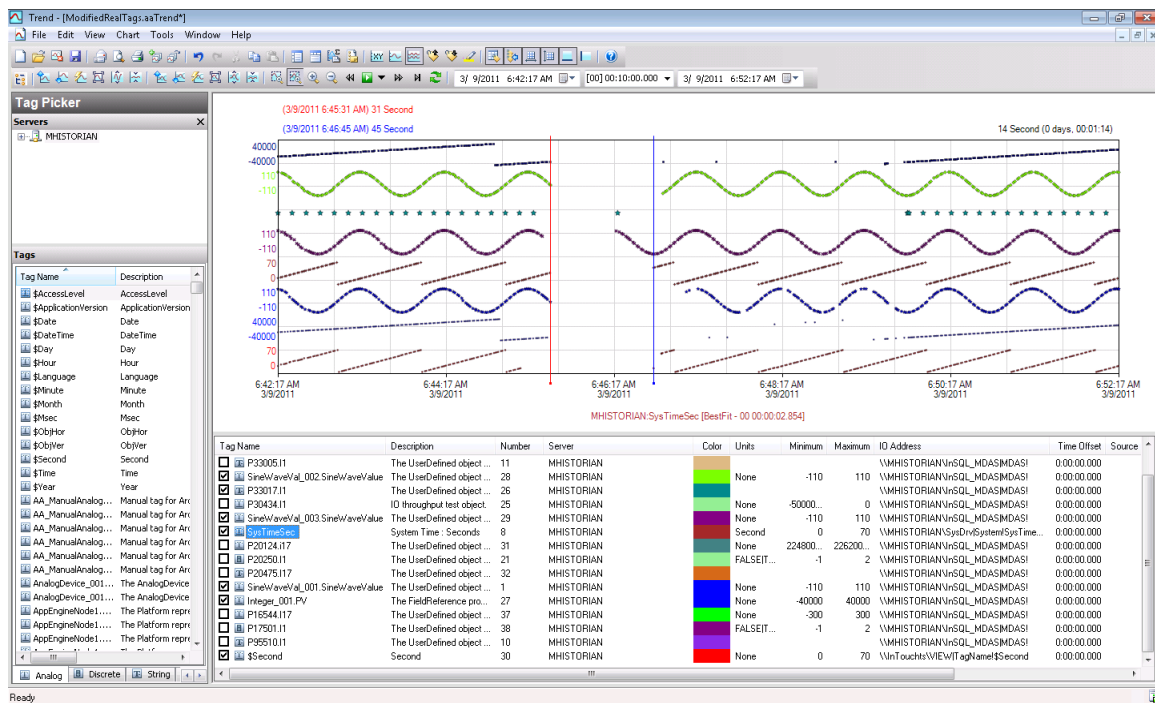
### IAS IO Tag (DASSiDirect) on GR node.



### \$Second (InTouch) on Historian node



### SysTimeSec on Historian node



## Scenario 2: Virtualization Server Hardware Fails

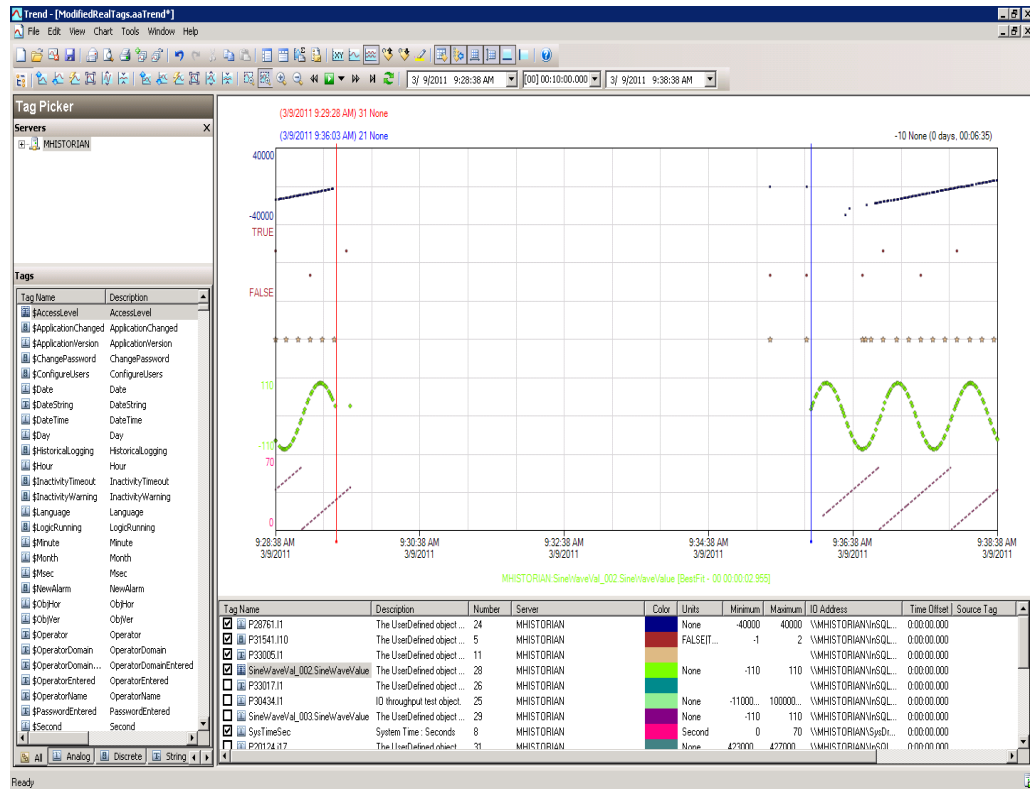
### Failover Due to Hardware failure

The failover occurs due to hardware failure, and it is simulated with power-off on the host server.

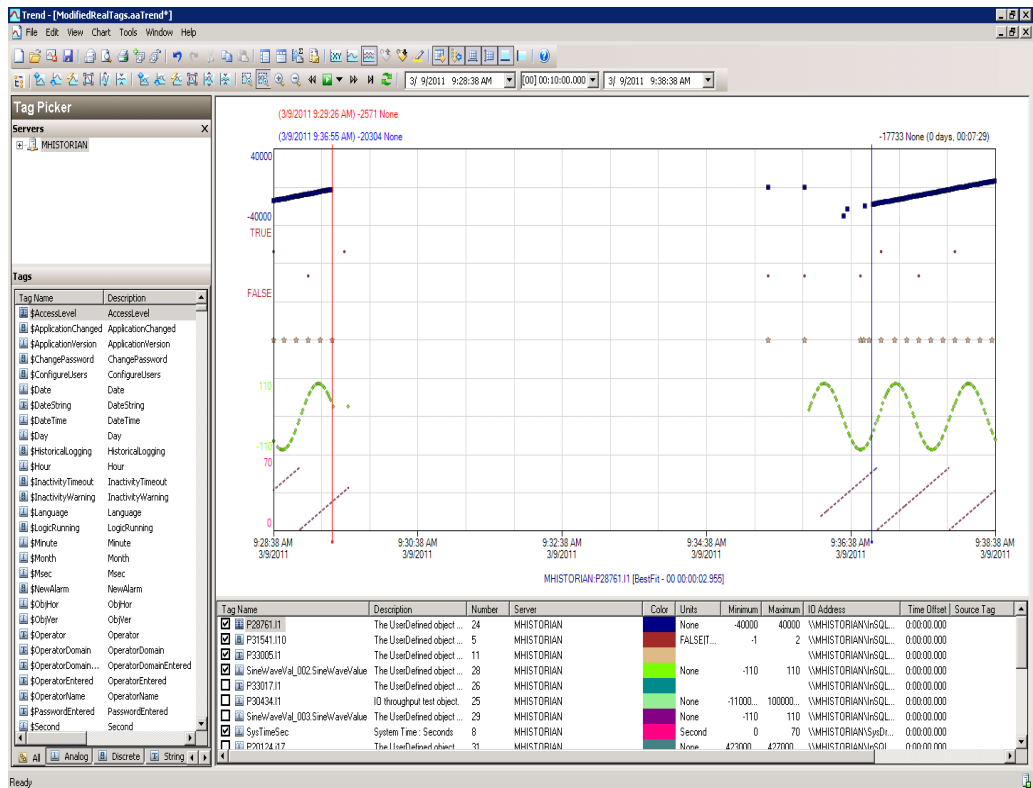
#### Trends:

### AppEngine1

### IAS Tag (Script)

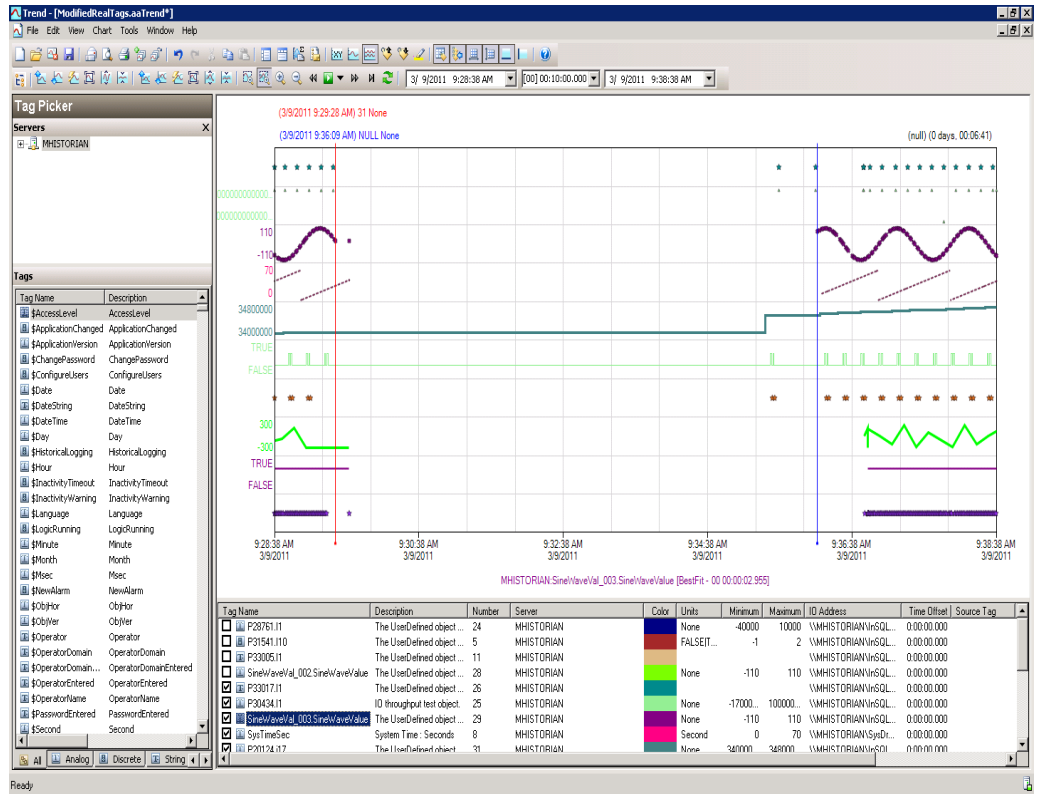


### IAS IO Tag (DASSiDirect)

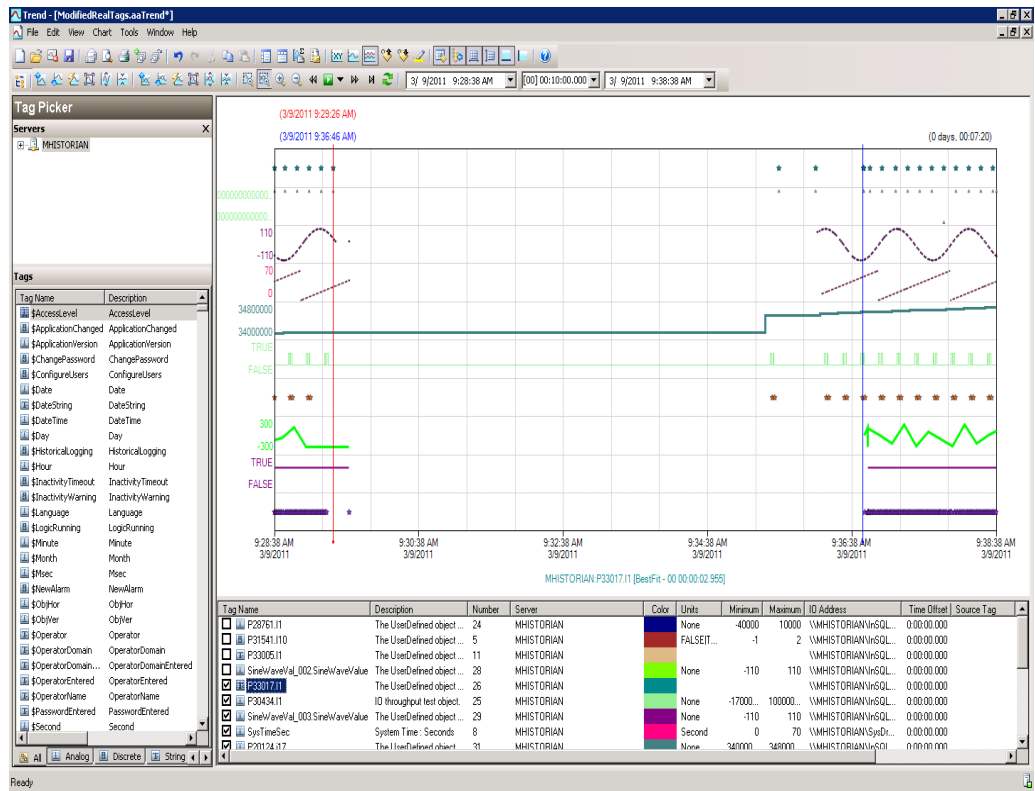


## AppEngine2

### IAS Tag (Script)



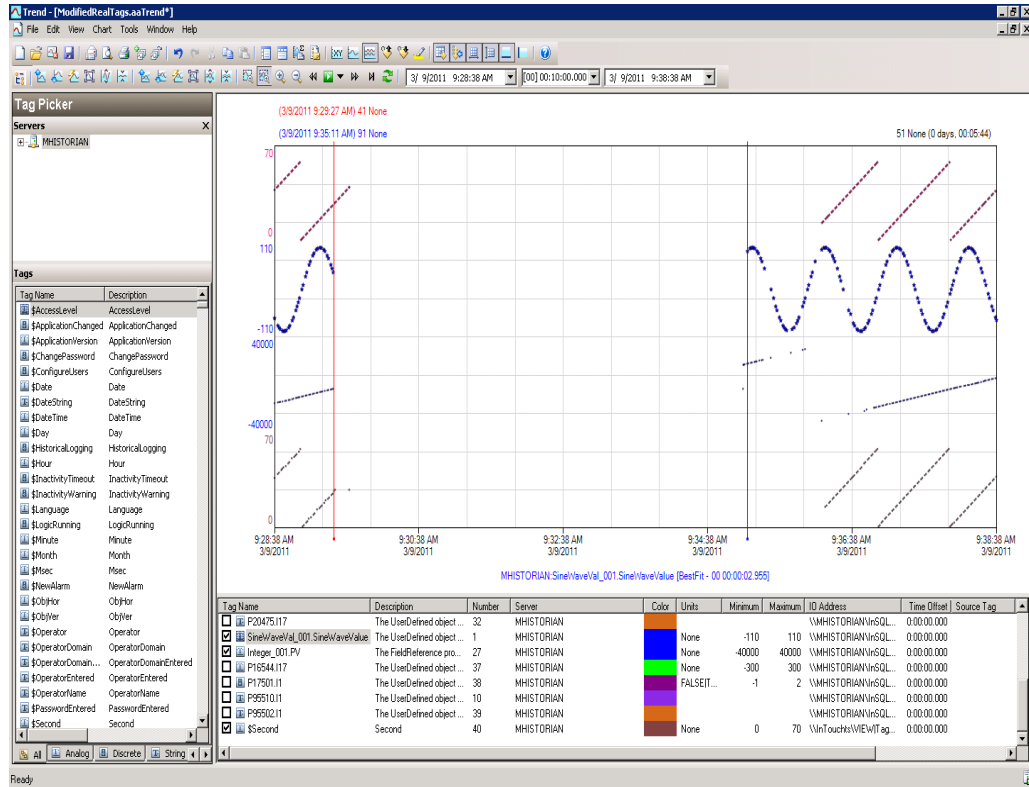
### IAS IO Tag (DASSiDirect)



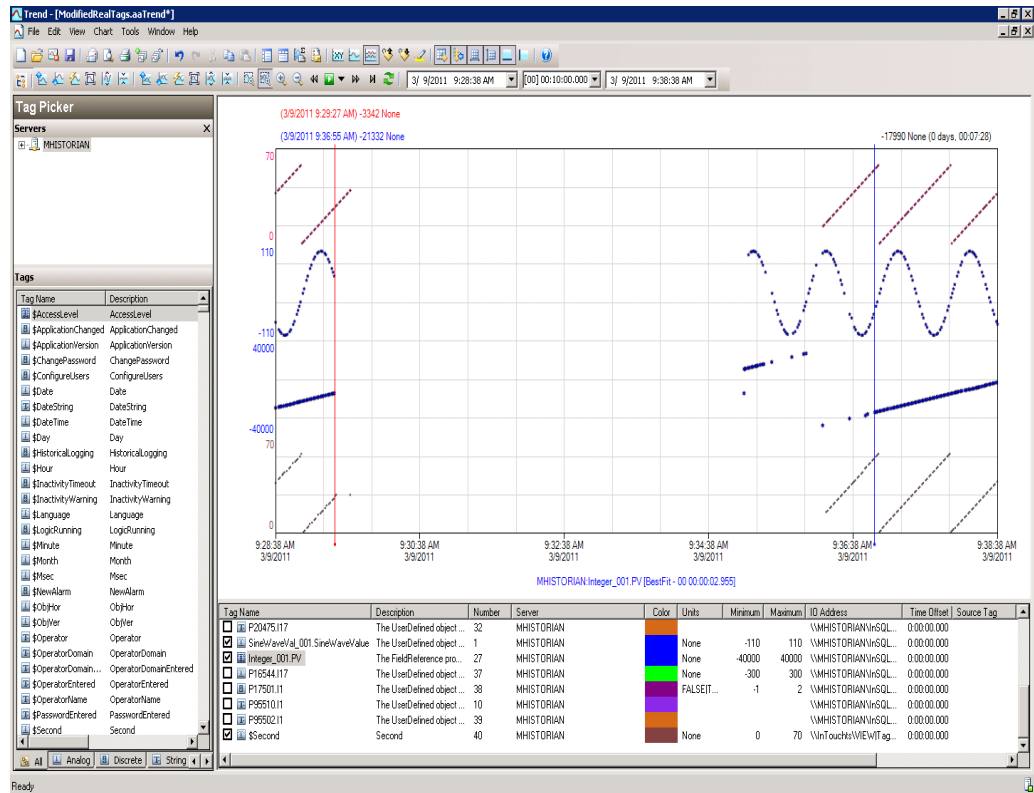


## GR node

### IAS Tag (Script)

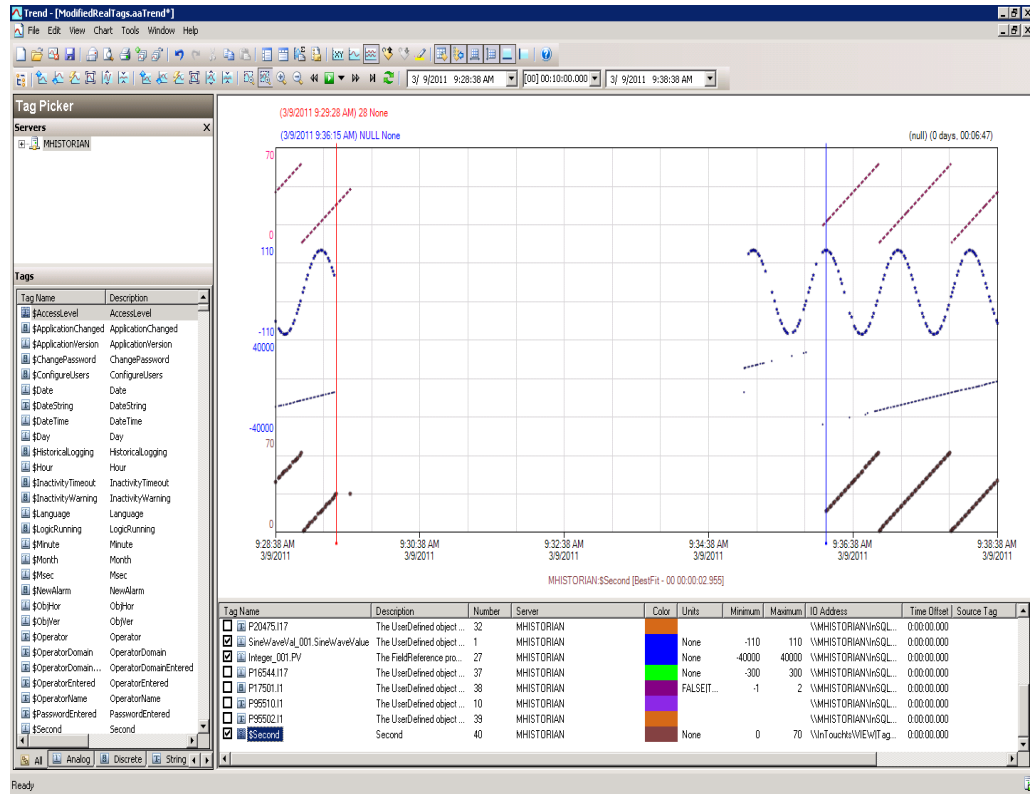


### IAS IO Tag (DASSiDirect)

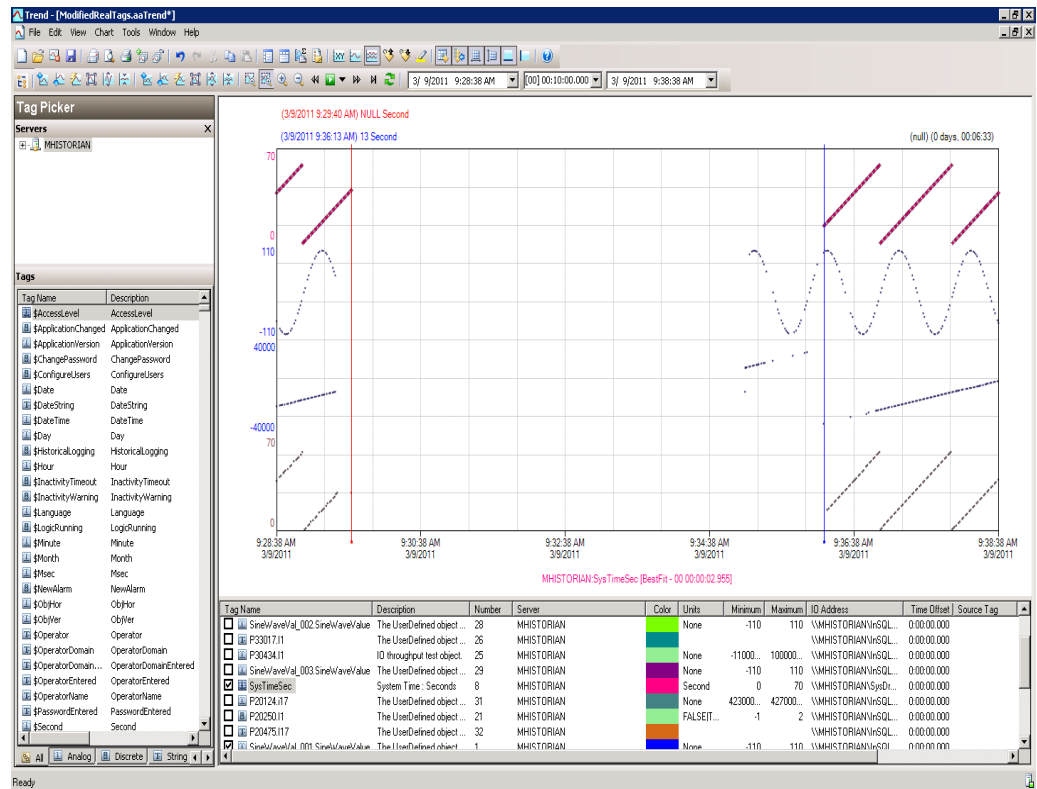


## Historian

### \$Second (InTouch)



## SysTimeSec (Historian)



### Observations

Error log after failover

#### GR node

```
515463092/16/20119:58:36 AM28161980Warning
EnginePrimitiveRuntimeEng:: m_GDC->GetFile failed. Error 2
(0x00000002): The system cannot find the file specified
aaEngine
```

```
515463832/16/20119:58:51 AM28161980WarningScriptRuntime
GR.privatebytes: Script timed out.aaEngine
```

#### AppEngine1

```
1121667922/16/20119:58:17 AM28602864WarningScriptRuntime
AppEngineNode1.privatebytes: Script timed out.aaEngine
```

```
1121671472/16/20119:58:59 AM2740388WarningDCMConnectionMgr
Open() of DCMConnection failed: 'A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
accessible. Verify that the instance name is correct and that
SQL Server is configured...aaEngine
```

```
1121671482/16/20119:58:59 AM2740388WarningSQLDataRuntime3
SQLTestResults Command Failure - A network-related or
```

instance-specific error occurred while establishing a connection to SQL Server. The server was not found or was not accessible. Verify that the instance name is correct and that SQL Server is configured...aaEngine

1121676622/16/20119:59:59 AM28602864WarningScriptRuntime  
AppEngineNode1.privatembytes: Script timed out.aaEngine

## **AppEngine2**

55385612/16/20119:57:50 AM31283132WarningScriptRuntime  
HourVal\_003.GenerateHourValue: Script timed out.aaEngine

55385752/16/20119:57:56 AM24521672WarningHistorianPrimitive  
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)aaEngine

55385952/16/20119:58:56 AM24521672WarningHistorianPrimitive  
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)aaEngine

55385962/16/20119:59:56 AM24521672WarningHistorianPrimitive  
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)aaEngine

55385982/16/201110:00:56 AM24521672WarningHistorianPrimitive  
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)aaEngine

55386042/16/201110:01:56 AM24521672WarningHistorianPrimitive  
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)aaEngine

## **Historian**

None

## **HistClient**

None

## **WIS**

None

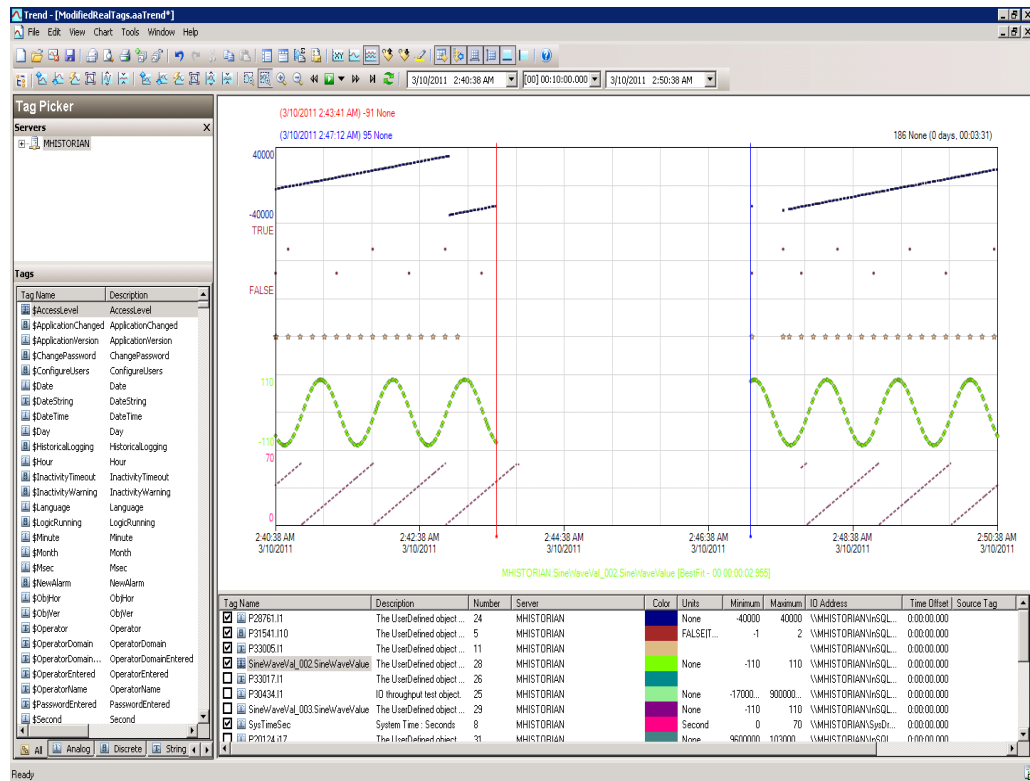
## Scenario 3: Network Fails on Virtualization Server

### Failover Due to Network Disconnect (Public)

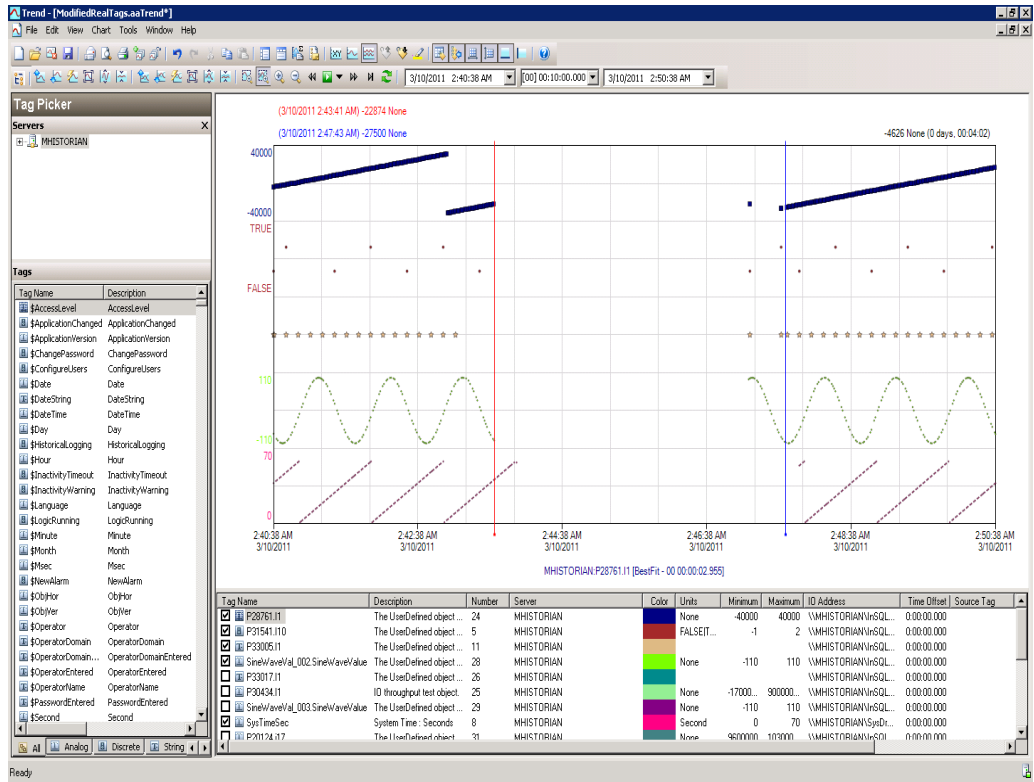
Trends:

AppEngine1

IAS Tag (Script)

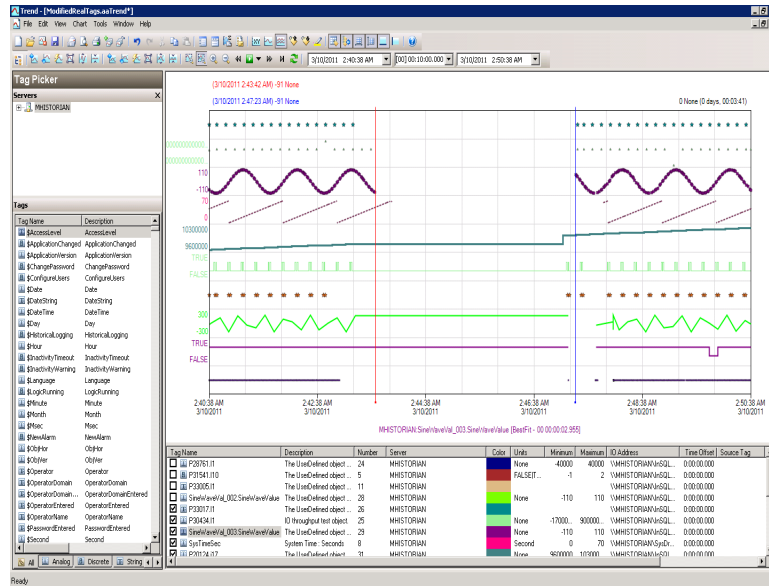


### IAS IO Tag (DASSiDirect)

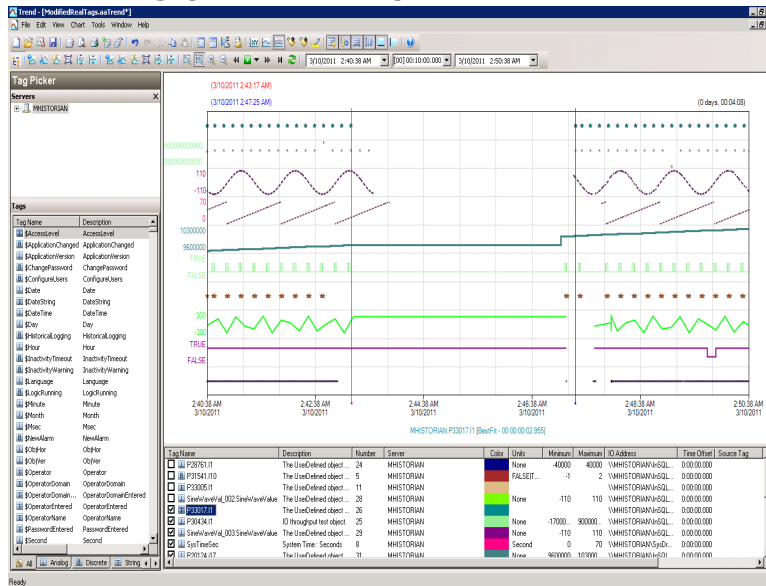


## AppEngine2

### IAS Tag (Script)



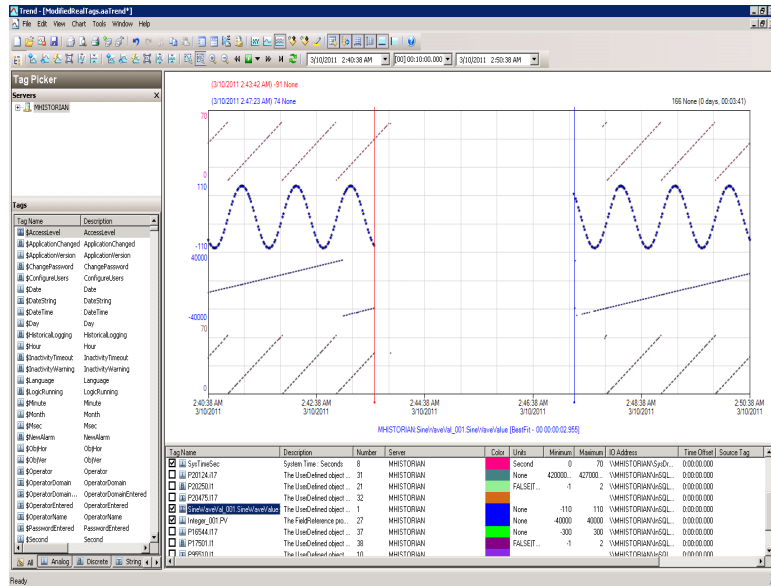
### IAS IO Tag (DASSiDirect)



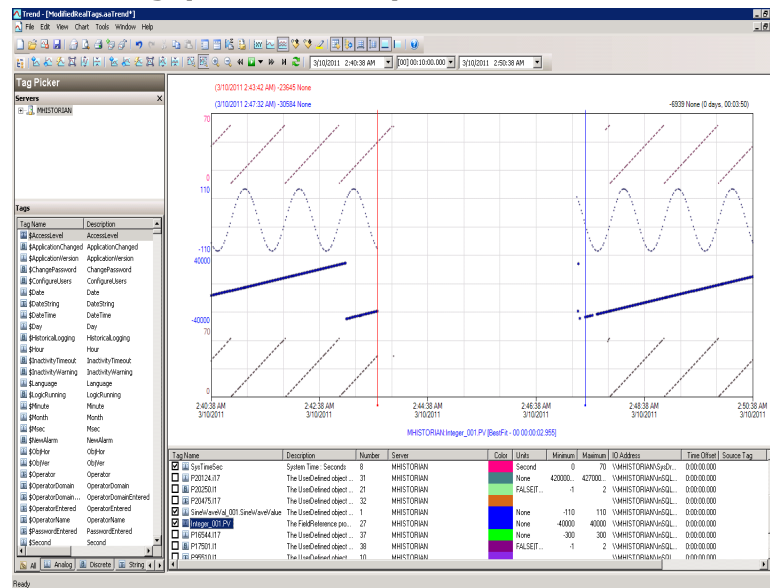


GR

IAS Tag (Script)

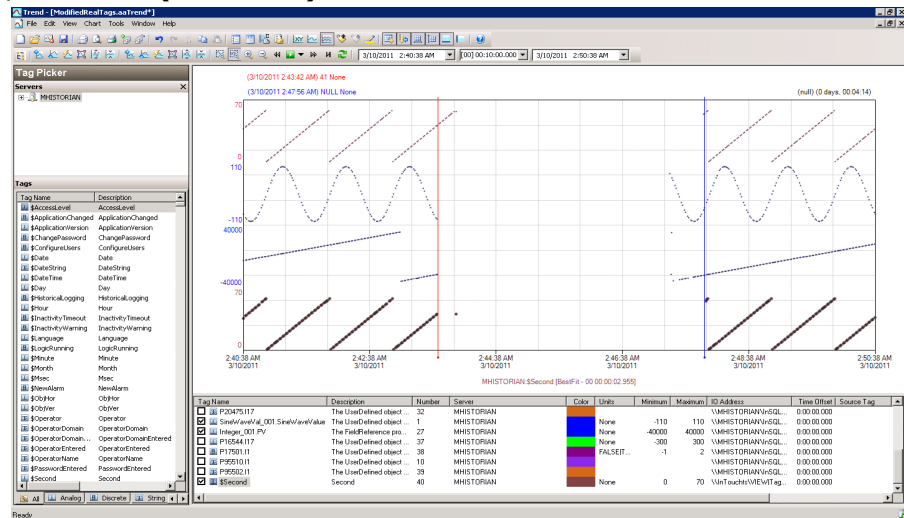


IAS IO Tag (DASSiDirect)

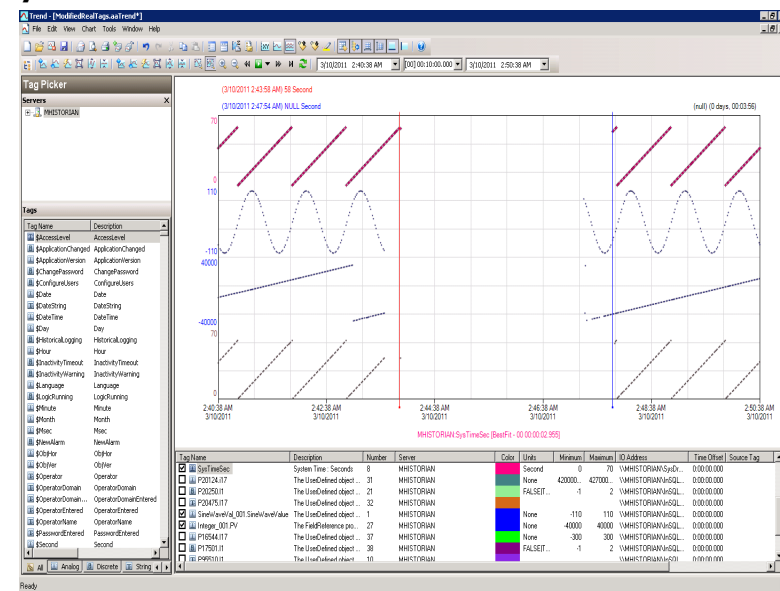


## Historian

### \$ Second (InTouch)



### SysTimeSec



## Observations

Error log after failover

### GR node

```
516659502/16/20113:05:39 PM30563060Warning
EnginePrimitiveRuntimeEng:: m_GDC->GetFile failed. Error 2
(0x00000002): The system cannot find the file specified
aaEngine
```

```
516660272/16/20113:06:03 PM30563060WarningScriptRuntime
GR.privatebytes: Script timed out.aaEngine
```

**AppEngine1**

```

1123841902/16/20112:55:38 PM29923008WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
1123841912/16/20112:55:38 PM29923008WarningNmxSvcPlatform 6
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
1123843442/16/20113:05:30 PM28922896WarningScriptRuntime
  AppEngineNode1.privatembytes: Script timed out.aaEngine
1123846742/16/20113:06:07 PM20161660WarningDCMConnectionMgr
  Open() of DCMConnection failed: 'A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...aaEngine
1123846752/16/20113:06:07 PM20161660WarningSQLDataRuntime3
  SQLTestResults Command Failure - A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...aaEngine
1123987662/16/20113:20:23 PM620436WarningInTouchProxyFailed to
  reconecnt to data source aaEngine
1123987832/16/20113:20:24 PM620436WarningInTouchProxyFailed to
  reconecnt to data source aaEngine

```

**AppEngine2**

```

55394192/16/20112:55:39 PM26801844WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
55394202/16/20112:55:39 PM26801844WarningNmxSvcPlatform 6
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
55395812/16/20113:03:41 PM31363140WarningScriptRuntime
  P10250.SetValues: Script timed out.aaEngine
55395822/16/20113:03:41 PM30843088WarningScriptRuntime
  P20250.SetValues: Script timed out.aaEngine
55396192/16/20113:03:56 PM32123216WarningScriptRuntime
  HourVal_003.GenerateHourValue: Script timed out.aaEngine
55396552/16/20113:04:09 PM23362332WarningHistorianPrimitive
  AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
  ArchestrA user account exist on Historian(InSQL) node or does
  Historian not exist?)aaEngine

```

**Historian**

```

235893212/16/20113:08:05 PM24164052WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"

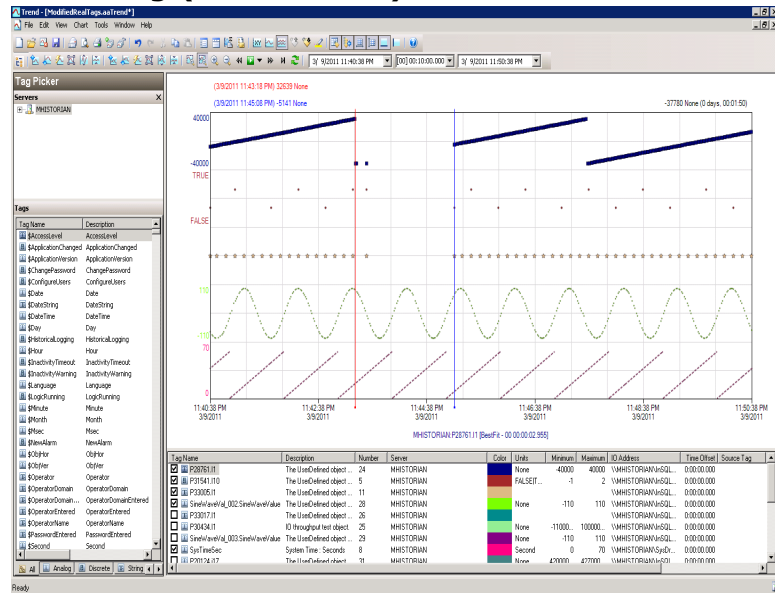
```

```
(02/16/11,15:08:04,096, 02/16/11,15:08:10,003) [HISTORIAN;  
Config.cpp; 2040]aahCfgSvc
```

## Failover Due to Network Disconnect (Plant) Trends

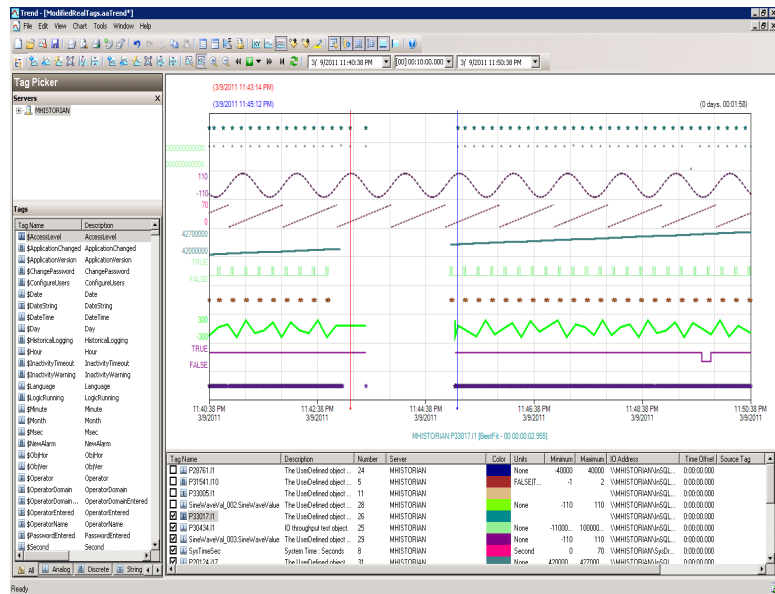
### AppEngine1

### IAS IO Tag (DASSiDirect)



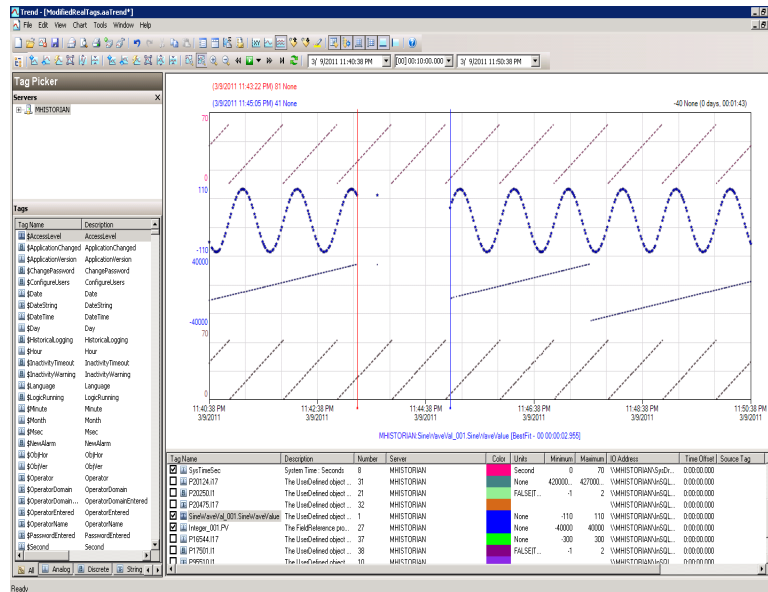
## AppEngine2

### IAS IO Tag (DASSiDirect)

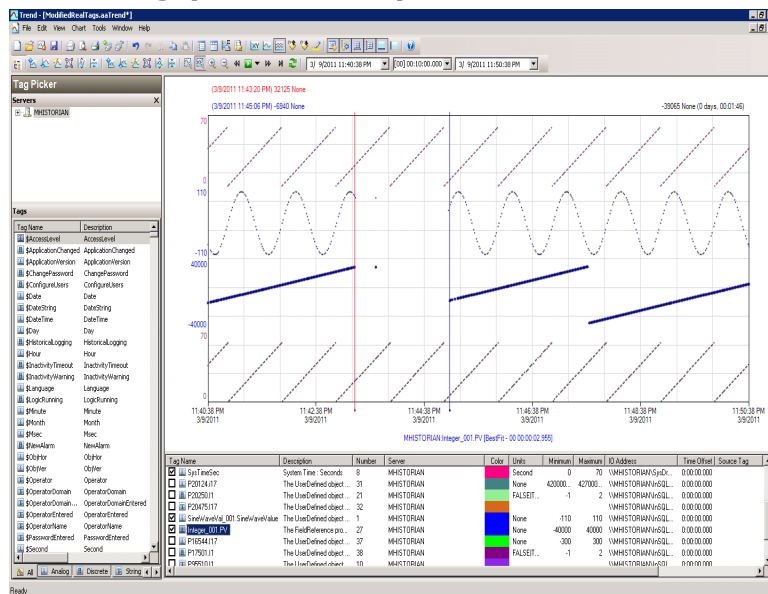


## GR

### IAS Tag (Script)



### IAS IO Tag (DASSiDirect)



## Observations

Error log after failover

## GR Node

None

## AppEngine1

```
1125514032/16/201111:17:30 PM29762996WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

**AppEngine2**

```
55402932/16/20116:17:31 PM26962720WarningNmxSvcPlatform 1  
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

**Historian**

```
235917472/16/20116:33:36 PM21444220WarningaahStoreSvcAttempt to  
  store values in the future; timestamps were overwritten with  
  current time (pipe name, TagName, wwTagKey, system time (UTC),  
  time difference (sec)) (historian_2, $Second, 38883,  
  2011/02/16 13:03:34.645, 2) [HISTORIAN; pipeserver.cpp; 1831]  
  aahCfgSvc
```

**WIS**

```
59751322/16/20116:17:35 PM37842276WarningNmxSvcPlatform 1  
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

## Scenario 4: Virtualization Server Becomes Unresponsive

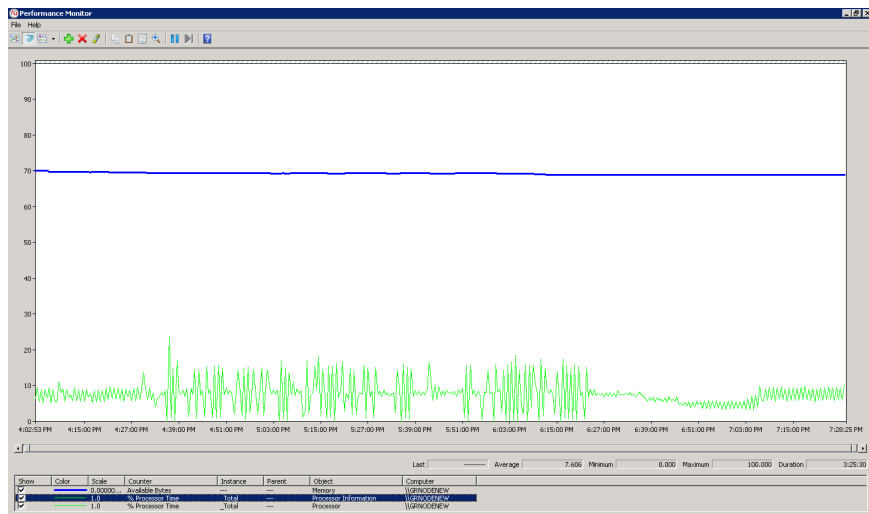
### **Hyper-V Virtual Machines with Static RAM and Reservations for Processors**

It has been observed that even when the Host Virtualization Server reaches 100% CPU utilization, there is no failover of the Hyper-V virtual machines running on it to the other Host Virtualization Server. However, the host server running at 100% CPU utilization fails to process all the network requirements of the Hyper-V virtual machines running on it. As a result, network disruptions on the Hyper-V virtual machines are observed that result in data loss.

### Host Virtualization Server performance when the CPU load is at 100%

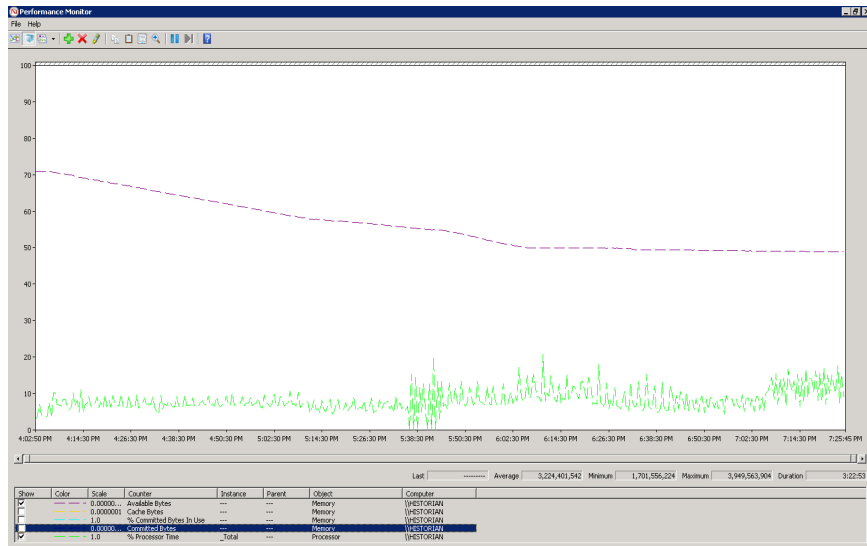


### GR Performance when the CPU load on the host server is at 100%





### Historian performance when the CPU load on the host server is at 100%



## Observations When CPU Load is 100% on Host Virtualization Server

The virtual machines do not failover when the CPU load was maintained at 100%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is high.

The message - "Snapshot write operation took longer than 10 seconds" - is expected when the virtual machines are running at high Processor Time% (Historian at 89% and GR Node at 35%).

As time is not synchronized on the Historian, AppEngine, and the GR nodes, a message - "Values in the past did not fit within the realtime window"- is expected.

### AppEngine1

```
1140593102/18/20115:31:25 PM36963700WarningScriptRuntime
  Insert.InsertValueOT: Script timed out.aaEngine
1140644952/18/20115:37:24 PM36963700WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.aaEngine
1140662112/18/20115:39:26 PM36963700WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.aaEngine
1140662282/18/20115:39:30 PM36963700WarningScriptRuntime
  Insert.InsertValuePeriodic: Script timed out.aaEngine
```

### AppEngine2

None

### GR node

None

### Historian node

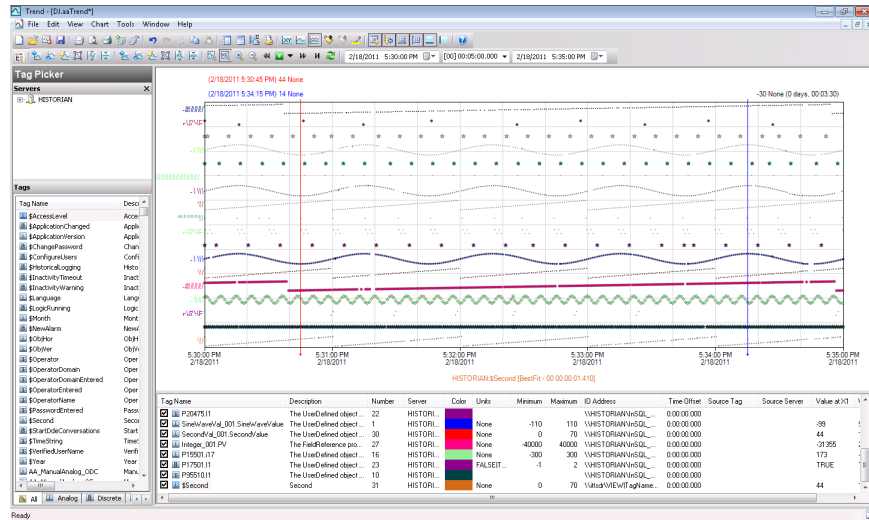
```
236067632/18/20115:10:40 PM33842780WarningaahStoreSvcSnapshot
  write operation took longer than 10 seconds. Change your
  system settings to decrease size of snapshot or stop other
  applications which may affect this parameter (1024, 3, 0,
  203203432, 5893027, 15) [HISTORIAN; deltastore.cpp; 2669]
  aahCfgSvc
236067642/18/20115:10:52 PM33842780WarningaahStoreSvcSnapshot
  write operation took longer than 10 seconds. Change your
  system settings to decrease size of snapshot or stop other
  applications which may affect this parameter (1024, 3, 0,
  209096459, 4186312, 11) [HISTORIAN; deltastore.cpp; 2669]
  aahCfgSvc
236067672/18/20115:11:24 PM33842780WarningaahStoreSvcAttempt to
  store values in the future; timestamps were overwritten with
  current time (pipe name, TagName, wwTagKey, system time (UTC),
  time difference (sec)) (HISTORIAN_mdas,
```

```
DifferentQuality.goodbool, 19605, 2011/02/18 11:37:11.126, 1)
[HISTORIAN; pipeser...aahCfgSvc
```

## WIS node

```
59756382/18/20115:11:23 PM36723676WarningNmxCfgSvcPlatform 1
exceed maximum heartbeats timeout of 8000 ms.NmxCfgSvc
```

## Trend when CPU utilization is 100%



From the above trend, it is observed that there is data loss for IAS IO tags and script tags also on the GR Node and the AppEngine nodes.

## Observations When CPU Load is 96% on Host Virtualization Server

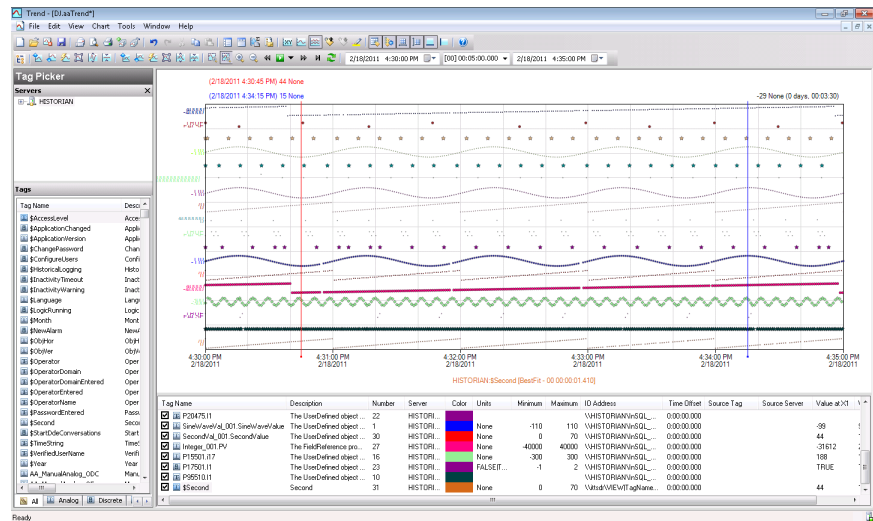
The virtual machines do not failover when the CPU load was maintained at 96%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is high.

Only the following warning message was observed when the CPU load of the host server was 96%.

## Historian node

```
236067282/18/20115:07:12 PM33842780WarningaahStoreSvcAttempt
to store values in the future; timestamps were overwritten with
current time (pipe name, TagName, wwTagKey, system time (UTC),
time difference (sec)) (HISTORIAN_mdas, DifferentQuality.goodbool,
19605, 2011/02/18 11:37:11.126, 1) [HISTORIAN; pipeser...aahCfgSvc
```

## Trend when CPU load is 96% on host Virtualization Server



From the above trend, it is observed that there is data loss for IAS IO tags and script tags on the GR node and the AppEngine nodes.

## Chapter 3

# Working with Disaster Recovery

This section introduces several Disaster Recovery (DR) virtualization solutions that improve the availability of System Platform Products. For more information refer to Chapter 1 Getting Started with High Availability and Disaster Recovery.

The set-up and configuration procedures, expected Recovery Time Objective (RTO) observations, Recovery Point Objective (RPO) observations, and data trend snapshots are presented first for small-scale virtualization environment, and are then repeated for medium-scale virtualization environment.

## Recommendations and Best Practices

- Ensure that auto log on is set up for all Hyper-V virtual machines running the System Platform products. This is to ensure that these Hyper-V virtual machines start up automatically after the failover.
- Ensure the time on all the Hyper-V Host Servers, the virtual machines and all other nodes which are part of the Disaster Recovery Environment are continuously synchronized. Otherwise, the Hyper-V virtual machines running on the host experience time drifts and results in discarding of data. You can add the time synchronization utility in the Start Up programs so that this utility starts automatically whenever the Hyper V machine reboots.

- On the host servers disable all the network cards which are not utilized by the System Platform Environment. This is to avoid any confusion during the network selections while setting up the cluster.
- As per the topology described above for the Disaster Recovery environment, only one network is used for all communications. If multiple networks are being used, then make sure only the primary network which is used for the communication between the Hyper-V Nodes is enabled for the Failover Cluster Communication. Disable the remaining cluster networks in Failover Cluster Manager.
- Ensure the virtual networks created in Hyper-V Manager have the same name across all the nodes which are participating in the Cluster. Otherwise, migration/failover of Hyper-V virtual machines will fail.

### **Best Practices for SteelEye DataKeeper Mirroring:**

- While creating the SteelEye DataKeeper mirroring job, ensure the drive letters of the source and target drives to be mirrored are same.
- It is suggested to have zero latency in the network when SteelEye DataKeeper mirroring, failover/migration of virtual machines between host servers take place. In case of networks with latency, refer to the SteelEye documentation on network requirements.
- While designing the network architecture particularly bandwidth between the hosts in the Disaster Recovery Environment, make sure to select the bandwidth based on the rate of data change captured from Disk Write Bytes/Sec on the host server for all the mirrored volumes. To verify that you have sufficient network bandwidth to successfully replicate your volume, use the Windows Performance Monitoring and Alerts tool to collect Write Bytes/sec on the replicated volumes to calculate the rate of data change. Collect this counter every 10 seconds and use your own data analysis program to estimate your rate of data change. For more details, refer to SteelEye documentation on network requirements.

SteelEye DataKeeper can handle the following average rates of change, approximately:

<b>Network Bandwidth</b>	<b>Rate of Change</b>
1.5 Mbps(T1)	182,000 Bytes/sec (1.45 Mbps)

10 Mbps	1,175,000 Bytes/sec (9.4 Mbps)
45 Mbps (T3)	5,250,000 Bytes/sec (41.75 Mbps)
100 Mbps	12,000,000 Bytes/sec (96 Mbps)
1000 Mbps (Gigabit)	65,000,000 Bytes/sec (520 Mbps)

The following table lists the impact on CPU utilization and Bandwidth with various Compression Levels.

- Medium Configuration Load: Approx. 50000 IO Points with Approx. 20000 attributes being historized
- Network: Bandwidth controller with bandwidth: 45Mbps and No Latency

These readings are when the mirroring is continuously happening between the source and destination storage SANs when all the VM are running on the source host server. The data captured shows that the % CPU utilization of the SteelEye mirroring process increases with increasing compression levels. Based on these findings we recommend Compression Level 2 in the Medium scale virtualization environment.

	<b>Impact on CPU of Source Host Server</b>		<b>Impact on Bandwidth</b>
	<b>% Processor Time (ExtMirrSvc)- SteelEye Mirroring process</b>	<b>% Processor Time (CPU) - Overall CPU</b>	<b>Total Bytes / Sec</b>
Compression 0	Min: 0 Max:4.679 Avg: 0.157	Min: 0 Max:28.333 Avg: 1.882	Min: 0 Max: 11,042,788 Avg: 2,686,598
Compression 1	Min: 0 Max: 4.680 Avg: 0.254	Min: 0 Max: 31.900 Avg: 1.895	Min: 0 Max: 10,157,373 Avg: 1,871,426
Compression 2	Min: 0 Max:6.239 Avg: 0.402	Min: 0 Max:37.861 Avg: 2.622	Min: 791.970 Max: 10,327,221 Avg: 1,199,242
Compression 9	Min: 0 Max:13.525 Avg: 0.308	Min: 0 Max:42.094 Avg: 3.244	Min: 0 Max: 7,066,439 Avg: 649,822



## System Platform Product-specific recommendations and observations

- During the preparation for Live and Quick migrations it is observed that the network freezes intermittently and then at the time of actual migration connectivity to the VM is lost. As a result, the System Platform node under migration experiences intermittent data loss during the preparation for Live and Quick migrations, and then has a data gap for the duration of actual migration.

### Historian

- In case of Live and Quick migration of Historian, you may notice that Historian logs values with quality detail 448 and there may be values logged twice with same timestamps. This is because the suspended Historian VM starts on the other cluster node with the system time it was suspended at before the migration. As a result, some of the data points it is receiving with the current time seem to be in the future to the Historian. This results in Historian modifying the timestamps to its system time and updating the QD to 448. This happens until the system time of the Historian node catches up with the real current time using the TimeSync utility, after which the problem goes away. So, it is recommended to stop the historian before the migration and restart it after the VM is migrated and its system time is synced up with the current time.
- Live and Quick migration of Historian should not be done when the block change over is in progress on the Historian node.
- If a failover happens (for example, due to a network disconnect on the source Host Virtualization Server) while the Historian status is still “Starting”, the Historian node fails over to the target Host Virtualization Server. In the target host, Historian fails to start. To recover from this state, kill the Historian services that failed to start and then start the Historian by launching the SMC.

### InTouch

- Ensure that InTouch Window Viewer is added to the Start Up programs so that the view is started automatically when the virtual machine reboots.

### Application Server

- If a failover happens (for example, due to a network disconnect on the source Host Virtualization Server) while the Galaxy Migration is in progress, the GR node fails over to the target Host Virtualization Server. In the target host, on opening the IDE for the galaxy, the templates do not appear in the Template toolbox and in Graphic toolbox. To recover from this state, delete the galaxy and create new Galaxy. Initiate the migration process once again.
- If a failover happens (for example, due to an abrupt power-off on the source Host Virtualization Server) while a platform deploy is in progress, the Platform node fails over to the target Host Virtualization Server. In the target host, some objects will be in deployed state and the rest will be in undeployed state. To recover from this state, redeploy the whole Platform once again.
- If a failover happens (for example, due to an abrupt power-off on the source Host Virtualization Server) while a platform undeploy is in progress, the Platform node fails over to the target Host Virtualization Server. In the target host, some objects will be in undeployed state and the rest will be in deployed state. To recover from this state, undeploy the whole Platform once again.

### Data Access Server

- In case of Live and Quick migration of I/O Server node (for example, DASSIDirect), InTouch I/O tags acquiring data from that I/O server needs to be reinitialized after the I/O server node is migrated. To automatically acquire the data for these tags from the I/O server after migration, it is recommended to have an InTouch script which monitors the quality status of any of those tags and triggers reinitialize I/O once the quality goes to bad. Execute this script every 3 to 5 seconds until the tag quality becomes good.

## Working with a Small Scale Virtualization Environment

This chapter contains the following topics:

- Setting Up Small Scale Virtualization Environment
- Configuration of System Platform Products in a Typical Small Scale Virtualization
- Expected Recovery Time Objective and Recovery Point Objective
- Snapshots of Data Trends and Observations

## Setting Up Small Scale Virtualization Environment

The following procedures help you to set up small scale virtualization disaster recovery environment.

### Planning for Disaster Recovery

The minimum and recommended hardware and software requirements for the Host and Virtual machines used for small scale virtualization disaster recovery environment.

#### Hyper-V Hosts

Processor:	Two - 2.66 GHz Intel Xeon with - 8 Cores
Operating System	Windows Server 2008 R2 Enterprise with Hyper-V Enabled
Memory	12GB
Storage	Local Volume with Capacity of 500 GB

**Note:** For the Hyper-V Host to function optimally, the server should have the same processor, RAM, storage and service pack level. Preferably, the servers should be purchased in pairs to avoid hardware discrepancies. Though the differences are supported, it will impact the performance during failovers.

#### Virtual Machines

Using the above Specified Hyper-V Host , three virtual machines can be created with below Configuration.

#### Virtual Machine 1: DAS SI, Historian, and Application Server (GR) Node

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Historian, ArcestraA, DAS SI

**Virtual Machine 2: Application Server Runtime Node 1**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	2 GB
Storage	40 GB
System Platform Products Installed	Application Server Runtime only and InTouch

**Virtual Machine 3: Information Server Node, InTouch, Historian Client**

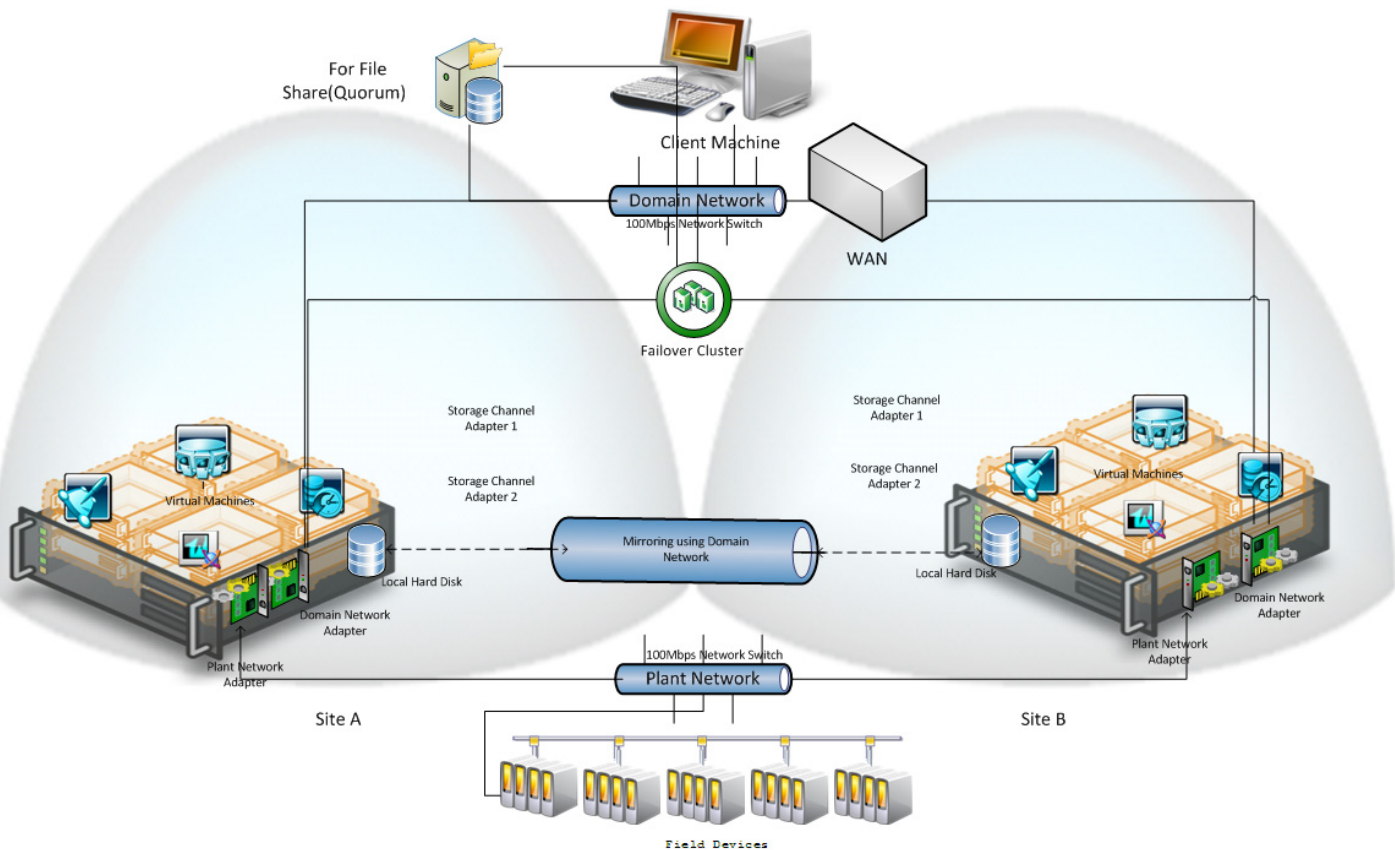
Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 Standard
Memory	4 GB
Storage	40 GB
System Platform Products Installed	Information Server , InTouch, Historian Client

**Network Requirements**

For this architecture, you can use one physical network card that needs to be installed on a host computer for domain network and the process network.

## Configuring Failover Cluster

The recommended topology of the failover cluster for disaster recovery process for small scale virtualization environment is given below:



This setup requires a minimum of two host servers with sufficient local disk space on each server to create logical drives for the virtual machines. Each logical drive is replicated to the two hosts for disaster recovery. Another independent node is used for configuring the quorum. For more information on configuring the quorum, refer to "Configuring Cluster Quorum Settings" on page 264.

The following process will guide how to set up the small virtualization disaster recovery environment.

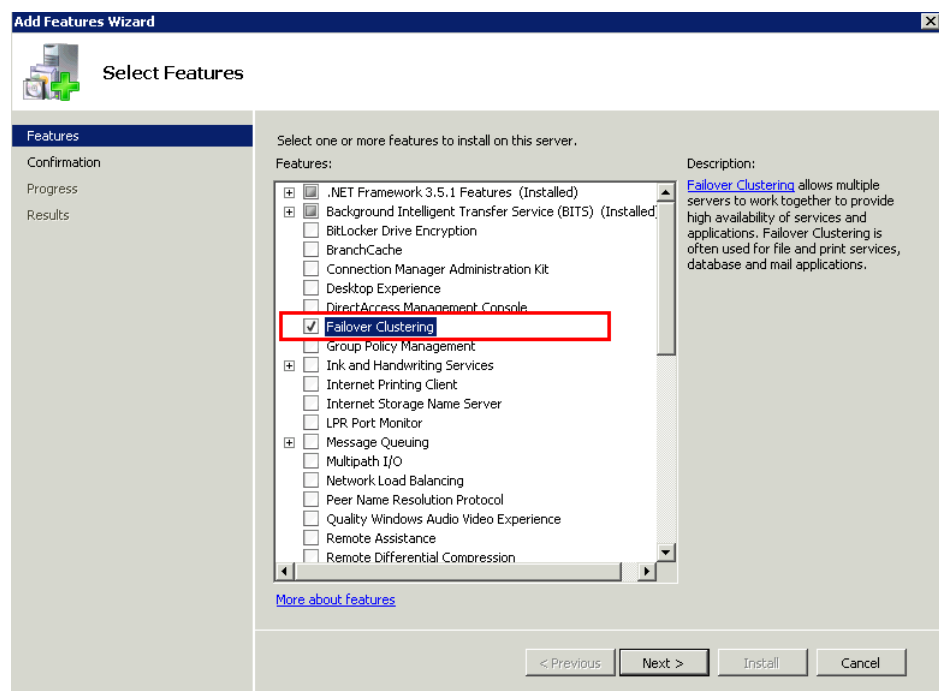
## Installing Failover Cluster

To install the failover cluster feature, you need to run Windows Server 2008 R2 Enterprise Edition on your server.

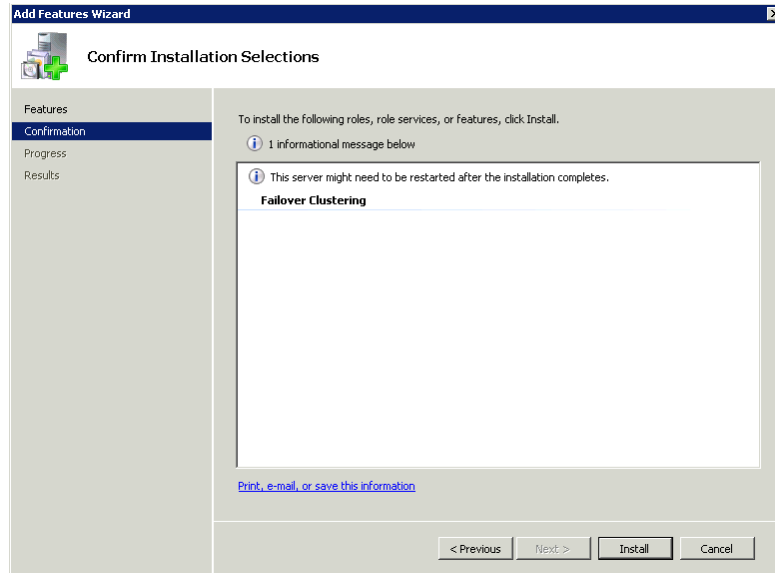
### To install the failover cluster feature on a server

- 1 On the **Initial Configuration Tasks** window, under **Customize This Server**, click **Add features**. The **Add Features Wizard** window appears.

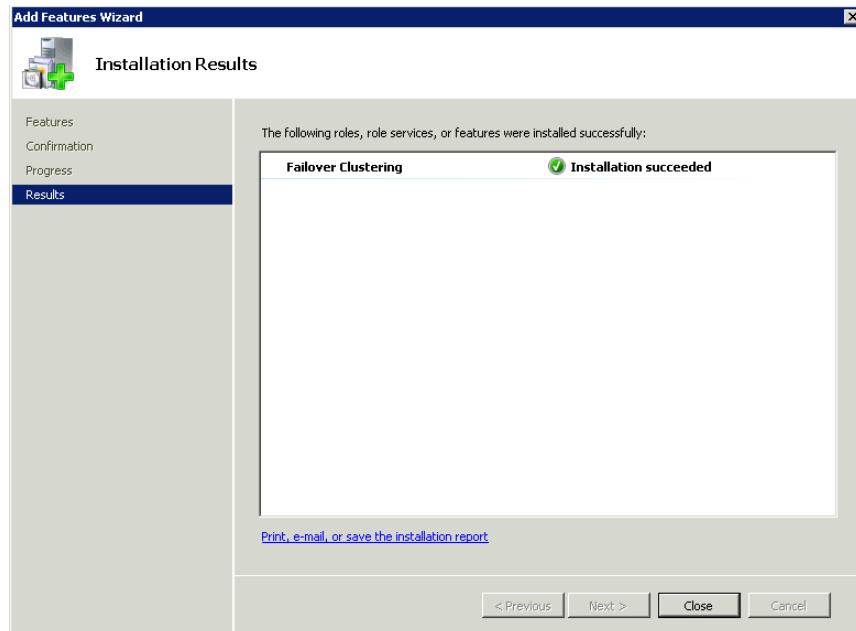
**Note:** The **Initial Configuration Tasks** window appears if you have already installed Windows Server 2008 R2. If it does not appear, open the **Server Manager** window, right-click **Features** and click **Add Features**.



- In the **Add Features Wizard** window, select the **Failover Clustering** check box, and then click **Next**. The **Confirm Installation Selections** area appears.



- Click **Install** to complete the installation. The **Installation Results** area with the installation confirmation message appears.



- Click **Close** to close the **Add Features Wizard** window.

**Note:** Repeat the procedure to include on all the other nodes that will be part of the Cluster configuration process.

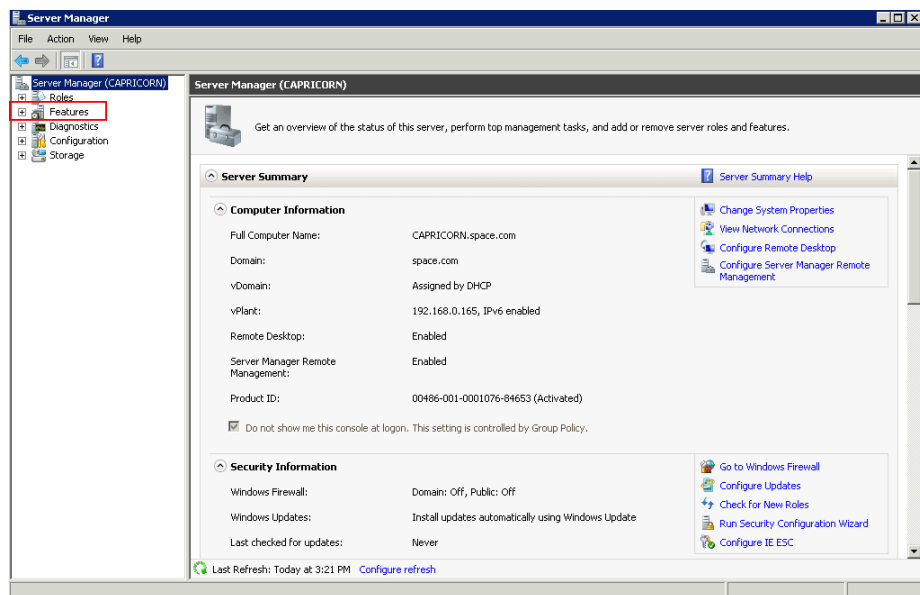
## Validating Cluster Configuration

Before creating a cluster, you must validate your configuration. Validation helps you confirm that the configuration of your servers, network, and storage meet the specific requirements for failover clusters.

### To validate the failover cluster configuration

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

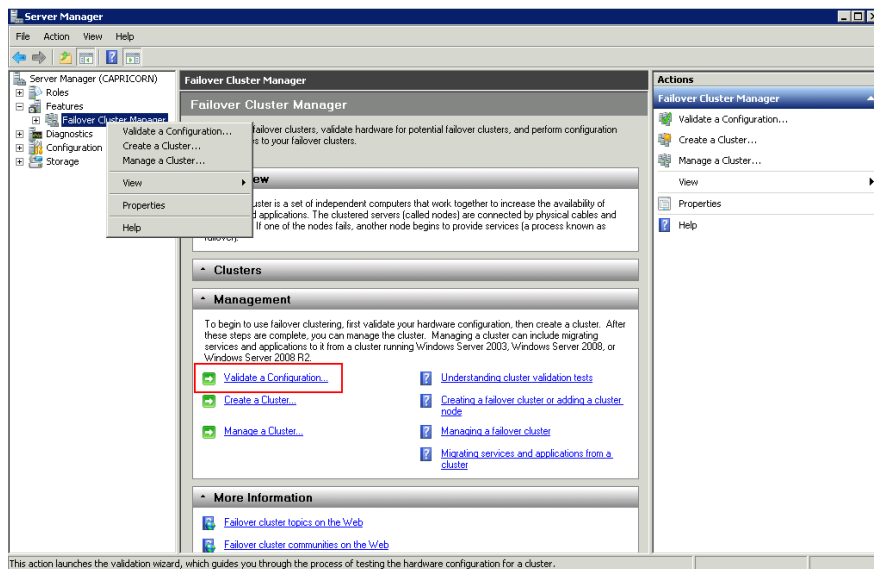
**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.



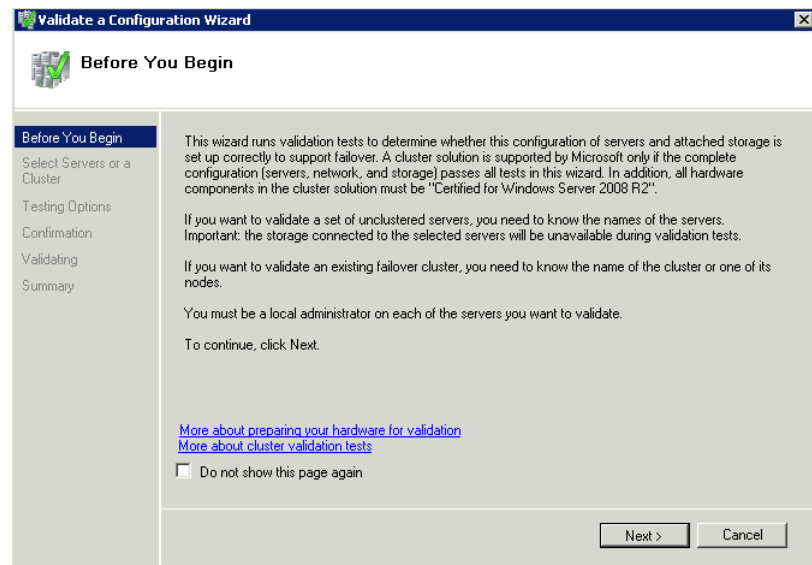


- Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



- 3 Under **Management**, click **Validate a Configuration**. The **Validate a Configuration Wizard** window appears. Click **Next**.

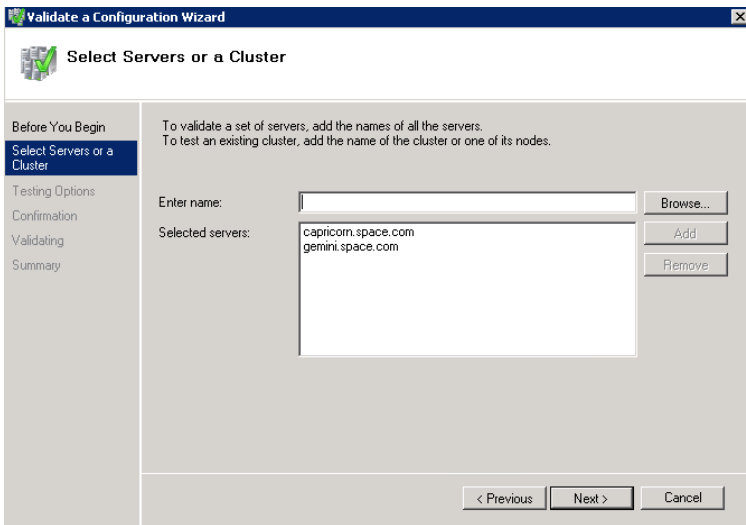


- 4 In the **Select Servers** or a **Cluster** screen, you need to do the following:
  - a Click **Browse** or enter next to the **Enter name** field and select the relevant server name.
  - b From the **Selected servers** list, select the relevant servers and click **Add**.
  - c Click **Next**. The **Testing Options** screen appears.
  - d Enter the server name and click **Add**. The server gets added to the server box.

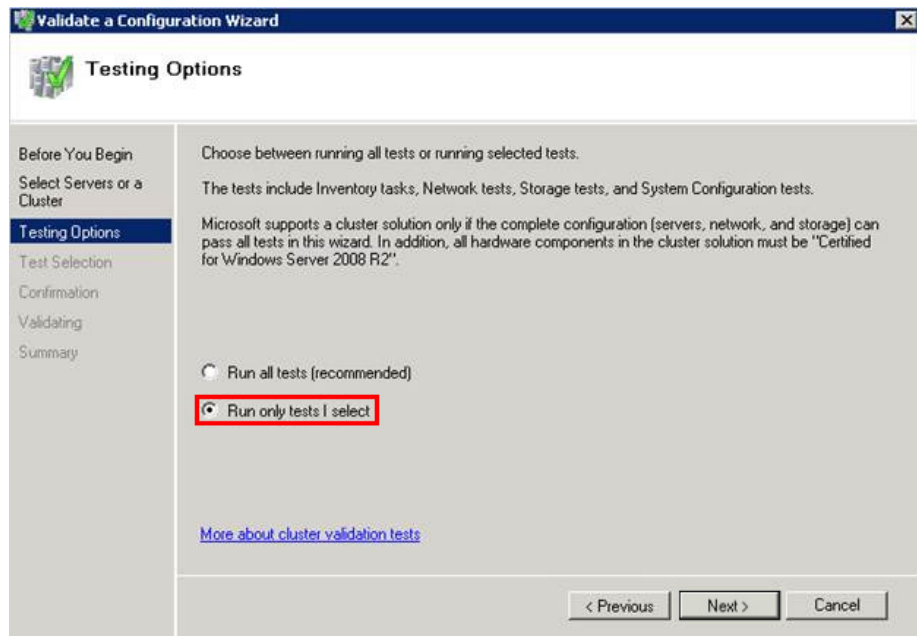
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**Note:** To remove a server, select the server and click **Remove**.

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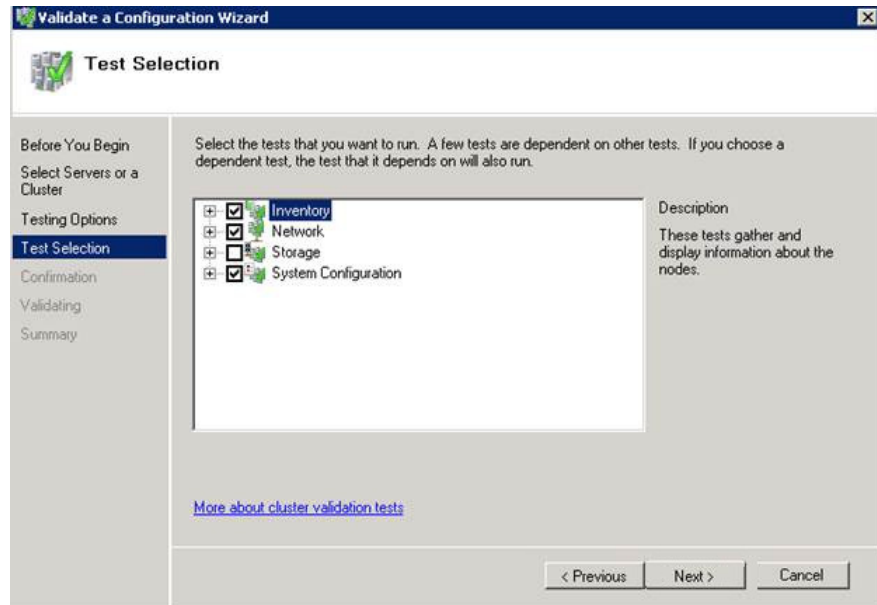


- 5 Click the **Run only the tests I select** option to skip the storage validation process, and click **Next**. The **Test Selection** screen appears.

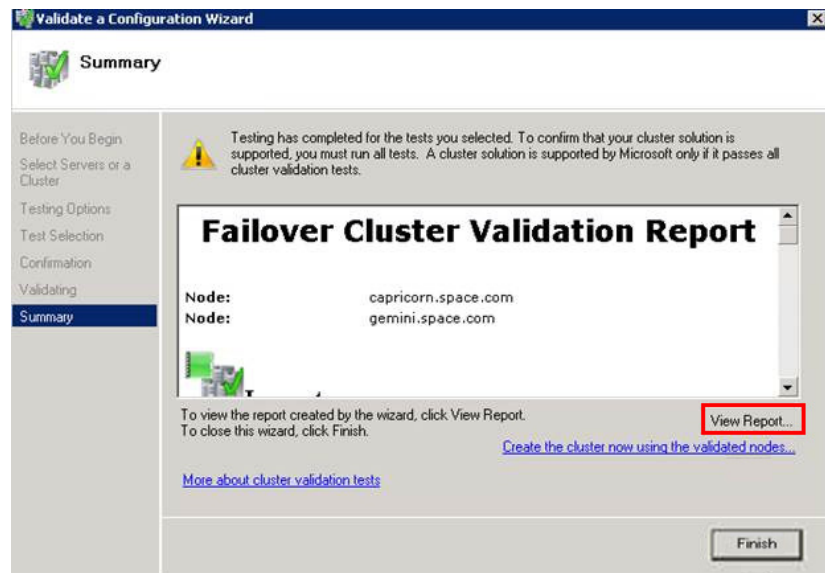


**Note:** Click the **Run all tests (recommended)** option to validate the default selection of tests.

- 6 Clear the **Storage** check box, and then click **Next**. The **Summary** screen appears.



- 7 Click **View Report** to view the test results or click **Finish** to close the **Validate a Configuration Wizard** window.



A warning message appears indicating that all the tests have not been run. This usually happens in a multisite cluster where the storage tests are skipped. You can proceed if there is no other error message. If the report indicates any other error, you need to fix the problem and re-run the tests before you continue. You can view the results of the tests after you close the wizard in `SystemRoot\Cluster\Reports\Validation Report date and time.html` where `SystemRoot` is the folder in which the operating system is installed (for example, `C:\Windows`).

To know more about cluster validation tests, click **More about cluster validation tests** on **Validate a Configuration** Wizard window.

## Creating a Cluster

To create a cluster, you need to run the Create Cluster wizard.

### To create a cluster

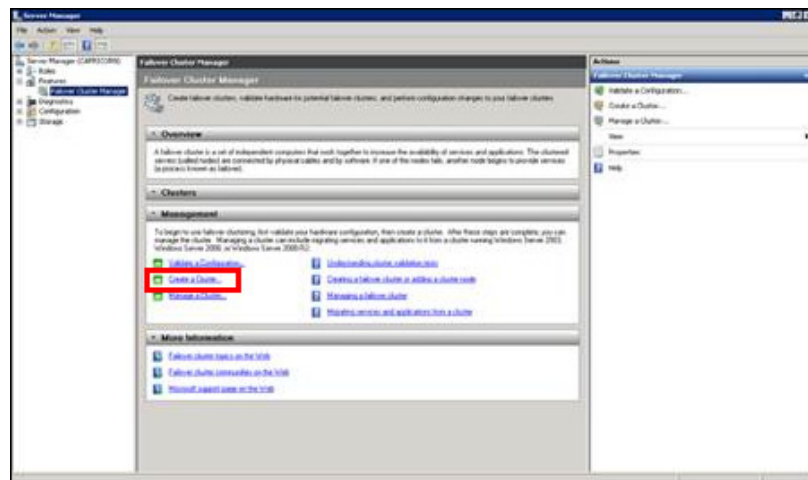
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the Start menu.

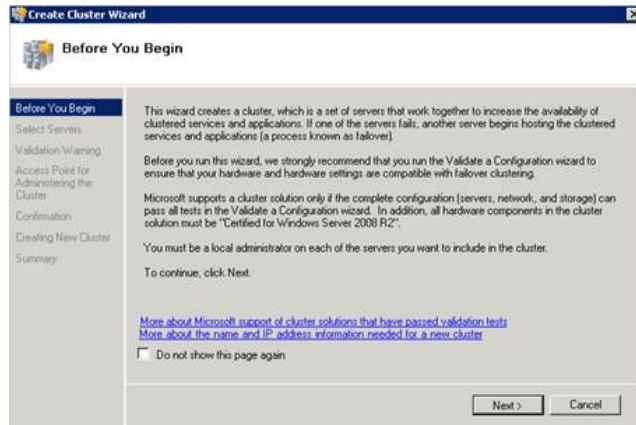


- 2 Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

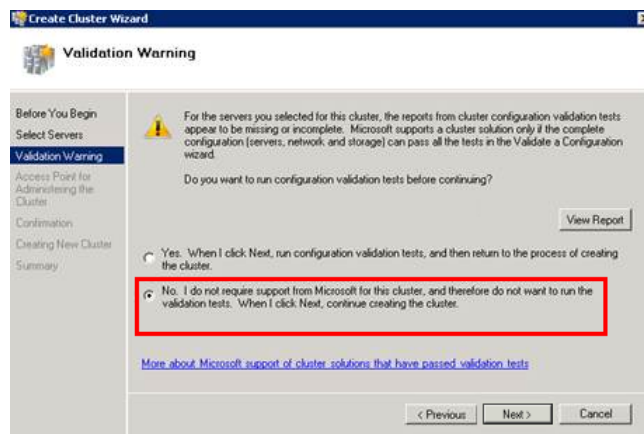
**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



- 3 Under **Management**, click **Create a cluster**. The **Create Cluster Wizard** window appears.

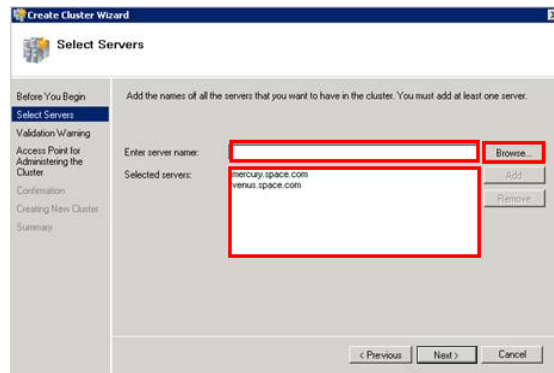


- 4 View the instructions and click **Next**. The **Validation Warning** area appears.



- 5 Click **No. I do not require support from Microsoft for this cluster, and therefore do not want to run the validation tests**. Click **When I click Next, continue creating the cluster** option and click **Next**. The **Select Servers** area appears.

**Note:** Click **Yes**. When I click **Next**, run configuration validation tests, and then return to the process of creating the cluster option if you want to run the configuration validation tests. Click **View Report** to view the cluster operation report.

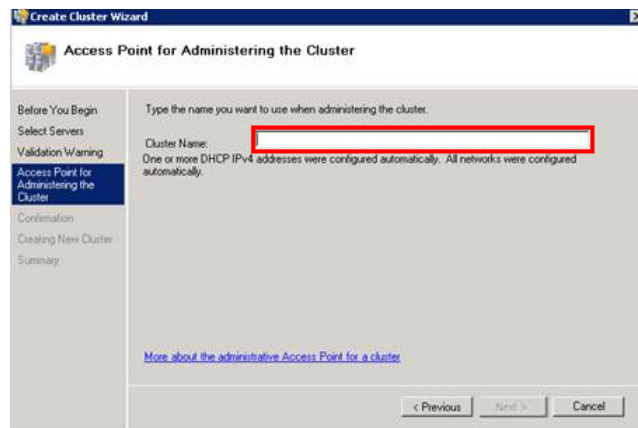


**6** In the **Select Servers** screen, do the following:

- a** In the **Enter server name** box, enter the relevant server name and click **Add**. The server name gets added in the **Selected servers** box.

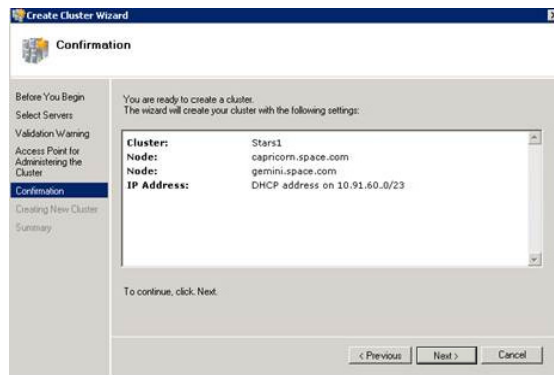
**Note:** You can either type the server name or click **Browse** to select the relevant server name.

- b** Click **Next**. The **Access Point for Administering the Cluster** area appears.



**7** In the **Cluster Name** box, type the name of the cluster and click **Next**. The **Confirmation** area appears.

**Note:** Enter a valid IP address for the cluster to be created if the IP address is not configured through Dynamic Host Configuration Protocol (DHCP).



8 Click **Next**. The cluster is created and the **Summary** area appears.



9 Click **View Report** to view the cluster report created by the wizard or click **Finish** to close the **Create Cluster Wizard** window.

## Configuring Cluster Quorum Settings

Quorum is the number of elements that need to be online to enable continuous running of a cluster. In most instances, the elements are nodes. In some cases, the elements also consist of disk or file share witnesses. Each of these elements determines whether the cluster should continue to run.

All elements, except the file share witnesses, have a copy of the cluster configuration. The cluster service ensures that the copies are always synchronized. The cluster should stop running if there are multiple failures or if there is a communication error between the cluster nodes.

After both nodes have been added to the cluster, and the cluster networking components have been configured, you must configure the failover cluster quorum.



The file share to be used for the node and File Share Majority quorum must be created and secured before configuring the failover cluster quorum. If the file share has not been created or correctly secured, the following procedure to configure a cluster quorum will fail. The file share can be hosted on any computer running a Windows operating system.

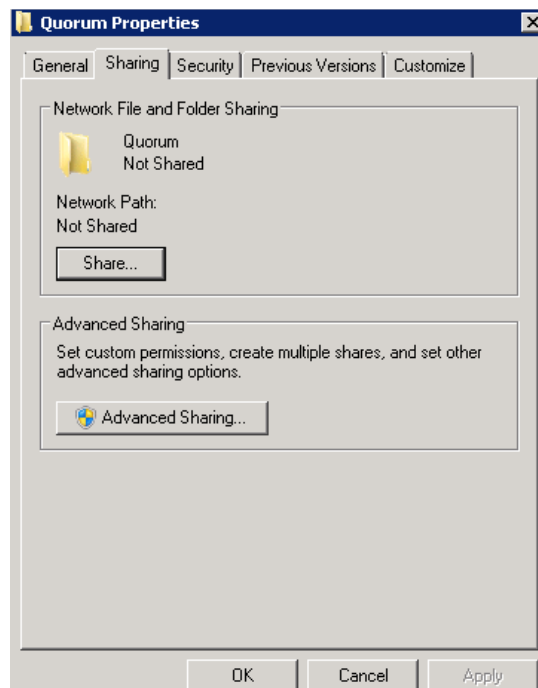
To configure the cluster quorum, you need to perform the following procedures:

- Create and secure a file share for the node and file share majority quorum
- Use the failover cluster management tool to configure a node and file share majority quorum

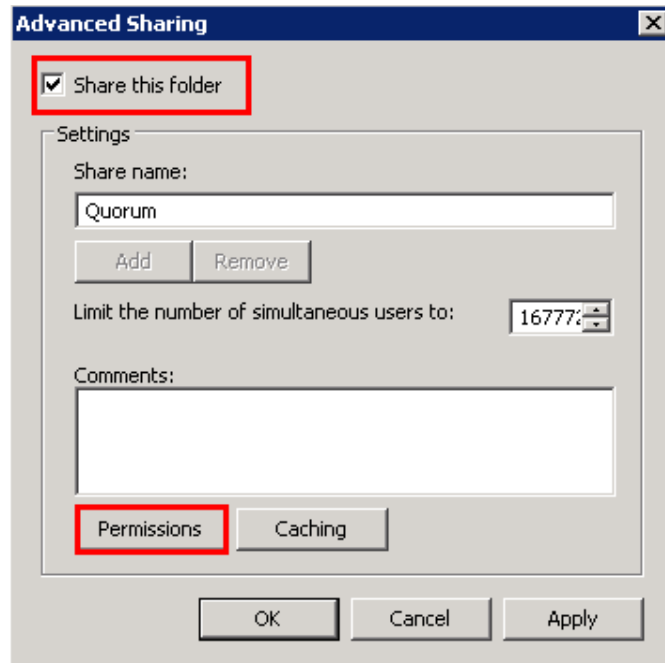
### To create and secure a file share for the node and file share majority quorum

- 1 Create a new folder on the system that will host the share directory.
- 2 Right-click the folder that you created and click **Properties**. The **Quorum Properties** window for the folder you created appears.

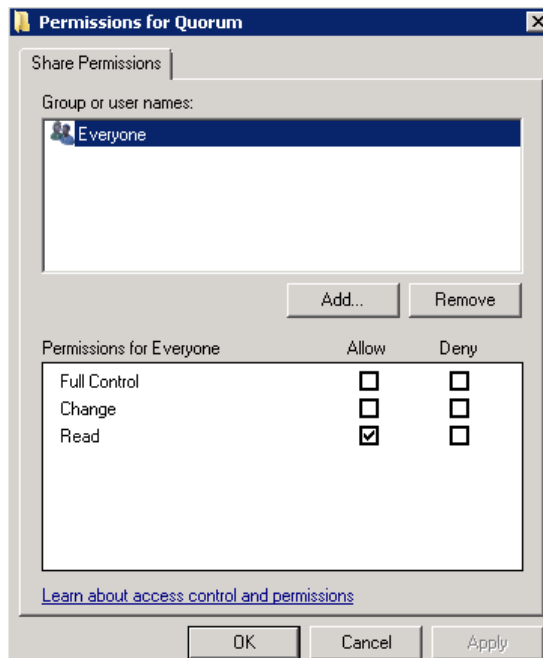
**Note:** In the following procedure, Quorum is the name of the folder.



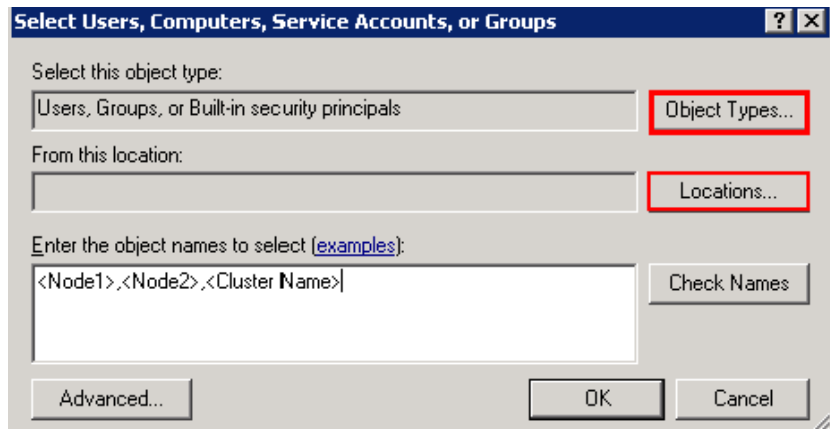
- 3 Click the **Sharing** tab, and then click **Advanced Sharing**. The **Advanced Sharing** window appears.



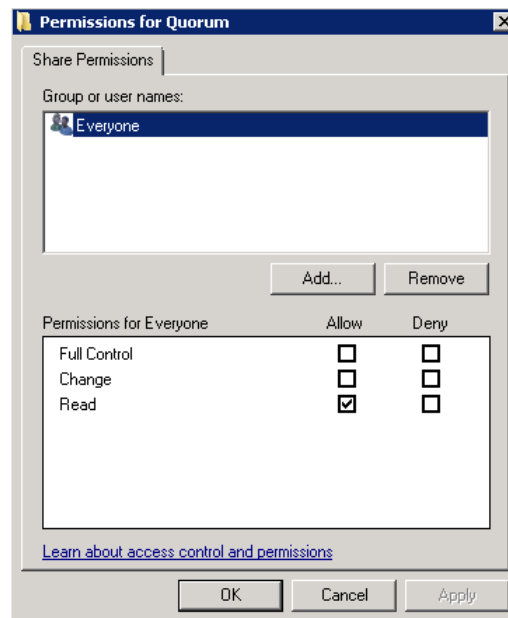
- 4 Select the **Share this folder** check box and click **Permissions**. The **Permissions for Quorum** window appears.



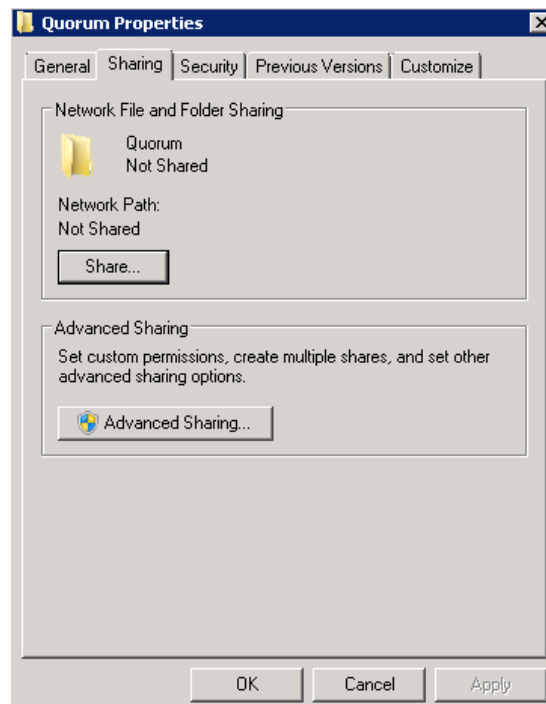
- 5 Click **Add**. The **Select Users, Computers, Service Accounts, or Groups** window appears.



- 6 In the **Enter the object name to select** box, enter the two node names used for the cluster in the small node configuration and click **OK**. The node names are added and the **Permissions for Quorum** window appears.



- 7 Select the **Full Control**, **Change**, and **Read** check boxes and click **OK**. The **Properties** window appears.

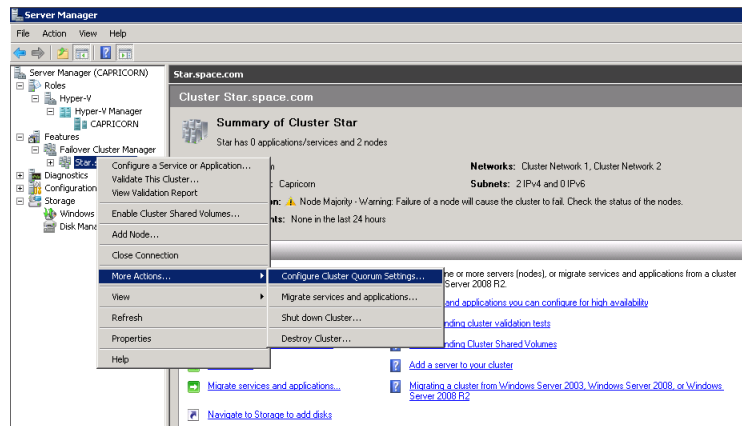


- 8 Click **OK**. The folder is shared and can be used to create virtual machines.

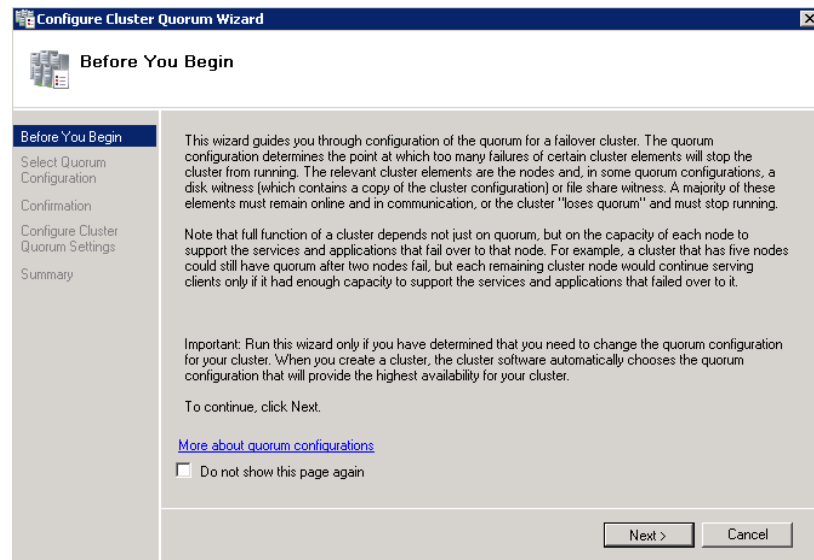
## To configure a node and file share majority quorum using the failover cluster management tool

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

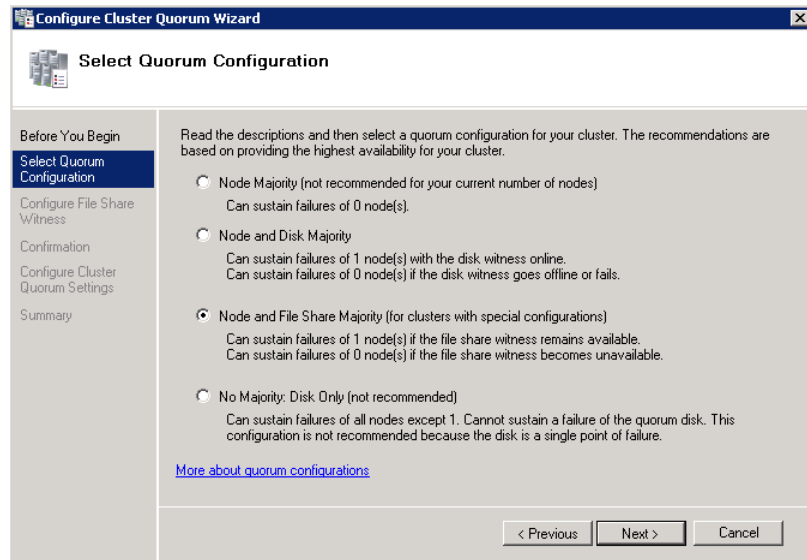


- 2 Right-click the name of the cluster you created and click **More Actions**. Click **Configure Cluster Quorum Settings**. The **Configure Cluster Quorum Wizard** window appears.



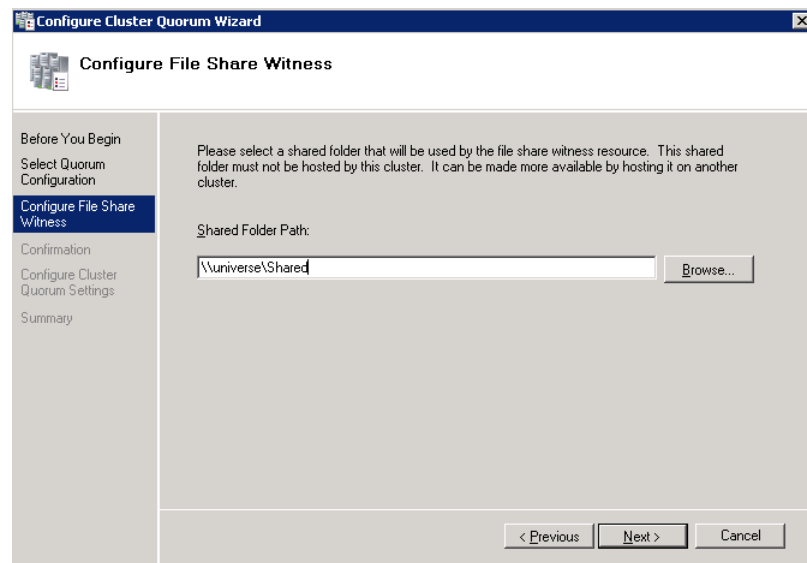
- 3 View the instructions on the wizard and click **Next**. The **Select Quorum Configuration** area appears.

**Note:** The **Before you Begin** screen appears the first time you run the wizard. You can hide this screen on subsequent uses of the wizard.



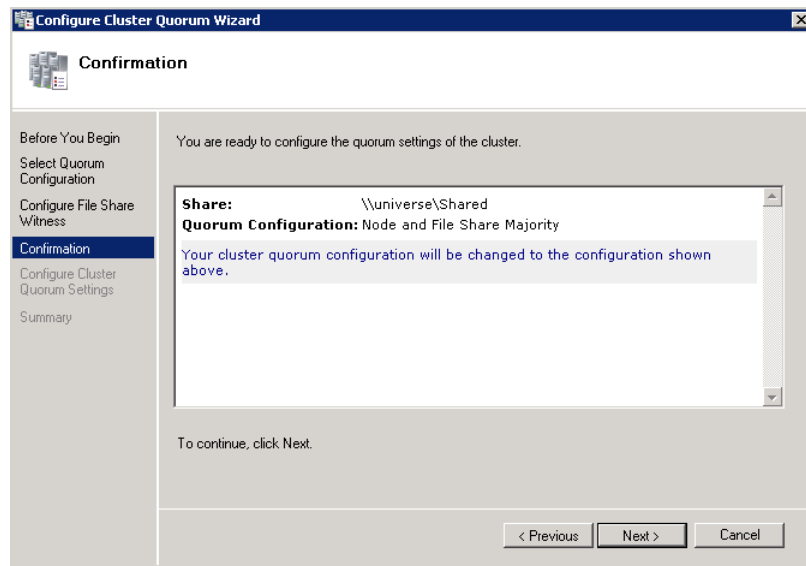
- 4 You need to select the relevant quorum node. For special configurations, click the **Node and File Share Majority** option and click **Next**. The **Configure File Share Witness** area appears.

**Note:** Click the **Node Majority** option if the cluster is configured for node majority or a single quorum resource. Click the **Node and Disk Majority** option if the number of nodes is even and not part of a multisite cluster. Click the **No Majority: Disk Only** option if the disk is being used only for the quorum.

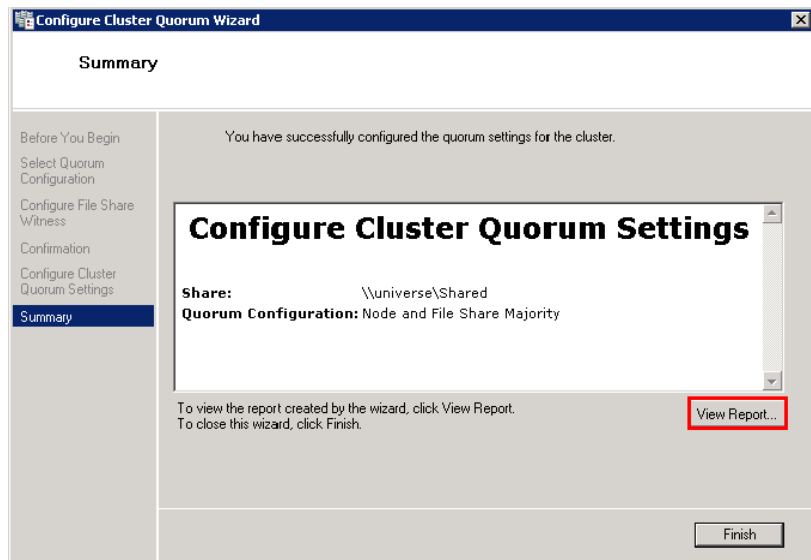


- 5 In the **Shared Folder Path** box, enter the Universal Naming Convention (UNC) path to the file share that you created in the Configure Cluster Quorum Settings. Click **Next**. Permissions to the share are verified. If there are no problems with the access to the share, then **Confirmation** screen appears.

**Note:** You can either enter the share name or click **Browse** to select the relevant shared path.



- 6 The details you selected are displayed. To confirm the details, click **Next**. The **Summary** screen appears and the configuration details of the quorum settings are displayed.



- 7 Click **View Report** to view a report of the tasks performed, or click **Finish** to close the window.

After you configure the cluster quorum, you must validate the cluster. For more information, refer to [http://technet.microsoft.com/en-us/library/bb676379\(EXCHG.80\).aspx](http://technet.microsoft.com/en-us/library/bb676379(EXCHG.80).aspx).

## Configuring Storage

For a smaller virtualization environment, storage is one of the central considerations in implementing a good virtualization strategy. But with Hyper-V, VM storage is kept on a Windows file system. You can put VMs on any file system that a Hyper-V server can access. As a result, HA can be built into the virtualization platform and storage for the virtual machines. This configuration can accommodate a host failure by making storage accessible to all Hyper-V hosts so that any host can run VMs from the same path on the shared folder. The back-end part of this storage can be a local, storage area network, iSCSI, or whatever is available to fit the implementation.

For this architecture, local partitions are used.

The following table lists the minimum storage recommendations to configure storage for each VM:

<b>System</b>	<b>Storage Capacity</b>
Historian and Application Server (GR Node) Virtual Machine	80 GB
Application Engine (Runtime Node) Virtual Machine	40 GB
InTouch and Information Server Virtual Machine	40 GB

The total storage capacity should be minimum recommended 1TB.

## Configuring Hyper-V

Microsoft Hyper-V Server 2008 R2 helps in creating a virtual environment that improves server utilization. It enhances patching, provisioning, management, support tools, processes, and skills. Microsoft Hyper-V Server 2008 R2 provides live migration, cluster shared volume support, expanded processor, and memory support for host systems.

Hyper-V is available in x64-based versions of Windows Server 2008 R2 operating system, specifically the x64-based versions of Windows Server 2008 R2 Standard, Windows Server 2008 R2 Enterprise, and Windows Server 2008 Datacenter.

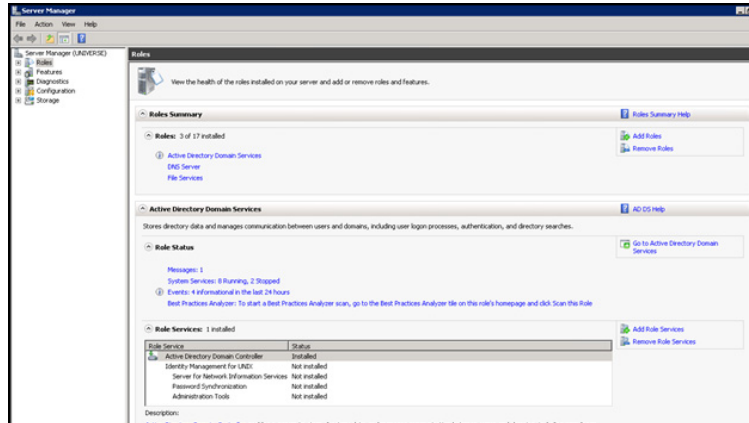


The following are the pre-requisites to set up Hyper-V:

- x64-based processor
- Hardware-assisted virtualization
- Hardware Data Execution Prevention (DEP)

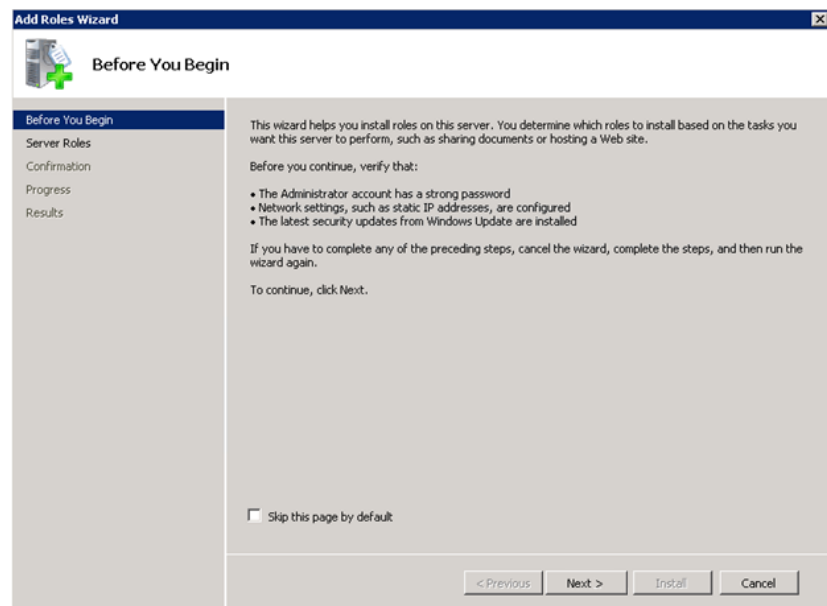
### To configure Hyper-V

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

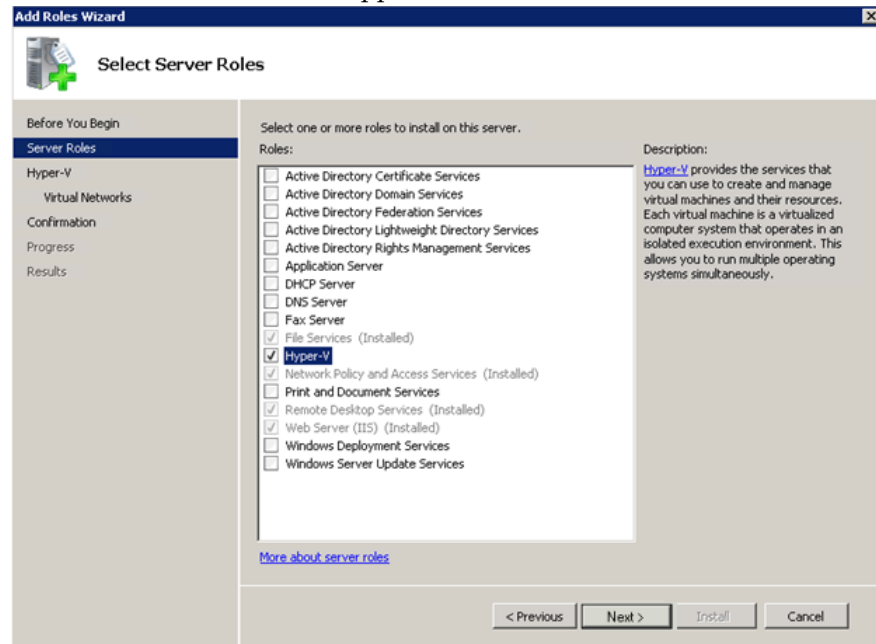


- 2 In the **Roles Summary** area, click **Add Roles**. The **Add Roles Wizard** window appears.

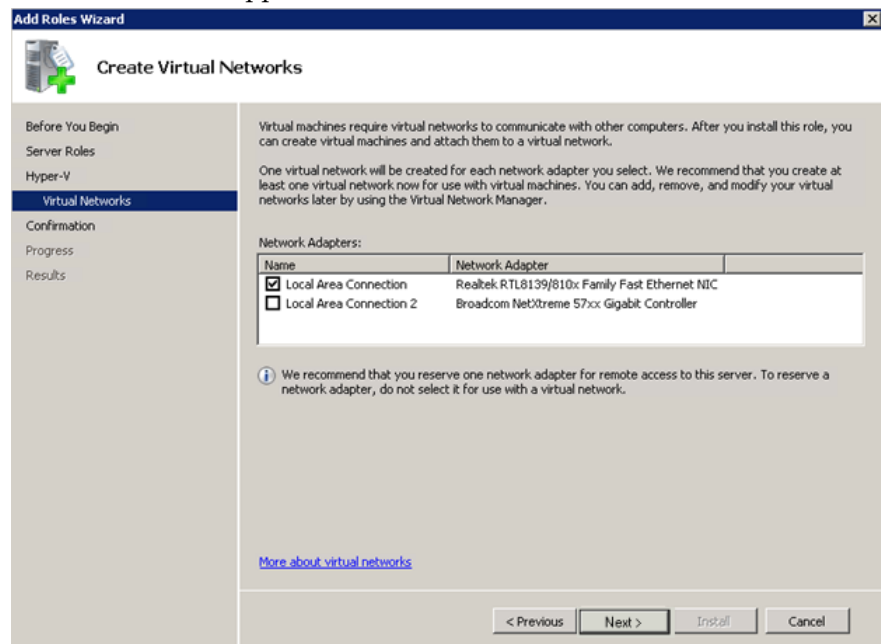
**Note:** You can also right-click **Roles** and then click **Add Roles Wizard** to open the **Add Roles Wizard** window.



- 3 View the instructions on the wizard and then click **Next**. The **Select Server Roles** area appears.

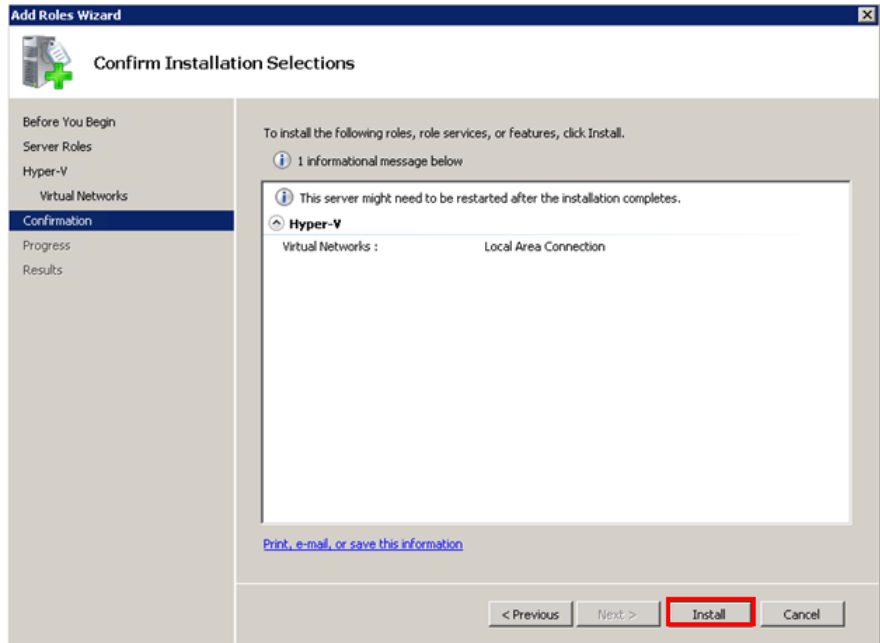


- 4 Select the **Hyper-V** check box and click **Next**. The **Create Virtual Networks** area appears.

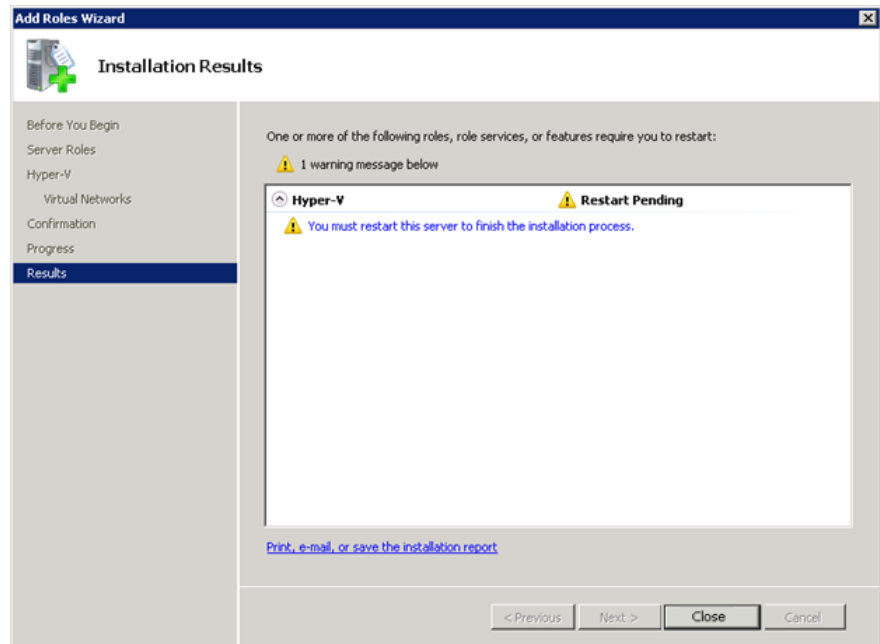


- 5 Select the check box next to the required network adapter to make the connection available to virtual machines. Click **Next**. The **Confirmation Installation Selections** area appears.

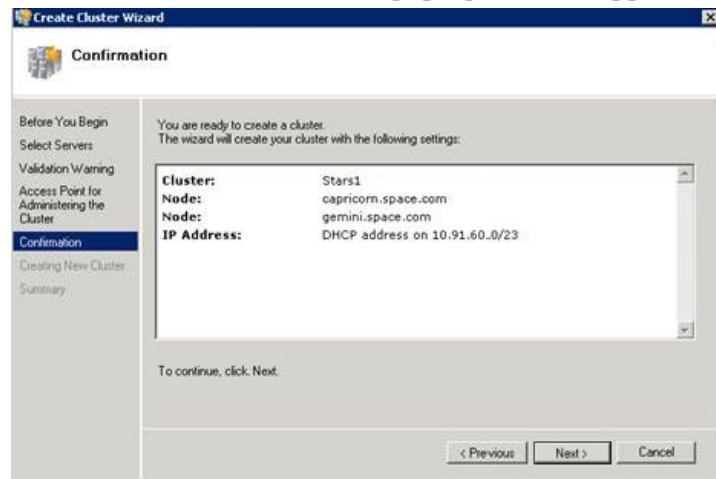
**Note:** You can select one or more network adapters.



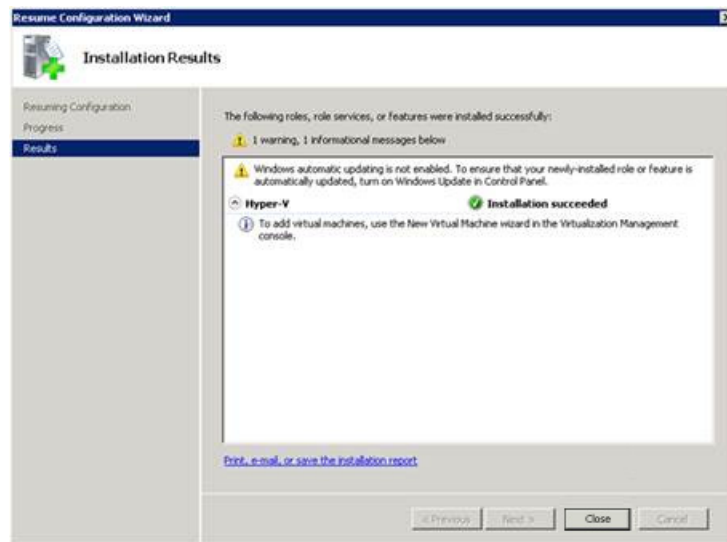
**6** Click **Install**. The **Installation Results** area appears.



- 7 A message appears prompting you to restart the computer. Click **Close**. The **Add Roles Wizard** pop-up window appears.



- 8 Click **Yes** to restart the computer.
- 9 After you restart the computer, log on with the same ID and password you used to install the **Hyper V** role. The installation is completed and the **Resume Configuration Wizard** window appears with the installation results.



- 10 Click **Close** to close the **Resume Configuration Wizard** window.

## Configuring SIOS (SteelEye) Mirroring Jobs

SIOS (SteelEye) DataKeeper is replication software for real-time Windows data. It helps replicate all data types, including the following:

- Open files
- SQL and Exchange Server databases
- Hyper-V .vhd files

SteelEye DataKeeper's ability to replicate live Hyper-V virtual machines ensures that a duplicate copy is available in case the primary storage array fails. This helps in disaster recovery (DR) without impacting production.

SteelEye DataKeeper Cluster Edition is a host-based replication solution, which extends Microsoft Windows Server 2008 R2 Failover Clustering (WSFC) and Microsoft Cluster Server (MSCS) features such as cross-subnet failover and tunable heartbeat parameters. These features make it possible to deploy geographically distributed clusters.

You can replicate a virtual machine across LAN, WAN, or any Windows server through SIOS Microsoft Management Console (MMC) interface. You can run the DataKeeper MMC snap-in from any server. The DataKeeper MMC snap-in interface is similar to the existing Microsoft Management tools.

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**Note:** For information on installing the SteelEye DataKeeper, refer to *SteelEye DataKeeper for Windows Server 2003/2008 Planning and Install Guide* and *SteelEye DataKeeper for Windows Server 2003/2008 Administration Guide* at <http://www.steeleye.com>. Ensure that the local security policies, firewall, and port settings are configured as per the details in these documents.

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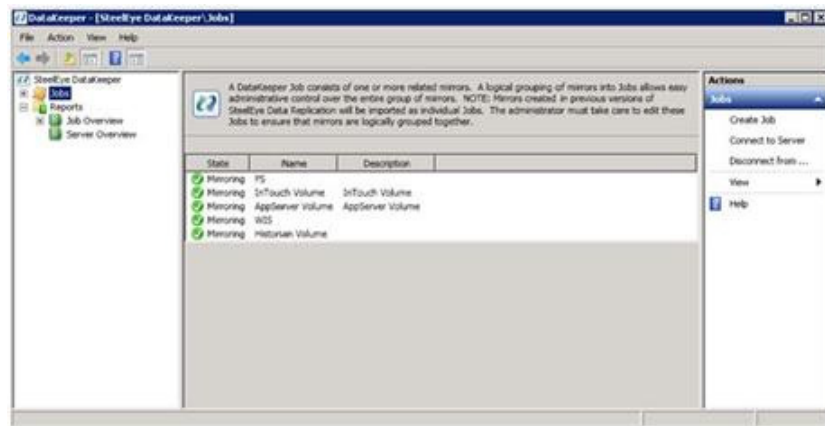
The following procedures help you set up a virtual machine in the Disaster Recovery environment.

### Creating a DataKeeper Mirroring Job

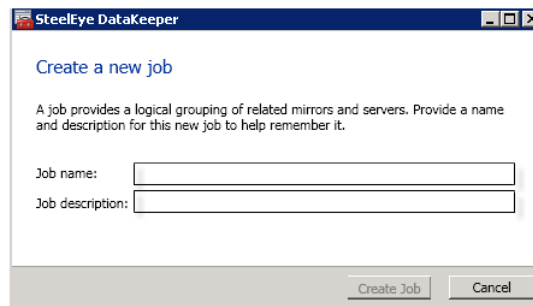
To set up a virtual machine in the Disaster Recovery environment you need to first create a SteelEye mirroring job.

## To create a SteelEye DataKeeper mirroring job

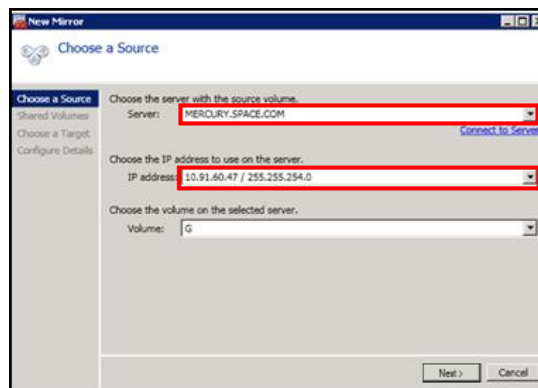
- 1 Click **Start**, and then from the **All Programs** menu, click **SteelEye DataKeeper MMC**. The **DataKeeper** window appears.



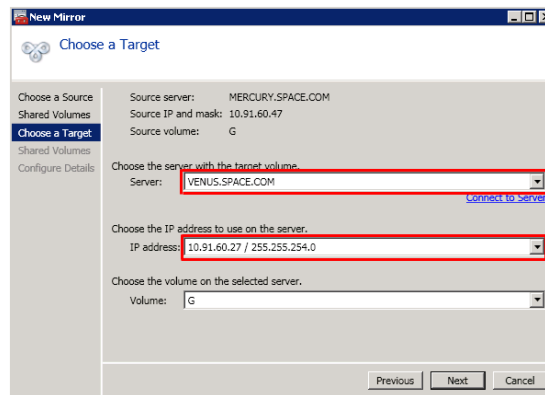
- 2 In the **Actions** pane, click **Create Job**. The **SteelEye DataKeeper** window appears.



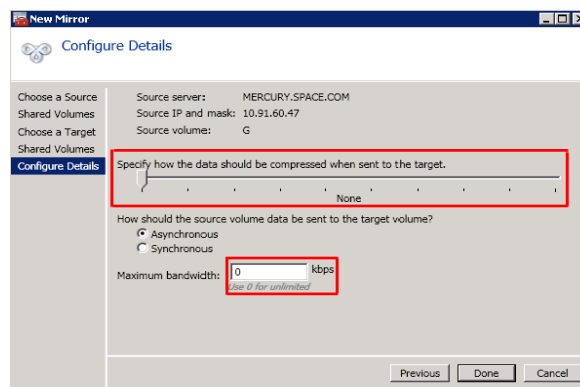
- 3 Type the relevant job name and description in the **Job name** and **Job description** boxes, and then click **Create Job**. The **New Mirror** window appears.



- 4 In the **Choose a Source** area, select the server name, IP address, and volume and click **Next**. The **Choose a Target** area appears.



- 5 Select the destination server name, IP address, and volume and click **Next**. The **Configure Details** area appears.



- 6 In the **Configure Details** area, do the following:
- Move the slider to select the level of data compression.
  - Click the relevant option to indicate the mode in which you want to send the source volume data to the target volume.
  - In the **Maximum** bandwidth box, type the network bandwidth to be used for data replication.

**Note:** Enter "0" to indicate that the bandwidth is unlimited.

- Click **Done**. The steel eye mirroring job is created.

## Disk Management Topologies

After you have completed setting up SteelEye Mirroring Jobs and created the datakeeper, you can view the topologies.

Open Disk Management to view all the disks which are replicated, by running the diskmgmt.msc from Run Command Prompt.

Volume	Layout	Type	File System	Status	Capacity	Free Space	% Free	Fault Tolerance
(C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)	97.56 GB	69.72 GB	71 %	No
Appengine (G:)	Simple	Basic	NTFS	Healthy (Logical Drive)	39.06 GB	32.48 GB	83 %	No
Appserver (E:)	Simple	Basic	NTFS	Healthy (Logical Drive)	78.13 GB	70.25 GB	90 %	No
Backups (K:)	Simple	Basic	NTFS	Healthy (Logical Drive)	166.28 GB	161.64 GB	97 %	No
Historian (D:)	Simple	Basic	NTFS	Healthy (Logical Drive)	78.13 GB	70.08 GB	90 %	No
InTouch (F:)	Simple	Basic	NTFS	Healthy (Logical Drive)	39.06 GB	32.48 GB	83 %	No
System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)	100 MB	72 MB	72 %	No
WIS (H:)	Simple	Basic	NTFS	Healthy (Logical Drive)	60.60 GB	48.43 GB	80 %	No

After creating all the Mirroring Jobs, Open the SteelEye DataKeeper UI from the All Programs menu, click SteelEye DataKeeper MMC. The DataKeeper window appears.

You can navigate to **Job Overview** under **Reports** to view all the Jobs in one place.

Volume	Mirror Role	State	File System	Total Size
FAIL0VERTEST01.MAGELLANDEV2000.DEV.WONDERWARE.COM ( FAIL0VERTEST01.MAGELLANDEV2000.DEV.WONDERWARE.COM ) Mirroring				
F	Target	Mirroring	N/A	N/A
D	Target	Mirroring	N/A	N/A
E	Source	Mirroring	NTFS	43.95 GB
H	Source	Mirroring	NTFS	43.95 GB
I	Source	Mirroring	NTFS	43.95 GB
J	None	Not mirrored	NTFS	13.03 GB
FAIL0VERTEST02.MAGELLANDEV2000.DEV.WONDERWARE.COM ( FAIL0VERTEST02 ) Mirroring				
F	Source	Mirroring	NTFS	43.95 GB
D	Source	Mirroring	NTFS	43.95 GB
E	Target	Mirroring	N/A	N/A
H	Target	Mirroring	N/A	N/A
I	Target	Mirroring	N/A	N/A
J	None	Not mirrored	NTFS	13.03 GB

You can navigate to **Server Overview** under **Reports** to view all the servers involved in job replication in one place.

Volume	Mirror Role	State	File System	Total Size
MERCURY.SPACE.COM ( MERCURY ) Resyncing				
D	Source	Mirroring	NTFS	78.12 GB
E	Source	Mirroring	NTFS	78.12 GB
F	Source	Mirroring	NTFS	39.05 GB
G	Source	Resyncing	NTFS	39.05 GB
H	Source	Resyncing	NTFS	60.50 GB
K	None	Not mirrored	NTFS	166.28 GB
VENUS.SPACE.COM ( VENUS ) Resyncing				
D	Target	Mirroring	N/A	N/A
E	Target	Mirroring	N/A	N/A
F	Target	Mirroring	N/A	N/A
G	Target	Resyncing	N/A	N/A
H	Target	Resyncing	N/A	N/A
K	None	Not mirrored	NTFS	166.28 GB



## Configuring Virtual Machines

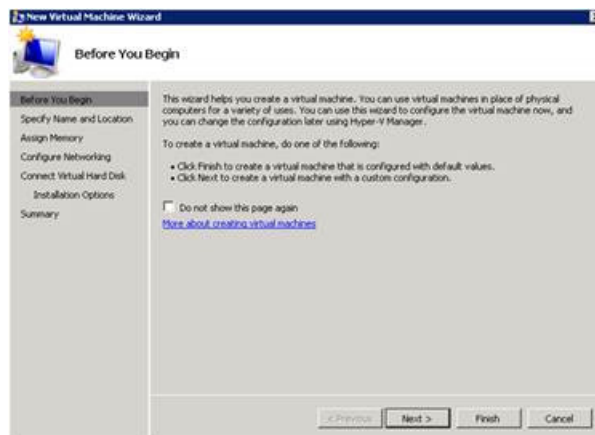
After creating a steel eye mirroring job, you need to create a virtual machine in the disk.

### To configure a virtual machine

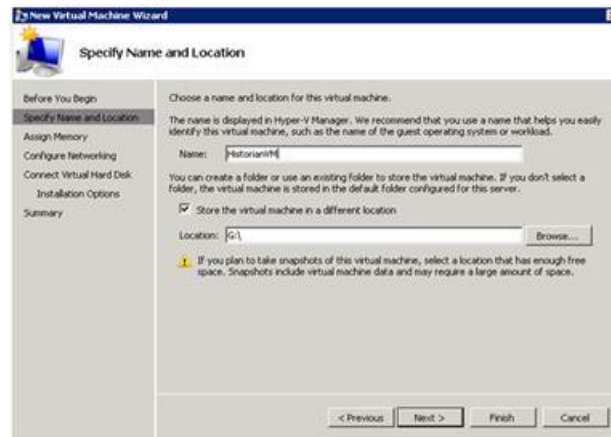
- 1 In the **Server Manager** window, right-click **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** tree expands.



- 2 Right-click **Services and applications**, and click **Virtual Machines**, and then click **New Virtual Machine**. The **New Virtual Machine Wizard** window appears.



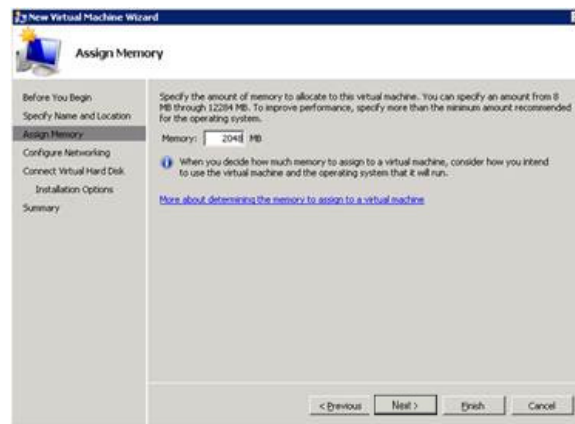
- 3 View the instructions in the **Before You Begin** area and click **Next**. The **Specify Name and Location** area appears.



- 4 In the **Specify Name and Location** area, do the following:
- In the **Name** box, type a name for the virtual machine.
  - Select the **Store the virtual machine in a different location** check box to be able to indicate the location of the virtual machine.
  - In the **Location** box, enter the location where you want to store the virtual machine.

**Note:** You can either type the location or click **Browse** to select the location where you want to store the virtual machine.

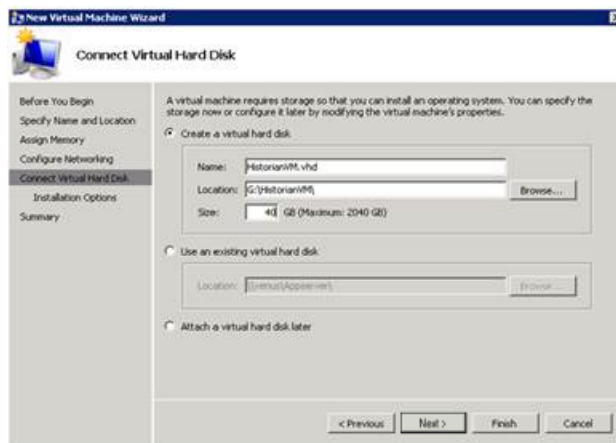
- d Click **Next**. The **Assign Memory** area appears.



- 5 Type the recommended amount of memory in the **Memory** box and click **Next**. The **Configure Networking** area appears.



- 6 Select the network to be used for the virtual machine and click **Next**. The **Connect Virtual Hard Disk** area appears.

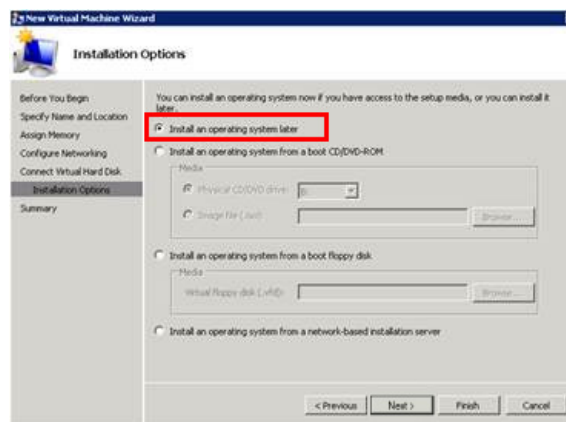


- 7 Click the **Create a virtual hard disk** option button , and then do the following:
  - a In the **Name** box, type the name of the virtual machine.
  - b In the **Location** box, enter the location of the virtual machine.

**Note:** You can either type the location or click **Browse** to select the location of the virtual machine.

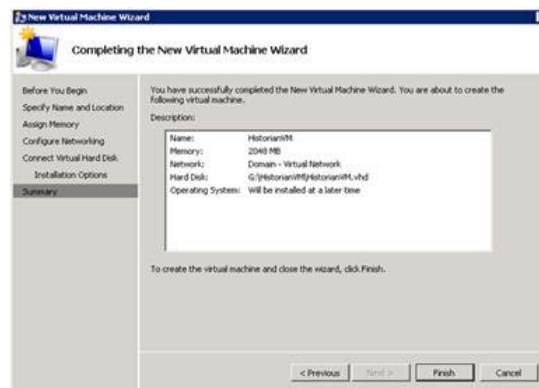
- c In the **Size** box, type the size of the virtual machine , and then click **Next**. The **Installation Options** area appears.

**Note:** You need to click either the **Use an existing virtual hard disk** or **Attach a virtual hard disk later** option, only if you are using an existing virtual hard disk or you want to attach a virtual disk later.



- 8 Click the **Install an operating system later** option and click **Next**. The **Completing the New Virtual Machine Window** area appears.

**Note:** If you want to install an operating system from a boot CD/DVD-ROM or a boot floppy disk or a network-based installation server, click the relevant option.



- 9 Click **Finish**. The virtual machine is created with the details you provided. As we have started this process from the Failover Cluster Manager, after completing the process of creating a virtual machine, the **High Availability Wizard** window appears.



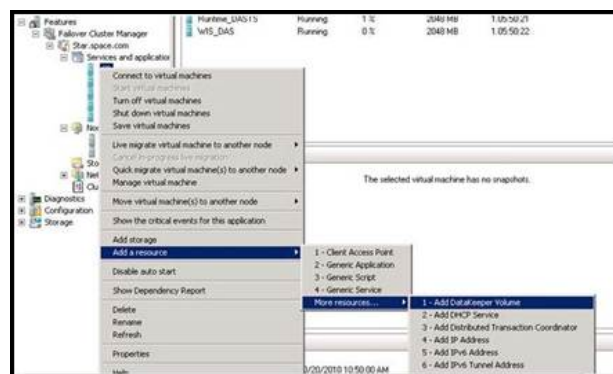
- 10 Click **View Report** to view the report or click **Finish** to close the **High Availability Wizard** window.

## Adding the Dependency between the Virtual Machine and the DataKeeper volume in the Cluster

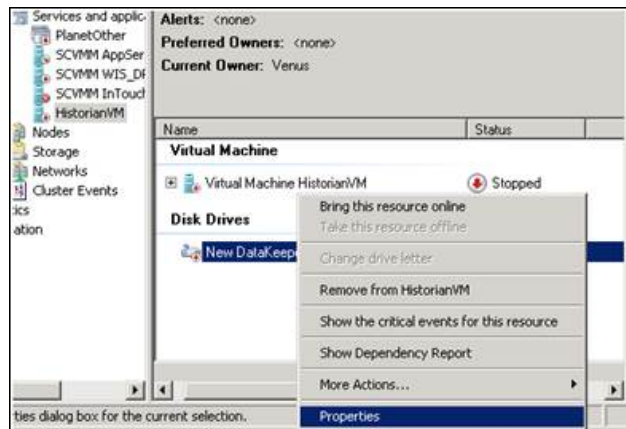
After creating the virtual machine, you need to add the dependency between the virtual machine and the datakeeper volume in the cluster. This dependency triggers the switching of the the source and target Servers of the SteelEye DataKeeper Volume resource when failover of the virtual machines occurs in the Failover Cluster Manager.

### To add the dependency between the virtual machine and the datakeeper volume in the cluster

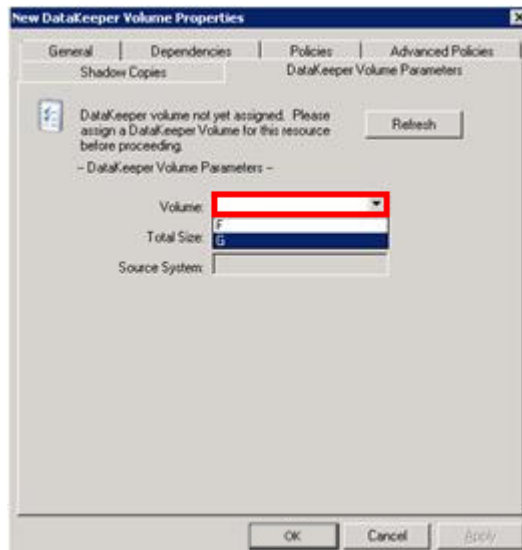
- 1 On the **Server Manager** window, right-click the virtual machine, that you have created and then point to **Add a resource, More Resources** and then click **Add DataKeeper Volumes**. The **Add a resource** menu appears.



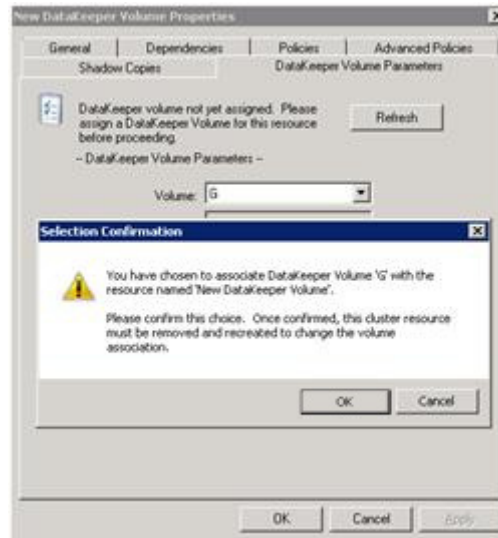
2 The **New DataKeeper Volume** is added under **Disk Drives**.



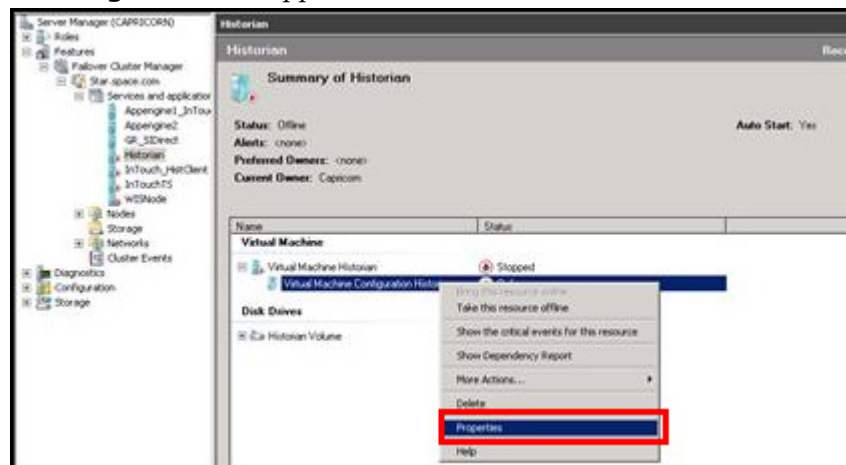
3 Right-click **New DataKeeper Volume**, and then click **Properties**. The **New DataKeeper Volume Properties** window appears.



- 4 Select the volume that you had entered while creating a SteelEye mirroring job and click **OK**. The **Selection Confirmation** window appears.

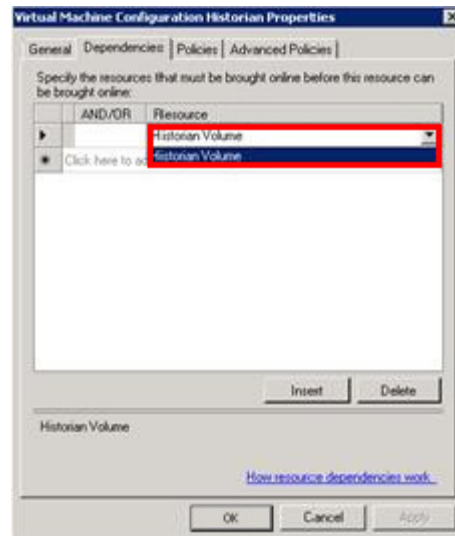


- 5 Click **OK** to validate the details that you have entered. The **Server Manager** window appears.

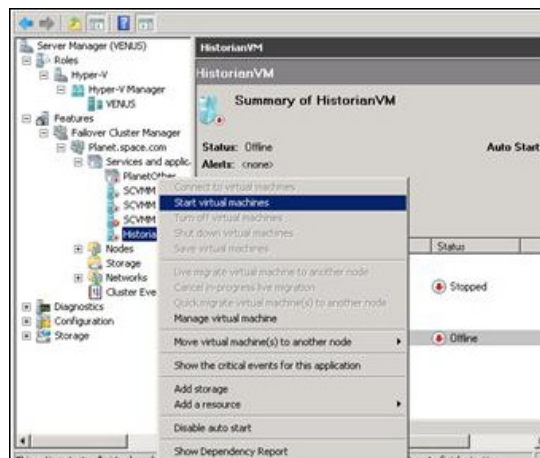


**Note:** To modify the selection, click **Cancel** and modify the detail as required in the **New DataKeeper Volume Properties** window, and then click **Apply**.

- 6 Under **Virtual Machine**, right-click the name of the virtual machine that you created. Click **Virtual Machine Configuration** and click **Properties**. The **Virtual Machine Configuration Historian Properties** window appears.



- 7 Click the **Dependencies** tab, then from the **Resource** list, select the name of the **DataKeeper Volume** resource that you created and click **OK**.



- 8 On the **Server Manager** window, right-click the name of the virtual machine that you created, and then click **Start virtual machines** to start the virtual machine.

**Note:** You can use the above procedure to create multiple virtual machines with appropriate names and configuration.



## Configuration of System Platform Products in a Typical Small Scale Virtualization

To record the expected Recovery Time Objective (RTO) and Recovery Point Objective (RPO), trends and various observations in a small scale virtualization environment, tests are performed with System Platform Product configuration shown below.

The virtualization host server used for small scale configuration consists of three virtual machines listed below.

Node 1: GR , Historian and DAS SI Direct – Windows 2008 R2 Standard edition (64bit) OS with SQL Server 2008 SP1 32 bit

Node 2 (AppEngine): Bootstrap , IDE and InTouch (Managed App) – Windows 2008 R2 Standard edition (64bit) OS

Node 3: Information Server , Bootstrap and IDE, InTouch Terminal Service and Historian Client – Windows Server 2008 SP2 (32bit) with SQL Server 2008 SP1 and Office 2007

<b>Virtual Node</b>	<b>IO tags (Approx.)</b>	<b>Historized tags (Approx.)</b>
GR	10000	2500
AppEngine	10000	5000

### Historized tags and their Update Rates for this Configuration

The following table shows historized tags and their update rates for this configuration:

#### Real Time data from DAS SI Direct

Topic Name	Update Rate	Device Items	Active Items
Topic 13	1000	480	144
Topic 1	10000	1	1
Topic 2	10000	1880	796
Topic 3	30000	1880	796
Topic 4	60000	1880	796
Topic 5	3600000	1880	796
Topic 7	600000	40	16
Topic 8	10000	1480	596
Topic 9	30000	520	352
Topic 6	1800000	1480	676
Topic 39	1000	4	4
Topic 16	1800000	1000	350

#### Late tags and buffered tags from DAS test Server

Topic Name	Update Rate	Device Items	Active Items
Late Data (1 hour)	1000	246	112
Buffered Data	1000	132	79

### **Application Server Configuration Details**

Total No of Engines: 14

#### **Number of objects under each Engine**

- Engine 1 : 9
- Engine 2 : 13
- Engine 3 : 13
- Engine 4 : 225
- Engine 5 : 118
- Engine 6 : 118
- Engine 7 : 195
- Engine 8 : 225
- Engine 9 : 102
- Engine 10: 2
- Engine 11: 3
- Engine 12: 21
- Engine 13: 1
- Engine 14: 1

The total number of DI objects is 6.

## Expected Recovery Time Objective and Recovery Point Objective

This section provides the indicative Recovery Time Objectives (RTO) and RecoveryPoint Objectives (RPO) for the load of IO and Attributes historized shown above and with the configuration of Host Virtualization Servers and Hyper-V virtual machines explained in the Setup instructions of Small Scale Virtualization. In addition to these factors, the exact RTO and RPO depend on factors like storage I/O performance, CPU utilization, memory usage, and network usage at the time of failover/migration activity.

### RTO and RPO Observations - DR Small Configuration

Scenarios and observations in this section:

Scenario	Observation
Scenario 1: IT provides maintenance on Virtualization Server	"Live Migration" on page 293
	"Quick Migration" on page 294
	"Quick Migration of All Nodes Simultaneously" on page 295
Scenario 2: Virtualization Server hardware fails	"Scenario 2: Virtualization Server hardware fails" on page 297
Scenario 3: Network fails on Virtualization Server	"Scenario 3: Network fails on Virtualization server" on page 299
Scenario 4: Virtualization Server becomes unresponsive	"Scenario 4: Virtualization Server becomes unresponsive" on page 301

The following tables display RTO and RPO Observations with approximately 20000 IO points with approximately 7500 attributes being historized:

### Scenario 1: IT provides maintenance on Virtualization Server

#### Live Migration

Primary Node	Products	RTO	RPO	
			Tags	Data Loss Duration
GR	IAS	14 sec	IAS tag (Script)	20 sec
			IAS IO tag (DASSiDirect)	26 sec
	Historian	19 sec	Historian Local tag	22 sec
			InTouch Tag \$Second	27 sec
			IAS IO Tag (DASSiDirect)	32 sec
			IAS tag (Script)	0 (data is SFed)
	DAS	21 sec	N/A	N/A

Primary Node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>WIS</b>	InTouch	12 sec	\$Second	12 sec
	WIS	12 sec	N/A	N/A
	Historian Client	12 sec	N/A	N/A
<b>AppEngine</b>	AppEngine	12 sec	IAS IO tag (DASSiDirect)	26 sec
			IAS tag Script)	13 sec
	InTouch	12 sec	\$Second	12 sec

### Quick Migration

Node Name	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>GR</b>	IAS	147 sec	IAS tag (Script)	160 sec
			IAS IO Tag (DASSiDirect)	167 sec
	Historian	156 sec	Historian Local tag	164 sec
			InTouch tag \$Second	171 sec
			IAS IO Tag (DASSiDirect)	170 sec
			IAS tag (Script)	0 (data is SFed)
	DAS	156 sec	N/A	N/A

<b>Node Name</b>	<b>Products</b>	<b>RTO</b>	<b>RPO</b>	
			<b>Tags</b>	<b>Data Loss Duration</b>
<b>WIS</b>	InTouch	91 sec	\$Second	91 sec
	WIS	91 sec	N/A	N/A
	Historian Client	91 sec	N/A	N/A
<b>AppEngine</b>	AppEngine	59 sec	IAS IO tag (DASSiDirect)	80 sec
			IAS Tag (Script)	73 sec
	InTouch	68 sec	\$Second	68 sec

### Quick Migration of All Nodes Simultaneously

<b>Primary node</b>	<b>Products</b>	<b>RTO</b>	<b>RPO</b>	
			<b>Tags</b>	<b>Data Loss Duration</b>
<b>GR</b>	IAS	221 sec	IAS tag (Script)	229 sec
			IAS IO tag (DASSiDirect)	234 sec
	Historian	225 sec	Historian Local tag	226 sec
			InTouch tag \$Second	238 sec
			IAS IO tag (DASSiDirect)	242 sec
			IAS tag (Script)	160 sec
	DAS	225 sec	N/A	

<b>Primary node</b>	<b>Products</b>	<b>RTO</b>	<b>RPO</b>	
			<b>Tags</b>	<b>Data Loss Duration</b>
<b>WIS</b>	InTouch	225 sec	\$Second	255 sec
	WIS	225 sec	N/AS	
	Historian Client	225 sec	N/A	
<b>AppEngine</b>	AppEngine	150 sec	IAS IO tag (DASSiDirect)	242 sec
			IAS tag (Script)	160 sec
	InTouch	149 sec	\$Second	149 sec



**Scenario 2: Virtualization Server hardware fails**

The Virtualization Server hardware failure results in failover that is simulated with power-off on the host server. In this case, the VMs restart, after moving to the other host server.

Primary node	Products	RTO	RPO	
			Tags	Data Loss Duration
GR	IAS	270 sec	IAS tag (Script)	5 Min 22 sec
			IAS IO tag (DASSiDirect)	5 Min 12 sec
	Historian	362 sec	Historian Local tag	6 Min 40 sec
			InTouch tag \$Second	6 Min 58 sec
			<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
			IAS IO tag (DASSiDirect)	5 Min 16 sec
			IAS tag (Script)	4 Min 55 sec
DAS	196 sec	N/A	N/A	

Primary Node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>WIS</b>	InTouch	240 sec + time taken by the user to start the InTouchView	\$Second	6 Min 58 sec <b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.
	WIS	240 sec + time taken by the user to start the Information Server	N/A	N/A
	Historian Client	240 sec + time taken by the user to start the Historian Client	N/A	N/A
<b>AppEngine</b>	AppEngine	267 sec	IAS IO tag (DASSiDirect)	5 Min 16 sec
			IAS tag (Script)	4 Min 55 sec
	InTouch	267 sec + time taken by the user to start the ITView	\$Second	267 sec + time taken by the user to start the ITView
			<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	

**Scenario 3: Network fails on Virtualization server**

The failure of network on the Virtualization Server results in failover due to network disconnect (Public). Bandwidth used is 45Mbps and there is no latency. In this case, the VMs restart, after moving to the other host server.

Primary Node	Products	RTO	RPO	
			Tags	Data Loss Duration
GR	IAS	251 sec	IAS tag (Script)	4 Min 42 sec
			IAS IO tag (DASSiDirect)	4 Min 47 sec
	Historian	290 sec	Historian local tag	5 Min 11 sec
			InTouch tag \$Second	5 Min 10 sec
			<p><b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.</p>	
			IAS IO tag (DASSiDirect)	4 Min 42 sec
			IAS tag (Script)	3 Min 58 sec
DAS	191 sec	N/A	N/A	

Primary Node	Products	RTO	RPO	
			Tags	Data Loss Duration
<b>WIS</b>	InTouch	215 sec + time taken by the user to start the InTouchView	\$Second	5 Min 10 sec
			<b>Note:</b> RPO is dependent on time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node which historizes this tag.	
	WIS	215 sec + time taken by the user to start the Information Server	N/A	N/A
	Historian Client	215 sec + time taken by the user to start the Historian Client	N/A	N/A
<b>AppEngine</b>	AppEngine	209 sec	IAS IO Tag (DASSiDirect)	4 Min 42 sec
			IAS tag (Script)	3 Min 58 sec
	InTouch	195 sec + time taken by the user to start the ITView	\$Second	195 sec
			<b>Note:</b> RPO is dependent on time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node which historizes this tag.	

**Scenario 4: Virtualization Server becomes unresponsive**

There is no failover of VMs to the other host server when the CPU utilization on the host server is 100%.

Primary Node	Products	RTO	RPO		
			Tags	Data Loss Duration	
<b>GR</b>	IAS	N/A	N/A	N/A	
			N/A	N/A	
	Historian		N/A	N/A	N/A
				N/A	N/A
				N/A	N/A
	DAS	N/A	N/A	N/A	
<b>WIS</b>	InTouch	N/A	N/A	N/A	
	WIS	N/A	N/A	N/A	
	Historian Client	N/A	N/A	N/A	
<b>AppEngine</b>	AppEngine	N/A	N/A	N/A	
			N/A	N/A	
	InTouch	N/A	N/A	N/A	

## Snapshots of Data Trends and Observations

Scenarios and observations in this section:

Scenario	Observation
Scenario 1: IT provides maintenance on Virtualization Server	"Live Migration of GR, Historian" on page 302
	"Live Migration of AppEngine" on page 305
	"Live Migration of WIS, InTouch, HistorianClient" on page 307
	"Quick Migration of GR, Historian" on page 308
	"Quick Migration of AppEngine" on page 312
	"Quick Migration of WIS, InTouch, HistorianClient" on page 316
Scenario 2: Virtualization Server hardware fails	"Failover due to Hardware Failure" on page 322
Scenario 3: Network fails on Virtualization Server	"Failover due to Network Disconnect (Public)" on page 324
Scenario 4: Virtualization Server becomes unresponsive	"Hyper-V Virtual Machines with Static RAM and Reservations for Processors" on page 327

### Scenario 1: IT Provides Maintenance on Virtualization Server

#### Live Migration of GR, Historian

##### Trend

In the following Historian Trend, the GR node tags are:

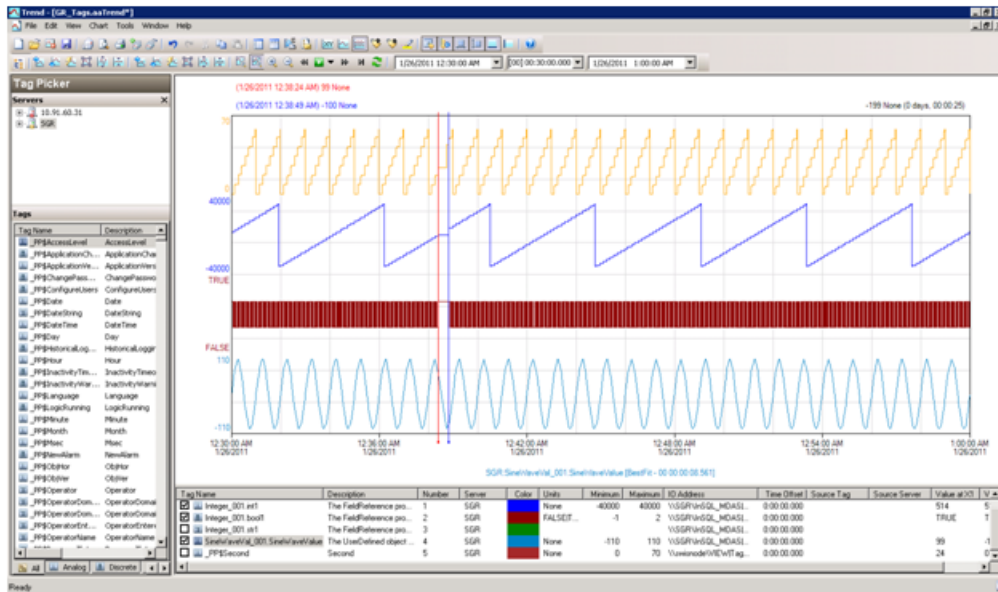
Tag1: SystemTimeSec tag of Historian

Tag2: I/O Tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O Tag (Integer\_001.bool1) getting data from DESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue) of GR node.

These are captured in the RPO table for Live Migration of the GR node.



In the following Historian Trend, the AppEngine node tags are:

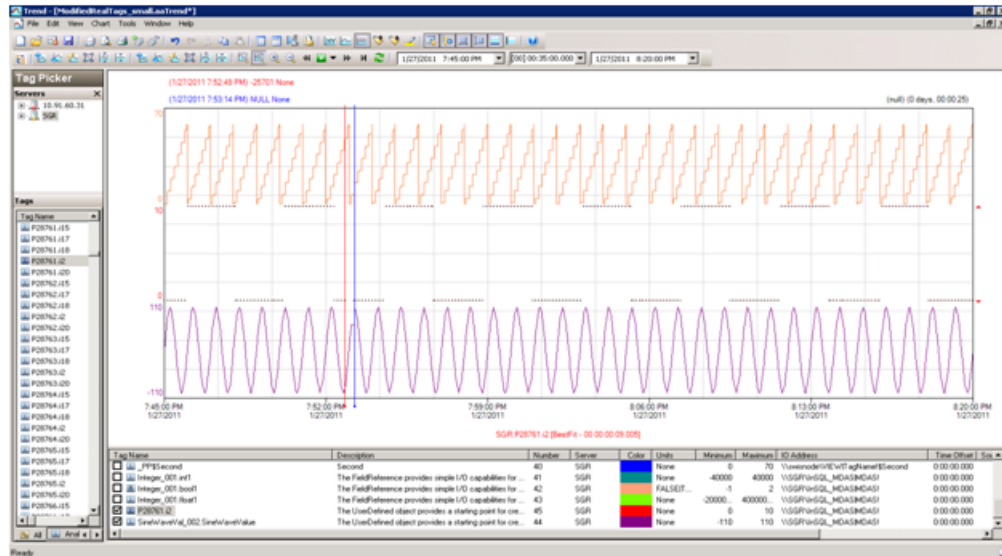
Tag1: SystemTimeSec tag of Historian local tag

Tag2: I/O Tag (P31541.I10) getting data from DASSI of GR node

Tag3: InTouch Tag (\_PP\$Second) from WIS node Historising to GR node.

Tag4: Script Tag (Sinewaveval\_002.SineWaveValue) of AppEngine node.

The IAS tag (script) does not have any data loss as the data is stored in the SF folder in the AppEngine1 node. This data is later forwarded after Live Migration.



### Observations

GR is Platform1 in the Galaxy deployed. During the Live Migration of GR, it is obvious that there will be an instance during Live Migration when the following occurs:

- GR, Historian will not be able to connect to the other deployed nodes (Platforms 2, 3, and 4).
- Other nodes will not be able to connect to GR (Platform1).
- Some data sent from GR will be discarded till the TimeSync utility is executed and system time of GR is synchronized.
- AppEngine node is in the Store Forward mode.
- Historian Client trend will not be able to connect to Historian, so the warning message is expected.
- Historian machine's time is not synchronized during the Live Migration of Historian, so the "Attempt to store values in the future" message is expected.
- After Live Migration, Historian's time needs to be synchronized. Therefore the server shifting warning message is expected.

After the Live Migration of GR, Historian node, the stored data is forwarded from the AppEngine node. As a result, you see the following warnings on each of the VM nodes.



**GR node**

```
361375951/26/201112:38:44 AM31243148WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
```

```
361375961/26/201112:38:44 AM31243148WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
```

```
361375971/26/201112:38:44 AM31243148WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
```

```
36137628/26/201112:38:47 AM15122440WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (01/26/11,00:38:45,616, 01/26/11,00:38:26,067) [SGR;
  Config.cpp; 2040]
```

**AppEngine node**

```
216391171/26/201112:38:33 AM25562572WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
216392501/26/201112:39:15 AM24522072WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
```

**WIS node**

```
17129361/26/201112:38:33 AM23923052WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
17129451/26/201112:38:47 AM27526332WarningaaAFCommonTypesUnable
  to create dataview: Server must be logged on before executing
  SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
  aaIQ=Quality, aaQD=QualityDetail, aaS=0
```

```
FROM History
```

```
WHERE TagName IN ('...
```

```
17129561/26/201112:38:47 AM27523136WarningaaAFCommonTypesUnable
  to create dataview: Server must be logged on before executing
  SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
  aaIQ=Quality, aaQD=QualityDetail, aaS=0
```

```
FROM History
```

```
WHERE TagName IN ('...
```

**Live Migration of AppEngine****Trends:**

In the Historian Trend shown below, the first three tags receive data from DDESuiteLinkClient in Industrial Application Server (IAS) from the PLC and are historized from Platform AppEngine.

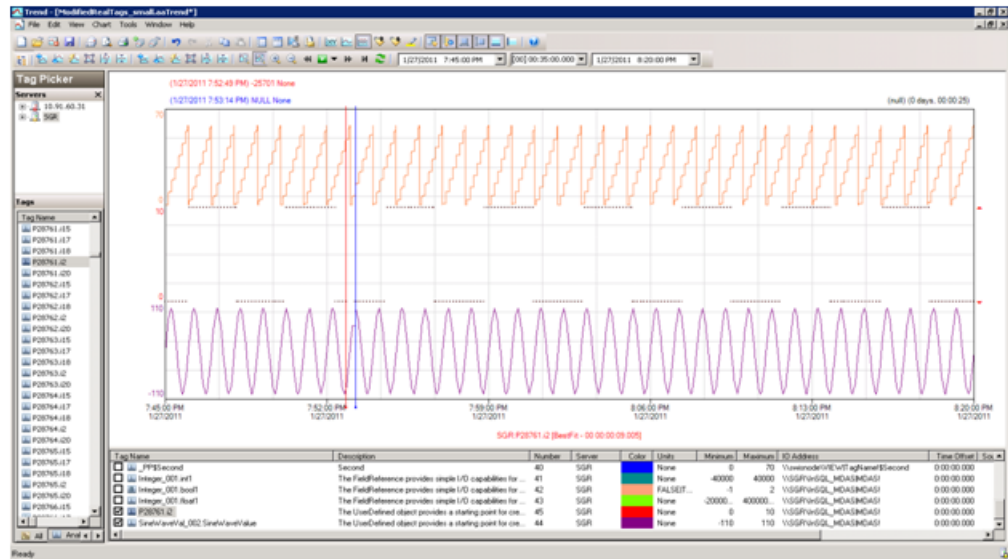
In the following Historian Trend, the AppEngine node tags are:

Tag1: SystemTimeSec tag of Historian local tag

Tag2: I/O Tag (P31541.I10) getting data from DASSI of GR node

Tag3: Script Tag (Sinewaveval\_002.SineWaveValue)

The RPO value is captured in the RPO table of Live Migration of the AppEngine node. .



## Observations

AppEngine is Platform2 in the Galaxy deployed. During the Live Migration of AppEngine, it is obvious that there will be an instance during Live Migration when the following occurs:

- AppEngine will not be able to connect to the other deployed nodes (Platforms 1, 3, and 4).
- Other nodes will not be able to connect to AppEngine (Platform2)
- Some data sent from AppEngine will be discarded till the TimeSync utility is executed and system time of AppEngine is synchronized. So Historian is bound to discard data from the AppEngine node.

As a result, you see the following warnings on each of the VM nodes.

### GR node

```
364408421/27/20117:52:59 PM30083108WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
```

### AppEngine

```
216460131/27/20117:52:51 PM28722876WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.
```

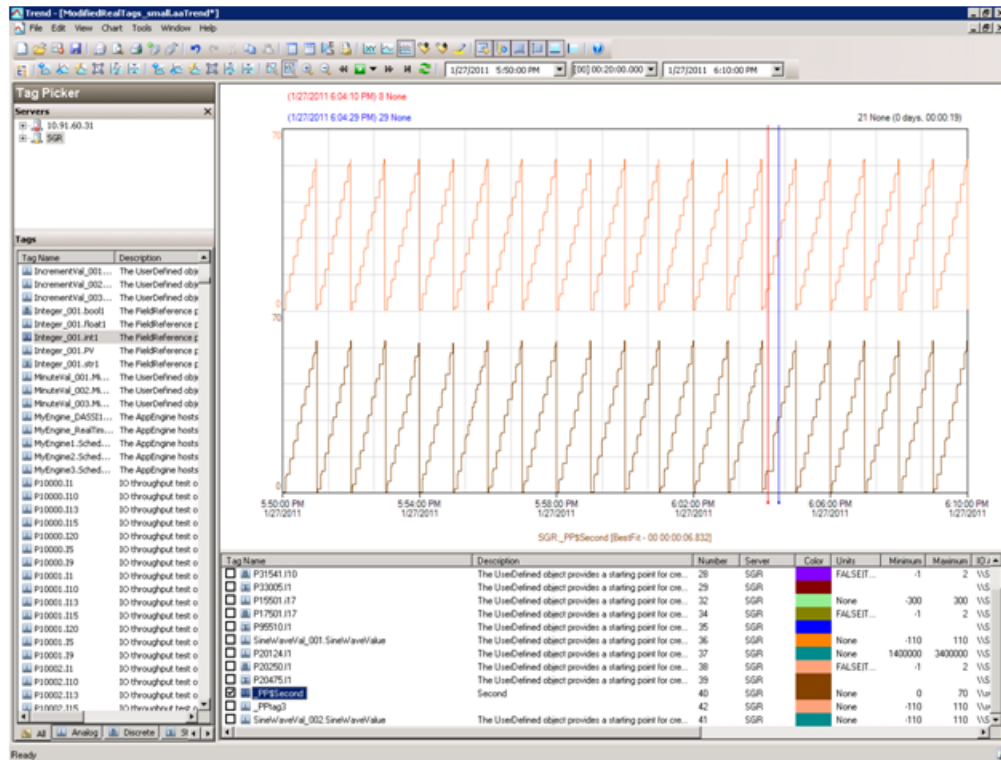
```
216460141/27/20117:53:11 PM24442460WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

## WIS node

17134351/27/20117:52:59 PM40642196WarningNmxCsvPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

## Live Migration of WIS, InTouch, HistorianClient Trends:

In the following Historian Trend , the last tag \$Second receives data from InTouch and is historized..



## Observations

WIS node is Platform4 in the Galaxy deployed. During the Live Migration of WIS node, it is obvious that there will be an instance during Live Migration when the following occurs:

- WIS will not be able to connect to the other deployed nodes (Platforms 1, 2, and 3).
- Other nodes will not be able to connect to WIS (Platform4)
- Historian Client trend will not be able to connect to Historian, so warning is expected.
- Historian machine's time is not synchronized during the Live Migration of WIS node, so the "Attempt to store values in the future" message is expected.

As a result, you see the following warnings on each of the VM nodes.

**GR node**

```
364213141/27/20116:04:19 PM30083068WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.

364213151/27/20116:04:21 PM15562488WarningaahStoreSvcAttempt to
  store values in the future; timestamps were overwritten with
  current time (pipe name, TagName, wwTagKey, system time (UTC),
  time difference (sec)) (SGR_2, _PP$Time, 9092, 2011/01/27
  12:34:20.343, 2) [SGR; pipeserver.cpp; 1831]
```

**AppEngine node**

```
216441281/27/20116:04:15 PM25482564WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
```

**WIS node**

```
17133261/27/20115:55:28 PM17843908Warning
  ArchestrA.Visualization.WCFServiceLMX WCF service: Exception
  while PushBackConfigurations(sync mode): [The operation has
  timed out.] at [Server stack trace:

  at
  System.ServiceModel.Channels.InputQueue`1.Dequeue(TimeSpan
  timeout)

  at System.ServiceModel.Channels.ServicePollingDuple...

17133301/27/20116:00:16 PM51445748WarningaaTrendFailed to
  acquire any type of license feature 'ActiveFactory_Pro' of
  version 10.0

17133311/27/20116:00:21 PM51445748WarningaaTrendFailed to
  acquire any type of license feature 'ActiveFactory_Pro' of
  version 10.0

17133341/27/20116:04:22 PM40642196WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

**Quick Migration of GR, Historian****Trends:**

GR node hosts the DDESuiteLinkObjects. Therefore, during the Quick Migration of GR node, there is data loss for tags that receive data from DAS Server/PLC.

In the following Historian Trend, the GRnode tags are:

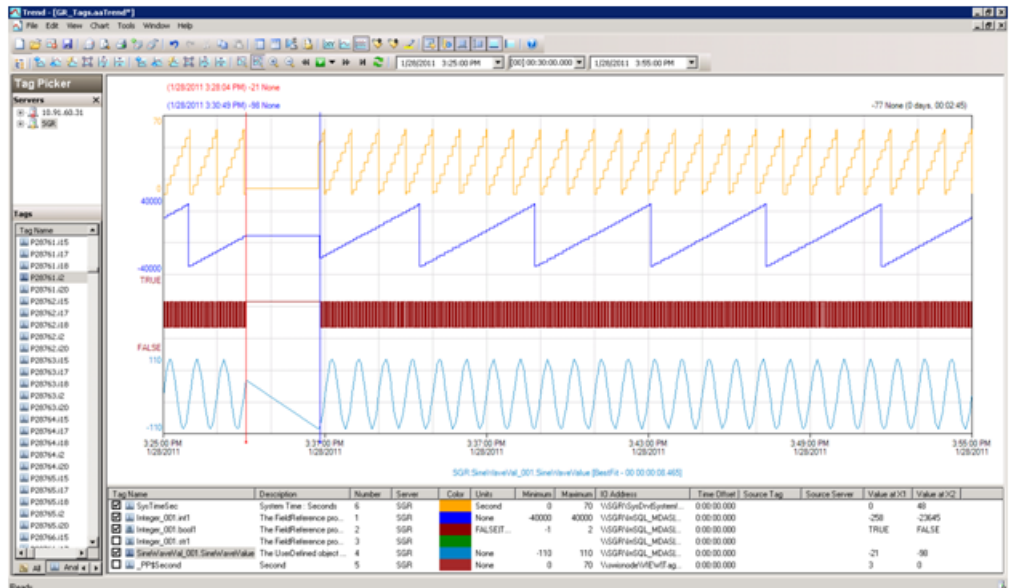
Tag1: SystemTimeSec tag of Historian.

Tag2: I/O Tag (Integer\_001.int1) getting data from  
DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O Tag (Integer\_001.bool1) getting data from  
DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue)

These are captured in the RPO table for Quick Migration of the GR node.



In the following Historian Trend, the AppEngine node tags are:

Tag1: SystemTimeSec tag of Historian local tag

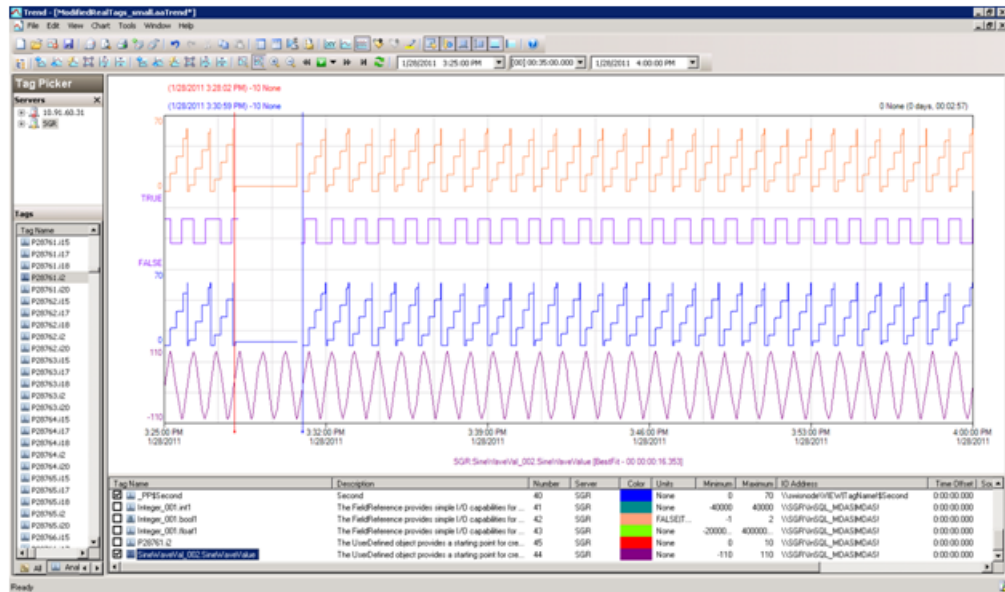
Tag2: I/O Tag (P31541.I10) getting data from DASSI of GR node

Tag3: InTouch Tag (\_PP\$Second) from WIS node historizing to GR node.

Tag4: Script Tag (Sinewaveval\_002.SineWaveValue)

The IAS tag (script) does not have any data loss as the data is stored in the SF folder in the AppEngine1 node. This data is later forwarded after Quick Migration.

These are captured in the RPO table for Quick Migration of the GR node.



## Observations

GR is Platform1 in the Galaxy deployed. During the Quick Migration of GR, it is obvious that there will be an instance during Quick Migration when the following occurs:

- GR, Historian will not be able to connect to the other deployed nodes (Platforms 2, 3, and 4).
- Other nodes will not be able to connect to GR (Platform1).
- Some data sent from GR will be discarded till the TimeSync utility is executed and system time of GR is synchronized.
- AppEngine node is in the Store Forward mode.
- Historian Client trend will not be able to connect to Historian, so warning message is expected.
- Historian machine's time is not synchronized during the Live Migration of Historian, so the "Attempt to store values in the future" message is expected.
- After Live Migration, Historian's time needs to be synchronized. Therefore, the server shifting warning message is expected.

After the Quick Migration of GR, Historian node, the stored data is forwarded from AppEngine node.

As a result, you see the following warnings on each of the VM nodes.

## GR node

```
364855861/28/20113:30:43 PM34003416WarningNmxSvcPlatform 2
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
364855871/28/20113:30:43 PM34003416WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
364855881/28/20113:30:43 PM34003416WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
364856201/28/20113:30:46 PM45444868WarningaaEngine0:D38 Values
  in the past did not fit within the realtime window; discarding
  data (218, 2011/01/28 09:58:05.466, 2011/01/28 10:00:44.529)
  [aahMDASSF.cpp; 3722; 1]aaEngine
364856211/28/20113:30:46 PM15442424WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (SGR_mdas, 9119, 2011/01/28 09:58:04.310, 2011/01/28
  10:00:43.832) [SGR; pipeserver.cpp; 2388]aahCfgSvc
364856241/28/20113:30:46 PM15442424WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (01/28/11,15:30:45,935, 01/28/11,15:28:07,638) [SGR;
  Config.cpp; 2040]aahCfgSvc
364856381/28/20113:30:47 PM45804768WarningaaEngine0:AB4 Values
  in the past did not fit within the realtime window; discarding
  data (9112, 2011/01/28 09:58:05.513, 2011/01/28 10:00:47.170)
  [aahMDASSF.cpp; 3722; 1]aaEngine
364856391/28/20113:30:48 PM32764128WarningaaEngine0:6F4 Values
  in the past did not fit within the realtime window; discarding
  data (150, 2011/01/28 09:58:05.295, 2011/01/28 10:00:47.029)
  [aahMDASSF.cpp; 3722; 1]aaEngine
364857051/28/20113:34:56 PM45444868WarningaaEngine0:D38 Values
  in the past did not fit within the realtime window; discarding
  data (218, 2011/01/28 09:58:05.466, 2011/01/28 10:00:44.529)
  [aahMDASSF.cpp; 3722; 27]aaEngine
364857061/28/20113:34:59 PM32764128WarningaaEngine0:6F4 Values
  in the past did not fit within the realtime window; discarding
  data (150, 2011/01/28 09:58:05.295, 2011/01/28 10:00:47.029)
  [aahMDASSF.cpp; 3722; 57]aaEngine
364857071/28/20113:34:59 PM45804768WarningaaEngine0:AB4 Values
  in the past did not fit within the realtime window; discarding
  data (9112, 2011/01/28 09:58:05.513, 2011/01/28 10:00:47.170)
  [aahMDASSF.cpp; 3722; 7]aaEngine
364857081/28/20113:35:00 PM15442424WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (SGR_mdas, 9119, 2011/01/28 09:58:04.310, 2011/01/28
  10:00:43.832) [SGR; pipeserver.cpp; 2388; 2]aahCfgSvc
```

### AppEngine node

```
216478441/28/20113:28:13 PM24442460WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
216479431/28/20113:29:28 PM28722876WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.
```

```
216479441/28/20113:30:23 PM28722876WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
```

### **WIS node**

```
17136281/28/20113:28:12 PM40642196WarningNmXSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
17136351/28/20113:29:06 PM58565984WarningaaAFCommonTypesUnable
  to create dataview: Server must be logged on before executing
  SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
  aaIQ=Quality, aaQD=QualityDetail, aaS=0

  FROM History

  WHERE TagName IN ('...
```

## **Quick Migration of AppEngine**

### **Trends:**

In the following Historian Trend, the first three tags receive data from DDESuiteLinkClient in Industrial Application Server (IAS) from the PLC and are historized from Platform AppEngine. In the following Historian Trend, the AppEngine node tags are:

Tag1: SystemTimeSec tag of Historian local tag

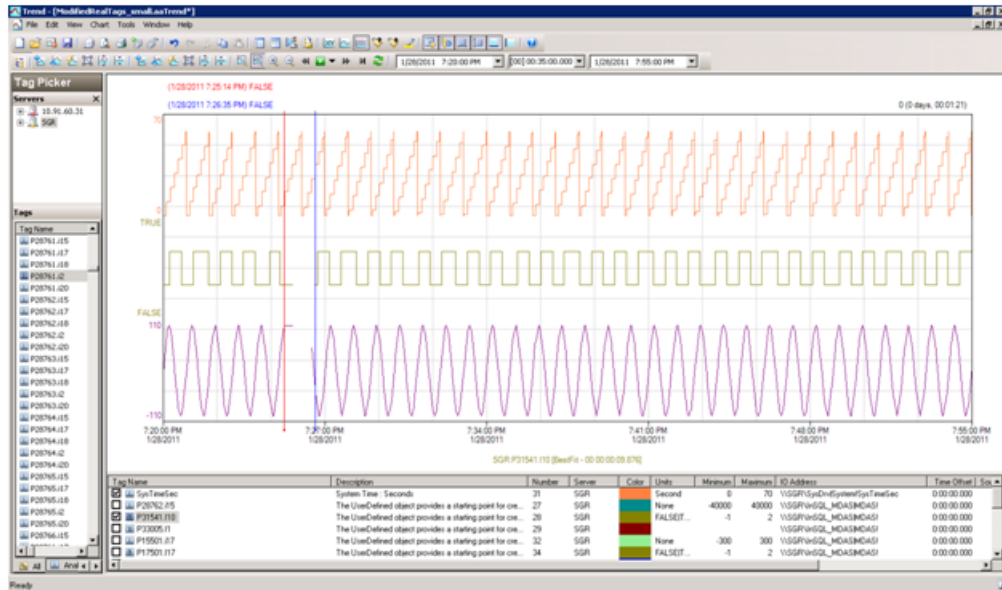
Tag2: I/O tag (P31541.I10) getting data from DASSI of GR node

Tag3: Script tag (Sinewaveval\_002.SineWaveValue)

The RPO value is captured in the RPO table of Live Migration of the AppEngine node.



RPO value are been captured in RPO table of QuickMigration of AppEngine node.



### Observations

AppEngine is Platform2 in the Galaxy deployed. During the Quick Migration of AppEngine, it is obvious that there will be an instance during Quick Migration when:

- AppEngine will not be able to connect to the other deployed nodes (Platforms 1, 3, and 4).
- Other nodes will not be able to connect to AppEngine (Platform2)
- Some data sent from AppEngine will be discarded till the TimeSync utility is executed and system time of AppEngine is synchronized. So Historian is bound to discard data from AppEngine node.
- AppEngine is not synchronized during the Quick Migration and a message “Values in the past did not fit within the realtime window” is expected on AppEngine.

As a result, you see the following warnings on each of the VM nodes.

### GR node

```
364959491/28/20117:25:23 PM34363452WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

### AppEngine

```
216497051/28/20117:26:25 PM30563052WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypepeaaEngine
```

```
216497391/28/20117:26:26 PM3204960WarningaaEngine0:C9C Values
  in the past did not fit within the realtime window; discarding
```

```
data (8941, 2011/01/28 13:55:14.626, 2011/01/28 13:56:26.068)
[aahMDASSF.cpp; 3709; 1]aaEngine

216497701/28/20117:26:27 PM31043344WarningaaEngine0:A4C Values
in the past did not fit within the realtime window; discarding
data (2403, 2011/01/28 13:55:13.895, 2011/01/28 13:56:26.287)
[aahMDASSF.cpp; 3709; 1]aaEngine

216497931/28/20117:26:28 PM31363916WarningaaEngine0:A00 Values
in the past did not fit within the realtime window; discarding
data (2584, 2011/01/28 13:55:14.939, 2011/01/28 13:56:28.577)
[aahMDASSF.cpp; 3709; 1]aaEngine

216498001/28/20117:26:29 PM24684736WarningaaEngine0:9B4 Values
in the past did not fit within the realtime window; discarding
data (326, 2011/01/28 13:55:14.939, 2011/01/28 13:56:28.577)
[aahMDASSF.cpp; 3709; 1]aaEngine

216498011/28/20117:26:29 PM26364440WarningaaEngine0:9C0 Values
in the past did not fit within the realtime window; discarding
data (330, 2011/01/28 13:55:14.939, 2011/01/28 13:56:28.593)
[aahMDASSF.cpp; 3709; 1]aaEngine

216498021/28/20117:26:29 PM24443800WarningaaEngine0:778 Values
in the past did not fit within the realtime window; discarding
data (268, 2011/01/28 13:55:15.173, 2011/01/28 13:56:28.983)
[aahMDASSF.cpp; 3709; 1]aaEngine

216498041/28/20117:26:29 PM31845100WarningaaEngine0:9F4 Values
in the past did not fit within the realtime window; discarding
data (328, 2011/01/28 13:55:15.048, 2011/01/28 13:56:28.967)
[aahMDASSF.cpp; 3709; 1]aaEngine

216498081/28/20117:26:30 PM6486540WarningaaEngine0:A1C Values
in the past did not fit within the realtime window; discarding
data (7646, 2011/01/28 13:55:14.939, 2011/01/28 13:56:28.577)
[aahMDASSF.cpp; 3709; 1]aaEngine

216498351/28/20117:27:00 PM320296WarningScriptRuntime
Insert.InsertValueWT: Script timed out.aaEngine

216499391/28/20117:30:38 PM31043344WarningaaEngine0:A4C Values
in the past did not fit within the realtime window; discarding
data (2403, 2011/01/28 13:55:13.895, 2011/01/28 13:56:26.287)
[aahMDASSF.cpp; 3709; 1894]aaEngine

216499401/28/20117:30:39 PM3204960WarningaaEngine0:C9C Values
in the past did not fit within the realtime window; discarding
data (8941, 2011/01/28 13:55:14.626, 2011/01/28 13:56:26.068)
[aahMDASSF.cpp; 3709; 2]aaEngine

216499411/28/20117:30:40 PM6486540WarningaaEngine0:A1C Values
in the past did not fit within the realtime window; discarding
data (7646, 2011/01/28 13:55:14.939, 2011/01/28 13:56:28.577)
[aahMDASSF.cpp; 3709; 1124]aaEngine
```

```
216499421/28/20117:30:41 PM31363916WarningaaEngine0:A00 Values
  in the past did not fit within the realtime window; discarding
  data (2584, 2011/01/28 13:55:14.939, 2011/01/28 13:56:28.577)
  [aahMDASSF.cpp; 3709; 2]aaEngine
```

```
216499431/28/20117:30:41 PM24443800WarningaaEngine0:778 Values
  in the past did not fit within the realtime window; discarding
  data (268, 2011/01/28 13:55:15.173, 2011/01/28 13:56:28.983)
  [aahMDASSF.cpp; 3709; 60]aaEngine
```

```
216499441/28/20117:30:42 PM31845100WarningaaEngine0:9F4 Values
  in the past did not fit within the realtime window; discarding
  data (328, 2011/01/28 13:55:15.048, 2011/01/28 13:56:28.967)
  [aahMDASSF.cpp; 3709; 2]aaEngine
```

```
216499451/28/20117:31:06 PM320296WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.aaEngine
```

### **WIS node**

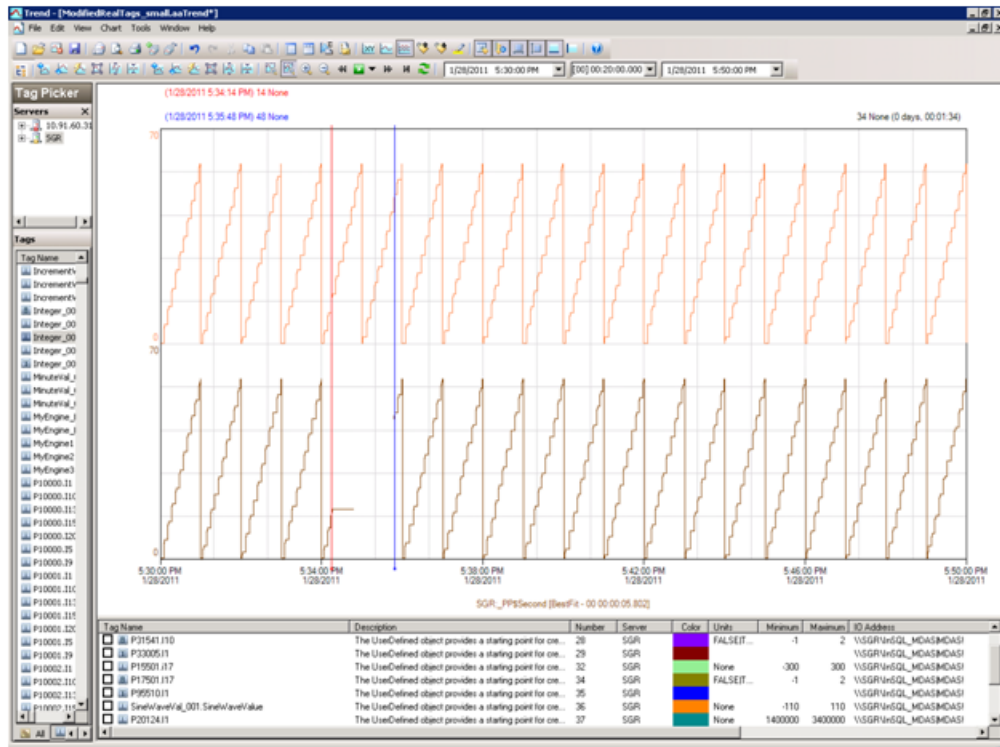
```
17137061/28/20117:25:22 PM40642196WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc.
```

## Quick Migration of WIS, InTouch, HistorianClient Trends:

In the following Historian Trend, the last tag \$Second receives data from InTouch and is historized.

Tag1: SysTimeSec

Tag2: \$Second InTouch tag



### Observations

WIS node is Platform4 in the Galaxy deployed. During the Quick Migration of WIS node, it is obvious that there will be an instance during Quick Migration when

- WIS will not be able to connect to the other deployed nodes (Platforms 1, 2, and 3).
- Other nodes will not be able to connect to WIS (Platform4)
- Historian Client trend will not be able to connect to Historian, so warning is expected.
- Historian machine's time is not synchronized during the Quick Migration of WIS node, so "Attempt to store values in the future" is expected.

As a result, you see the following warnings on each of the VM nodes.

**GR node**

```
364954901/28/20115:34:24 PM34363452WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
```

**AppEngine node**

```
216495751/28/20115:34:25 PM25882604WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
```

```
216495761/28/20115:35:10 PM320296WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
```

```
216495771/28/20115:35:16 PM320296WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
```

**WIS node**

```
17136831/28/20115:35:54 PM58563024WarningaaAFCommonTypesUnable
  to create dataview: Server must be logged on before executing
  SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
  aaIQ=Quality, aaQD=QualityDetail, aaS=0
  FROM History
  WHERE TagName IN ('....
```

**Quick Migration of all nodes****Trends:**

GR node hosts the DDESuiteLinkObjects, so during the Quick Migration of GR node, there is data loss for tags that does receive data from DAS Server/PLC.

In the following Historian Trend GR node tags are:

Tag1: I/O Tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag2: I/O Tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

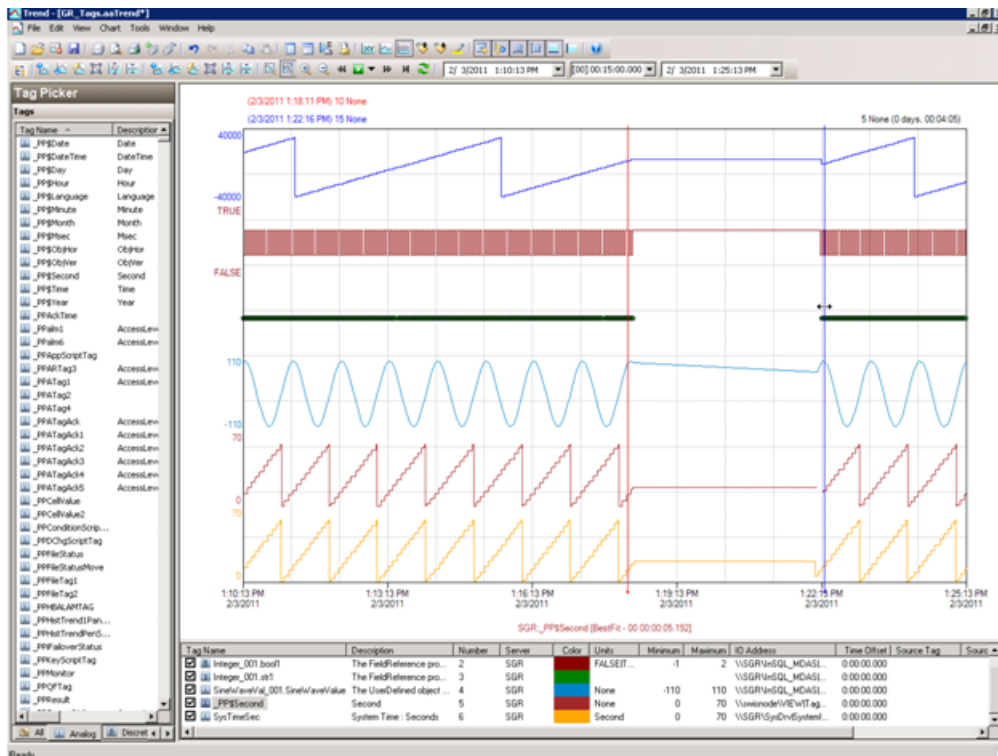
Tag3: I/O Tag (Integer\_001.str1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue)

Tag5: InTouch Tag (\_PP\$Second) from WIS node Historising to GR node.

Tag6: SystemTimeSec tag of Historian.

RPO value are been captured in RPO table of Quick Migration of All nodes.



In the following Historian Trend, AppEngine tags are:

Tag: I/O Tag (P28762.i15) getting data from DASSI on GR

Tag: I/O Tag (P31541.i10) getting data from DASSI on GR

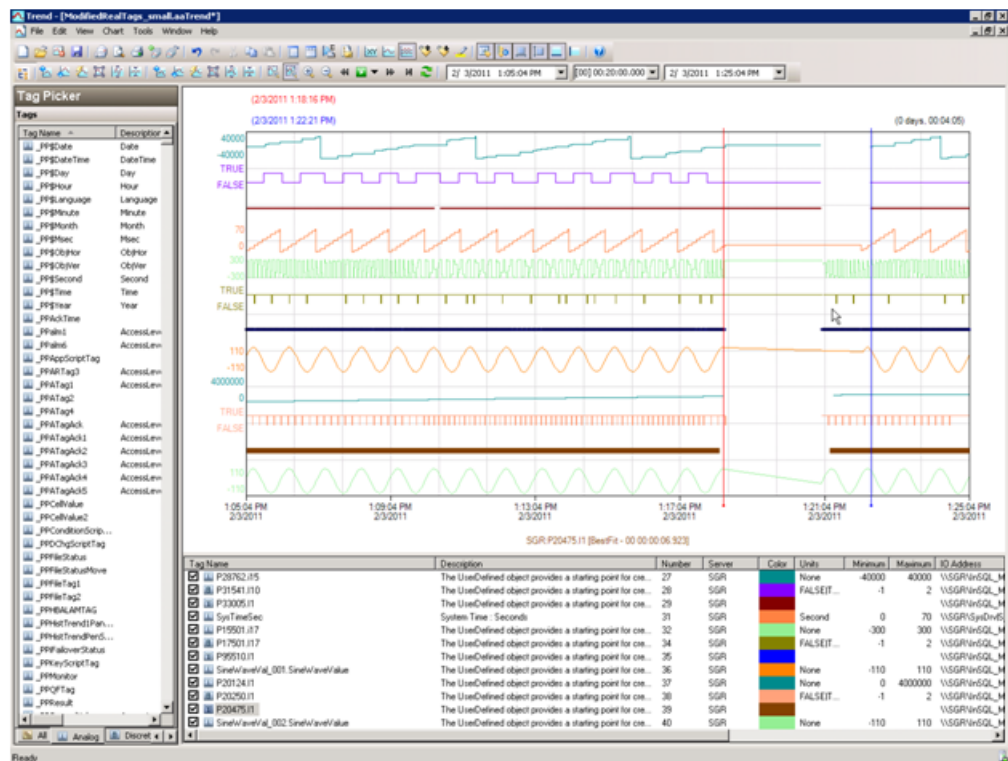
Tag: I/O Tag (P20124.i1) Buffer data tag getting data from DASSI on GR

Tag: I/O Tag (P20475.i1) Buffer data tag getting data from DASSI on GR

Tag: Script Tag (SineWaveVal\_001.SineWaveValue) of GR

Tag: Script Tag (SineWaveVal\_002.SineWaveValue) of AppEngine

Tag: SystemTimeSec tag of Historian.



## Observations

The following warnings are observed.

### GR node

```
367411892/3/20111:22:07 PM2128668WarningNmxSvcPlatform 2 exceed
maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
367411902/3/20111:22:07 PM2128668WarningNmxSvcPlatform 3 exceed
maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
367411912/3/20111:22:07 PM2128668WarningNmxSvcPlatform 4 exceed
maximum heartbeats timeout of 8000 ms.NmxSvc
```

```
367412182/3/20111:22:08 PM15122572WarningaahCfgSvc"Server time
is shifting (Expected time, Current time)"
(02/03/11,13:22:07,829, 02/03/11,13:18:20,507) [SGR;
Config.cpp; 2040]aahCfgSvc
```

```
367412322/3/20111:22:09 PM35965032WarningaaEngine0:D00 Values
in the past did not fit within the realtime window; discarding
data (218, 2011/02/03 07:48:19.663, 2011/02/03 07:52:07.873)
[aahMDASSF.cpp; 3722; 1]aaEngine
```

```
367412372/3/20111:22:09 PM29364564WarningaaEngine0:D58 Values
in the past did not fit within the realtime window; discarding
data (205, 2011/02/03 07:48:17.728, 2011/02/03 07:52:08.231)
[aahMDASSF.cpp; 3722; 1]aaEngine
```

```
367412462/3/20111:22:11 PM6964900WarningaaEngine0:A84 Values in
the past did not fit within the realtime window; discarding
data (9112, 2011/02/03 07:48:19.530, 2011/02/03 07:52:09.934)
[aahMDASSF.cpp; 3722; 1]aaEngine

367413442/3/20111:26:20 PM35965032WarningaaEngine0:D00 Values
in the past did not fit within the realtime window; discarding
data (218, 2011/02/03 07:48:19.663, 2011/02/03 07:52:07.873)
[aahMDASSF.cpp; 3722; 28]aaEngine

367413452/3/20111:26:20 PM29364564WarningaaEngine0:D58 Values
in the past did not fit within the realtime window; discarding
data (205, 2011/02/03 07:48:17.728, 2011/02/03 07:52:08.231)
[aahMDASSF.cpp; 3722; 40]aaEngine

367413462/3/20111:26:22 PM6964900WarningaaEngine0:A84 Values in
the past did not fit within the realtime window; discarding
data (9112, 2011/02/03 07:48:19.530, 2011/02/03 07:52:09.934)
[aahMDASSF.cpp; 3722; 7]aaEngine
```

## AppEngine

```
217672662/3/20111:18:18 PM19922372WarningScriptRuntime
Insert.InsertValueDataChange: Script timed out.aaEngine

217672672/3/20111:20:58 PM25642580WarningNmxSvcPlatform 1
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

217672682/3/20111:20:58 PM25642580WarningNmxSvcPlatform 3
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

217672732/3/20111:20:59 PM5961044WarningScanGroupRuntime2Can't
convert Var data type to MxDataTypesaaEngine

217672742/3/20111:20:59 PM5961044WarningScanGroupRuntime2Can't
convert Var data type to MxDataTypesaaEngine

217673112/3/20111:21:02 PM24643744WarningaaEngine0:778 Values
in the past did not fit within the realtime window; discarding
data (299, 2011/02/03 07:48:19.967, 2011/02/03 07:51:02.144)
[aahMDASSF.cpp; 3709; 1]aaEngine

217673202/3/20111:21:03 PM28924968WarningaaEngine0:9A8 Values
in the past did not fit within the realtime window; discarding
data (1738, 2011/02/03 07:48:18.846, 2011/02/03 07:51:02.769)
[aahMDASSF.cpp; 3709; 1]aaEngine

217673252/3/20111:21:03 PM30764724WarningaaEngine0:A18 Values
in the past did not fit within the realtime window; discarding
data (2329, 2011/02/03 07:48:18.685, 2011/02/03 07:51:02.191)
[aahMDASSF.cpp; 3709; 1]aaEngine

217673652/3/20111:21:04 PM31002412WarningaaEngine0:9DC Values
in the past did not fit within the realtime window; discarding
data (2916, 2011/02/03 07:48:19.389, 2011/02/03 07:51:02.894)
[aahMDASSF.cpp; 3709; 1]aaEngine
```



```
217673812/3/2011:21:05 PM31443524WarningaaEngine0:9CC Values
  in the past did not fit within the realtime window; discarding
  data (4280, 2011/02/03 07:48:19.732, 2011/02/03 07:51:03.863)
  [aahMDASSF.cpp; 3709; 1]aaEngine

217673822/3/2011:21:05 PM23443668WarningaaEngine0:9B4 Values
  in the past did not fit within the realtime window; discarding
  data (729, 2011/02/03 07:48:20.951, 2011/02/03 07:51:03.847)
  [aahMDASSF.cpp; 3709; 1]aaEngine

217673832/3/2011:21:06 PM26362300WarningaaEngine0:A0C Values
  in the past did not fit within the realtime window; discarding
  data (7646, 2011/02/03 07:48:19.077, 2011/02/03 07:51:04.160)
  [aahMDASSF.cpp; 3709; 1]aaEngine

217674042/3/2011:22:10 PM19922372WarningScriptRuntime
  Insert.InsertValuePeriodic: Script timed out.aaEngine

217674062/3/2011:22:15 PM19922372WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.aaEngine

217675242/3/2011:25:14 PM31002412WarningaaEngine0:9DC Values
  in the past did not fit within the realtime window; discarding
  data (2916, 2011/02/03 07:48:19.389, 2011/02/03 07:51:02.894)
  [aahMDASSF.cpp; 3709; 181]aaEngine

217675252/3/2011:25:14 PM24643744WarningaaEngine0:778 Values
  in the past did not fit within the realtime window; discarding
  data (299, 2011/02/03 07:48:19.967, 2011/02/03 07:51:02.144)
  [aahMDASSF.cpp; 3709; 88]aaEngine

217675262/3/2011:25:15 PM28924968WarningaaEngine0:9A8 Values
  in the past did not fit within the realtime window; discarding
  data (1738, 2011/02/03 07:48:18.846, 2011/02/03 07:51:02.769)
  [aahMDASSF.cpp; 3709; 308]aaEngine

217675272/3/2011:25:15 PM30764724WarningaaEngine0:A18 Values
  in the past did not fit within the realtime window; discarding
  data (2329, 2011/02/03 07:48:18.685, 2011/02/03 07:51:02.191)
  [aahMDASSF.cpp; 3709; 5111]aaEngine

217675282/3/2011:25:15 PM31443524WarningaaEngine0:9CC Values
  in the past did not fit within the realtime window; discarding
  data (4280, 2011/02/03 07:48:19.732, 2011/02/03 07:51:03.863)
  [aahMDASSF.cpp; 3709; 126]aaEngine

217675292/3/2011:25:16 PM23443668WarningaaEngine0:9B4 Values
  in the past did not fit within the realtime window; discarding
  data (729, 2011/02/03 07:48:20.951, 2011/02/03 07:51:03.847)
  [aahMDASSF.cpp; 3709; 8]aaEngine

217675302/3/2011:25:16 PM26362300WarningaaEngine0:A0C Values
  in the past did not fit within the realtime window; discarding
  data (7646, 2011/02/03 07:48:19.077, 2011/02/03 07:51:04.160)
  [aahMDASSF.cpp; 3709; 1124]aaEngine
```

**WIS node**

```
17158432/3/20111:18:28 PM38524104WarningNmxSvcPlatform 1 exceed
maximum heartbeats timeout of 8000 ms.NmxSvc

17158462/3/20111:18:33 PM38524104WarningNmxSvcPlatform 2 exceed
maximum heartbeats timeout of 8000 ms.NmxSvc

17158532/3/20111:21:20 PM60483068WarningaaAFCommonTypesUnable
to create dataview: Server must be logged on before executing
SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
aaIQ=Quality, aaQD=QualityDetail, aaS=0

FROM History

WHERE TagName IN ('...aaTrend
```

## Scenario 2: Virtualization Server Hardware Fails

**Failover due to Hardware Failure**

The failover occurs due to hardware failure, and it is simulated with power-off on the host server.

**Trends:**

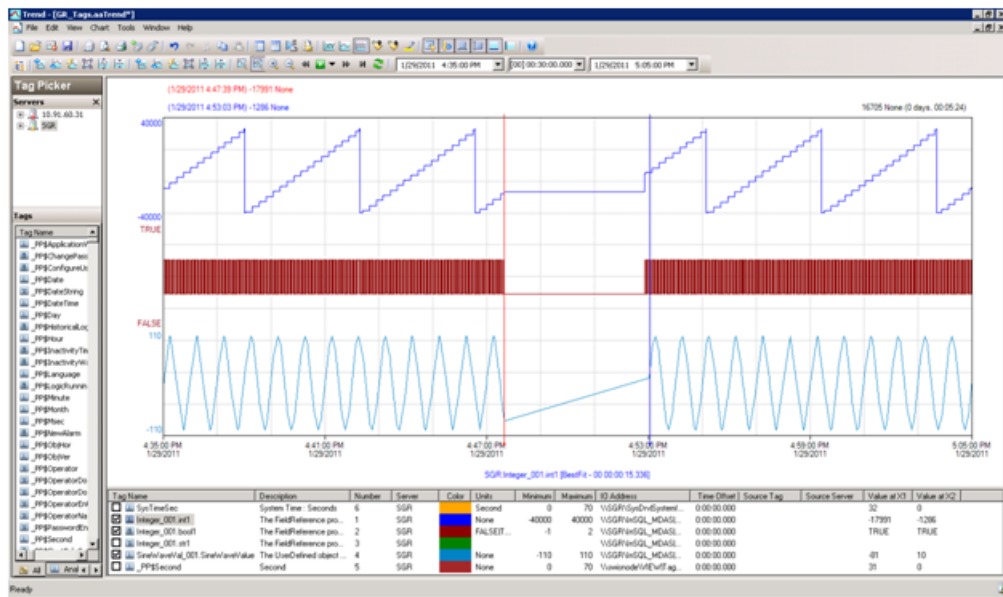
In the following Historian Trend, GRnode tags are:

Tag1: SystemTimeSec tag of Historian.

Tag2: I/O Tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O Tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue)

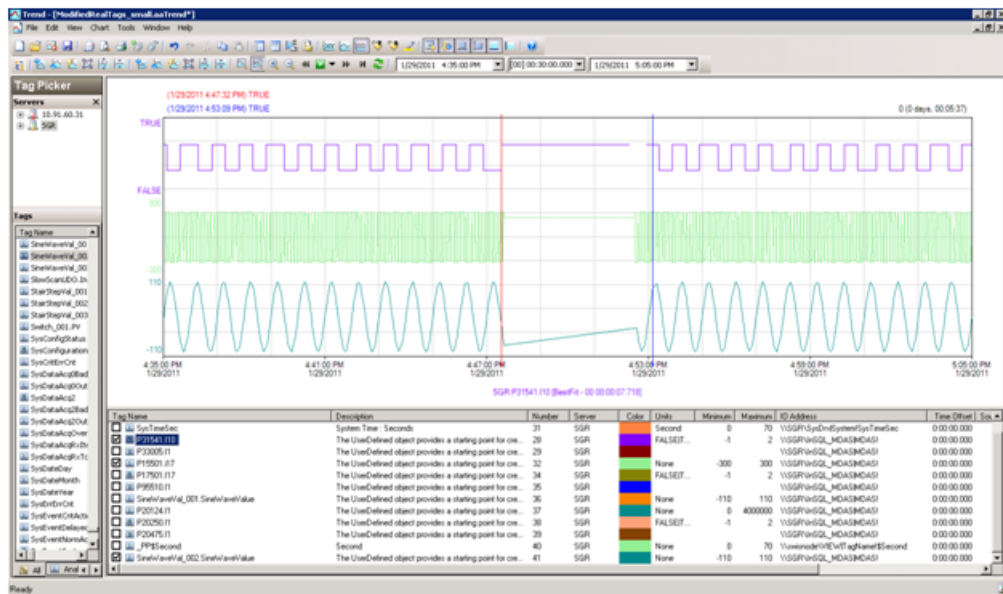


In the following Historian Trend, AppEngine node tags are:

Tag1: I/O Tag (P31541.I10) getting data from DASSI of GR node

Tag2: I/O Tag (P15501.I17) getting data

Tag3: Script Tag (Sinewaveval\_002.SineWaveValue)



### Observations

#### GR node

365102481/29/20114:52:37 PM15523068WarningaahCfgSvc"Server time is shifting (Expected time, Current time)"

```
(01/29/11,16:52:36,421, 01/29/11,16:52:42,044) [SGR;
Config.cpp; 2040]
365103161/29/20114:52:47 PM29082912WarningScriptRuntime
GR.privatembytes: Script timed out.
365106351/29/20114:53:13 PM29085088WarningaaEngine0:7D4 Values
in the past did not fit within the realtime window; discarding
data (193, 2011/01/29 11:22:20.000, 2011/01/29 11:23:12.198)
[aahMDASSF.cpp; 3722; 1]
365177651/29/20114:57:25 PM29085088WarningaaEngine0:7D4 Values
in the past did not fit within the realtime window; discarding
data (193, 2011/01/29 11:22:20.000, 2011/01/29 11:23:12.198)
[aahMDASSF.cpp; 3722; 38]
```

### AppEngine node

```
216506701/29/20114:52:13 PM24762480WarningScriptRuntime
AppEngineNode1.privatembytes: Script timed out.aaEngine
216509601/29/20114:52:52 PM3924936WarningDCMConnectionMgrOpen()
of DCMConnection failed: 'A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
accessible. Verify that the instance name is correct and that
SQL Server is configured...aaEngine
```

### WIS node

```
17138461/29/20114:56:32 PM23163916WarningNmxSvcPlatform 1
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
17139371/29/20115:11:53 PM23163916WarningNmxSvcPlatform 1
exceed maximum heartbeats timeout of 8000 ms.NmxSvc
17141071/29/20115:27:42 PM57085456Warning
ArchestraA.Visualization.WCFServiceLMX WCF service: Exception
while PushBackConfigurations(sync mode): [The operation has
timed out.] at [
Server stack trace:
at
System.ServiceModel.Channels.InputQueue`1.Dequeue(TimeSpan
timeout)
at System.ServiceModel.Channels.ServicePollingDuple...w3wp
```

## Scenario 3: Network Fails on Virtualization Server

### Failover due to Network Disconnect (Public)

#### Trends:

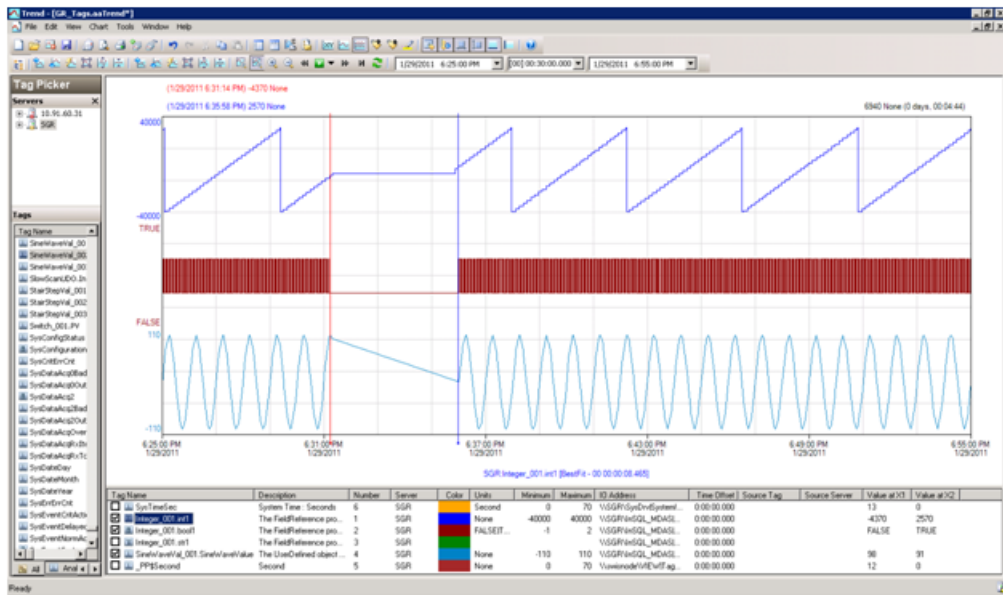
In the following Historian Trend, GRnode tags are:

Tag1: SystemTimeSec tag of Historian.

Tag2: I/O Tag (Integer\_001.int1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag3: I/O Tag (Integer\_001.bool1) getting data from DDESuiteLinkClient\_001.Topic39.RealIO10000

Tag4: Script Tag (SineWaveVal\_001.SineWaveValue)

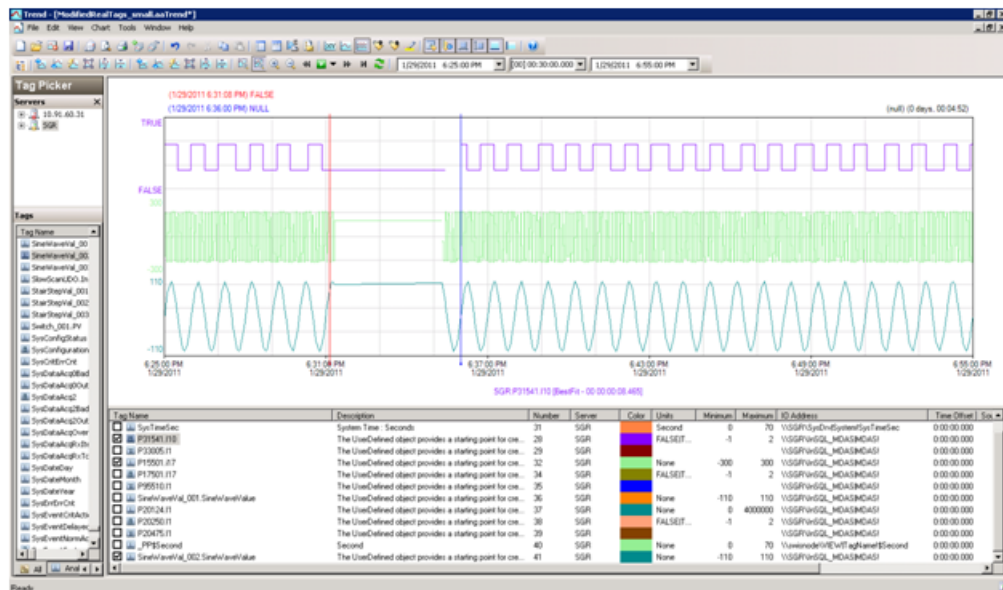


In the following Historian Trend, AppEngine node tags are:

Tag1: I/O Tag (P31541.I10) getting data from DASSI of GR node

Tag2: I/O Tag (P15501.I17) getting data.

Tag3: Script Tag (Sinewaveval\_002.SineWaveValue)



### Observations

During the network disconnect of host server, all the nodes will be moved to other Host server and all the VM's in the host server will get restarted.

### GR node

```
365197041/29/20116:35:37 PM16282572WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (01/29/11,18:35:36,507, 01/29/11,18:35:40,334) [SGR;
  Config.cpp; 2040]aahCfgSvc

365197161/29/20116:35:43 PM28442848WarningScriptRuntime
  GR.privatembytes: Script timed out.aaEngine

365200231/29/20116:36:00 PM28444660WarningaaEngine0:6F4 Values
  in the past did not fit within the realtime window; discarding
  data (193, 2011/01/29 13:05:16.771, 2011/01/29 13:06:00.106)
  [aahMDASSF.cpp; 3722; 1]aaEngine

365201071/29/20116:36:16 PM38965028WarningaaEngine0:C88 Values
  in the past did not fit within the realtime window; discarding
  data (215, 2011/01/29 13:05:29.000, 2011/01/29 13:06:15.355)
  [aahMDASSF.cpp; 3722; 1]aaEngine

365269551/29/20116:36:36 PM16282572WarningaahStoreSvcAttempt to
  store value prior to disconnect time. Value discarded -
  possible loss of data (SGR_mdas, 2916, 2011/01/29
  13:06:36.090, 2011/01/29 13:06:35.519) [SGR; pipeserver.cpp;
  958]aahCfgSvc

365271041/29/20116:40:12 PM28444660WarningaaEngine0:6F4 Values
  in the past did not fit within the realtime window; discarding
  data (193, 2011/01/29 13:05:16.771, 2011/01/29 13:06:00.106)
  [aahMDASSF.cpp; 3722; 33]aaEngine

365271051/29/20116:40:27 PM38965028WarningaaEngine0:C88 Values
  in the past did not fit within the realtime window; discarding
  data (215, 2011/01/29 13:05:29.000, 2011/01/29 13:06:15.355)
  [aahMDASSF.cpp; 3722; 17]aaEngine

365271071/29/20116:40:53 PM16282572WarningaahStoreSvcAttempt to
  store value prior to disconnect time. Value discarded -
  possible loss of data (SGR_mdas, 2916, 2011/01/29
  13:06:36.090, 2011/01/29 13:06:35.519) [SGR; pipeserver.cpp;
  958; 56]aahCfgSvc
```

### AppEngine node

```
216513881/29/20116:35:05 PM25002504WarningScriptRuntime
  AppEngineNode1.privatembytes: Script timed out.aaEngine

216516741/29/20116:35:41 PM22843016WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.aaEngine
```

```
216516861/29/20116:35:45 PM22844824WarningDCMConnectionMgr
  Open() of DCMConnection failed: 'A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...aaEngine

216516891/29/20116:35:46 PM22844824WarningSQLDataRuntime3
  SQLTestResults Command Failure - A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...aaEngine

216518961/29/20116:37:28 PM13162080WarningInTouchProxyFailed to
  reconnect to data source aaEngine
```

**WIS node**

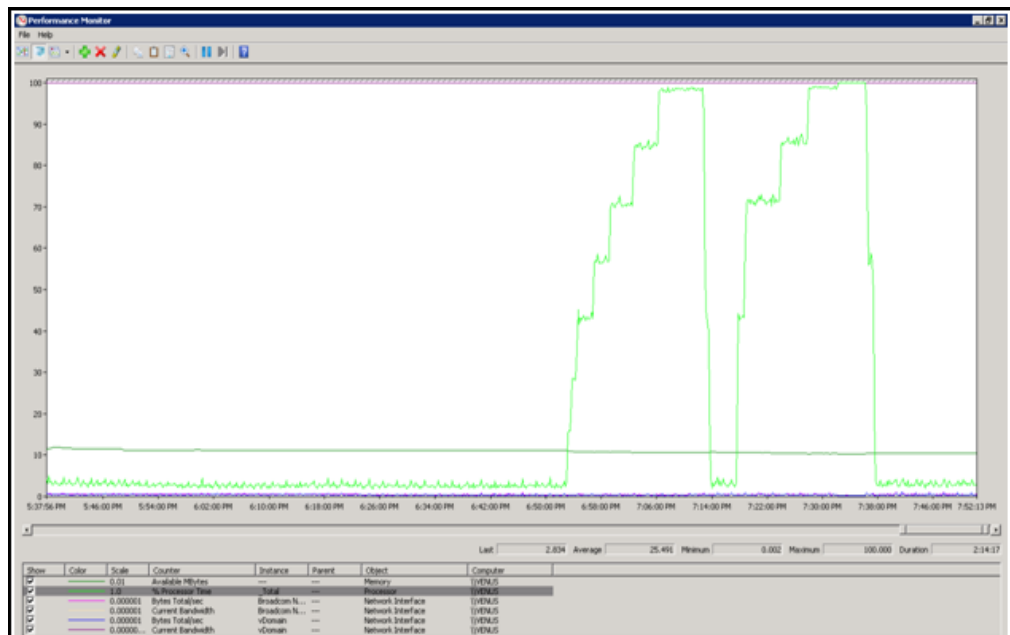
None

## Scenario 4: Virtualization Server Becomes Unresponsive

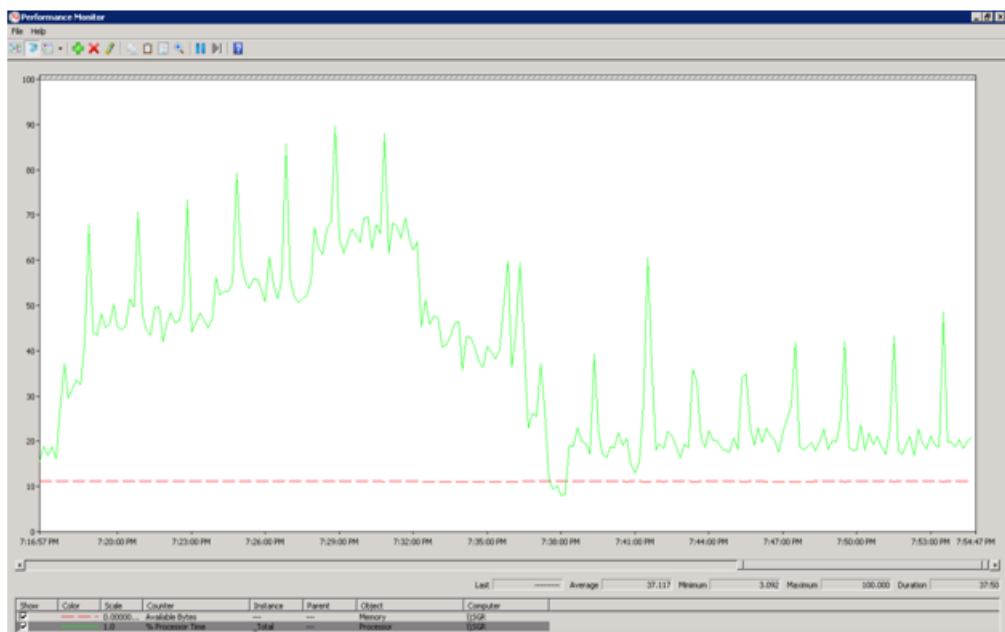
### **Hyper-V Virtual Machines with Static RAM and Reservations for Processors**

It has been observed that even when the Host Virtualization Server reaches 100% CPU utilization, there is no failover of the Hyper-V virtual machines running on it to the other Host Virtualization Server. However, the host server running at 100% CPU utilization fails to process all the network requirements of the Hyper-V virtual machines running on it. As a result, network disruptions on the Hyper-V virtual machines are observed that result in data loss.

### Host Virtualization Server Performance with CPU Load at 100%

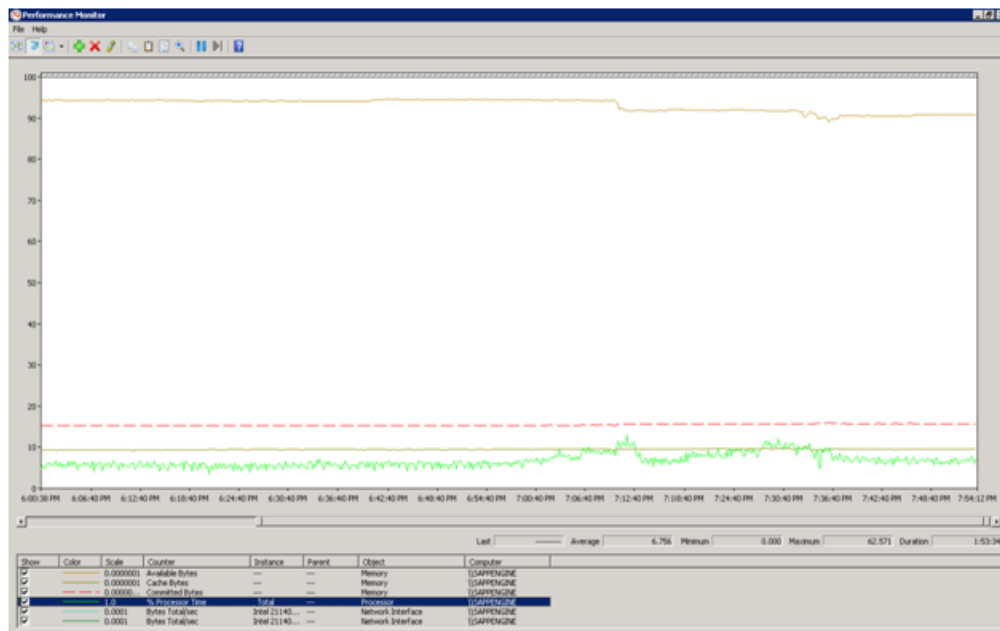


### GR Performance with Host Server running at 100% CPU Load





## AppEngine Performance with Host Server running at 100% CPU Load



### Observations When CPU Load is 100% on host Virtualization Server

The virtual machines do not failover when CPU load stays at 100%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is at 100%.

The messages "Snapshot write operation took longer than 10 seconds" are expected when the virtual machines are running at high Processor time % (Historian at 100% and AppEngine node at 50%).

The execution of time sync utility is impacted and the time is not synchronized on the Historian, AppEngine nodes and GR node. As a result, the message "Values in the past did not fit within the realtime window" is observed.

### GR node

```
367202572/2/20117:32:56 PM15122572WarningaahStoreSvcSnapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (2, 1, 0, 320749,
10166, 15) [SGR; deltastore.cpp; 2669]aahCfgSvc
```

```
367202842/2/20117:33:34 PM35965032WarningaaEngine0:D00 Snapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (4, 6, 0, 0, 932,
24) [minideltastore.cpp; 2208; 1]aaEngine
```

```

367203072/2/20117:33:49 PM15122572WarningaahStoreSvcValues in
the past did not fit within the realtime window; discarding
data (SGR_mdas, 9119, 2011/02/02 14:02:54.731, 2011/02/02
14:03:49.272) [SGR; pipeserver.cpp; 2388]aahCfgSvc

367203222/2/20117:34:06 PM35963184WarningScriptRuntime
AsynchronousBuffer.script2: Script timed out.aaEngine

367203592/2/20117:35:32 PM35963184WarningScriptRuntime
AsynchronousBuffer.script6: Script timed out.aaEngine

367203602/2/20117:35:33 PM29362940WarningaaEngineUnexpected
packet from ND Area_LateBool <P2 E4>, structId 938336640,
request 0, start 14583, end 14583, count 5, set 14578, sub
14578, state 1, commAlarm 0, subStatus <success -1 category 0
detectedBy 0 detail 0>, subQual 192, setCnt 313, setResultCnt
313,...aaEngine

367203772/2/20117:35:33 PM29362940WarningaaEngineUnexpected
packet from ND Area_DASTS <P2 E9>, structId 938336640, request
0, start 13753, end 13753, count 3, set 13751, sub 13751,
state 1, commAlarm 0, subStatus <success -1 category 0
detectedBy 0 detail 0>, subQual 192, setCnt 313, setResultCnt
313, wa...aaEngine

367203902/2/20117:35:33 PM29362940WarningaaEngineUnexpected
packet from ND MyEngine_RealTimeDASTS <P2 E9>, structId
938336640, request 0, start 4, end 4, count 1, set 2, sub 2,
state 1, commAlarm 0, subStatus <success -1 category 0
detectedBy 0 detail 0>, subQual 192, setCnt 313, setResultCnt
313, waitSc...aaEngine

367204062/2/20117:35:41 PM43164748WarningaahIDASSvc (local)
SGR_2: Failed to send acquisition status. Connection to server
timed out (This operation returned because the timeout period
expired)aahIDASSvc

367204172/2/20117:35:51 PM15122572WarningaahCfgSvcDriver
stopped (System driver, 2011/02/02 19:35:01.356) [SGR;
aahCfgSvc.cpp; 8401]aahCfgSvc

367204242/2/20117:35:51 PM15122572WarningaahStoreSvcAttempt to
store value prior to disconnect time. Value discarded -
possible loss of data (SGR_sysdrv, 12, 2011/02/02
14:05:48.060, 2011/02/02 14:05:48.000) [SGR; pipeserver.cpp;
958]aahCfgSvc

```

### AppEngine node

```

217656272/2/20117:33:35 PM32044068WarningaaEngine0:A00 Snapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (1, 2, 0, 0,
9156, 22) [minideltastore.cpp; 2211; 1]aaEngine

```

```
217656372/2/20117:33:38 PM26244968WarningaaEngine0:C88 Snapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (4, 1, 0, 0, 260,
26) [minideltastore.cpp; 2211; 1]aaEngine
```

```
217656512/2/20117:33:55 PM30844132WarningaaEngine0:9AC Values
in the past did not fit within the realtime window; discarding
data (1738, 2011/02/02 14:02:54.731, 2011/02/02 14:03:55.637)
[aahMDASSF.cpp; 3709; 1]aaEngine
```

```
217657772/2/20117:36:14 PM26244968WarningaaEngine0:C88 Snapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (4, 1, 0, 0, 260,
13) [minideltastore.cpp; 2211; 1]aaEngine
```

### WIS node

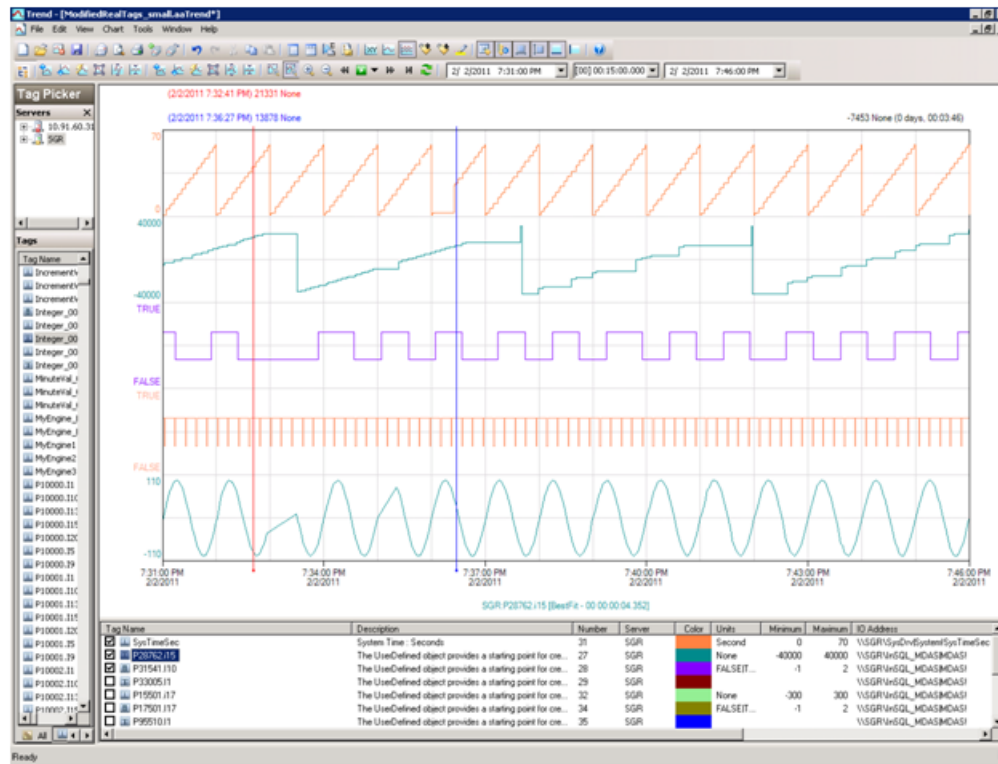
```
17157102/2/20117:36:25 PM60485304WarningaaAFCommonTypesUnable
to create dataview: Server must be logged on before executing
SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
aaIQ=Quality, aaQD=QualityDetail, aaS=0
```

```
FROM History
```

```
WHERE TagName IN ('...aaTrend
```

```
17157122/2/20117:36:27 PM60484536WarningaaAFCommonTypesUnable
to create dataview: Server must be logged on before executing
SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
aaIQ=Quality, aaQD=QualityDetail, aaS=0
```

### Trend when CPU utilization is 100%



From the above trend, it is observed that there that there are frequent data losses for all types tags IO and Script generated from GR and AppEngine nodes.

### Observations When CPU Load is 98% on host Virtualization Server

The virtual machines do not failover when CPU load stays at 98%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is high.

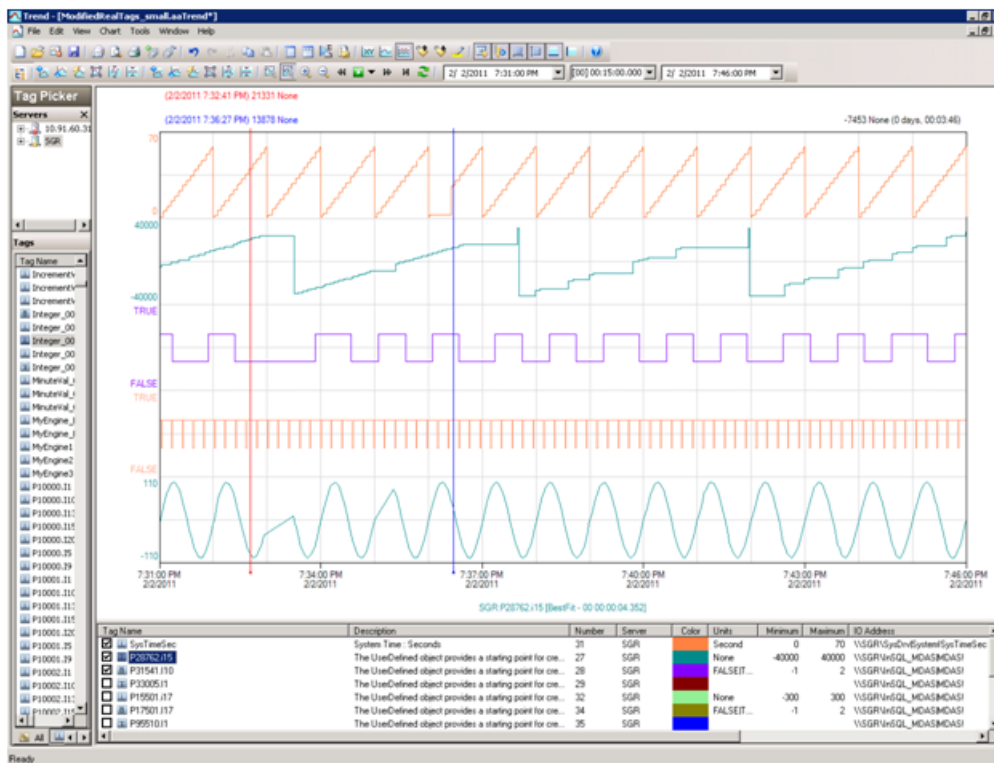
Only below warning message is observed when CPU load of host is 98%.

#### AppEngine node

```
217655642/2/20117:29:03 PM26242644WarningScriptRuntime
Insert.InsertValueWF: Script timed out.aaEngine
```

```
217655722/2/20117:32:25 PM26242644WarningScriptRuntime
Insert.InsertValueWT: Script timed out.aaEngine
```

### Trend when CPU Load is 98% on host Virtualization Server



From the above trend, it is observed that there is data loss for Script tags of AppEngine node.

# Working with a Medium Scale Virtualization Environment

This section contains the following topics:

- Setting Up Medium Scale Virtualization Environment
- Configuring System Platform Products in a Typical Medium Scale Virtualization
- Expected Recovery Time Objective and Recovery Point Objective
- Snapshots of Data Trends and Observations

## Setting Up Medium Scale Virtualization Environment

The following procedures help you to set up small scale virtualization disaster recovery environment.

### Planning for Disaster Recovery

The minimum and recommended hardware and software requirements for the Host and Virtual machines used for small scale virtualization disaster recovery environment.

#### Hyper-V Hosts

Processor	Two 2.79 GHz Intel Xeon with 24 Cores
Operating System	Windows Server 2008 R2 Enterprise with Hyper-V enabled
Memory	48 GB
Storage	SAN with 1TB storage disk

**Note:** For the Hyper-V Host to function optimally, the server should have the same processor, RAM, storage and service pack level. Preferably the servers should be purchased in pairs to avoid hardware discrepancies. Though the differences are supported, it will impact the performance during failovers.

## Virtual Machines

Using the Hyper-V host specified above, seven virtual machines can be created in the environment with the configuration given below.

### Virtual Machine 1: Historian Node

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	8 GB
Storage	200 GB
System Platform Products Installed	Historian

### Virtual Machine 2: Application Server Node, DAS SI

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	8 GB
Storage	100 GB
System Platform Products Installed	ArchestrA-Runtime, DAS SI

**Virtual Machine 3: InTouch TS Node**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	InTouch with TS enabled

**Virtual Machine 4: Application Server Runtime Node 1**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Application Server Runtime only and InTouch

**Virtual Machine 5: Application Server Runtime Node 2**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Application Server Runtime only



**Virtual Machine 6: Information Server Node**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Information Server

**Virtual Machine 7: Historian Client Node**

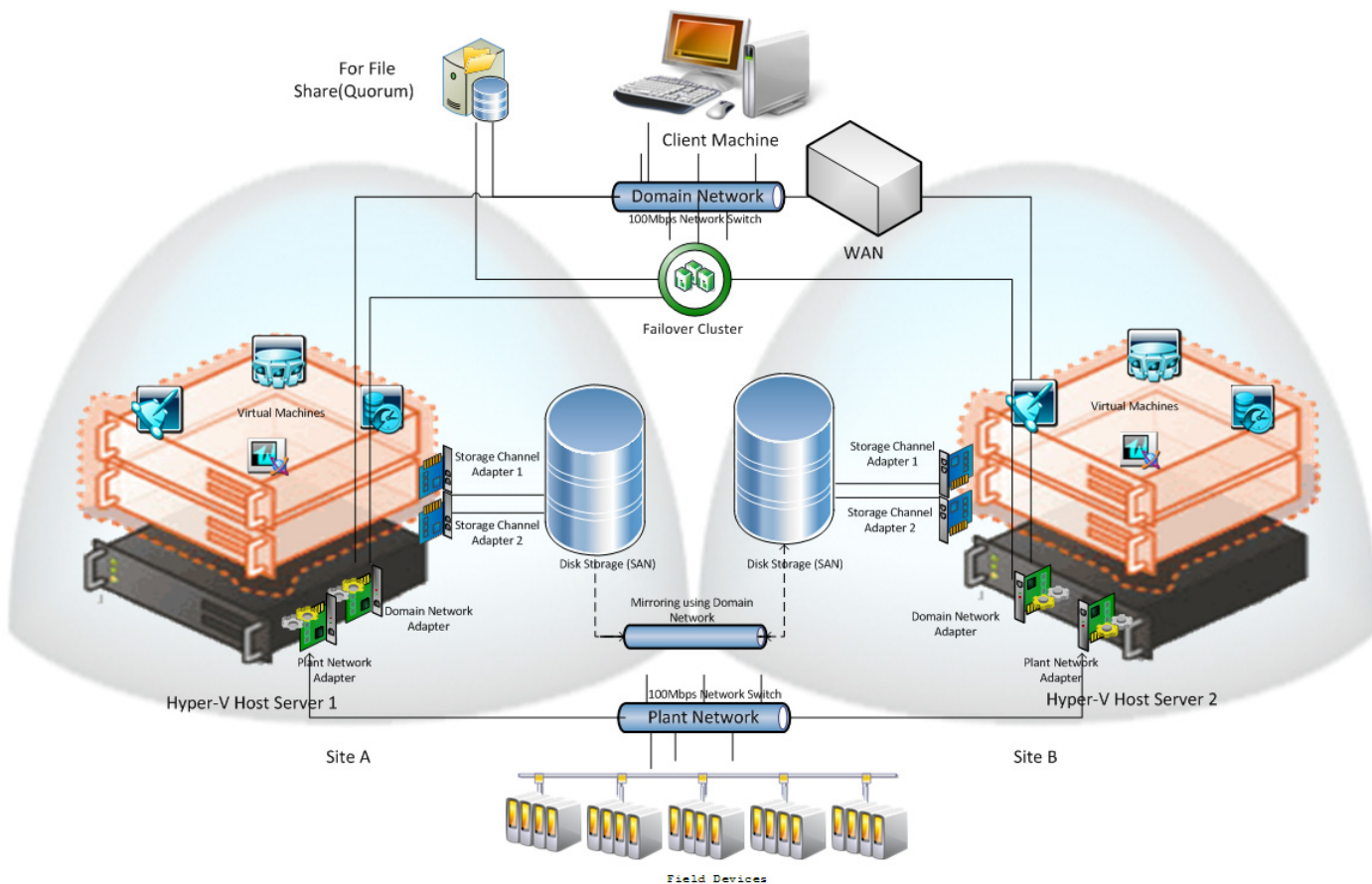
Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows 7 Enterprise
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Historian Client

**Network Requirements**

For this architecture, you can use one physical network card that needs to be installed on a host computer for the domain network and the process network.

## Configuring Failover Cluster

The recommended topology of the failover cluster for disaster recovery process for medium scale virtualization environment is given below:



This setup requires a minimum of two host servers and two storage servers connected to each host independently. Another independent node is used for configuring the quorum. For more information on configuring the quorum, refer to "Configuring Cluster Quorum Settings" on page 348.

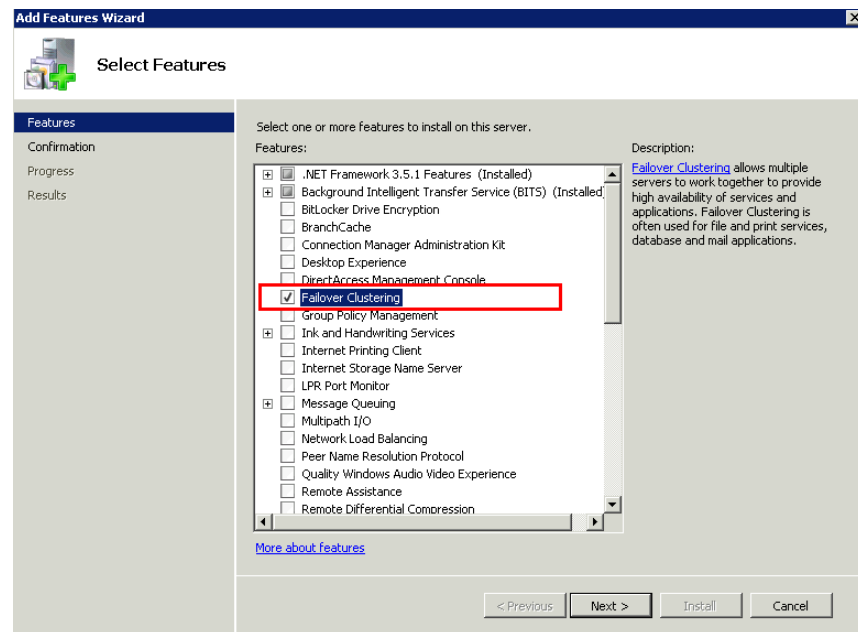
The following procedures help you install and configure a failover cluster that has two nodes to set up on medium configuration.

To install the failover cluster feature, you need to run Windows Server 2008 R2 Enterprise Edition on your server.

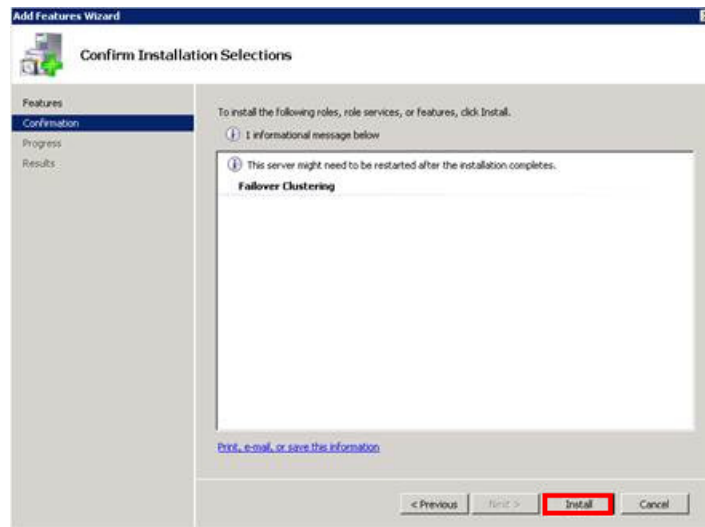
## To configure failover cluster

- 1 On the **Initial Configuration Tasks** window, under **Customize This Server**, click **Add** features. The **Add Features Wizard** window appears.

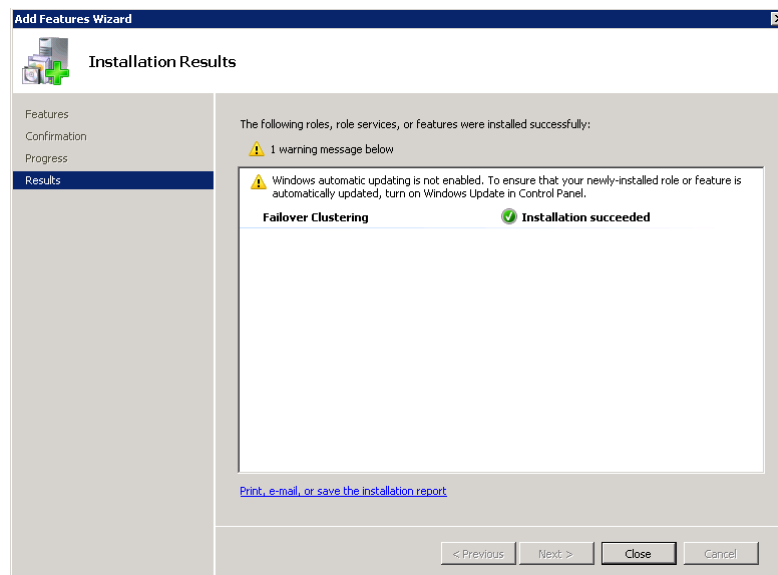
**Note:** The **Initial Configuration Tasks** window appears if you have already installed Windows Server 2008 R2. If it does not appear, open the **Server Manager** window, right-click **Features** and click **Add Features**.



- 2 In the **Add Features Wizard** window, select the **Failover Clustering** check box, and then click **Next**. The **Confirm Installation Selections** area appears.



- 3 Click **Install** to complete the installation. The **Installation Results** area with the installation confirmation message appears.



- 4 Click **Close** to close the **Add Features Wizard** window.

**Note:** Repeat the procedure to include on all the other nodes that will be part of the Cluster configuration process.

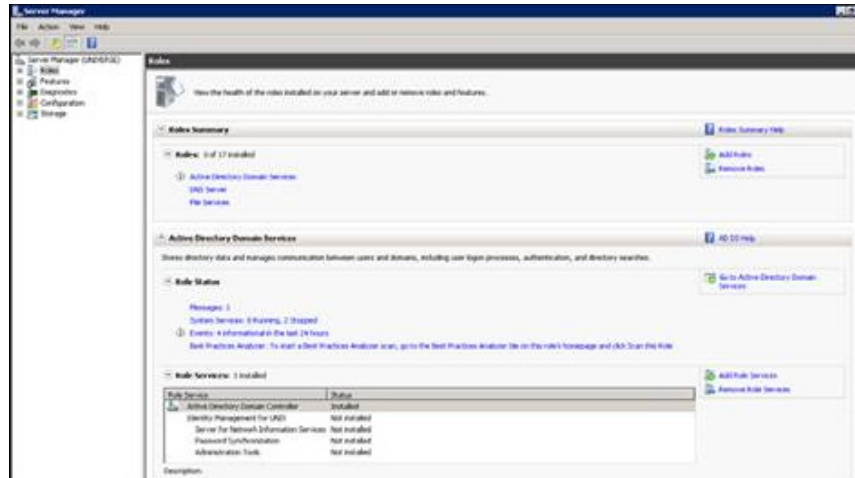
## Validating Cluster Configuration

Before creating a cluster, you must validate your configuration. Validation helps you confirm that the configuration of your servers, network, and storage meet the specific requirements for failover clusters.

## To validate the failover cluster configuration

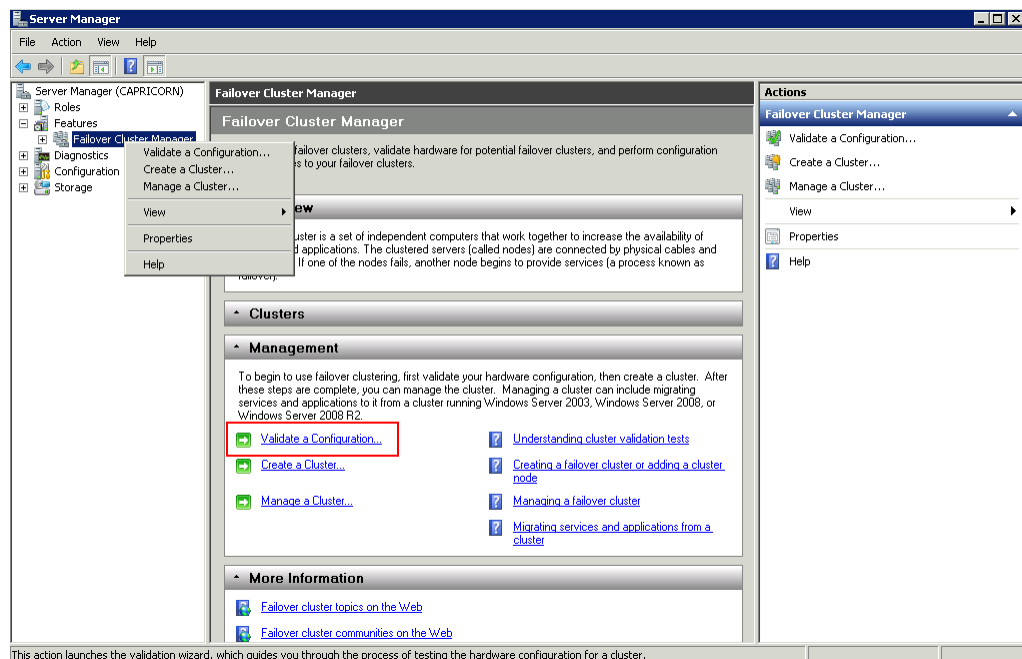
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.



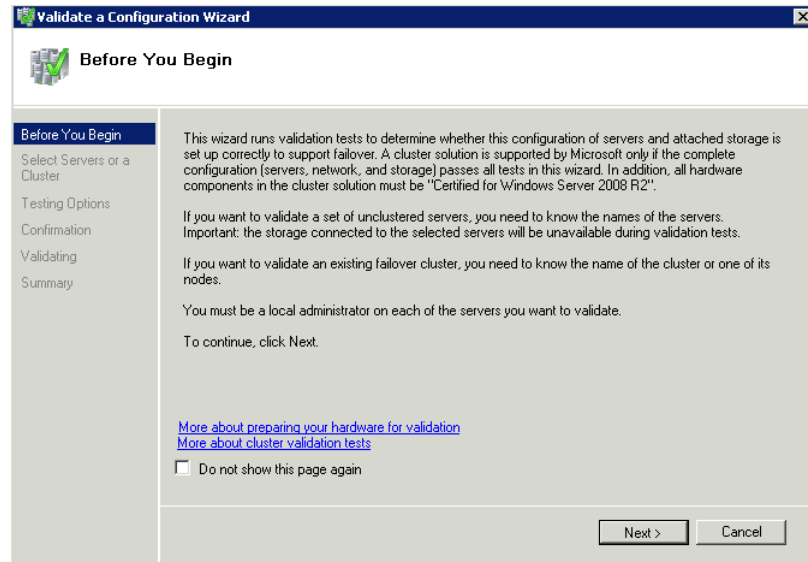
- 2 Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



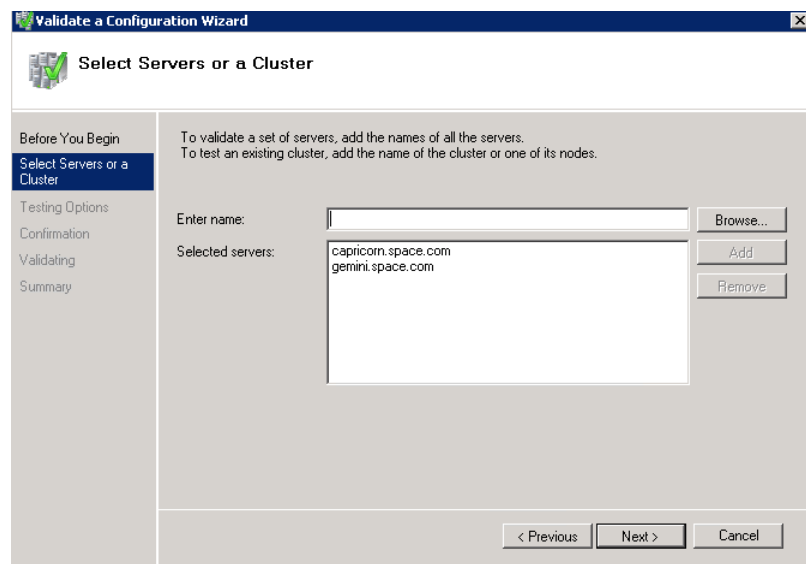
This action launches the validation wizard, which guides you through the process of testing the hardware configuration for a cluster.

- 3 Under **Management**, click **Validate a Configuration**. The **Validate a Configuration Wizard** window appears. Click **Next**.

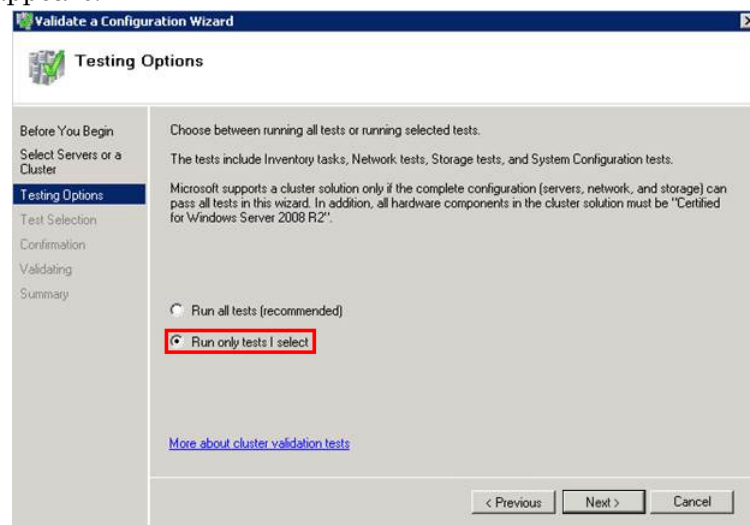


- 4 In the **Select Servers** or a **Cluster** screen, you need to do the following:
  - d Click **Browse** or enter next to the **Enter name** box and select the relevant server name.
  - e From the **Selected servers** list, select the relevant servers and click **Add**.
  - f Click **Next**. The **Testing Options** screen appears.
  - g Enter the server name and click **Add**. The server gets added to the server box.

**Note:** To remove a server, select the server and click **Remove**.

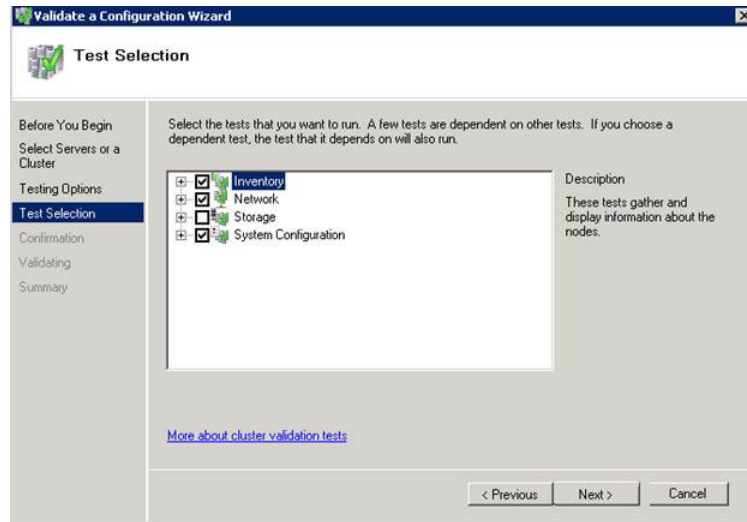


- 5 Click the **Run only the tests I select** option to skip the storage validation process, and click **Next**. The **Test Selection** screen appears.

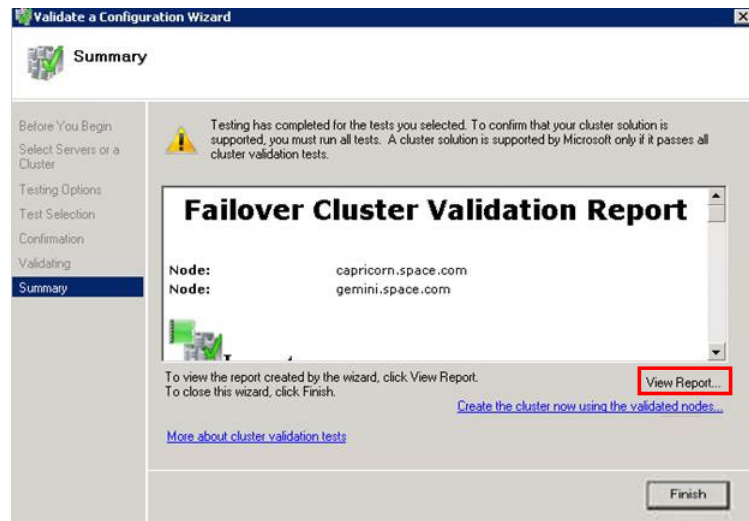


**Note:** Click the **Run all tests (recommended)** option to validate the default selection of tests.

- 6 Clear the **Storage** check box, and then click **Next**. The **Summary** screen appears.



- 7 Click **View Report** to view the test results or click **Finish** to close the **Validate a Configuration Wizard** window.



A warning message appears indicating that all the tests have not been run. This usually happens in a multisite cluster where the storage tests are skipped. You can proceed if there is no other error message. If the report indicates any other error, you need to fix the problem and re-run the tests before you continue. You can view the results of the tests after you close the wizard in `SystemRoot\Cluster\Reports\Validation Report date and time.html` where `SystemRoot` is the folder in which the operating system is installed (for example, `C:\Windows`).



To know more about cluster validation tests, click **More about cluster validation tests** on **Validate a Configuration** Wizard window.

## Creating a Cluster

To create a cluster, you need to run the **Create Cluster wizard**.

### To create a cluster

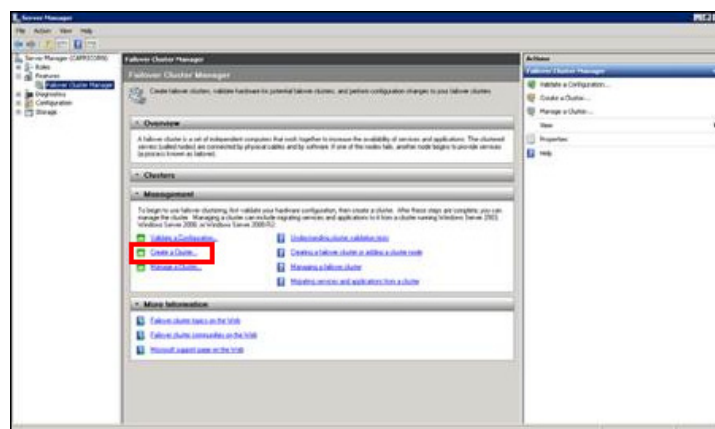
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

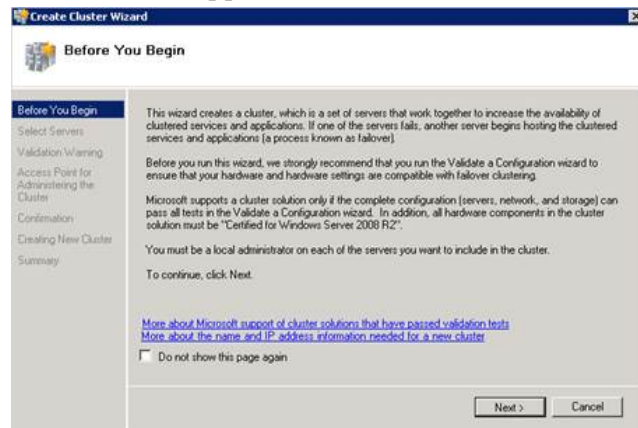


- 2 Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

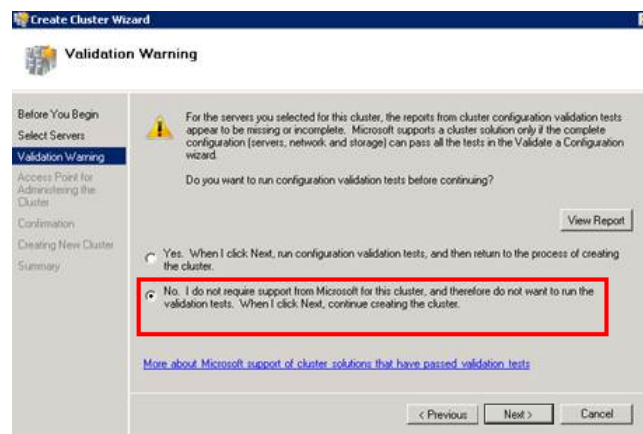
**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



- 3 Under Management, click **Create a cluster**. The **Create Cluster Wizard** window appears.

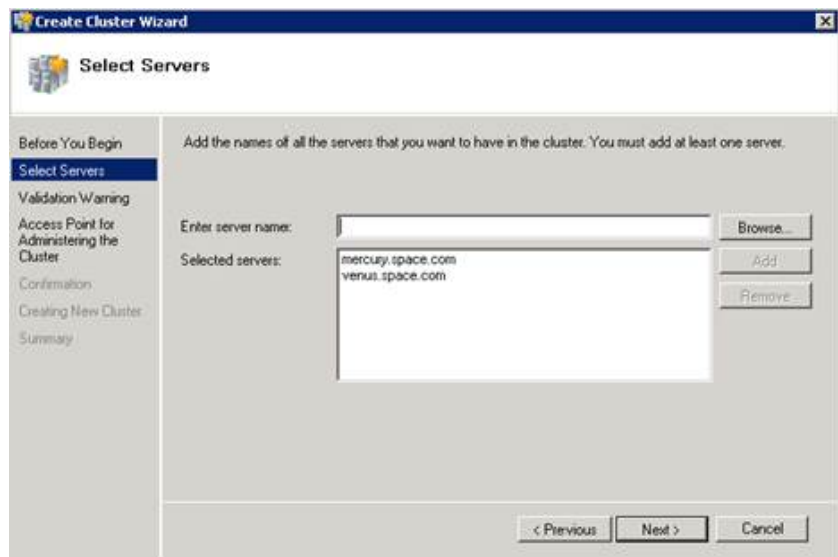


- 4 View the instructions and click **Next**. The **Validation Warning** area appears.



- 5 Click **No. I do not require support from Microsoft for this cluster, and therefore do not want to run the validation tests.** When I click **Next**, continue creating the cluster option and click **Next**. The **Select Servers** area appears.

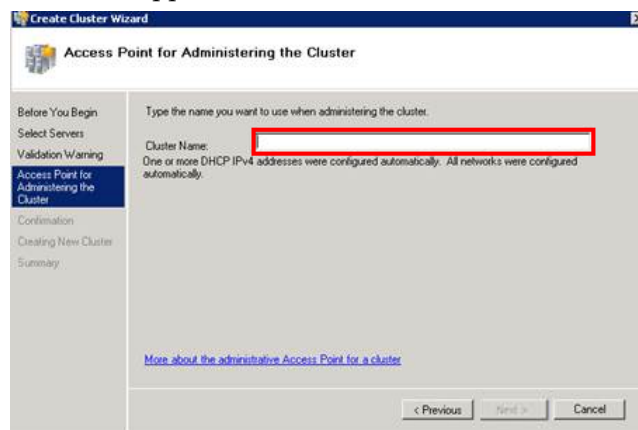
**Note:** Click **Click Yes. When I click Next, run configuration validation tests, and then return to the process of creating the cluster** option if you want to run the configuration validation tests. **Click View Report** to view the cluster operation report.



- 6 In the **Select Servers** screen, do the following:
- In the **Enter server name** box, enter the relevant server name and click **Add**. The server name gets added in the **Selected servers** box.

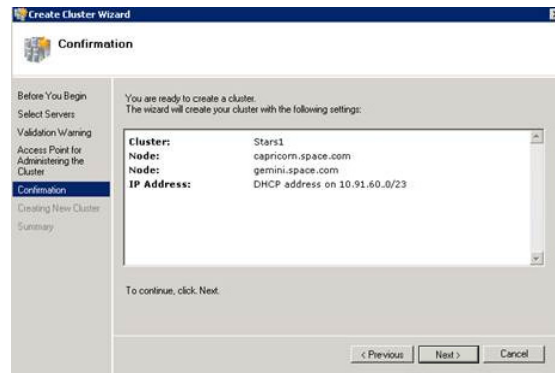
**Note:** You can either type the server name or click **Browse** to select the relevant server name.

- Click **Next**. The **Access Point for Administering the Cluster area** appears.



- 7 In the **Cluster Name** box, type the name of the cluster and click **Next**. The **Confirmation** area appears.

**Note:** Enter a valid IP address for the cluster to be created if the IP address is not configured through Dynamic Host Configuration Protocol (DHCP).



- 8 Click **Next**. The cluster is created and the **Summary** area appears.



- 9 Click **View Report** to view the cluster report created by the wizard or click **Finish** to close the **Create Cluster Wizard** window.

## Configuring Cluster Quorum Settings

Quorum is the number of elements that need to be online to enable continuous running of a cluster. In most instances, the elements are nodes. In some cases, the elements also consist of disk or file share witnesses. Each of these elements determines whether the cluster should continue to run.

All elements, except the file share witnesses, have a copy of the cluster configuration. The cluster service ensures that the copies are always synchronized. The cluster should stop running if there are multiple failures or if there is a communication error between the cluster nodes.

After both nodes have been added to the cluster, and the cluster networking components have been configured, you must configure the failover cluster quorum.

You must create and secure the file share that you want to use for the node and the file share majority quorum before configuring the failover cluster quorum. If the file share has not been created or correctly secured, the following procedure to configure a cluster quorum will fail. The file share can be hosted on any computer running a Windows operating system.

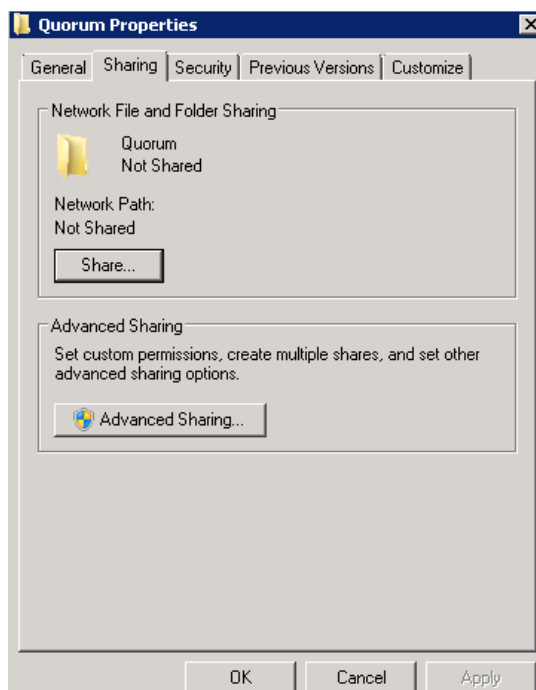
To configure the cluster quorum, you need to perform the following procedures:

- Create and secure a file share for the node and file share majority quorum
- Use the failover cluster management tool to configure a node and file share majority quorum

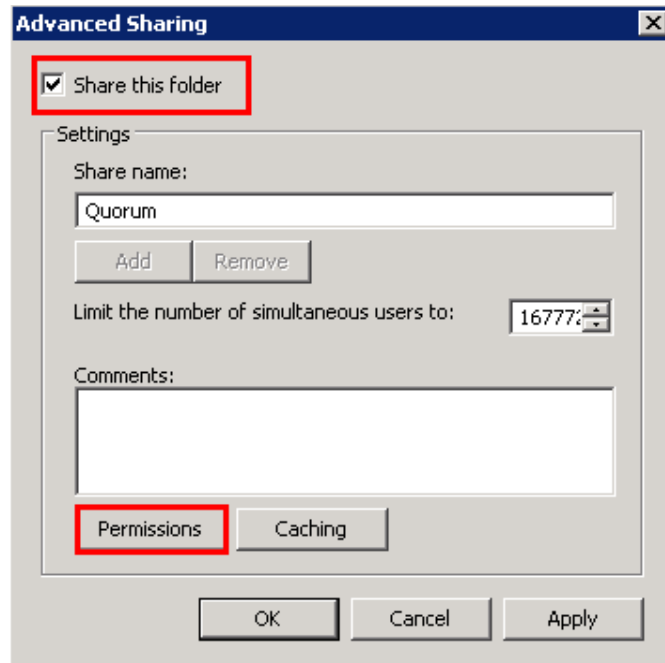
### To create and secure a file share for the node and file share majority quorum

- 1 Create a new folder on the system that will host the share directory.
- 2 Right-click the folder that you created and click **Properties**. The **Quorum Properties** window for the folder you created appears.

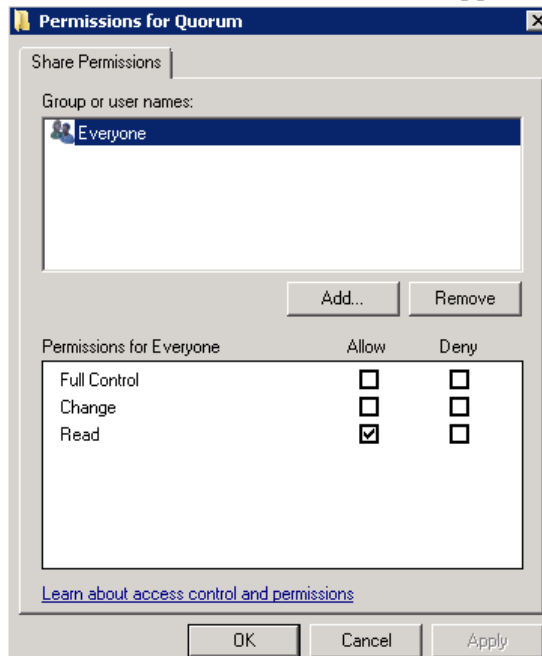
**Note:** In the following procedure, Quorum is the name of the folder.



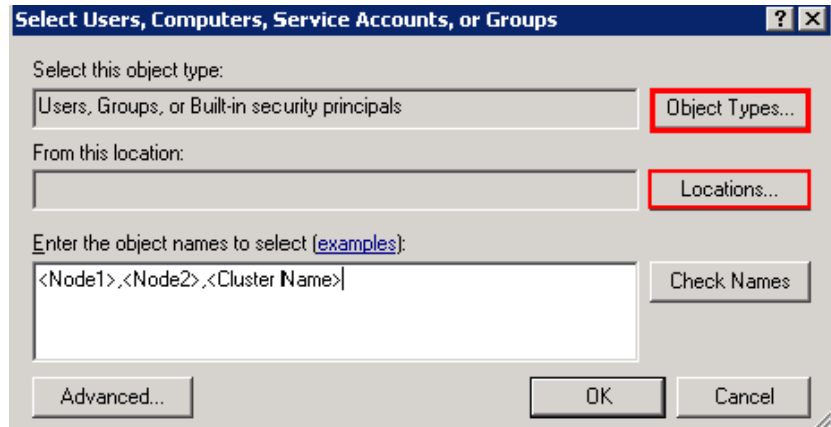
- 3 Click the **Sharing** tab, and then click **Advanced Sharing**. The **Advanced Sharing** window appears.



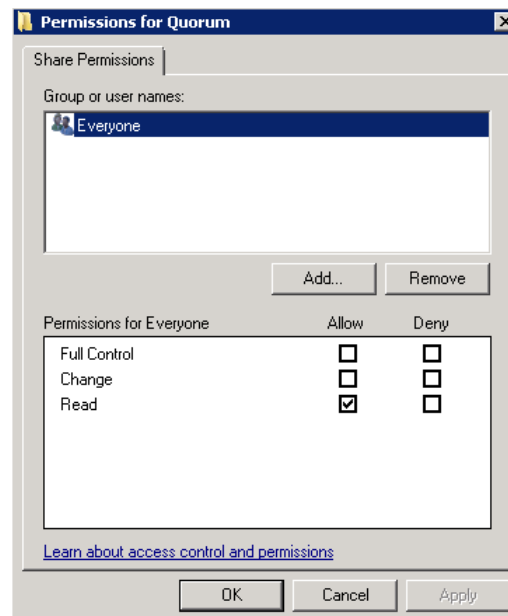
- 4 Select the **Share this folder** check box and click **Permissions**. The **Permissions for Quorum** window appears.



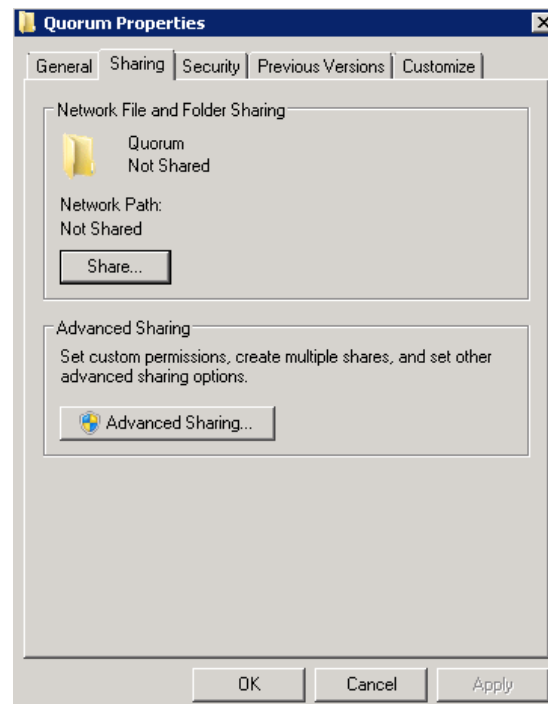
- 5 Click **Add**. The **Select Users, Computers, Service Accounts, or Groups** window appears.



- 6 In the **Enter the object name to select** box, enter the two node names used for the cluster in the medium node configuration and click **OK**. The node names are added and the **Permissions for Quorum** window appears.



- 7 Select the **Full Control**, **Change**, and **Read** check boxes and click **OK**. The **Properties** window appears.



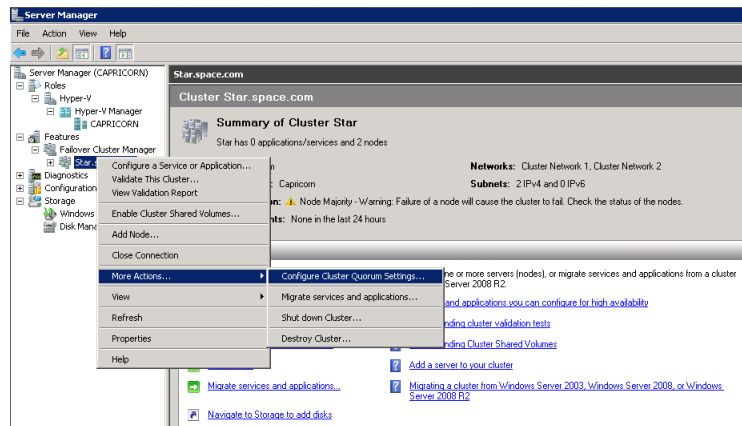
- 8 Click **Ok**. The folder is shared and can be used to create virtual machines.



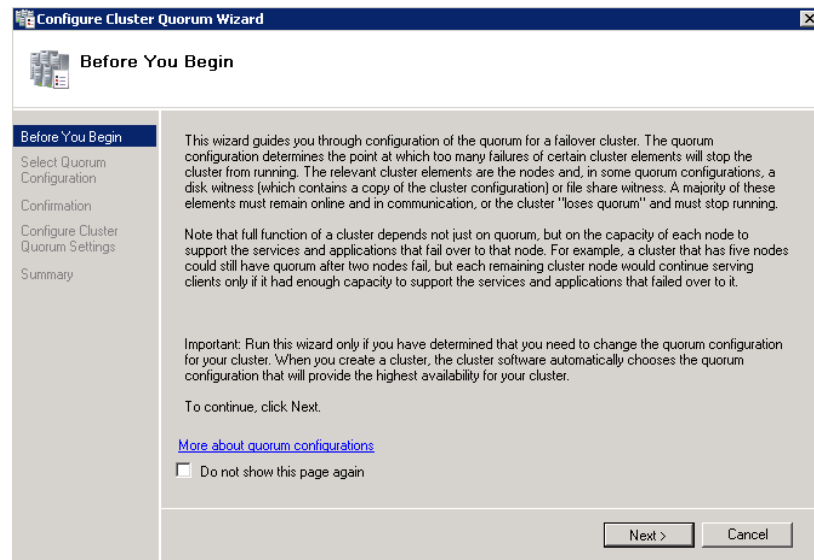
## To configure a node and file share majority quorum using the failover cluster management tool

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

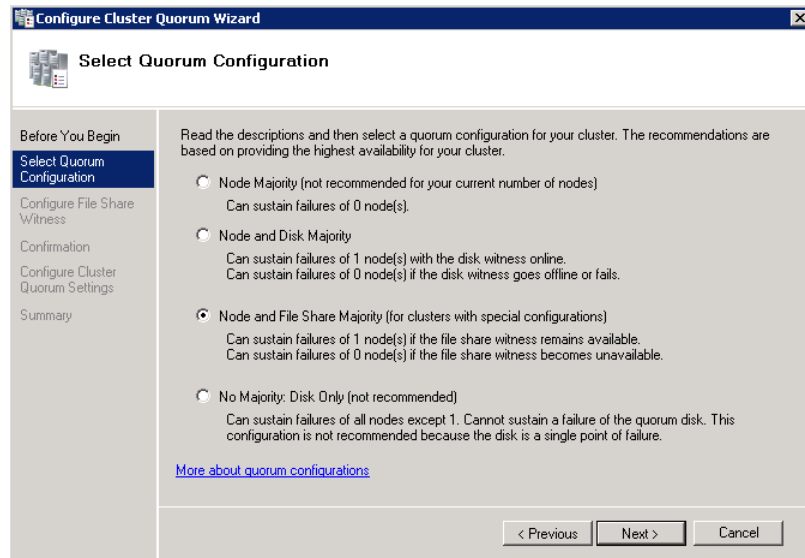


- 2 Right-click the name of the cluster you created and click **More Actions**. Click **Configure Cluster Quorum Settings**. The **Configure Cluster Quorum Wizard** window appears.



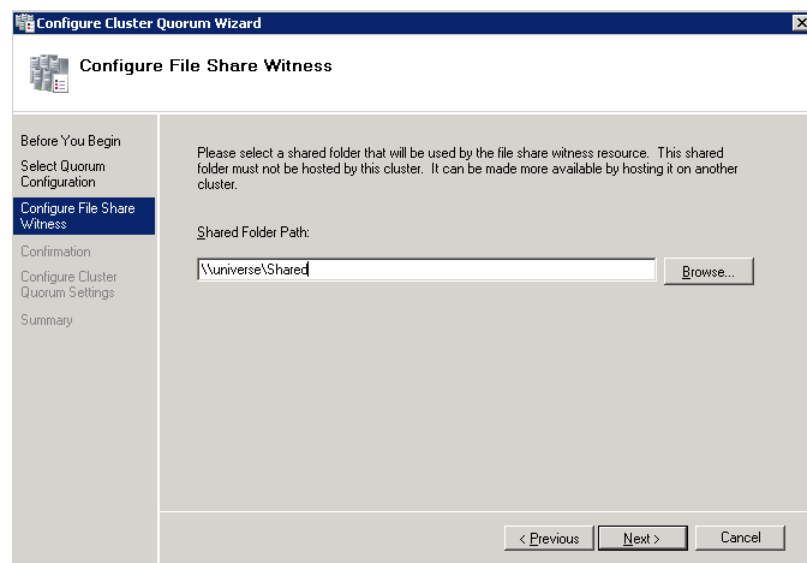
- 3 View the instructions on the wizard and click **Next**. The **Select Quorum Configuration** area appears.

**Note:** The **Before you Begin** screen appears the first time you run the wizard. You can hide this screen on subsequent uses of the wizard.



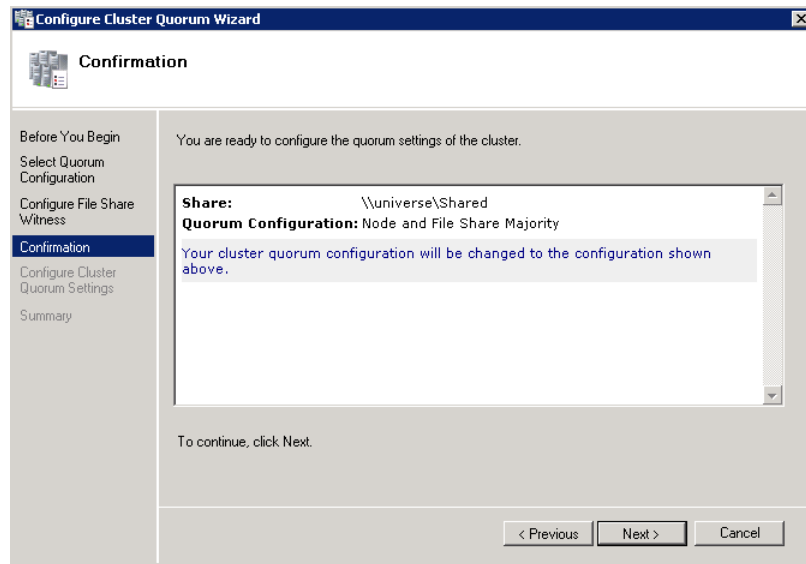
- 4 You need to select the relevant quorum node. For special configurations, click the **Node and File Share Majority** option and click **Next**. The **Configure File Share Witness** area appears.

**Note:** Click the **Node Majority** option if the cluster is configured for node majority or a single quorum resource. Click the **Node and Disk Majority** option if the number of nodes is even and not part of a multisite cluster. Click the **No Majority: Disk Only** option if the disk being used is only for the quorum.

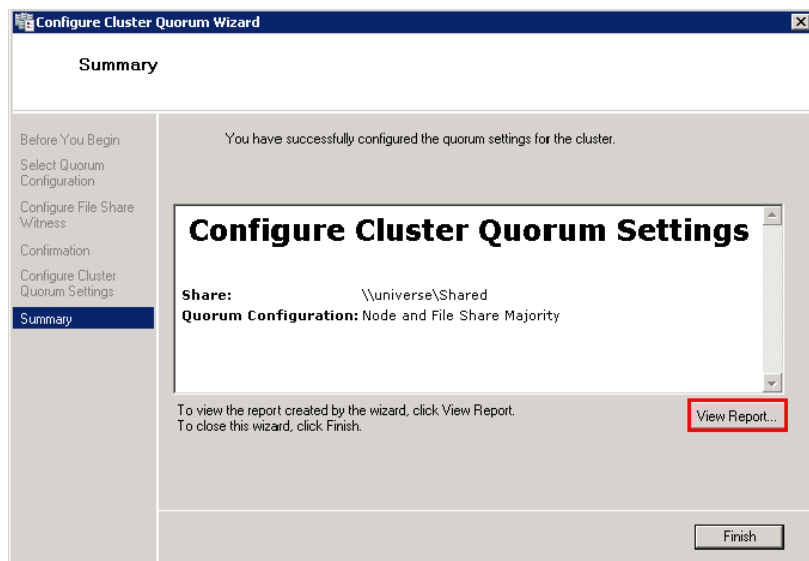


- In the **Shared Folder Path** box, enter the Universal Naming Convention (UNC) path to the file share that you created in the Configure Cluster Quorum Settings. Click **Next**. Permissions to the share are verified. If there are no problems with the access to the share, then **Confirmation** screen appears.

**Note:** You can either enter the share name or click **Browse** to select the relevant shared path.



- The details you selected are displayed. To confirm the details, click **Next**. The **Summary** screen appears and the configuration details of the quorum settings are displayed.



- 7** Click **View Report** to view a report of the tasks performed, or click **Finish** to close the window.

After you configure the cluster quorum, you must validate the cluster. For more information, refer to [http://technet.microsoft.com/en-us/library/bb676379\(EXCHG.80\).aspx](http://technet.microsoft.com/en-us/library/bb676379(EXCHG.80).aspx).

## Configuring Storage

For any virtualization environment, storage is one of the central barriers to implementing a good virtualization strategy. But with Hyper-V, VM storage is kept on a Windows file system. Users can put VMs on any file system that a Hyper-V server can access. As a result, you can build HA into the virtualization platform and storage for the virtual machines. This configuration can accommodate a host failure by making storage accessible to all Hyper-V hosts so that any host can run VMs from the same path on the shared folder. The back-end part of this storage can be a local, storage area network, iSCSI or whatever is available to fit the implementation.

The following table lists the minimum storage recommendations for each VM :

<b>System</b>	<b>Storage Capacity</b>
Historian Virtual Machine	200 GB
Application Server (GR node) Virtual Machine	100 GB
Application Engine 1(Runtime node) Virtual Machine	80 GB
Application Engine 2 (Runtime node) Virtual Machine	80 GB
InTouch Virtual Machine	80 GB
Information Server Virtual Machine	80 GB
Historian Client	80 GB

The total storage capacity should be minimum recommended 1 TB.

## Configuring Hyper-V

Microsoft® Hyper-V™ Server 2008 R2 helps in the creating of virtual environment that improves server utilization. It enhances patching, provisioning, management, support tools, processes, and skills. Microsoft Hyper-V Server 2008 R2 provides live migration, cluster shared volume support, expanded processor, and memory support for host systems.

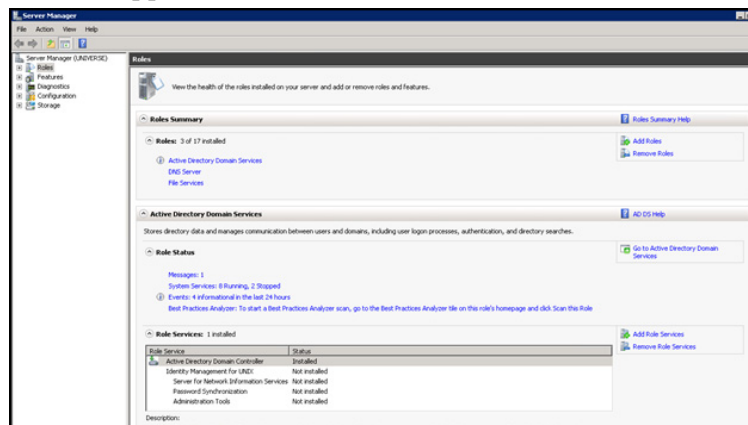
Hyper-V is available in x64-based versions of Windows Server 2008 R2 operating system, specifically the x64-based versions of Windows Server 2008 R2 Standard, Windows Server 2008 R2 Enterprise, and Windows Server 2008 Datacenter.

The following are the pre-requisites to set up Hyper-V:

- x64-based processor
- Hardware-assisted virtualization
- Hardware Data Execution Prevention (DEP)

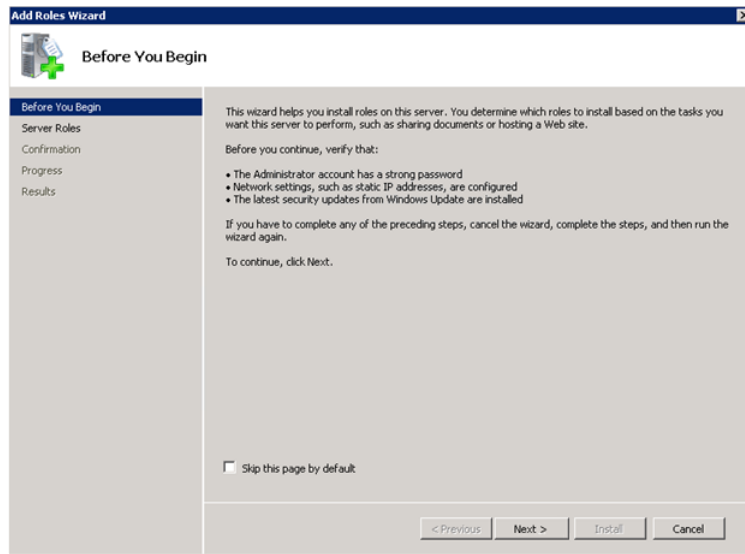
### To configure Hyper-V

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

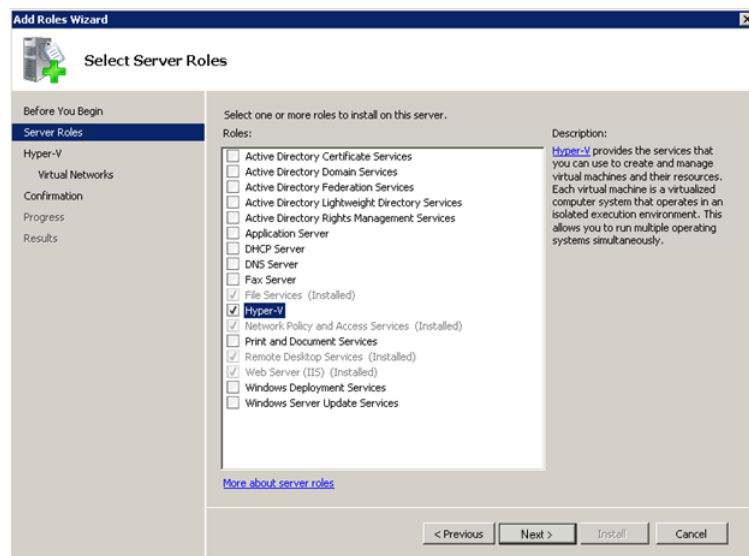


- 2 In the **Roles Summary** area, click **Add Roles**. The **Add Roles Wizard** window appears.

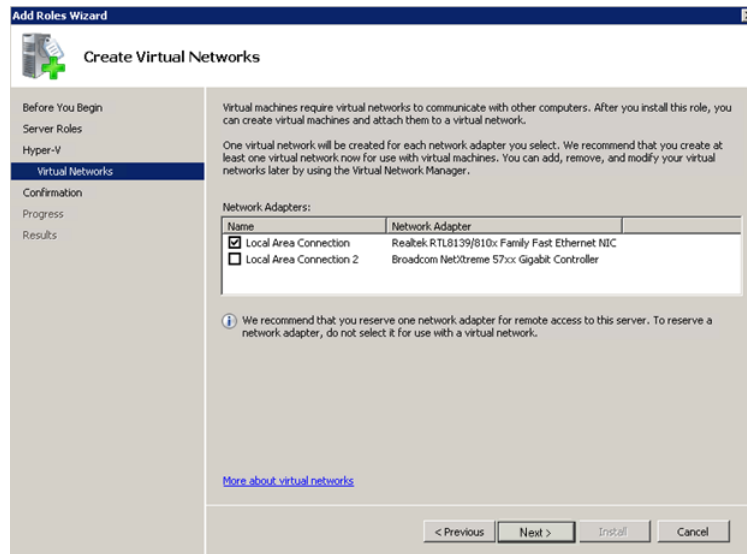
**Note:** You can also right-click **Roles** and then click **Add Roles Wizard** to open the **Add Roles Wizard** window.



- 3 View the instructions on the wizard, and then click **Next**. The **Select Server Roles** area appears.

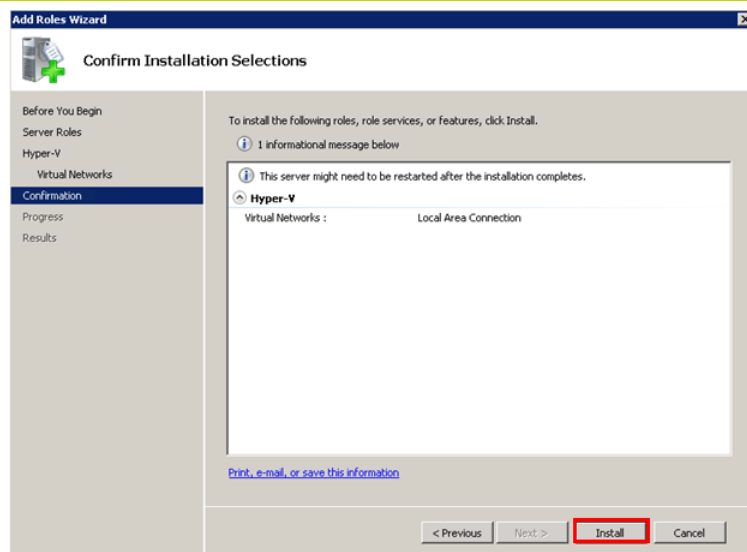


- 4 Select the **Hyper-V** check box and click **Next**. The **Create Virtual Networks** area appears.

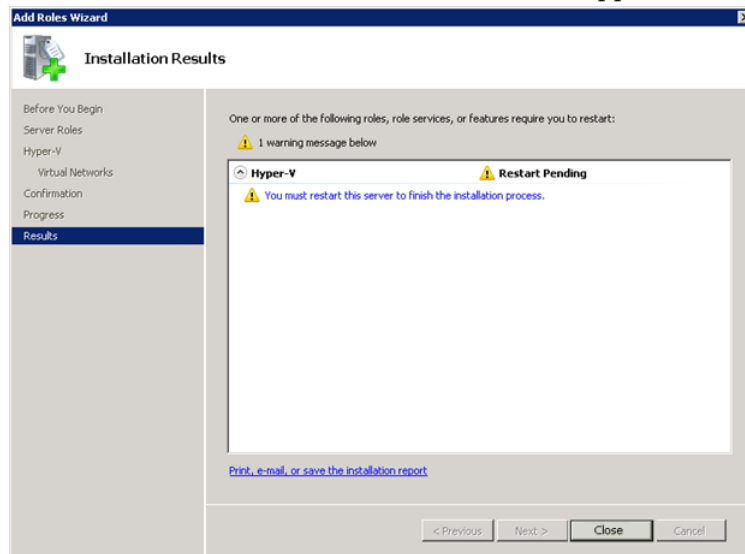


- 5 Select the check box next to the required network adapter to make the connection available to virtual machines. Click **Next**. The **Confirmation Installation Selections** area appears.

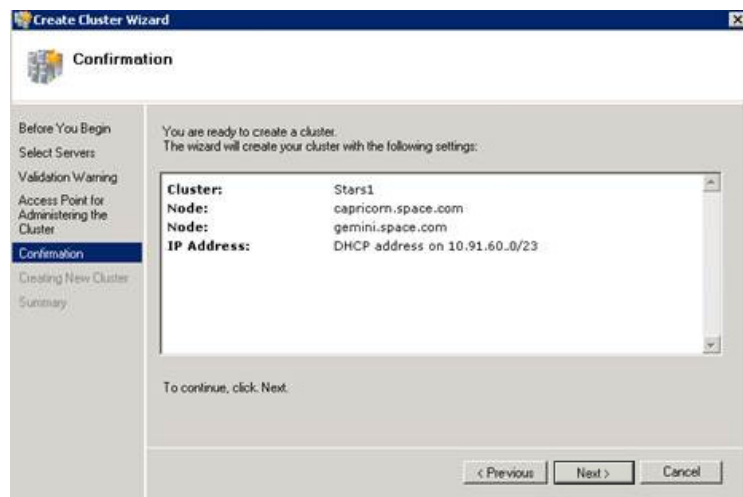
**Note:** You can select one or more network adapters.



- 6 Click **Install**. The **Installation Results** area appears.



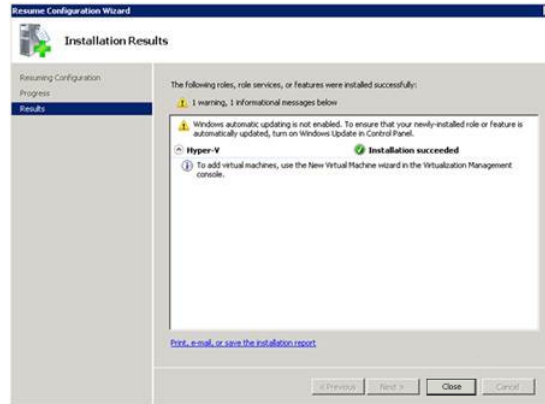
- 7 A message appears prompting you to restart the computer. Click **Close**. The **Add Roles Wizard** pop-up window appears.



- 8 Click **Yes** to restart the computer.



- 9 After you restart the computer, log on with the same ID and password you used to install the Hyper V role. The installation is completed and the **Resume Configuration Wizard** window appears with the installation results.



- 10 Click **Close** to close the **Resume Configuration Wizard** window.

## Configuring SIOS(SteelEye)DataKeeper Mirroring Jobs

SteelEye DataKeeper is replication software for real-time Windows data. It helps replicate all data types, including the following:

- Open files
- SQL and Exchange Server databases
- Running Hyper-V virtual machines

SteelEye DataKeeper's ability to replicate live Hyper-V virtual machines ensures that a duplicate copy is available in case the primary storage array fails. This helps in disaster recovery without impacting production.

SteelEye DataKeeper Cluster Edition is a host-based replication solution, which extends Microsoft Windows Server 2008 R2 Failover Clustering (WSFC) and Microsoft Cluster Server (MSCS) features, such as cross-subnet failover and tunable heartbeat parameters. These features make it possible to deploy geographically distributed clusters.

You can replicate a virtual machine across LAN, WAN, or any Windows server through SIOS Microsoft Management Console (MMC) interface. You can run the DataKeeper MMC snap-in from any server. The DataKeeper MMC snap-in interface is similar to the existing Microsoft Management tools.

**Note:** For information on installing the SteelEye DataKeeper, refer to *SteelEye DataKeeper for Windows Server 2003/2008 Planning and Install Guide* and *SteelEye DataKeeper for Windows Server 2003/2008 Administration Guide*. Ensure that the local security policies, firewall, and port settings are configured as per the details in these documents.

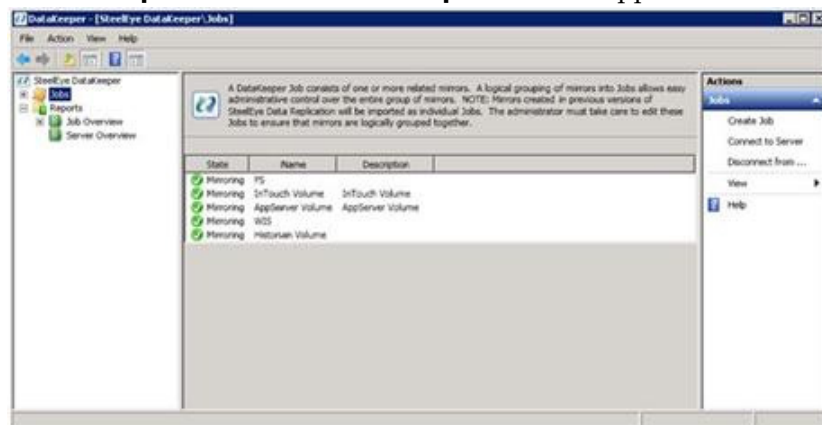
The following procedures help you set up a virtual machine in the Disaster Recovery environment.

## Creating a SteelEye DataKeeper Mirroring Job

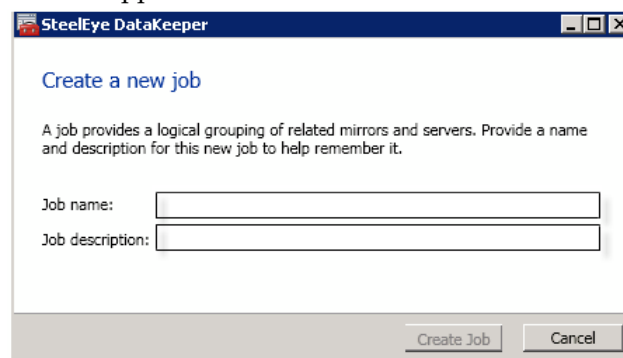
To set up a virtual machine in the disaster recovery environment, you need to first create a SteelEye mirroring job.

### To create a SteelEye DataKeeper mirroring job

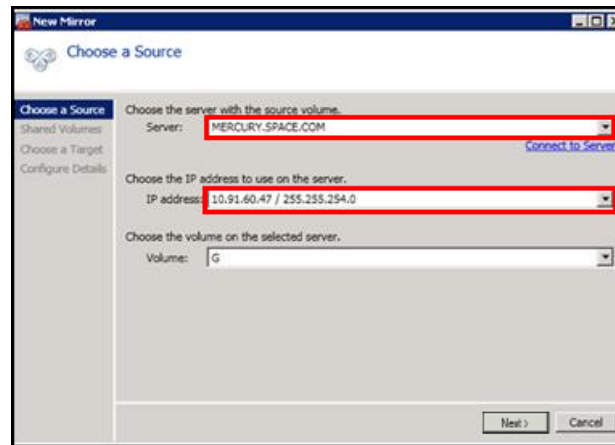
- 1 Click **Start**, and then from the **All Programs** menu, click **SteelEye DataKeeper MMC**. The **DataKeeper** window appears.



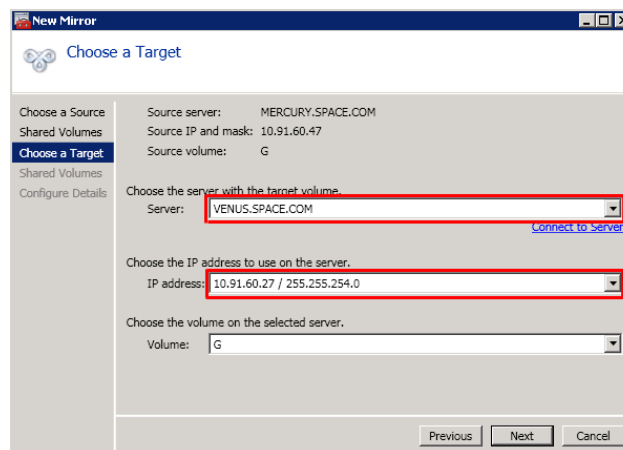
- 2 In the **Actions** pane, click **Create Job**. The **SteelEye DataKeeper** window appears.



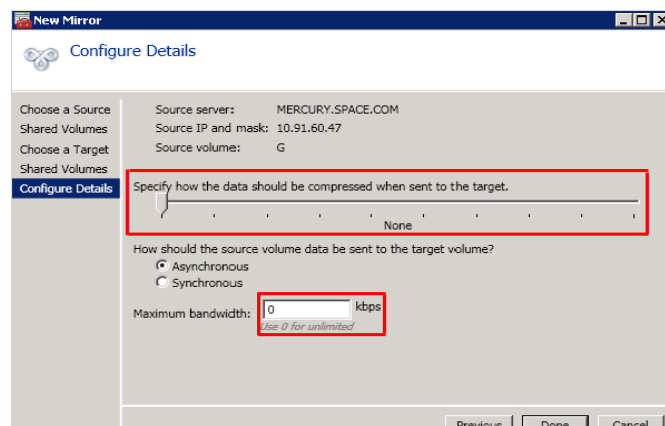
- 3 Type the relevant job name and description in the **Job name** and **Job description** boxes , and then click **Create Job**. The **New Mirror** window appears.



- 4 In the **Choose a Source** area, select the server name, IP address, and volume and click **Next**. The **Choose a Target** area appears.



- 5 Select the destination server name, IP address, and volume and click **Next**. The **Configure Details** area appears.



- 6 In the **Configure Details** area, do the following:
  - a Move the slider to select the level of data compression.
  - b Click the relevant option to indicate the mode in which you want to send the source volume data to the target volume.
  - c In the **Maximum bandwidth** box, type the network bandwidth to be used for data replication.

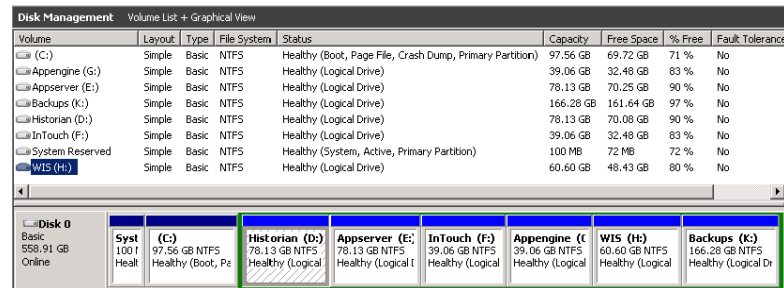
**Note:** Enter "0" to indicate that the bandwidth is unlimited.

- d Click **Done**. The SteelEye mirroring job is created.

## Disk Management Topologies

After you have completed setting up SteelEye Mirroring Jobs and created the datakeeper, you can view the following topologies:

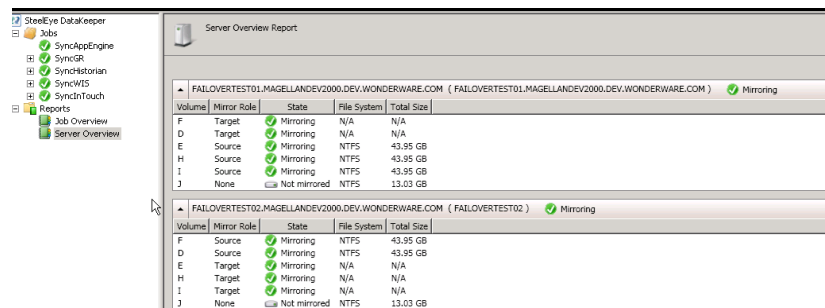
Open Disk Management to view all the disks which are replicated, by running the diskmgmt.msc from Run Command Prompt.



Volume	Layout	Type	File System	Status	Capacity	Free Space	% Free	Fault Tolerance
(C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)	97.56 GB	69.72 GB	71 %	No
Appengine (G:)	Simple	Basic	NTFS	Healthy (Logical Drive)	39.06 GB	32.48 GB	83 %	No
Appserver (E:)	Simple	Basic	NTFS	Healthy (Logical Drive)	78.13 GB	70.25 GB	90 %	No
Backups (K:)	Simple	Basic	NTFS	Healthy (Logical Drive)	166.28 GB	161.64 GB	97 %	No
Historian (D:)	Simple	Basic	NTFS	Healthy (Logical Drive)	78.13 GB	70.08 GB	90 %	No
InTouch (F:)	Simple	Basic	NTFS	Healthy (Logical Drive)	39.06 GB	32.48 GB	83 %	No
System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)	100 MB	72 MB	72 %	No
WIS (H:)	Simple	Basic	NTFS	Healthy (Logical Drive)	60.60 GB	48.43 GB	80 %	No

After creating all the Mirroring Jobs, open the **SteelEye DataKeeper UI** from the **All Programs** menu, click **SteelEye DataKeeper MMC**. The **DataKeeper** window appears.

You can navigate to **Server Overview** under **Reports** to view all the servers involved in job replication in one place.



Volume	Mirror Role	State	File System	Total Size
FAILOVERTEST01.MAGELLANDEV2000.DEV.WONDERWARE.COM ( FAILOVERTEST01.MAGELLANDEV2000.DEV.WONDERWARE.COM ) Mirroring				
F	Target	Mirroring	N/A	N/A
D	Target	Mirroring	N/A	N/A
E	Source	Mirroring	NTFS	43.95 GB
H	Source	Mirroring	NTFS	43.95 GB
I	Source	Mirroring	NTFS	43.95 GB
J	None	Not mirrored	NTFS	13.03 GB
FAILOVERTEST02.MAGELLANDEV2000.DEV.WONDERWARE.COM ( FAILOVERTEST02 ) Mirroring				
F	Source	Mirroring	NTFS	43.95 GB
D	Source	Mirroring	NTFS	43.95 GB
E	Target	Mirroring	N/A	N/A
H	Target	Mirroring	N/A	N/A
I	Target	Mirroring	N/A	N/A
J	None	Not mirrored	NTFS	13.03 GB

## Configuring a Virtual Machine

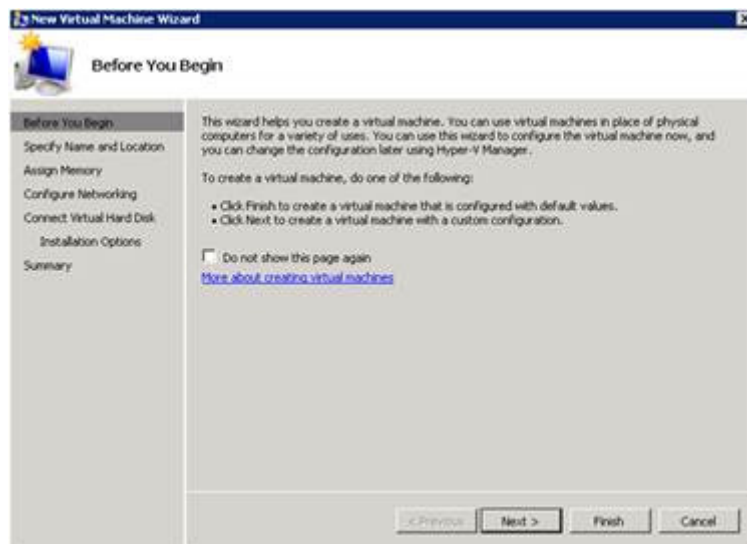
After creating a DataKeeper mirroring job, you need to create a virtual machine on disk.

### To configure a virtual machine

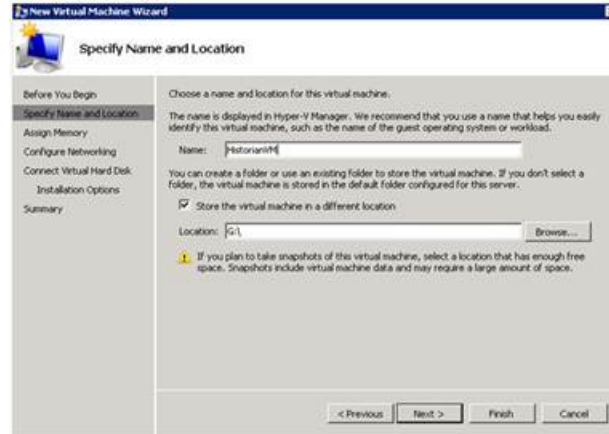
- 1 In the **Server Manager** window, right-click **Features** , and then click **Failover Cluster Manager**. The **Failover Cluster Manager** tree expands.



- 2 Right-click **Services and applications**, then click **Virtual Machines**, and then **New Virtual Machine**. The **New Virtual Machine Wizard** window appears.



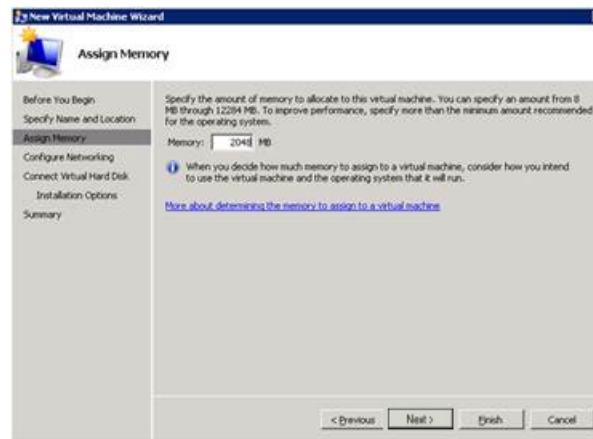
- 3 View the instructions in the **Before You Begin** area and click **Next**. The **Specify Name and Location** area appears.



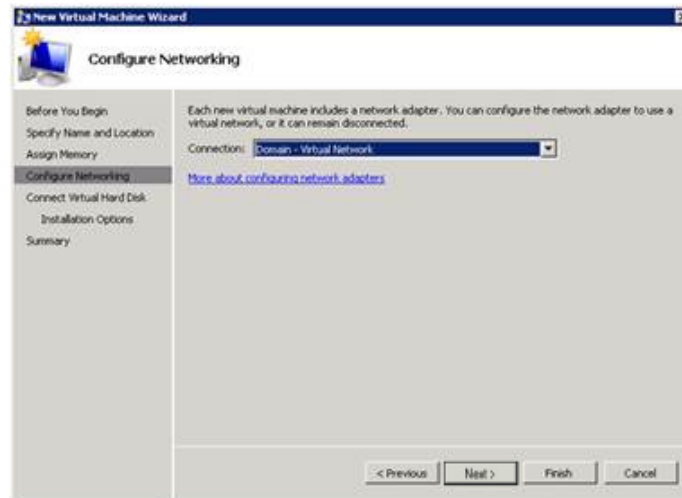
- 4 In the **Specify Name and Location** area, do the following:
- In the **Name** box, type a name for the virtual machine.
  - Select the **Store the virtual machine in a different location** check box to be able to indicate the location of the virtual machine.
  - In the **Location** box, enter the location where you want to store the virtual machine.

**Note:** You can either type the location or click **Browse** to select the location where you want to store the virtual machine.

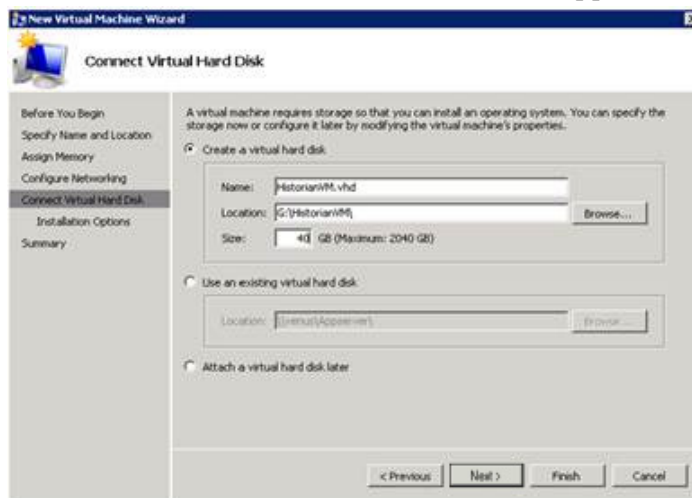
- d Click **Next**. The **Assign Memory** area appears.



- 5 Type the recommended amount of memory in the **Memory** box and click **Next**. The **Configure Networking** area appears.



- 6 Select the network to be used for the virtual machine and click **Next**. The **Connect Virtual Hard Disk** area appears.

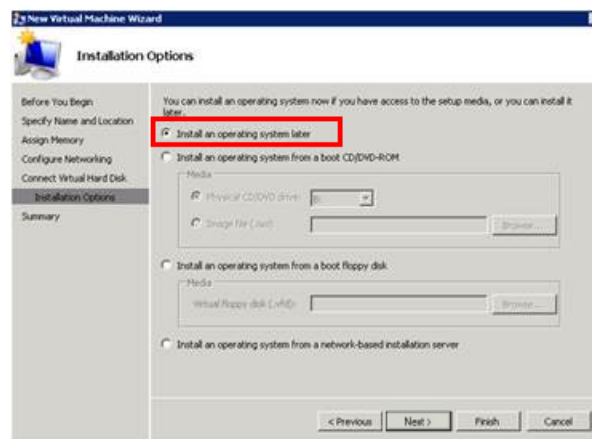


- 7 Click the **Create a virtual hard disk** option and then do the following:
  - a In the **Name** box, type the name of the virtual machine.
  - b In the **Location** box, enter the location of the virtual machine.

**Note:** You can either type the location or click **Browse** to select the location of the virtual machine.

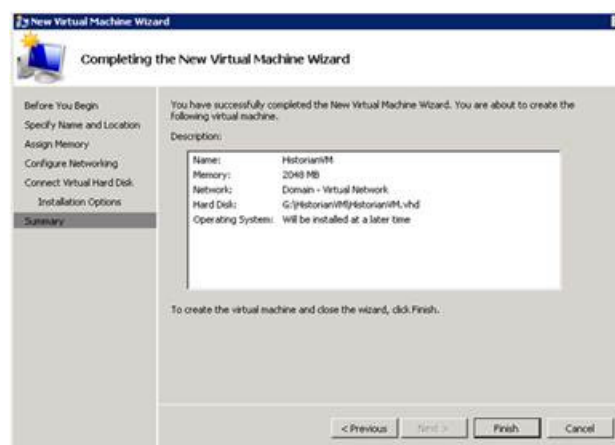
- c In the **Size** box, type the size of the virtual machine and then click **Next**. The **Installation Options** area appears.

**Note:** You need to click either the **Use an existing virtual hard disk** or the **Attach a virtual hard disk later** option, only if you are using an existing virtual hard disk or you want to attach a virtual disk later.



- 8 Click **Install an operating system later** option and click **Next**. **Completing the New Virtual Machine Window** area appears.

**Note:** If you want to install an operating system from a boot CD/DVD-ROM or a boot floppy disk or a network-based installation server, click the relevant option.





- 9 Click **Finish**. The virtual machine is created with the details you provided. As we have started this process from the Failover Cluster Manager, after completing the process of creating a virtual machine, the **High Availability Wizard** window appears.



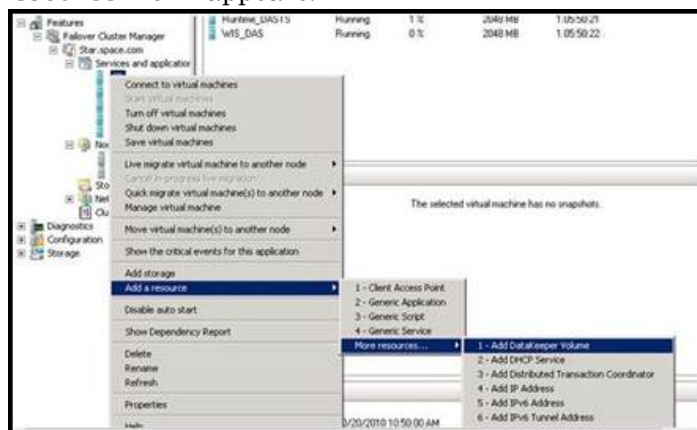
- 10 Click **View Report** to view the report or click **Finish** to close the **High Availability Wizard** window.

## Adding the Dependency between the Virtual Machine and the Disk in the Cluster

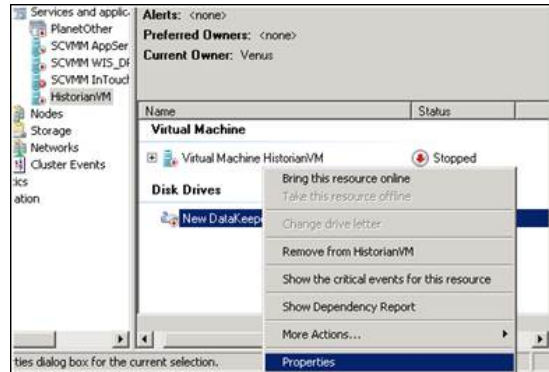
After creating the virtual machine, you need to add the dependency between the virtual machine and the datakeeper volume in the cluster. This dependency triggers the switching of the the source and target Servers of the SteelEye DataKeeper Volume resource when failover of the virtual machines occurs in the Failover Cluster Manager.

### To add the dependency between the virtual machine and the disk in the cluster

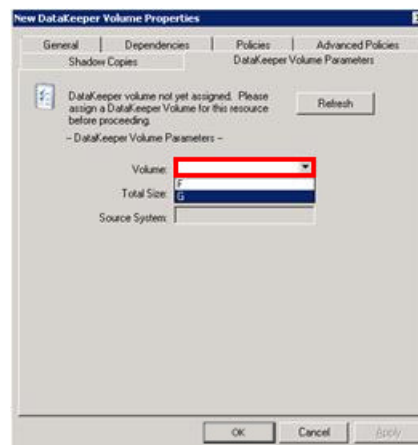
- 1 On the **Server Manager** window, right-click the virtual machine, that you have created and then point to **Add a resource, More Resources** and then click **Add DataKeeper Volumes**. The **Add a resource** menu appears.



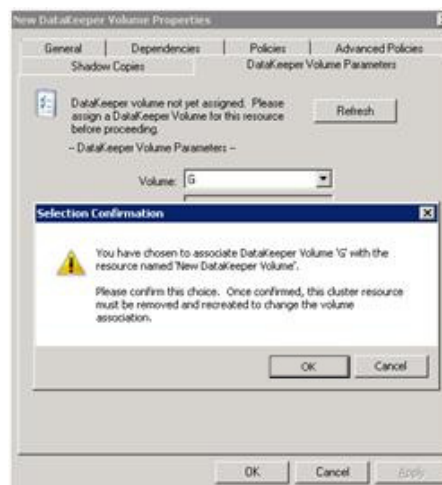
**2** The **New DataKeeper Volume** is added under **Disk Drives**.



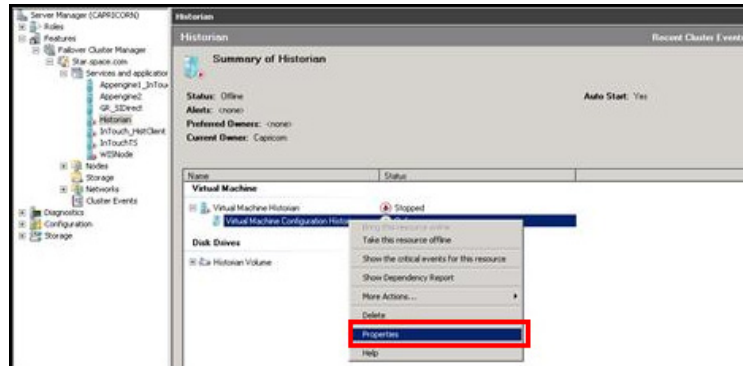
**3** Right-click **New DataKeeper Volume** and then click **Properties**. The **New DataKeeper Volume Properties** window appears.



**4** Select the volume for creating a SteelEye mirroring job and click **OK**. The **Selection Confirmation** window appears.

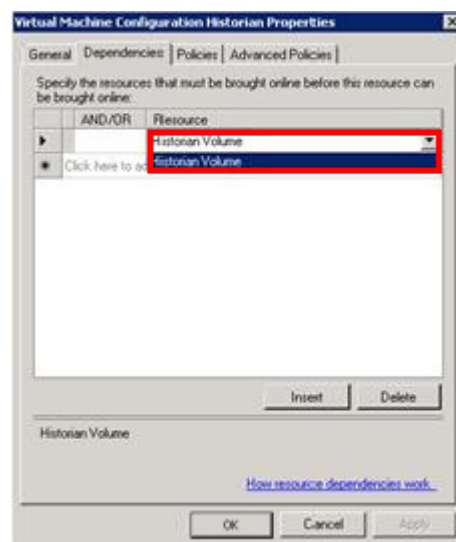


- 5 Click **OK** to validate the details that you have entered. The **Server Manager** window appears.

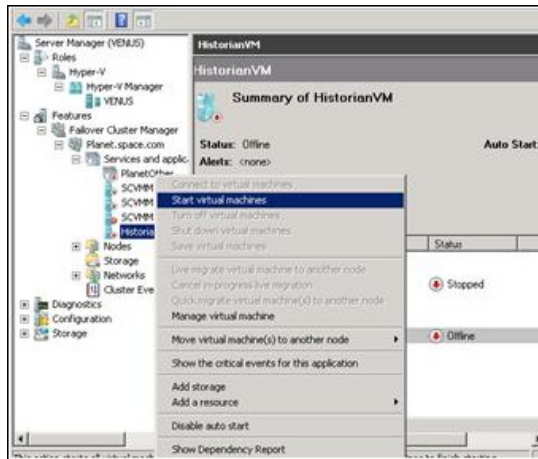


**Note:** To modify the selection, click **Cancel** and modify the detail as required in the **New DataKeeper Volume Properties** window, and click **Apply**.

- 6 Under **Virtual Machine**, right-click the name of the virtual machine that you created. Click **Virtual Machine Configuration** and click **Properties**. The **Virtual Machine Configuration Historian Properties** window appears.



- 7 Click the **Dependencies** tab. From **Resource** list, select the name of the DataKeeper Volume resource that you created and click **OK**.



- 8 On the **Server Manager** window, right-click the name of the virtual machine that you created, and then click **Start virtual machines** to start the virtual machine.

## Configuring System Platform Products in a Typical Medium Scale Virtualization

The expected Recovery Time Objective (RTO) and Recovery Point Objective (RPO), trends and various observations in a medium scale virtualization environment are recorded by performing tests with System Platform Product configuration.

The virtualization host server used for medium scale configuration consists of seven virtual machines listed below.

- Node 1 (GR): GR , InTouch and DAS SI Direct – Windows 2008 R2 Standard edition (64bit) OS with SQL Server 2008 SP1 32 bit
- Node 2 (AppEngine1): Bootstrap , IDE and InTouch (Managed App) – Windows 2008 R2 Standard edition (64bit) OS
- Node 3 (AppEngine2): Bootstrap , IDE – Windows 2008 R2 Standard edition (64bit) OS

- Node 4: Historian – Windows 2008 R2 Standard edition (64bit) OS with SQL Server 2008 SP1 32 bit
- Node 5: Information Server , Bootstrap and IDE – Windows Server 2008 SP2 (32bit) with SQL Server 2008 SP1 and Office 2007
- Node 6: InTouch Terminal Service – Windows 2008 R2 Standard edition (64bit) OS enabled with Terminal Service
- Node 7: Historian Client and InTouch – Windows 7 Professional Edition (64bit) OS with SQL Server 2008 SP1 32 bit

The following table displays the approximate data of virtual nodes, IO tags and historized tags in a medium scale virtualization environment:

<b>Virtual Node</b>	<b>IO tags (Approx.)</b>	<b>Historized tags(Approx.)</b>
AppEngine1	25000	10000
AppEngine2	25000	10000

### Tags getting historized and their update rates for this configuration

The following table shows tags getting historized and their update rates for this configuration:

<b>Real Time data from DAS SI Direct</b>			
<b>Topic Name</b>	<b>Update Rate</b>	<b>Device Items</b>	<b>Active Items</b>
Topic 13	1000	1241	374
Topic 0	500	14	5
Topic 1	1000	1	1
Topic 2	10000	5002	2126
Topic 3	30000	5002	2126
Topic 4	60000	5002	2126
Topic 5	3600000	5001	2125
Topic 7	600000	5001	2589
Topic 8	10000	3841	1545
Topic 9	30000	1281	885
Topic 6	18000000	2504	1002
Topic 39	1000	4	4
Topic 16	180000	1000	350

---

### Late tags and buffered tags from DAS test Server

---

Topic Name	Update Rate	Device Items	Active Items
Late Data (1 hour)	1000	465	208
Buffered Data	1000	198	119

---

### Application Server Configuration Details

Total No of Engines: 15

#### Number of objects under each Engine

- Engine 1 : 9
- Engine 2 : 2
- Engine 3 : 492
- Engine 4 : 312
- Engine 5 : 507
- Engine 6 : 2
- Engine 7 : 24
- Engine 8 : 24
- Engine 9 : 250
- Engine 10: 508
- Engine 11: 506
- Engine 12: 4
- Engine 13: 22
- Engine 14: 1
- Engine 15: 1

Number of DI objects: 6

## Expected Recovery Time Objective and Recovery Point Objective

This section provides the indicative Recovery Time Objectives (RTO) and Recovery Point Objectives (RPO) for the load of IO and Attributes historized shown above and with the configuration of Host Virtualization Servers and Hyper-V virtual machines explained in the Setup instructions of Medium Scale Virtualization. For more information refer to "Setting Up Medium Scale Virtualization Environment" on page 334. In addition to these factors, the exact RTO and RPO depend on factors like storage I/O performance, CPU utilization, memory usage, and network usage at the time of failover/migration activity.

### RTO and RPO Observations - DR Medium Configuration

Scenario	Observation
Scenario 1: IT provides maintenance on Virtualization Server	"Live Migration" on page 377
	"Quick Migration of all nodes simultaneously" on page 380
	"Shut down of host server" on page 382
Scenario 2: Virtualization Server hardware fails	"Scenario 2: Virtualization Server hardware fails" on page 383
Scenario 3: Network fails on Virtualization Server	"Scenario 3: Network fails on Virtualization Server" on page 385
Scenario 4: Virtualization Server becomes unresponsive	"Scenario 4: Virtualization Server becomes unresponsive" on page 388

The following tables display RTO and RPO Observations with approximately 50000 IO points with approximately 20000 attributes being historized:



## Scenario 1: IT provides maintenance on Virtualization Server

### Live Migration

Product	RTO	RPO	
		Tags	Data Loss Duration
InTouch	9 sec	Data Loss for \$Second tag (Imported to Historian)	1 min 52 sec
GR	8 sec	IAS tag (Script)	13 sec
		IAS IO tag (DASSiDirect)	1 min 35 sec

Product	RTO	RPO	
		Tags	Data Loss Duration
AppEngine1	7 sec	IAS tag (Script)	15 sec
		IAS IO Tag (DASSiDirect)	1 min 13 sec
AppEngine2	13 sec	IAS tag (Script)	15 sec
		IAS IO tag (DASSiDirect)	1 min 14 sec

Historian	27 sec	SysTimeSec (Historian)	17 sec
		\$Second (InTouch)	26 sec
		IAS tag (Script)	0 (data is SFed)
		IAS IO tag (DASSiDirect)	0 (data is SFed)
DAS SIDirect	13 sec	N/A	N/A
Historian Client	12 sec	N/A	N/A
Information Server	9 sec	N/A	N/A

Product	RTO	RPO	
		Tags	Data Loss Duration
InTouch	1 min 18 sec	Data Loss for \$Second tag (Imported to Historian)	1min 23 sec
GR	1 min 55 sec	IAS tag (Script)	2 min 43 sec
		IAS IO tag (DASSiDirect)	2 min 55 sec
AppEngine1	3 min 25 sec	IAS Tag (Script)	3 min 40 sec
		IAS IO Tag (DASSiDirect)	3min 49 sec
AppEngine2	2 min 20 sec	IAS Tag (Script)	2 min 48 sec
		IAS IO tag (DASSiDirect)	2 min 54 sec
Historian	6 min 27 sec	SysTimeSec (Historian)	5 min 57 sec
		\$Second (InTouch)	6 min 19 sec
		IAS tag (Script)	0 (data is SFed)
		IAS IO tag (DASSiDirect)	0 (data is SFed)
DAS SIDirect	2min 1 sec	N/A	N/A

**Quick Migration of all nodes simultaneously**

Quick Migration of all nodes occurs simultaneously to migrate all nodes.

Product	RTO	RPO	
		Tags	Data Loss Duration
InTouch	3 min 29 sec	Data Loss for \$Second tag (Imported to Historian)	12 min 8 sec
GR	6 min 11 sec	IAS tag (Script)	6 Min 35 sec
		IAS IO tag (DASSiDirect)	7 Min 26 sec
AppEngine1	8 min 12 sec	IAS tag (Script)	8 Min 6 sec
		IAS IO Tag (DASSiDirect)	8 Min 28 sec
AppEngine2	6min 6 sec	IAS tag (Script)	6 min 58 sec
		IAS IO tag (DASSiDirect)	7 min 34 sec

Product	RTO	RPO	
		Tags	Data Loss Duration
Historian	11 min 59 sec	SysTimeSec (Historian)	12 min 2 sec
		\$Second (InTouch)	12 min 8 sec
		IAS tag (Script)	6 min 35 sec
		IAS IO tag (DASSiDirect)	7 min 26 sec
DAS SIDirect	6 min 48 sec	N/A	N/A
Historian Client	9 min 4 sec	N/A	N/A
Information Server	4 min 59 sec	N/A	N/A

**Shut down of host server**

<b>Product</b>	<b>RTO</b>	<b>RPO</b>	
		<b>Tags</b>	<b>Data Loss Duration</b>
InTouch	12 min 32 sec	Data Loss for \$Second tag (Imported to Historian)	14 min
GR	11 min 41 sec	IAS tag (Script)	12 Min 58 sec
		IAS IO tag (DASSiDirect)	13 Min 11 sec
AppEngine1	11 min 38 sec	IAS tag (Script)	12 Min 6 sec
		IAS IO Tag (DASSiDirect)	13 Min 49 sec
AppEngine2	11 min 57 sec	IAS tag (Script)	12 Min 58 sec
		IAS IO tag (DASSiDirect)	13 Min 54 sec
Historian	12 Min 55 sec	SysTimeSec (Historian)	13 Min
		\$Second (InTouch)	14 Min
		IAS tag (Script)	12 Min 58 sec
		IAS IO tag (DASSiDirect)	13 Min 11 sec

Product	RTO	RPO	
		Tags	Data Loss Duration
DAS SIDirect	6 Min 48 sec	N/A	N/A
Historian Client	9 Min 4 sec	N/A	N/A
Information Server	4 Min 59 sec	N/A	N/A

### Scenario 2: Virtualization Server hardware fails

The failover occurs due to hardware failure, and it is simulated with power-off on the host server.

Product	RTO	RPO	
		Tags	Data Loss Duration
InTouch	11 Min 43 sec + time taken by the user to start the InTouchView	Data Loss for \$Second tag (Imported to Historian)	12 Min 27  <b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.
GR	10 Min 51 sec	IAS tag (Script)	11 Min 16
		IAS IO tag (DASSiDirect)	11 Min 02
AppEngine1	10 min 29 sec	IAS tag (Script)	10 Min 40
		IAS IO Tag (DASSiDirect)	11 Min 16

Product	RTO	RPO	
		Tags	Data Loss Duration
AppEngine2	10 min 59 sec	IAS tag (Script)	9 Min 26
		IAS IO tag (DASSiDirect)	11 Min 08
Historian	14 Min 49 sec	SysTimeSec (Historian)	12 Min 21
		\$Second (InTouch)	12 Min 27
		<p><b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node which historizes this tag.</p>	
		IAS tag (Script)	11 Min 16
		IAS IO tag (DASSiDirect)	11 Min 02
DAS SIDirect	11 Min 20 sec	N/A	N/A



Products	RTO	Tags	RPO Data Loss Duration
Historian Client	7 Min 16 sec + time taken by the user to start the Historian Client	N/A	N/A
Information Server	9 Min 39 sec + time taken by the user to start the Information Server	N/A	N/A

### Scenario 3: Network fails on Virtualization Server

There is a failover due to network disconnect (Public). In this case, the VMs restart, after moving to the other host server.

Products	RTO	Tags	RPO Data Loss Duration
InTouch	8 min 55 sec + time taken by the user to start the InTouchView	Data Loss for \$Second tag (Imported to Historian)	14 min
		<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
GR	11 min 32 sec	IAS Tag (Script)	12 min 01
		IAS IO Tag (DASSiDirect)	12 min

Products	RTO	RPO	
		Tags	Data Loss Duration
AppEngine1	10 min 52 sec	IAS Tag (Script)	11 min 26
		IAS IO Tag (DASSiDirect)	11 min 58
AppEngine2	10 min 28 sec	IAS Tag (Script)	10 min 19
		IAS IO Tag (DASSiDirect)	12 min 04
Historian	13 min 20 sec	SysTimeSec (Historian)	13 min 52
		\$Second (InTouch)	14 min
		<p><b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.</p>	
		IAS Tag (Script)	12 min 01
		IAS IO Tag (DASSiDirect)	12 min
DAS SIDirect	9 min 9 sec	N/A	N/A

<b>Products</b>	<b>RTO</b>	<b>RPO</b>	
		<b>Tags</b>	<b>Data Loss Duration</b>
Historian Client	8 min + time taken by the user to start the Historian Client	N/A	N/A
Information Server	8 min 25 sec + time taken by the user to start the Information Server	N/A	N/A

**Scenario 4: Virtualization Server becomes unresponsive**

There is no failover of VMs to the other host server when the CPU utilization on the host server is 100%.

<b>Primary Node</b>	<b>Products</b>	<b>RTO(sec)</b>	<b>RPO</b>
<b>InTouch</b>	N/A	N/A	N/A
<b>GR</b>	N/A	N/A	N/A
	N/A	N/A	N/A
<b>AppEngine1</b>	N/A	N/A	N/A
	N/A	N/A	N/A
<b>AppEngine2</b>	N/A	N/A	N/A
	N/A	N/A	N/A
<b>Historian</b>	N/A	N/A	N/A
	N/A	N/A	N/A
	N/A	N/A	N/A
	N/A	N/A	N/A
<b>DAS SIDirect</b>	N/A	N/A	N/A
<b>Historian Client</b>	N/A	N/A	N/A
<b>Information Server</b>	N/A	N/A	N/A

## Snapshots of Data Trends and Observations

Scenarios and observations in this section:

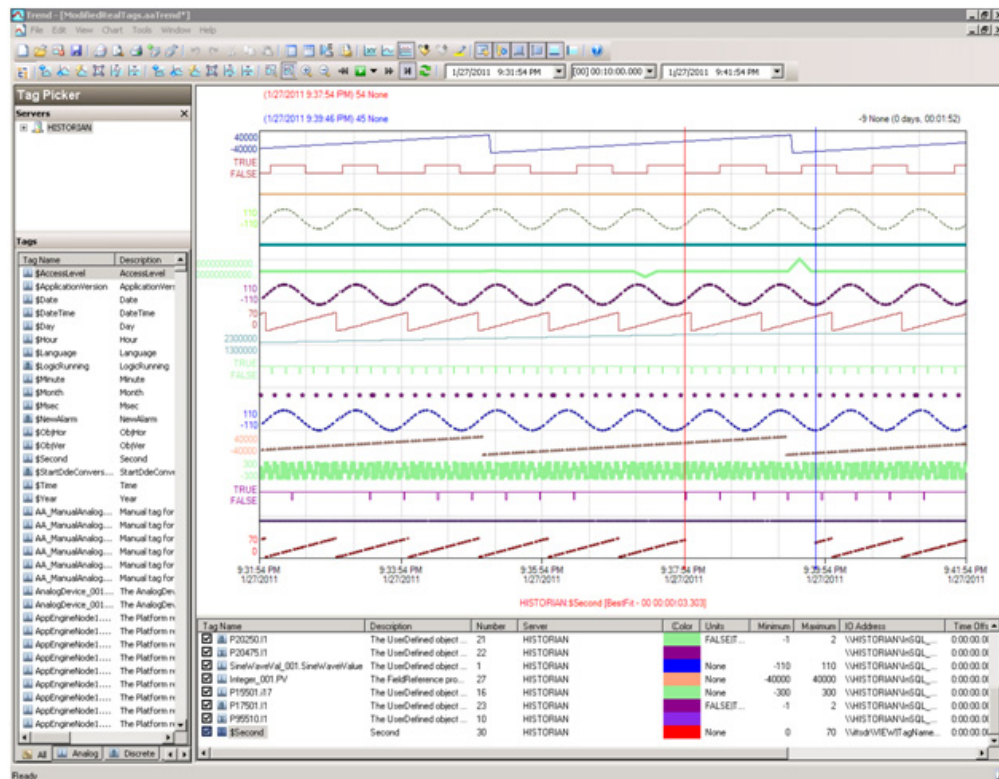
Scenario	Observation
Scenario 1: IT provides maintenance on Virtualization Server	<p>"Live Migration of InTouch" on page 390</p> <p>"Live Migration of GR" on page 391</p> <p>"Live Migration of AppEngine1" on page 394</p> <p>"Live Migration of AppEngine2" on page 397</p> <p>"Live Migration of Historian" on page 399</p> <p>"Quick Migration of InTouch" on page 403</p> <p>"Quick Migration of GR" on page 404</p> <p>"Quick Migration of AppEngine1" on page 408</p> <p>"Quick Migration of AppEngine2" on page 412</p> <p>"Quick Migration of Historian" on page 416</p> <p>"Shut down of Source Host Virtualization Server" on page 419</p>
Scenario 2: Virtualization Server hardware fails	"Failover Due to Hardware failure" on page 428
Scenario 3: Network fails on Virtualization Server	"Failover Due to Network Disconnect (Public)" on page 434
Scenario 4: Virtualization Server becomes unresponsive	"Hyper-V Virtual Machines with Static RAM and Reservations for Processors" on page 440

## Scenario 1: IT provides Maintenance on Virtualization Server

### Live Migration of InTouch

#### Trends:

In the following Historian Trend, the last tag `$Second` receives data from InTouch and is historized. This is also captured in the RPO table for Live Migration of InTouch.



```
select DateTime, tagName, vValue, Quality
, QualityDetail, wwParameters from
historian.runtime.dbo.History where TagName = '$second' and
DateTime > '2011-01-27 21:37:53.000'
```

```
2011-01-27 21:37:53.3850000$Second5301921
2011-01-27 21:37:54.3670000$Second5401921
2011-01-27 21:37:54.6180000$SecondNULL1241
2011-01-27 21:39:46.1460000$Second4502521
2011-01-27 21:39:46.3590000$Second4601921
```

#### Observations

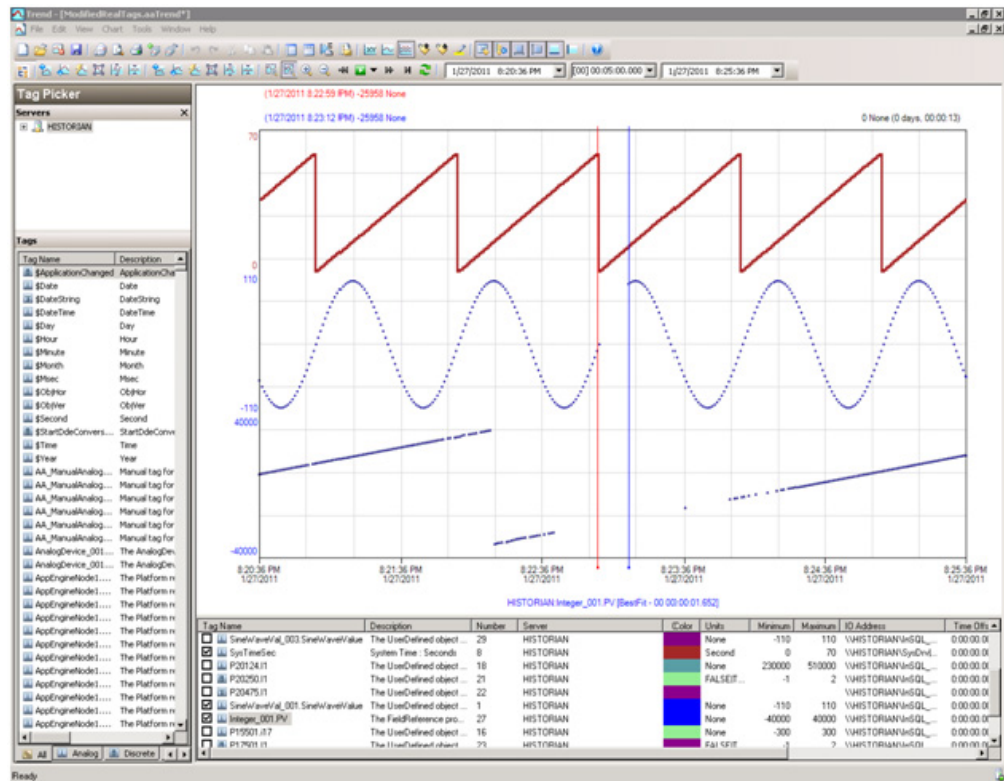
There were no errors and warnings observed on any of the virtual nodes.

## Live Migration of GR

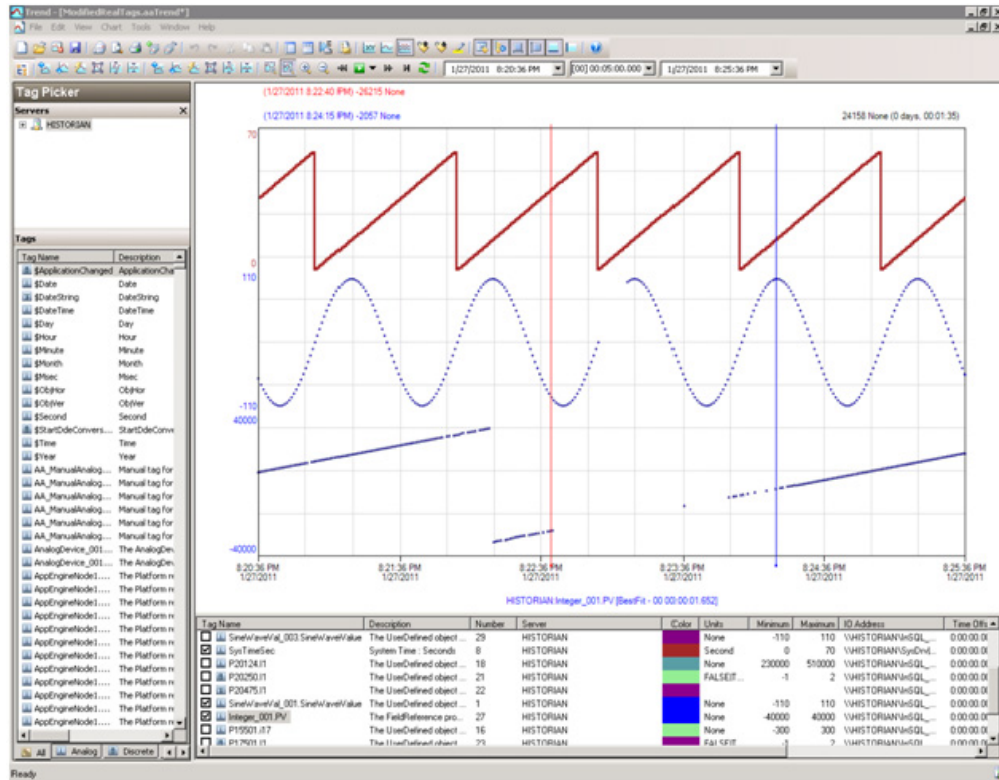
### Trends:

In the following Historian Trend, the middle tag SineWaveCal\_001.SinewaveValue receives data from scripts on GR and is historized.

This is also captured in the RPO table for Live Migration of GR (for IAS tag (Script)).



In the following Historian Trend, the last tag Integer\_001.PV receives data from DDESuiteLinkObject on GR and is historized. This is also captured in the RPO table for Live Migration of GR (for IAS IO tag (DASSiDirect)).



### Observations

GR node is Platform1 in the Galaxy deployed. During the Live Migration of GR, it is obvious that there will be an instance during the Live Migration when the following occurs:

- GR node will not be able to connect to the other deployed nodes (Platforms 2, 3, 4, and 5).
- Rest of Virtual machines will not be able to connect to GR node (Platform1)

As a result, you see the following warnings on each of the VM nodes.



**GR**

```

338704741/27/20118:23:12 PM30562192WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
338704751/27/20118:23:12 PM30562192WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
338704761/27/20118:23:12 PM30562192WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
338704771/27/20118:23:12 PM30562192WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.
338708221/27/20118:24:11 PM37803784WarningScanGroupRuntime2
  Cannot convert Var data type to MxDataType

```

**AppEngine1**

AppEngine1 virtual node has SDK scripts to insert data to Historian, so the Scripts triggered during the Live Migration of GR node are bound to timeout.

Note: GR Node has SDK installed on it, so all the sdk scripts triggered during the live migration of GR node will be affected.

The below warnings are observed on the AppEngine1 node during the Live Migration of GR node.

```

950760131/27/20118:11:24 PM39043908WarningScriptRuntime
  Insert.InsertValuePeriodic: Script timed out.
950768461/27/20118:12:14 PM39043908WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
950869671/27/20118:22:49 PM16522908WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.

```

**AppEngine2 node**

The below warnings are observed on the AppEngine1 node during the Live Migration of GR node.

```

54466751/27/20118:22:49 PM20882104WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.

```

**Historian**

None

**WIS node**

```

30972761/27/20118:22:49 PM33002960WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.

```

**HistClient**

None

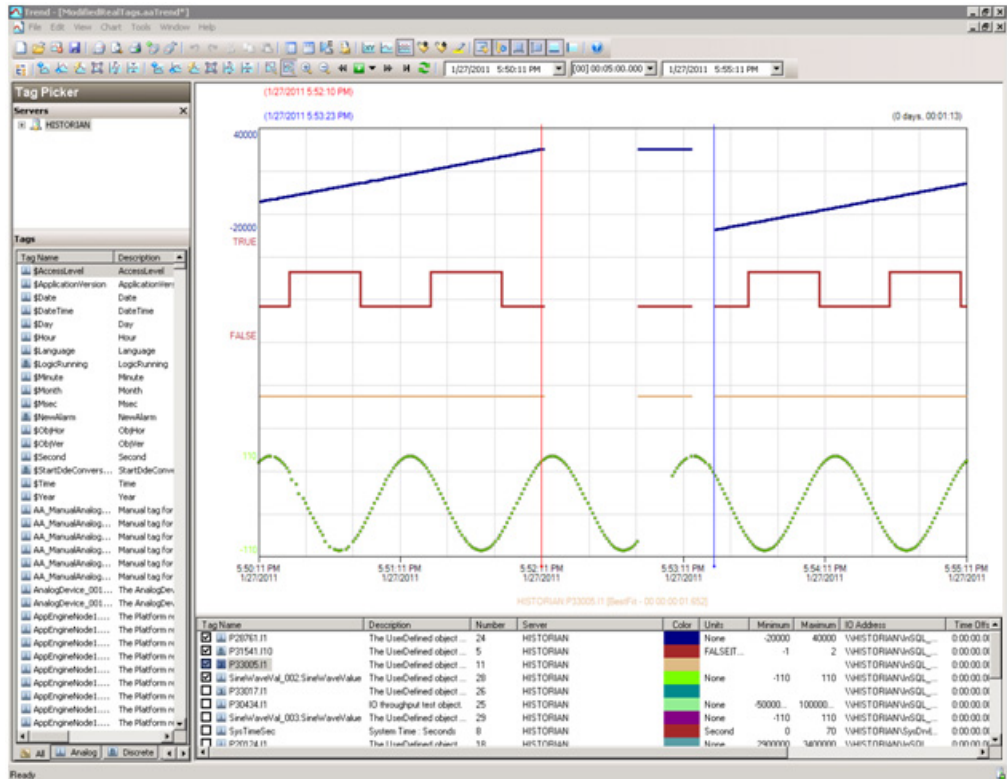
## Live Migration of AppEngine1

### Trends:

IAS tags receiving data from IO Server (DAS SI Direct)

In the following Historian Trend, the first three tags receive data from DDESuiteLinkClient in IAS from the PLC and are historized from Platform AppEngine1.

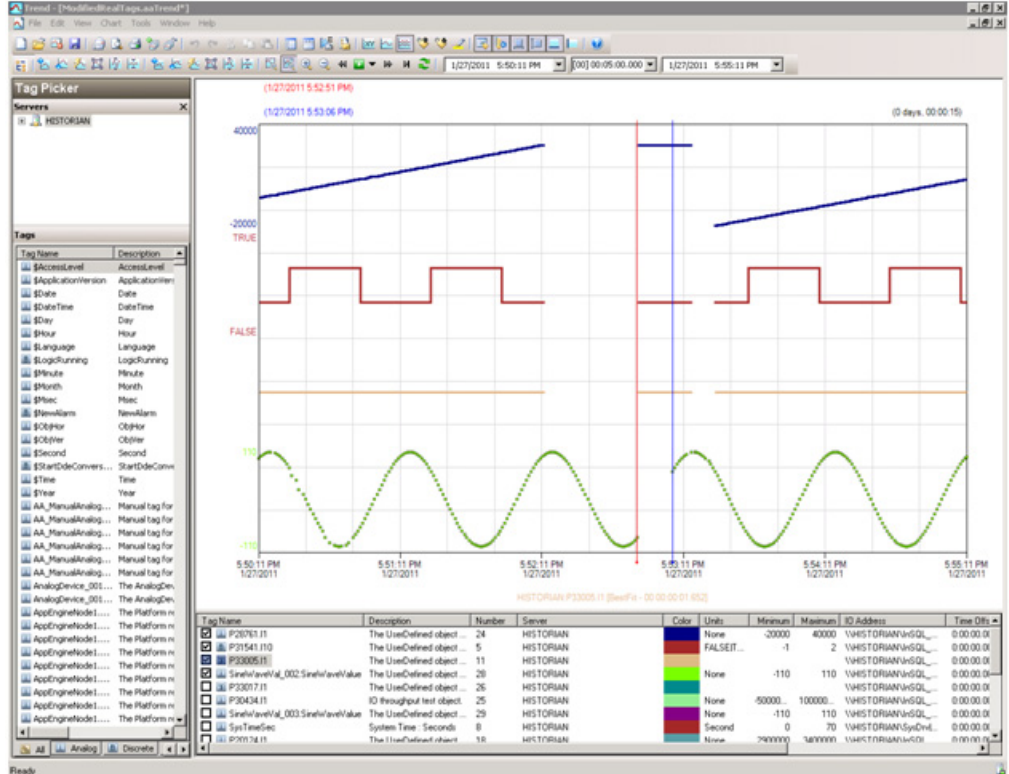
This is also captured in the RPO table for Live Migration of AppEngine1 (for IAS IO tag (DASSiDirect)).



IAS tags (tags generated by scripts)

In the following Historian Trend, the last tag is modified using scripts and is historized from Platform AppEngine1.

This is also captured in the RPO table for Live Migration of AppEngine1 (for IAS tag (Script)).



### Observations

AppEngine1 is Platform2 in the Galaxy deployed. During Live Migration of the AppEngine1, it is obvious that there will be an instance during Live Migration when

- AppEngine1 will not be able to connect to the other deployed nodes (Platforms 3, 4, and 5).
- Other nodes will not be able to connect to AppEngine1(Platform2)
- Some data sent from AppEngine1 will be discarded till the TimeSync utility is executed and system time of AppEngine1 is synchronized. So Historian is bound to discard data from AppEngine1 node

As a result, you see the following warnings on each of the VM nodes.

### GR node

```
338163681/27/20115:52:20 PM30562192WarningNmxSvcPlatform 2
exceed maximum heartbeats timeout of 8000 ms.
```

**AppEngine1**

949341461/27/20115:53:06 PM16522908WarningNmxSvcPlatform 3  
exceed maximum heartbeats timeout of 8000 ms.

949341471/27/20115:53:06 PM16522908WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.

949341481/27/20115:53:06 PM16522908WarningNmxSvcPlatform 5  
exceed maximum heartbeats timeout of 8000 ms.

**AppEngine2**

54464381/27/20115:52:20 PM20882104WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

**Historian**

95837141/27/20115:53:13 PM14923380WarningaahStoreSvcValues in  
the past did not fit within the realtime window; discarding  
data (HISTORIAN\_mdas, 19017, 2011/01/27 12:22:27.608,  
2011/01/27 12:23:12.991) [HISTORIAN; pipeserver.cpp; 2388]

95838831/27/20115:57:27 PM14923380WarningaahStoreSvcValues in  
the past did not fit within the realtime window; discarding  
data (HISTORIAN\_mdas, 19017, 2011/01/27 12:22:27.608,  
2011/01/27 12:23:12.991) [HISTORIAN; pipeserver.cpp; 2388;  
17881]

**WIS node**

30972381/27/20115:52:18 PM33002960WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

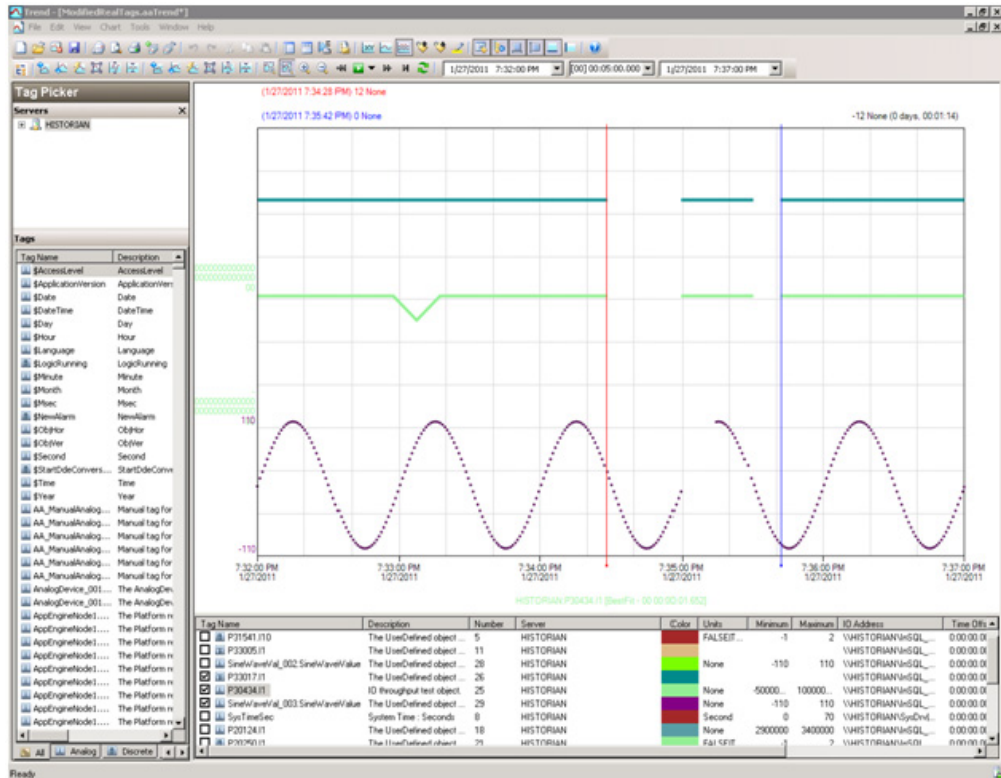
## Live Migration of AppEngine2

### Trends:

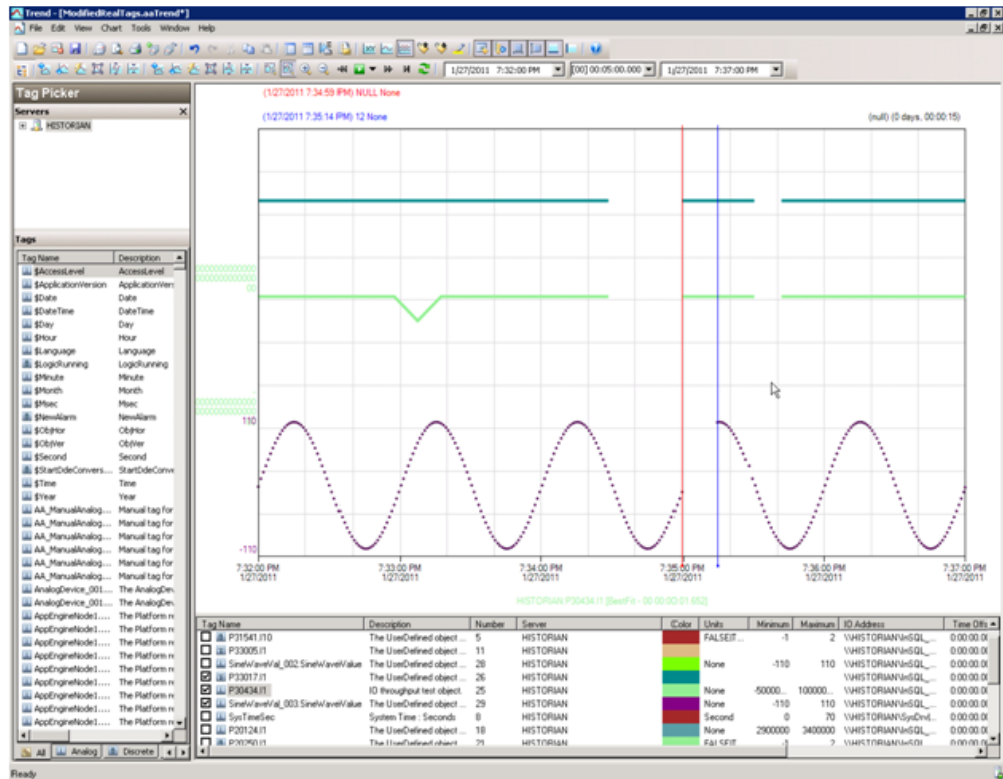
IAS tags receiving data from IO Server (DAS SI Direct)

In the following Historian Trend, the first two tags receive data from DDESuiteLinkClient in IAS from the PLC and are historized from Platform AppEngine2.

This is also captured in the RPO table for Live Migration of AppEngine2 (for IAS IO tag (DASSiDirect)).



In the following Historian Trend, the last tag is modified using scripts and is historized from Platform AppEngine2. This is also captured in the RPO table for Live Migration of AppEngine2 (for IAS tag (Script)).



### Observations

AppEngine2 is Platform4 in the Galaxy deployed. During the Live Migration of AppEngine2, it is obvious that there will be an instance during Live Migration when the following occurs:

- AppEngine2 will not be able to connect to the other deployed nodes (Platforms 3, 1, and 2).
- Other nodes will not be able to connect to AppEngine2(Platform4)
- Some data sent from AppEngine2 will be discarded till the TimeSync utility is executed and system time of AppEngine2 is synchronized. So Historian is bound to discard data from AppEngine2 node

As a result, you see the following warnings on each of the VM nodes.

### GR node

```
338529761/27/20117:34:30 PM30562192WarningNmxSvcPlatform 4
exceed maximum heartbeats timeout of 8000 ms.
```

```
338533811/27/20117:35:38 PM37803784WarningScanGroupRuntime2
Can't convert Var data type to MxDataType
```

## AppEngine1

The warnings below are observed on the AppEngine1 node during the Live Migration of AppEngine2.

```

950335701/27/20117:29:36 PM39043908WarningScriptRuntime
  Insert.InsertValueDataChange: Script timed out.
950341791/27/20117:30:13 PM39043908WarningScriptRuntime
  Insert.InsertValueWF: Script timed out.
950353481/27/20117:31:25 PM39043908WarningScriptRuntime
  Insert.InsertValuePeriodic: Script timed out.
950384051/27/20117:34:29 PM16522908WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.

```

## AppEngine2

```

54465261/27/20117:35:14 PM20882104WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
54465271/27/20117:35:14 PM20882104WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
54465281/27/20117:35:14 PM20882104WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.

```

## Historian

```

95851951/27/20117:35:28 PM14923380WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 7033, 2011/01/27 14:04:54.532,
  2011/01/27 14:05:27.276) [HISTORIAN; pipeserver.cpp; 2388]
95852311/27/20117:39:41 PM14923380WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 7033, 2011/01/27 14:04:54.532,
  2011/01/27 14:05:27.276) [HISTORIAN; pipeserver.cpp; 2388;
  2872]

```

## Live Migration of Historian

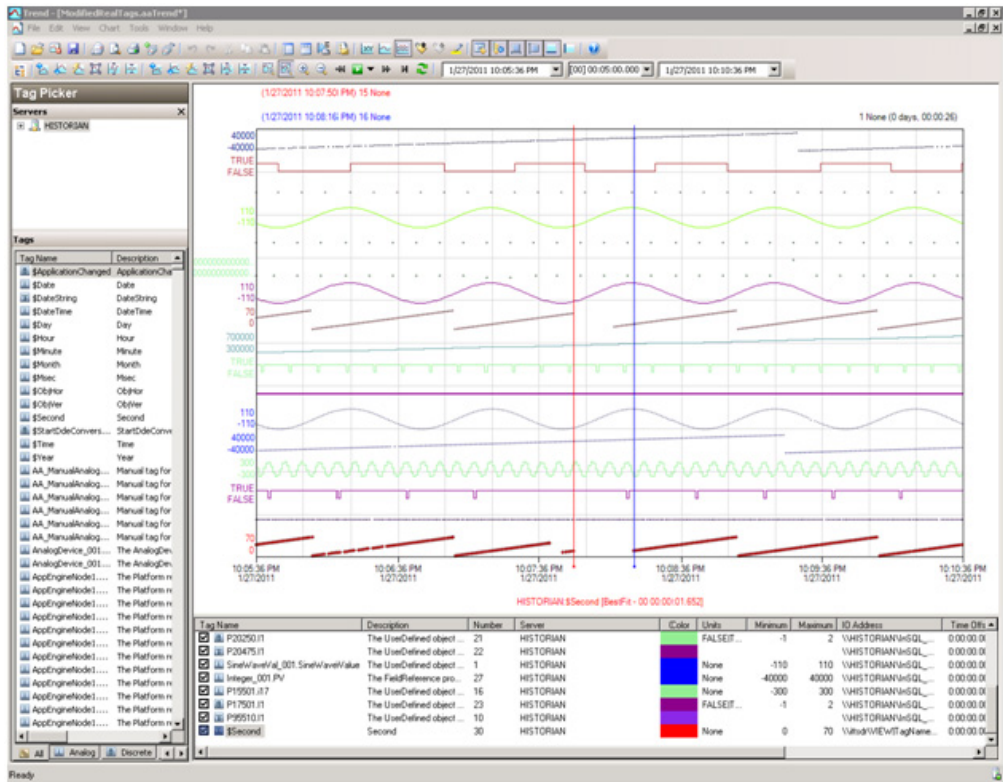
### Trends:

In the following Historian Trend, the IAS tag (Script) and IAS IO tag (DASSiDirect) do not have any data loss as the data is Stored in SF folder in GR node, AppEngine1 and AppEngine2 nodes. This data is later forwarded after Live Migration.

This is also captured in the RPO table for Live Migration of IAS IO Tag (DASSiDirect) and IAS tag (Script) as no data loss.

In the following Historian Trend, the last tag \$Second gets data from InTouch and is historized.

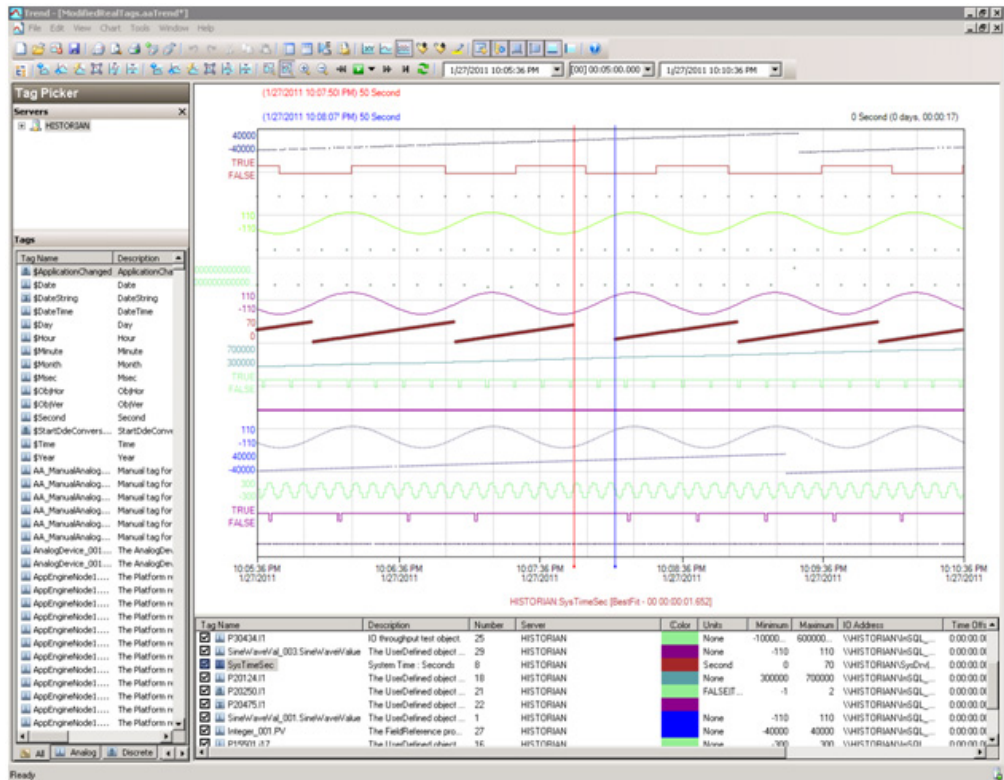
This is also captured in the RPO table for Live Migration of Historian for \$Second(InTouch).



In the following Historian Trend, it is observed that the Historian system tag SysTimeSec has a data gap.



This is also captured in the RPO table for Live Migration of Historian for SysTimeSec (Historian).



## Observations

When the Historian node undergoes Live Migration

- GR and AppEngine nodes are in Store Forward mode
- Historian Client trend will not be able to connect to Historian, so warning is expected.
- Historian machine's time is not synchronized during the Live Migration of Historian, so "Attempt to store values in the future" is expected.
- After Live Migration, historian's time needs to be synchronized so Server Shifting warning is expected.

After the Live Migration of Historian node, the stored data is forwarded from GR and AppEngine nodes.

## GR node

```
339084501/27/201110:08:07 PM37803312WarningaahMDASTime
synchronization with historian node out of spec, please resync
to avoid data loss. (129406198613500000, 129406198876145320)
[StorageNode.cpp,2576]
```

```
95871031/27/201110:08:17 PM50765116InfoaahDrvSvcHISTORIAN_1:
Server is too busy (buffers full)
```

```

95871041/27/201110:08:17 PM50765116InfoaahDrvSvcHISTORIAN_1:
  Clearing buffer cache for recovery (buffers full)

95871051/27/201110:08:17 PM50765116InfoaahDrvSvcHISTORIAN_1:
  HISTORIAN: 722 data buffers lost: header/dirty time of the
  last lost buffer = 22:07:51.000/22:08:17.018

95871061/27/201110:08:19 PM14923380InfoaahManStSvcSuccessfully
  processed file (name)
  (C:\Historian\Data\DataImport\Manual\LateData\latedata_129406
  197731664416_0000.bin) [HISTORIAN; insertmanual.cpp; 736]

```

**AppEngine1**

None

**AppEngine2**

None

**Historian**

```

95871021/27/201110:07:48 PM14923380WarningaahStoreSvcAttempt to
  store values in the future; timestamps were overwritten with
  current time (pipe name, TagName, wwTagKey, system time (UTC),
  time difference (sec)) (HISTORIAN_2, $Time, 23556, 2011/01/27
  16:37:47.216, 24) [HISTORIAN; pipeserver.cpp; 1831]

95871161/27/201110:08:21 PM14923380WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (01/27/11,22:08:20,898, 01/27/11,22:07:54,696) [HISTORIAN;
  Config.cpp; 2040]

```

**WIS node**

None

**HistClient**

```

1235971/27/201110:07:59 PM32321312WarningaaAFCommonTypesUnable
  to create dataview: Server must be logged on before executing
  SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
  aaIQ=Quality, aaQD=QualityDetail, aaS=0

FROM History

WHERE TagName IN ('...

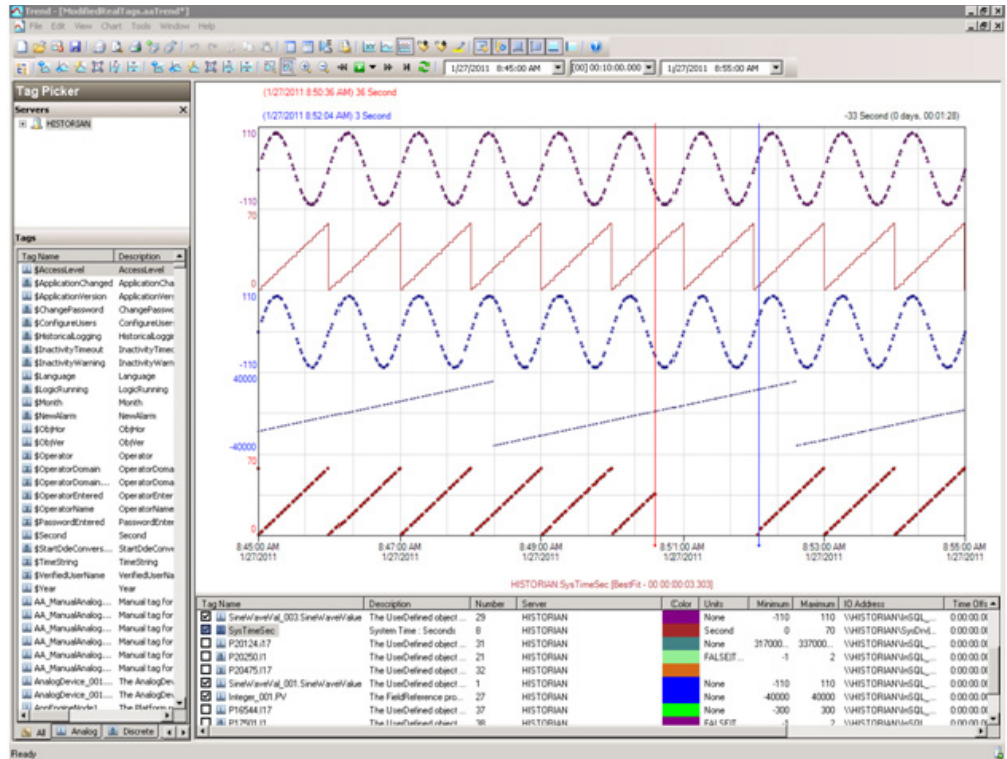
1235981/27/201110:07:59 PM32321312WarningaaTrendDataSetProvider
  The configured InSQL server HISTORIAN is either Disconnected
  from Network or in ShutDown/Disable state.

```

## Quick Migration of InTouch

### Trends:

In the following Historian Trend, the last tag \$Second receives data from InTouch and is historized.



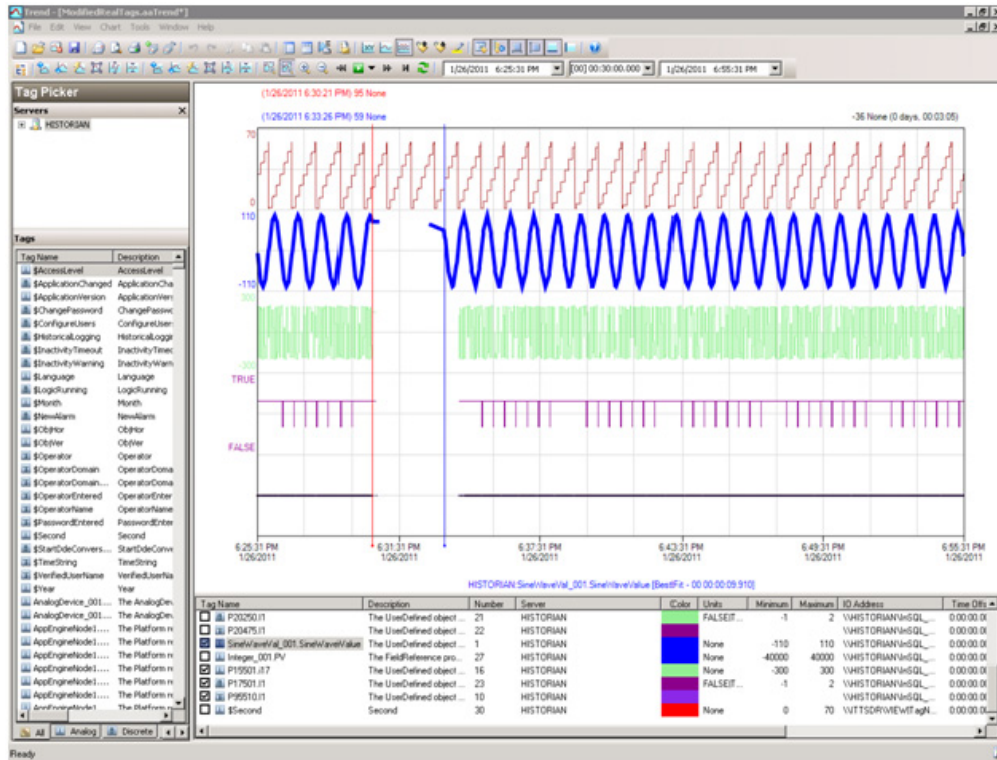
### Observations

There were no errors and warnings observed on any of the virtual nodes.

## Quick Migration of GR

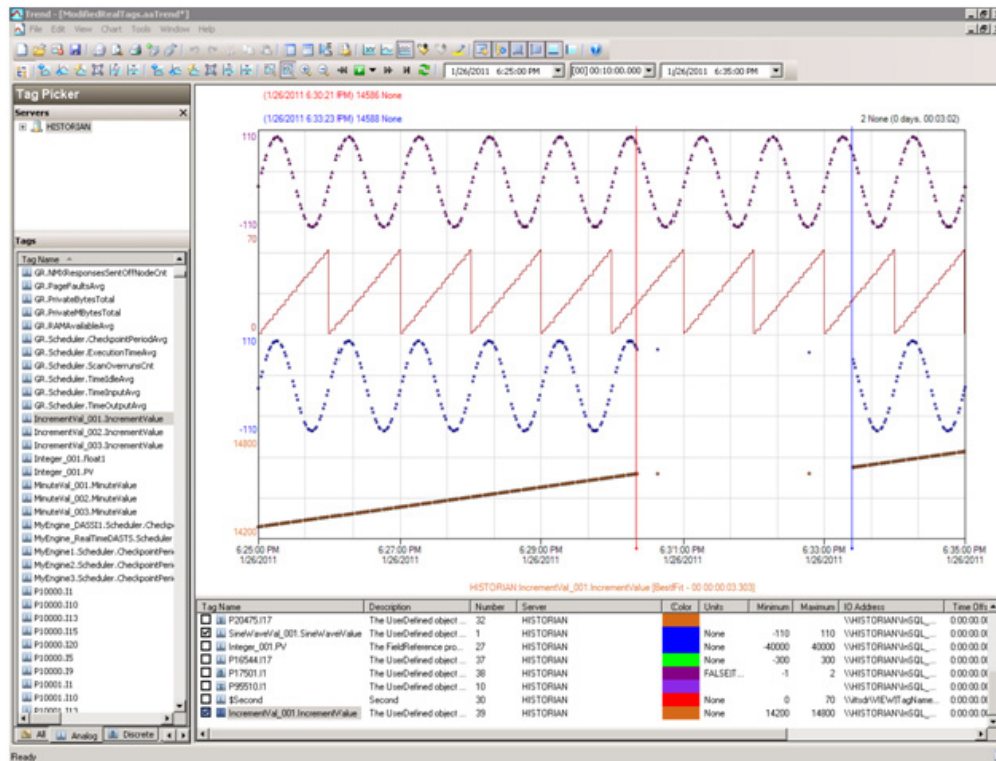
Trends:

### Industrial Application Server (IAS) tag (Script)



## Industrial Application Server (IAS) IO tag (DASSiDirect)

GR node hosts the DDESuiteLinkObjects, so during the Quick Migration of GR node, there is data loss for tags that receive data from DAS Server/PLC.



### Observations

GR node is Platform1 in the Galaxy deployed. During the Quick Migration of GR node it is obvious that there will be an instance during Quick Migration when the following occurs:

- GR node will not be able to connect to the other deployed nodes (Platforms 2, 3, 4, and 5).
- Rest of Virtual machines will not be able to connect to GR node (Platform1)
- Since DAS SI Direct provides data to DDESuiteLinkObject and DAS SI Direct is on GR node, the message "DAServerManager Target node is down" is expected on AppEngine1 and AppEngine2.
- Script involving SDK script library calls timeout during the Quick Migration of GR node.

**GR Node**

```
510877212/15/20113:11:51 PM32043224WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
510877222/15/20113:11:51 PM32043224WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
510877232/15/20113:11:51 PM32043224WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
510877242/15/20113:11:51 PM32043224WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
510877252/15/20113:11:51 PM32043224WarningNmxSvcPlatform 6
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
510877402/15/20113:11:52 PM3681032WarningaaEngine0:B5C Values
  in the past did not fit within the realtime window; discarding
  data (19598, 2011/02/15 09:40:24.026, 2011/02/15
  09:41:51.565) [aahMDASSF.cpp; 3709; 1]aaEngine
510877482/15/20113:11:52 PM38044344WarningaaEngine0:E14 Values
  in the past did not fit within the realtime window; discarding
  data (19594, 2011/02/15 09:40:21.407, 2011/02/15
  09:41:51.924) [aahMDASSF.cpp; 3709; 1]aaEngine
510877722/15/20113:11:54 PM23884496WarningaaEngine0:704 Values
  in the past did not fit within the realtime window; discarding
  data (19529, 2011/02/15 09:40:24.863, 2011/02/15
  09:41:53.731) [aahMDASSF.cpp; 3709; 1]aaEngine
510878202/15/20113:12:03 PM32043224WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
510878492/15/20113:12:08 PM32043224WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
510880302/15/20113:12:30 PM3683932WarningScanGroupRuntime2Can't
  convert Var data type to MxDataTypeaaEngine
510894042/15/20113:16:03 PM3681032WarningaaEngine0:B5C Values
  in the past did not fit within the realtime window; discarding
  data (19598, 2011/02/15 09:40:24.026, 2011/02/15
  09:41:51.565) [aahMDASSF.cpp; 3709; 14]aaEngine
510894082/15/20113:16:04 PM38044344WarningaaEngine0:E14 Values
  in the past did not fit within the realtime window; discarding
  data (19594, 2011/02/15 09:40:21.407, 2011/02/15
  09:41:51.924) [aahMDASSF.cpp; 3709; 45]aaEngine
510894152/15/20113:16:05 PM23884496WarningaaEngine0:704 Values
  in the past did not fit within the realtime window; discarding
  data (19529, 2011/02/15 09:40:24.863, 2011/02/15
  09:41:53.731) [aahMDASSF.cpp; 3709; 57]aaEngine
```

**AppEngine1**

```
1112021172/15/20113:10:32 PM57965620WarningDAServerManager
  Target node is down. DASC will stop scanning for Server
  active state.mmc
1112021502/15/20113:10:33 PM29162932WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
1112031342/15/20113:11:31 PM39923228WarningPackageManagerNet
  GalaxyMonitor PollPackageServer Communication failed. A
  connection attempt failed because the connected party did not
  properly respond after a period of time, or established
  connection failed because connected host has failed to respond
  10.91.60.63:8090aaIDE
```

**AppEngine2**

```
55350642/15/20113:10:33 PM27002684WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
55350652/15/20113:11:33 PM16722940WarningPackageManagerNet
  GalaxyMonitor PollPackageServer Communication failed. A
  connection attempt failed because the connected party did not
  properly respond after a period of time, or established
  connection failed because connected host has failed to respond
  10.91.60.63:8090aaIDE
```

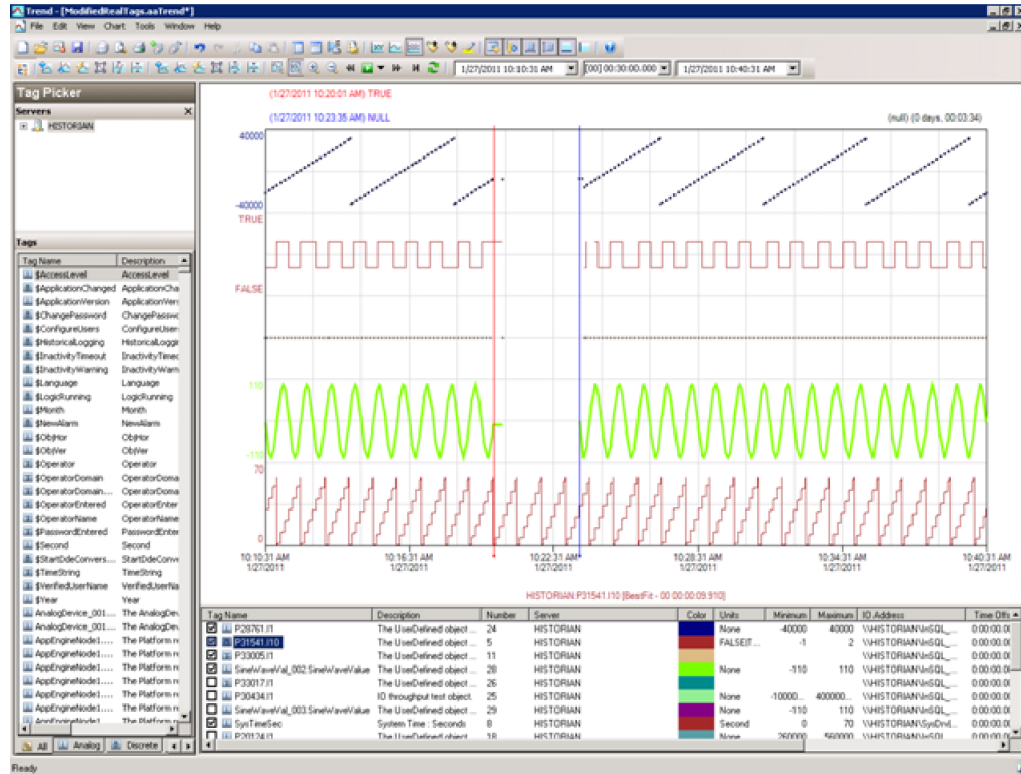
**WIS node**

```
59743762/15/20113:10:32 PM8443788WarningNmxSvcPlatform 1 exceed
  maximum heartbeats timeout of 8000 ms.NmxSvc
```

## Quick Migration of AppEngine1

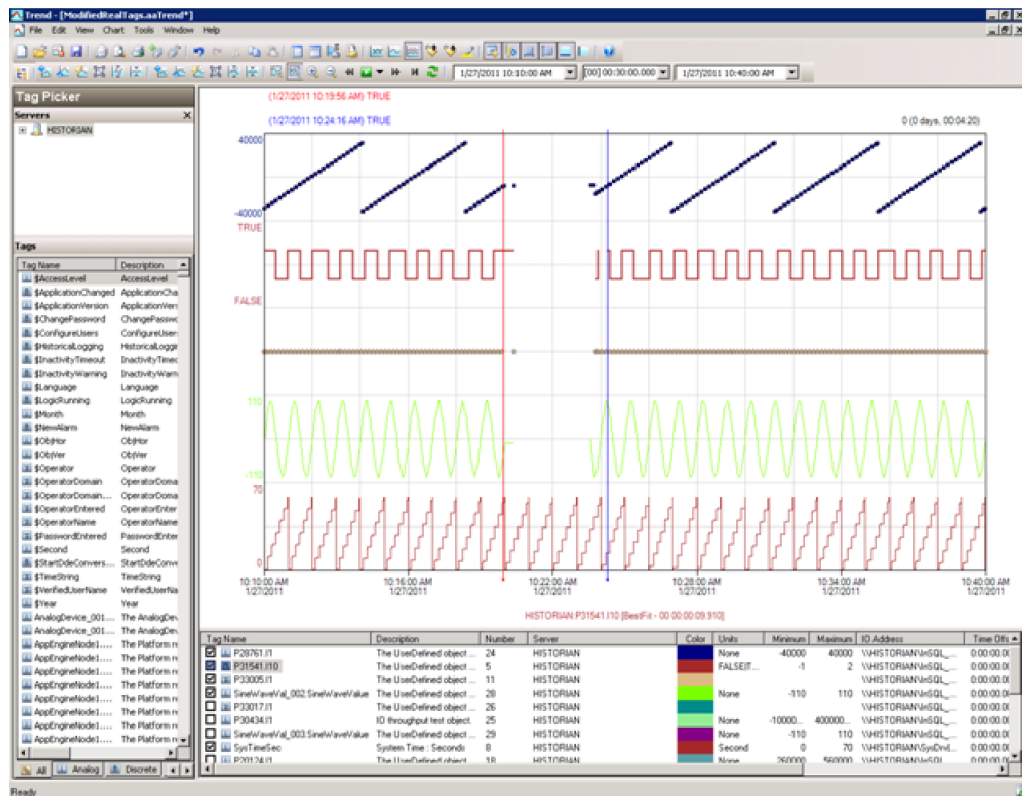
### Trends:

## Industrial Application Server (IAS) tag (Script)





## Industrial Application Server (IAS) IO tag (DASSiDirect)



### Observations

AppEngine1 is Platform2 in the Galaxy deployed. During the Live Migration of AppEngine1, it is obvious that there will be an instance during Live Migration when the following occurs:

- AppEngine1 will not be able to connect to the other deployed nodes (Platforms 3, 4, and 5).
- Rest of Virtual machines will not be able to connect to AppEngine1(Platform2)
- AppEngine1 is not time synchronized during the Quick Migration and a message “Values in the past did not fit within the realtime window” is expected on AppEngine1.
- AppEngine1 is not time synchronized during the Quick Migration and a message “Values in the past

**GR node**

```
336481011/27/201110:20:09 AM30562192WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc
```

**AppEngine1**

```
944715761/27/201110:20:00 AM1652796WarningMessageChannel
  idcinsql21 address was not resolved. Error = 10022NmxSvc

944716581/27/201110:23:38 AM16522908WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc

944716591/27/201110:23:38 AM16522908WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.NmxSvc

944716721/27/201110:23:39 AM39441968WarningaaEngine0:9AC Values
  in the past did not fit within the realtime window; discarding
  data (648, 2011/01/27 04:50:04.767, 2011/01/27 04:53:39.338)
  [aahMDASSF.cpp; 3709; 1]aaEngine

944717251/27/201110:23:41 AM39243636WarningaaEngine0:9E8 Values
  in the past did not fit within the realtime window; discarding
  data (21030, 2011/01/27 04:50:04.564, 2011/01/27
  04:53:41.400) [aahMDASSF.cpp; 3709; 1]aaEngine

944717421/27/201110:23:41 AM39763940WarningaaEngine0:9C8 Values
  in the past did not fit within the realtime window; discarding
  data (6650, 2011/01/27 04:50:05.002, 2011/01/27 04:53:40.713)
  [aahMDASSF.cpp; 3709; 1]aaEngine

944717441/27/201110:23:41 AM39042588WarningaaEngine0:B64 Values
  in the past did not fit within the realtime window; discarding
  data (21040, 2011/01/27 04:50:05.298, 2011/01/27
  04:53:39.838) [aahMDASSF.cpp; 3709; 1]aaEngine

944718251/27/201110:23:45 AM28721828WarningaaEngine0:690 Values
  in the past did not fit within the realtime window; discarding
  data (297, 2011/01/27 04:50:04.298, 2011/01/27 04:53:45.619)
  [aahMDASSF.cpp; 3709; 1]aaEngine

944766431/27/201110:27:51 AM39441968WarningaaEngine0:9AC Values
  in the past did not fit within the realtime window; discarding
  data (648, 2011/01/27 04:50:04.767, 2011/01/27 04:53:39.338)
  [aahMDASSF.cpp; 3709; 4248]aaEngine

944766561/27/201110:27:51 AM39042588WarningaaEngine0:B64 Values
  in the past did not fit within the realtime window; discarding
  data (21040, 2011/01/27 04:50:05.298, 2011/01/27
  04:53:39.838) [aahMDASSF.cpp; 3709; 2]aaEngine

944766771/27/201110:27:53 AM39243636WarningaaEngine0:9E8 Values
  in the past did not fit within the realtime window; discarding
  data (21030, 2011/01/27 04:50:04.564, 2011/01/27
  04:53:41.400) [aahMDASSF.cpp; 3709; 2449]aaEngine
```

```
944766941/27/201110:27:53 AM39763940WarningaaEngine0:9C8 Values
  in the past did not fit within the realtime window; discarding
  data (6650, 2011/01/27 04:50:05.002, 2011/01/27 04:53:40.713)
  [aahMDASSF.cpp; 3709; 374]aaEngine
```

```
944767591/27/201110:27:57 AM28721828WarningaaEngine0:690 Values
  in the past did not fit within the realtime window; discarding
  data (297, 2011/01/27 04:50:04.298, 2011/01/27 04:53:45.619)
  [aahMDASSF.cpp; 3709; 62]aaEngine
```

## **AppEngine2**

```
54457791/27/201110:20:08 AM20882104WarningNmxSvcPlatform 2
  exceed maximum heartbeats timeout of 8000 ms.
```

## **Historian**

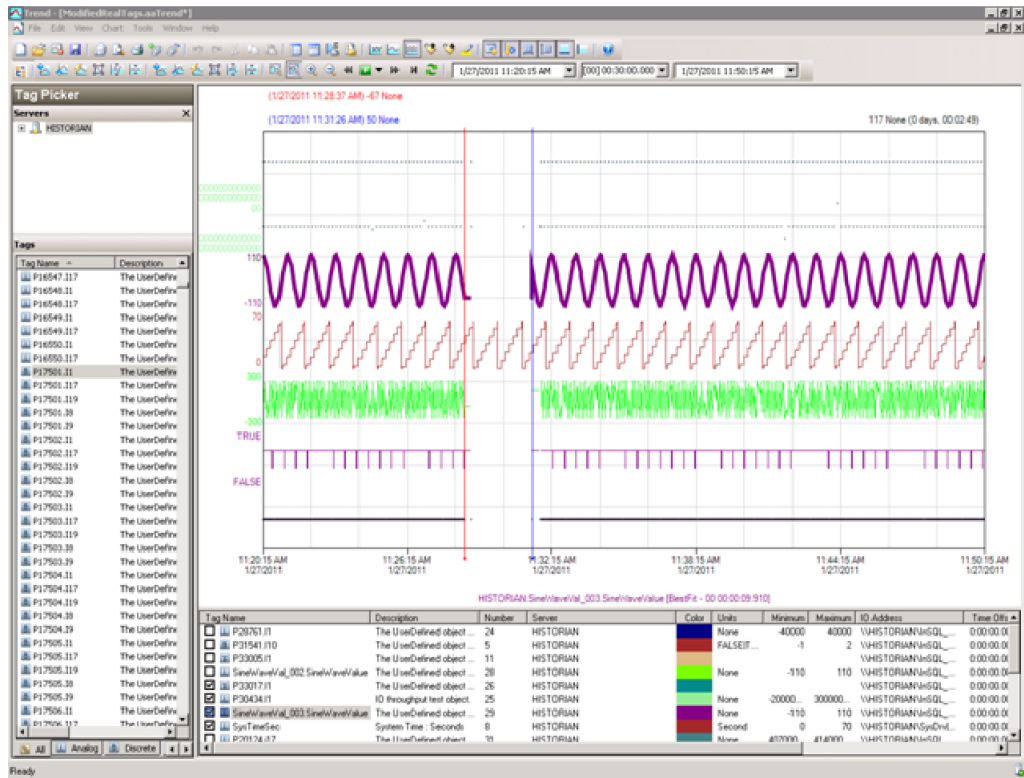
```
95774041/27/201110:21:01 AM14923380WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 11057, 2011/01/27 04:50:09.341,
  2011/01/27 04:51:00.524) [HISTORIAN; pipeserver.cpp; 2388]
```

```
95774811/27/201110:25:12 AM14923380WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 11057, 2011/01/27 04:50:09.341,
  2011/01/27 04:51:00.524) [HISTORIAN; pipeserver.cpp; 2388;
  16827]
```

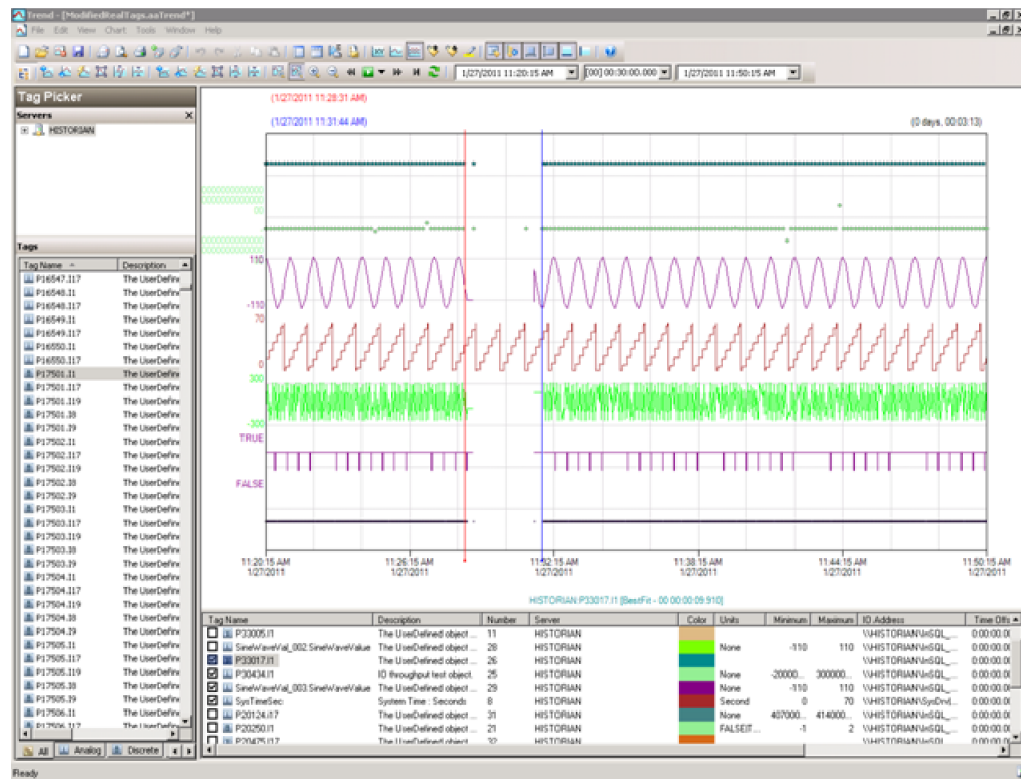
## Quick Migration of AppEngine2

Trends:

### Industrial Application Server (IAS) tag (Script)



## Industrial Application Server (IAS) IO tag (DASSiDirect)



### Observations

AppEngine2 is Platform4 in the Galaxy deployed. During the Quick Migration of AppEngine2 it is obvious that there will be an instance during Quick Migration when

- AppEngine2 node will not be able to connect to the other deployed nodes (Platforms 1,3, 2, and 5).
- Rest of Virtual machines will not be able to connect to AppEngine2 (Platform4)
- AppEngine2 is not time synchronized during the Quick Migration and a message "Values in the past did not fit within the realtime window" is expected on AppEngine2.
- AppEngine2 is not time synchronized during the Quick Migration and a message "Values in the past did not it within the realtime window" is expected on Historian node.

**GR node**

336724161/27/201111:28:47 AM30562192WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

336733851/27/201111:31:33 AM30562192WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

**AppEngine1**

945466161/27/201111:28:43 AM54804996WarningDAServerManager  
Target node is down. DASCC will stop scanning for Server  
active state.mmc

945467031/27/201111:28:47 AM16522908WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.NmxSvc

945467061/27/201111:28:47AM54804996WarningDAServerManagerTarget  
node is down. DASCC will stop scanning for Server active  
state.mmc

**AppEngine2**

54457871/27/201111:28:51 AM20882104WarningNmxSvcPlatform 1  
exceed maximum heartbeats timeout of 8000 ms.

54458041/27/2011 11:31:24 AM20882104WarningNmxSvc  
Connection to platform 1 was established, but no initial  
packet was received for 152473ms. Timeout

3000054458051/27/201111:31:24 AM20882104WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

5445806 1/27/201111:31:24 AM20882104WarningNmxSvcPlatform 3  
exceed maximum heartbeats timeout of 8000 ms.

54458261/27/201111:31:26 AM39044260WarningaaEngine0:99C Values  
in the past did not fit within the realtime window; discarding  
data (12307, 2011/01/27 05:58:38.795, 2011/01/27  
06:01:25.145) [aahMDASSF.cpp; 3709;1]

54458361/27/201111:31:27 AM38803388WarningaaEngine0:968 Values  
in the past did not fit within the realtime window; discarding  
data (11056, 2011/01/27 05:58:41.670, 2011/01/27  
06:01:26.020) [aahMDASSF.cpp; 3709; 1]

54458471/27/201111:31:28 AM38563344WarningaaEngine0:994 Values  
in the past did not fit within the realtime window; discarding  
data (16262, 2011/01/27 05:58:59.655, 2011/01/27  
06:01:27.583) [aahMDASSF.cpp; 3709; 1]

54459091/27/201111:35:37 AM39044260WarningaaEngine0:99C Values  
in the past did not fit within the realtime window;discarding  
data (12307, 2011/01/27 05:58:38.795, 2011/01/27  
06:01:25.145)[aahMDASSF.cpp; 3709; 13886]

```
54459101/27/201111:35:39 AM38803388WarningaaEngine0:968 Values
  in the past did not fit within the realtime window; discarding
  data (11056, 2011/01/2705:58:41.670, 2011/01/27 06:01:26.020)
  [aahMDASSF.cpp; 3709; 4402]
```

```
54459111/27/201111:35:41 AM38563344WarningaaEngine 0:994 Values
  in the past did not fit within the realtime window; discarding
  data (16262, 2011/01/27 05:58:59.655, 2011/01/27
  06:01:27.583) [aahMDASSF.cpp; 3709; 4701]
```

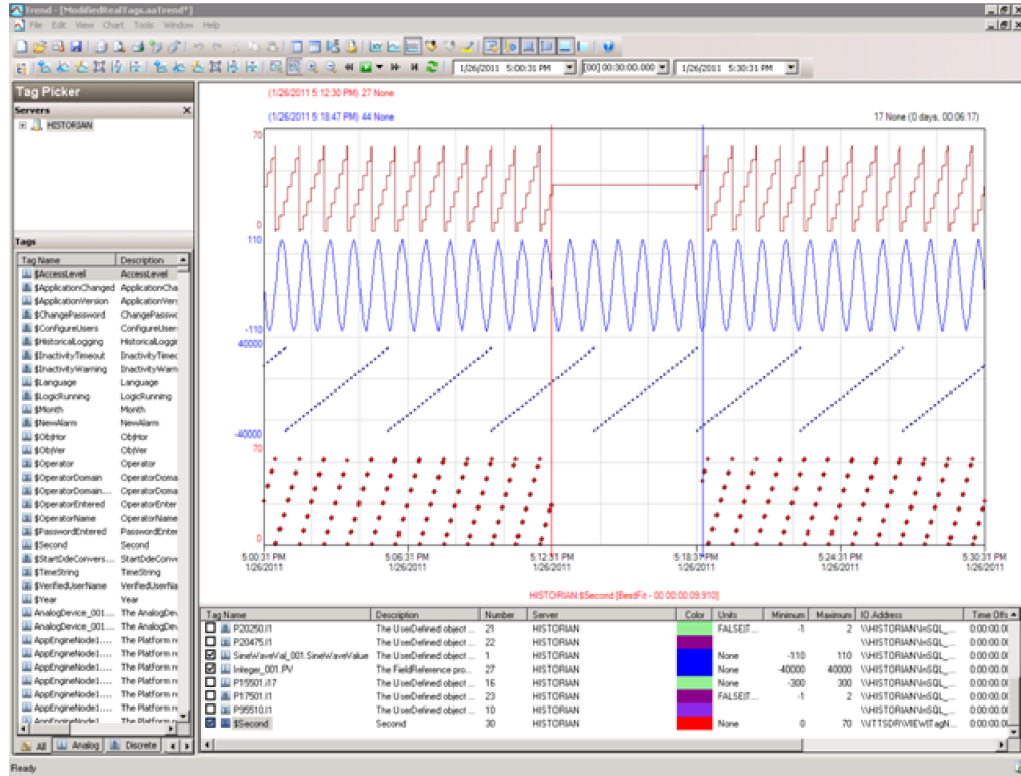
**Historian:**

```
95783041/27/201111:29:43 AM14923380WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 1024, 2011/01/27 05:58:52.136,
  2011/01/27 05:59:41.757) [HISTORIAN; pipeserver.cpp; 2388]
```

```
95786821/27/201111:33:55 AM14923380WarningaahStoreSvcValues in
  the past did not fit within the realtime window; discarding
  data (HISTORIAN_mdas, 1024, 2011/01/27 05:58:52.136,
  2011/01/27 05:59:41.757) [HISTORIAN; pipeserver.cpp; 2388;
  12243]
```

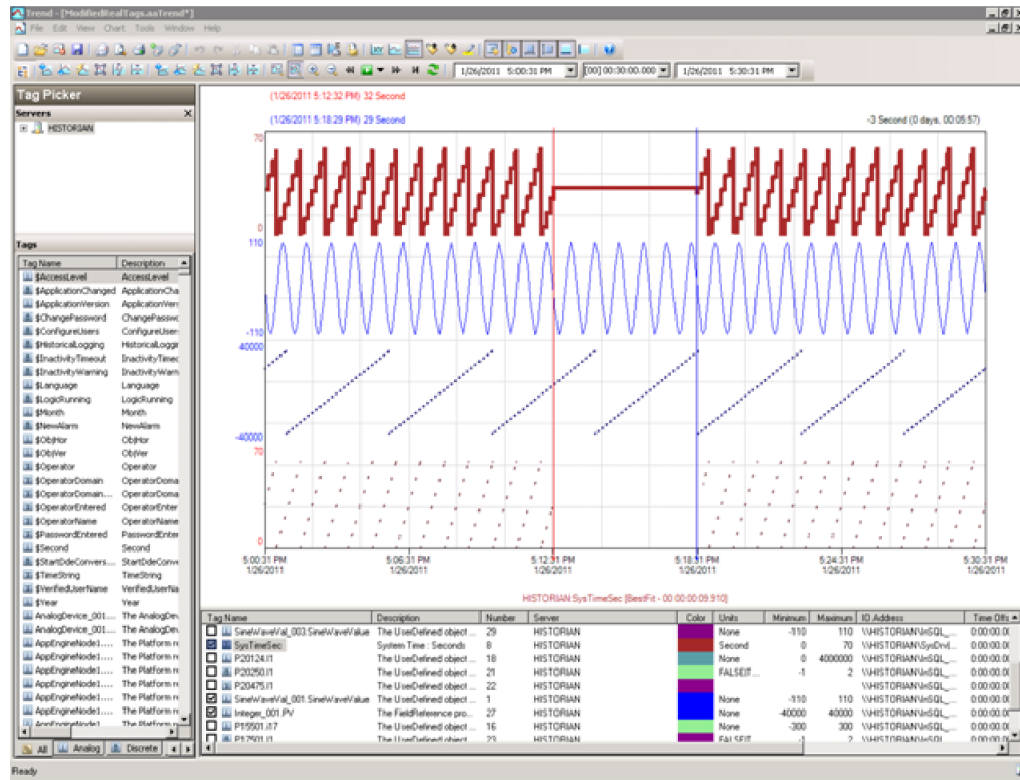
## Quick Migration of Historian Trends:

### \$Second(InTouch)





## SysTimeSec (Historian)



### Industrial Application Server (IAS) tag (Script) and IAS IO Tag (DASSiDirect)

There is no data loss for IAS Tag (Script) and IAS IO Tag (DASSiDirect) as observed from the tags in the middle from the above snapshot.

#### Observations

During the Quick Migration of Historian node, it is expected that

- SDK scripts will timeout on Appengine1 and GR node.
- AppEngine2 fails to connect to Historian
- Historian is not synchronized during the Quick Migration and a message "Specified time cannot be in the future" is expected on Historian node.
- Late data acquired from PLC Historian is not synchronized during the Quick Migration and a message "Processing file produced errors: file moved to support folder" is expected on Historian node.
- Historian Client will be unable to connect to Historian.

**GR Node**

```
332273241/26/20115:13:38 PM42163488WarningScriptRuntime
  AsynchronousBuffer.script6: Script timed out.aaEngine
```

**AppEngine1**

```
934165241/26/20115:13:50 PM39043908WarningScriptRuntime
  Insert.InsertValueWT: Script timed out.aaEngine93417566
```

**AppEngine2**

```
54453561/26/20115:13:53 PM852484WarningHistorianPrimitive
  AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
  ArcestrA user account exist on Historian(InSQL) node or does
  Historian not exist?)
```

**Historian**

```
95646651/26/20115:12:30 PM14642120ErroraahStoreSvcERROR:
  Specified time cannot be in the future (2011/01/26
  11:42:29.856, 2011/01/26 11:48:39.085) [HISTORIAN;
  cmanualpipe.cpp; 697]

95646661/26/20115:12:30 PM14642120ErroraahStoreSvcERROR: Data
  packet lost - broken packet saved in bpack.bin
  (HISTORIAN_ManualDataPipe, bPacket_129405157498567410.bin)
  [HISTORIAN; cmanualpipe.cpp; 1267]

95647071/26/20115:18:45 PM14642120WarningaahCfgSvc"Server time
  is shifting (Expected time, Current time)"
  (01/26/11,17:18:44,306, 01/26/11,17:12:35,057) [HISTORIAN;
  Config.cpp; 2040]

95647171/26/20115:18:58 PM14642120WarningaahManStSvcCannot
  insert values for delta tags into history block (18,
  P10128.i20, 2011/01/26 11:42:22.293, 3) [HISTORIAN;
  insertmanual.cpp; 4787]

95647181/26/20115:18:58 PM14642120WarningaahManStSvcCannot
  insert values for delta tags into history block (18,
  P10125.i20, 2011/01/26 11:42:22.293, 3) [HISTORIAN;
  insertmanual.cpp; 4787]

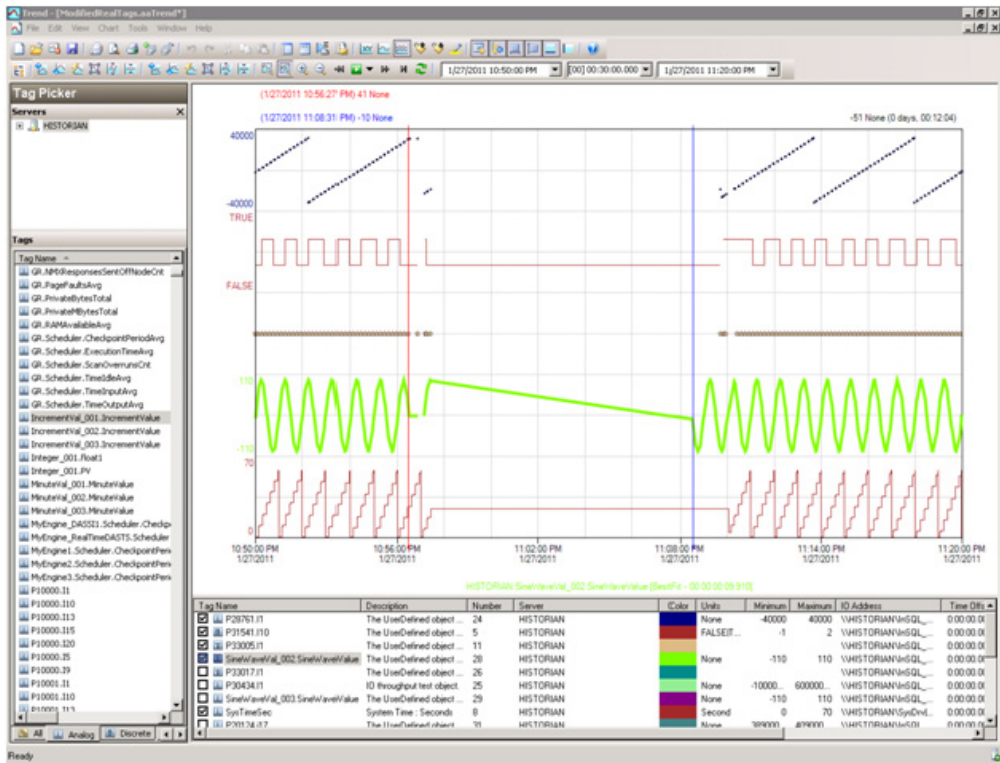
95647191/26/20115:18:58 PM14642120ErroraahManStSvcERROR:
  Processing file produced errors: file moved to support folder
  (latedata_129405161297112310_0000.bin) [HISTORIAN;
  insertmanual.cpp; 771]
```

**Hist Client**

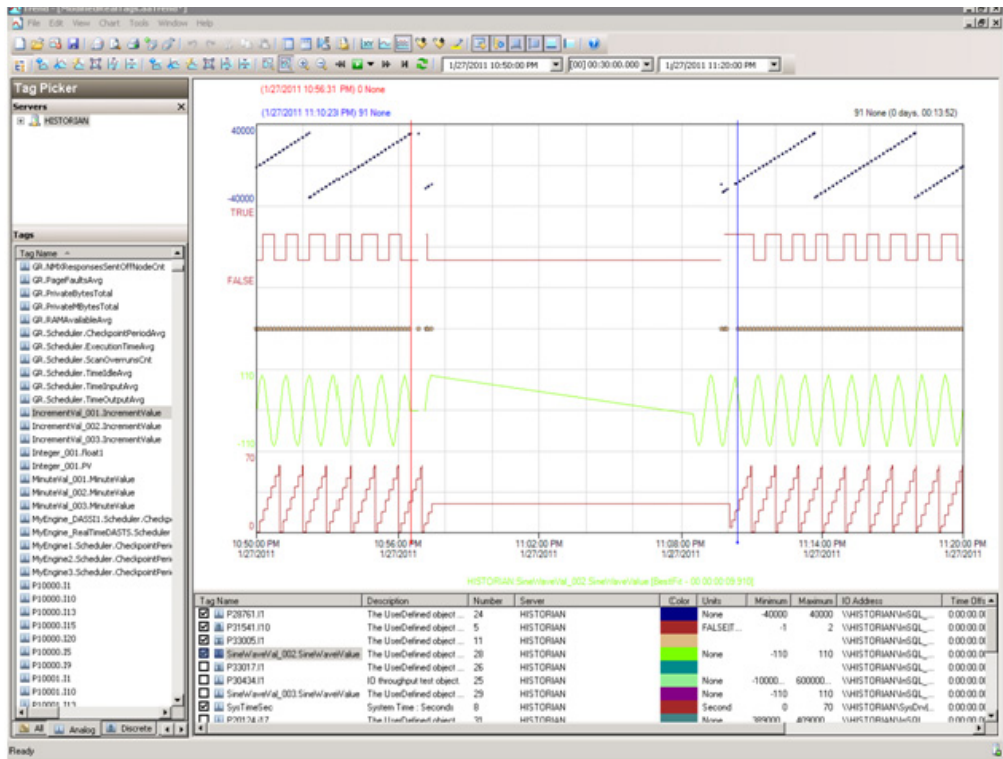
```
1134381/26/20115:13:29 PM3232884WarningaaAFCommonTypesUnable to
  create dataview: Server must be logged on before executing SQL
  query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
  aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
```

```
aaIQ=Quality, aaQD=QualityDetail, aaS=0
FROM History
WHERE TagName IN ('...
```

**Shut down of Source Host Virtualization Server Trends:**  
**AppEngine1**  
**IAS (Script tags)**

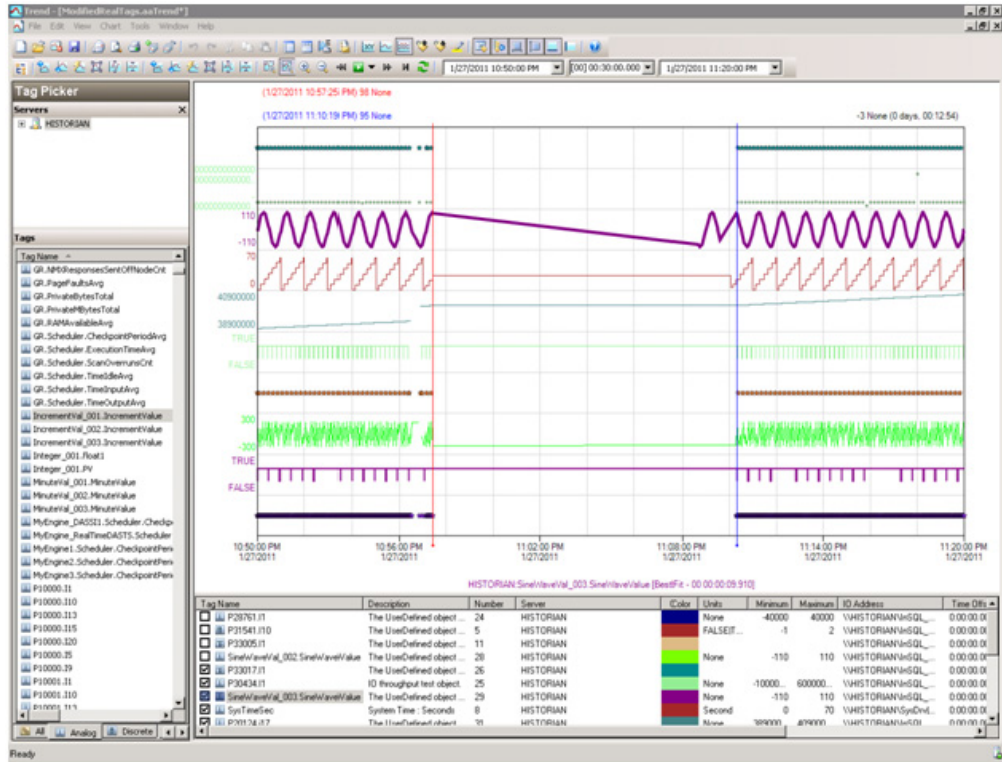


### IAS IO Tag (DASSiDirect)

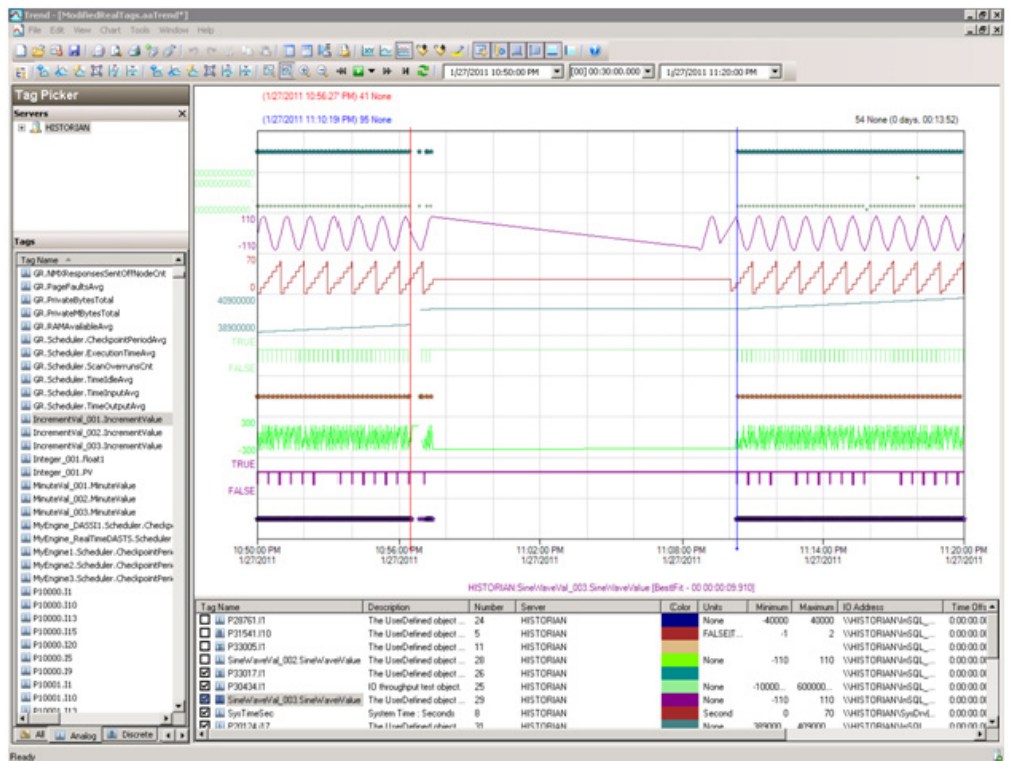


## AppEngine2

### IAS (Script tags)

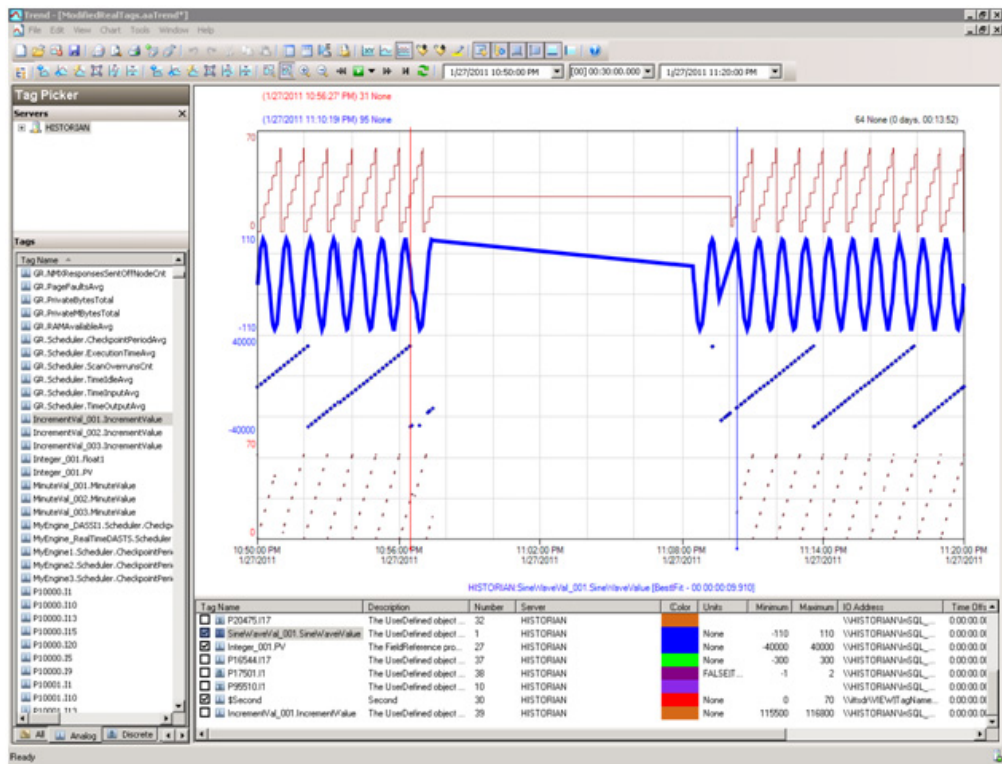


### IAS IO Tag (DASSiDirect)

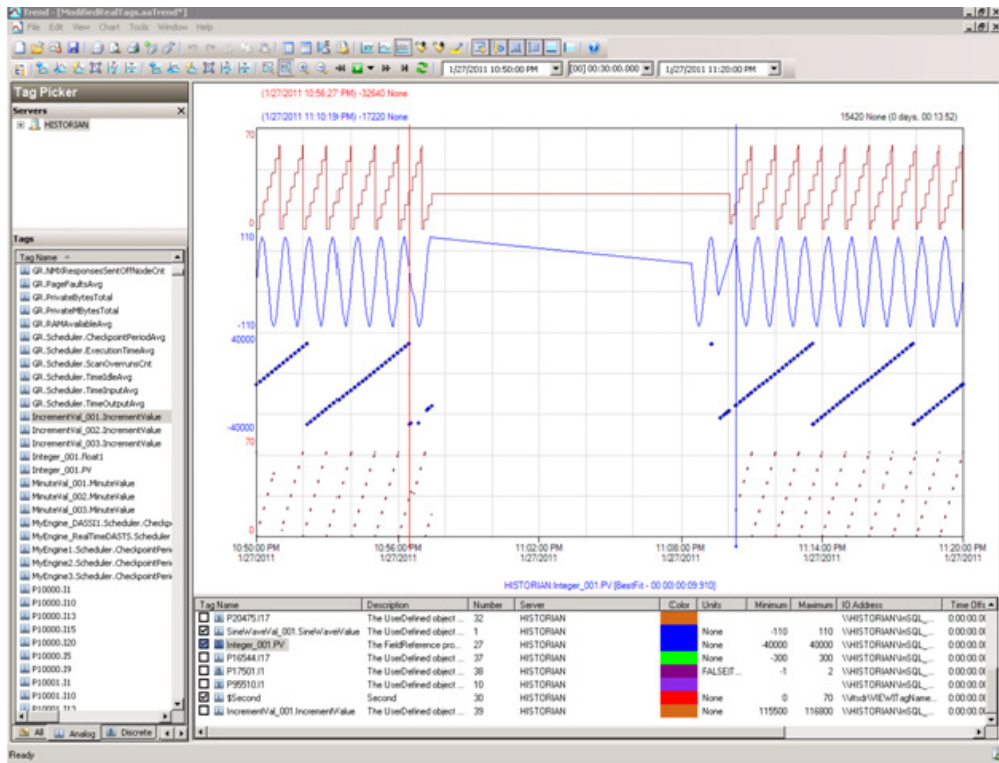


### GR

### IAS (Script tags)

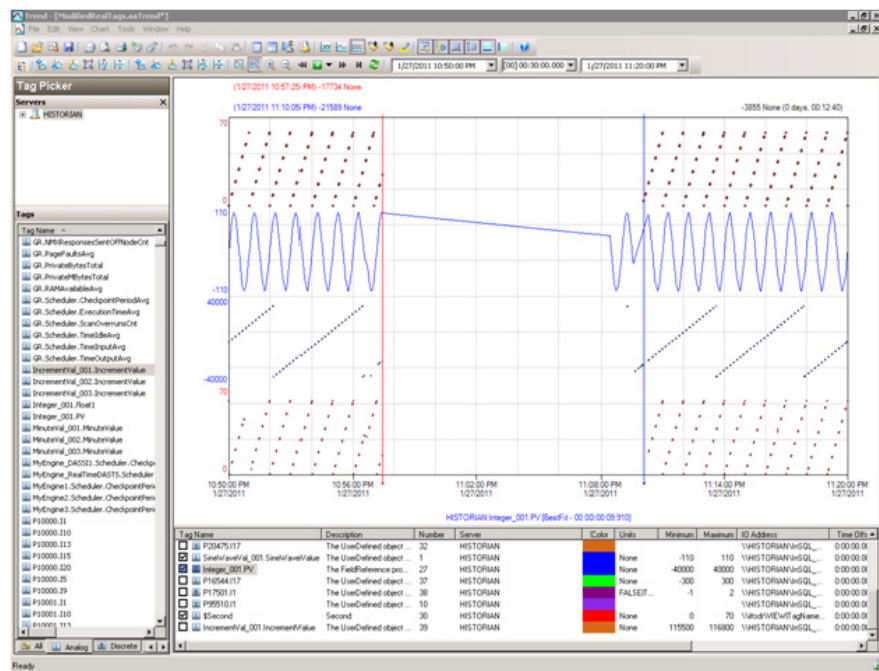


### IAS IO Tag (DASSiDirect).

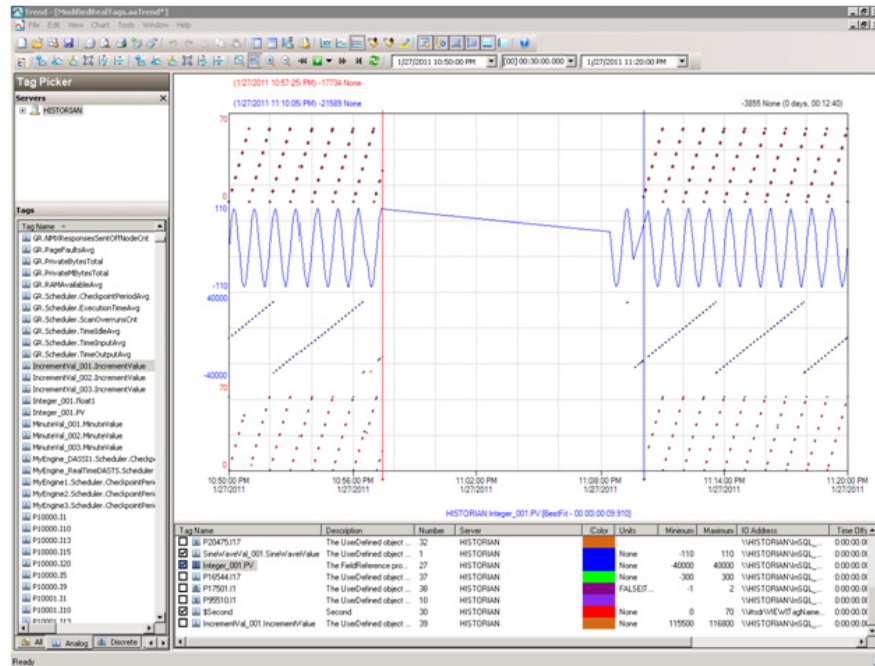


### Historian

### SysTimeSec (Historian)



## \$Second tag (In Touch)



### Observations

#### GR Node

339257881/27/201110:56:34 PM37803784WarningScanGroupRuntime2  
Can't convert Var data type to MxDataType

339258091/27/201111:08:25 PM30562192WarningNmxSvcPlatform 2  
exceed maximum heartbeats timeout of 8000 ms.

339258101/27/201111:08:25 PM30562192WarningNmxSvcPlatform 3  
exceed maximum heartbeats timeout of 8000 ms.

339258111/27/201111:08:25 PM30562192WarningNmxSvcPlatform 4  
exceed maximum heartbeats timeout of 8000 ms.

339258121/27/201111:08:25 PM30562192WarningNmxSvcPlatform 5  
exceed maximum heartbeats timeout of 8000 ms.

339258131/27/201111:08:26 PM37443748WarningScriptRuntime  
AsynchronousBuffer.script2: Script timed out.

339258411/27/201111:08:31 PM27683860WarningaaEngine0:6D4 Values  
in the past did not fit within the realtime window; discarding  
data (182, 2011/01/27 17:26:32.562, 2011/01/27 17:38:30.874)  
[aahMDASSF.cpp; 3709; 1]

339263771/27/201111:09:53 PM37444076WarningaahMDASTime  
synchronization with historian node out of spec, please resync  
to avoid data loss. (12940622821060000, 129406235937946214)  
[StorageNode.cpp,2576]



```
339274101/27/201111:12:43 PM27683860WarningaaEngine0:6D4 Values
  in the past did not fit within the realtime window; discarding
  data (182, 2011/01/27 17:26:32.562, 2011/01/27 17:38:30.874)
[aahMDASSF.cpp; 3709; 72]
```

### **AppEngine1**

```
952460831/27/201110:56:40 PM16522908WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.
```

```
952460931/27/201111:08:30 PM16522908WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
952460941/27/201111:08:30 PM16522908WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
```

```
952460951/27/201111:08:30 PM16522908WarningNmxSvcPlatform 4
  exceed maximum heartbeats timeout of 8000 ms.
```

```
952461121/27/201111:08:32 PM39441968WarningaaEngine0:9AC Values
  in the past did not fit within the realtime window; discarding
  data (338, 2011/01/27 17:26:32.170, 2011/01/27 17:38:30.885)
[aahMDASSF.cpp; 3709; 1]
```

```
952461611/27/201111:09:29 PM39043908WarningScriptRuntime
  Insert.InsertValueOT: Script timed out.
```

```
952595461/27/201111:23:01 PM39763940WarningaaEngine0:9C8
  Snapshot write operation took longer than 10 seconds. Change
  your system settings to decrease size of snapshot or stop
  other applications which may affect this parameter (1, 2, 0,
  0, 25796, 10) [minideltastore.cpp; 2211; 1]
```

```
952597811/27/201111:23:18 PM39443948WarningScriptRuntime
  P30930.SetValues: Script timed out.
```

```
952598611/27/201111:23:31 PM39043908WarningScriptRuntime
  Insert.InsertValueOF: Script timed out.
```

```
952637011/27/201111:27:13 PM39441968WarningaaEngine0:9AC Values
  in the past did not fit within the realtime window; discarding
  data (568, 2011/01/27 17:52:30.859, 2011/01/27 17:53:00.890)
[aahMDASSF.cpp; 3709; 574]
```

### **AppEngine2**

```
54468511/27/201110:56:41 PM20882104WarningNmxSvcPlatform 5
  exceed maximum heartbeats timeout of 8000 ms.
```

```
54468571/27/201110:56:45 PM20882104WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 8000 ms.
```

```
54468641/27/201111:08:39 PM20882104WarningNmxSvcPlatform 3
  exceed maximum heartbeats timeout of 8000 ms.
```

```
54468771/27/201111:08:40 PM38563344WarningaaEngine0:994 Values
  in the past did not fit within the realtime window; discarding
```

```

data (16262, 2011/01/27 17:26:33.903, 2011/01/27
17:38:39.841) [aahMDASSF.cpp; 3709; 1]
54470211/27/201111:22:59 PM38324072WarningaaEngine0:97C
Snapshot write operation took longer than 10 seconds. Change
your system settings to decrease size of snapshot or stop
other applications which may affect this parameter (1024, 3,
0, 0, 244, 11) [minideltastore.cpp; 2211; 1]
54471201/27/201111:27:16 PM39044260WarningaaEngine0:99C Values
in the past did not fit within the realtime window; discarding
data (12307, 2011/01/27 17:52:32.183, 2011/01/27
17:53:03.354) [aahMDASSF.cpp; 3709; 3835]
54471211/27/201111:27:28 PM38803388WarningaaEngine0:968 Attempt
to store values in the future; timestamps were overwritten
with current time (11057, 2011/01/27 17:53:16.324, 2011/01/27
17:53:16.323) [aahMDASSF.cpp; 3315; 38]

```

## Historian

```

95878001/27/201110:56:42 PM14923380WarningaahStoreSvcAttempt to
store values in the future; timestamps were overwritten with
current time (pipe name, TagName, wwTagKey, system time (UTC),
time difference (sec)) (HISTORIAN_2, $Time, 23556, 2011/01/27
17:26:40.479, 771) [HISTORIAN; pipeserver.cpp; 1831]
95878041/27/201110:56:58 PM14923380ErroraahStoreSvcERROR:
Specified time cannot be in the future (2011/01/27
17:26:58.457, 2011/01/27 17:39:51.164) [HISTORIAN;
cmanualpipe.cpp; 697]
95878051/27/201110:56:58 PM14923380ErroraahStoreSvcERROR: Data
packet lost - broken packet saved in bpack.bin
(HISTORIAN_ManualDataPipe, bPacket_129406228184574640.bin)
[HISTORIAN; cmanualpipe.cpp; 1267]
95878591/27/201111:10:18 PM39563920InfoaahIDASSvc (local)
HISTORIAN_2: Network or server is too busy (max time lag
reached, time lag 773733 ms)
95878601/27/201111:10:18 PM39563920InfoaahIDASSvc (local)
HISTORIAN_2: Clearing buffer cache for recovery (max time lag
reached)
95878611/27/201111:10:18 PM39563920InfoaahIDASSvc (local)
HISTORIAN_2: A data buffer lost: header/dirty time of the lost
buffer = 22:57:24.413/23:10:18.145
95878641/27/201111:10:18 PM50765116InfoaahDrvSvcHISTORIAN_1:
HISTORIAN: 17 data buffers lost: header/dirty time of the last
lost buffer = 22:57:26.000/23:10:18.389
95879431/27/201111:10:20 PM14923380WarningaahStoreSvcAttempt to
store values in the future; timestamps were overwritten with
current time (pipe name, TagName, wwTagKey, system time (UTC),

```

```

time difference (sec)) (HISTORIAN_2, $Time, 23556, 2011/01/27
17:26:40.479, 771) [HISTORIAN; pipeserver.cpp; 1831; 77980]
95879571/27/201111:10:26 PM14923380WarningaahCfgSvc"Server time
is shifting (Expected time, Current time)"
(01/27/11,23:10:25,776, 01/27/11,22:57:33,033) [HISTORIAN;
Config.cpp; 2040]
95881611/27/201111:23:02 PM14923380WarningaahStoreSvcSnapshot
write operation took longer than 10 seconds. Change your
system settings to decrease size of snapshot or stop other
applications which may affect this parameter (2, 1, 0,
2154928, 21081, 14) [HISTORIAN; deltastore.cpp; 2669]
95881671/27/201111:23:04 PM14923380WarningaahStoreSvcValues in
the past did not fit within the realtime window; discarding
data (HISTORIAN_mdas, 23580, 2011/01/27 17:52:32.691,
2011/01/27 17:53:04.250) [HISTORIAN; pipeserver.cpp; 2388]
95879431/27/201111:10:20 PM14923380WarningaahStoreSvcAttempt to
store values in the future; timestamps were overwritten with
current time (pipe name, TagName, wwTagKey, system time (UTC),
time difference (sec)) (HISTORIAN_2, $Time, 23556, 2011/01/27
17:26:40.479, 771) [HISTORIAN; pipeserver.cpp; 1831; 77980]

```

### HistClient

```

1382081/27/201110:56:42 PM32322264WarningaaAFCommonTypesUnable
to create dataview: Server must be logged on before executing
SQL query: SELECT aaT=DateTime, aaN=TagName, aaDV=Value,
aaSV=CONVERT(nvarchar(512),vValue), aaQ=OPCQuality,
aaIQ=Quality, aaQD=QualityDetail, aaS=0
FROM History
WHERE TagName IN ('...
1382091/27/201110:56:42 PM32322264WarningaaTrendDataSetProvider
The configured InSQL server HISTORIAN is either Disconnected
from Network or in shutdown/Disable state

```

### WISNode

```

30973991/27/201110:56:40 PM33002960WarningNmxSvcPlatform 4
exceed maximum heartbeats timeout of 8000 ms.
30974011/27/201111:09:31 PM33002960WarningNmxSvcPlatform 1
exceed maximum heartbeats timeout of 8000 ms.

```

## Scenario 2: Virtualization Server Hardware Fails

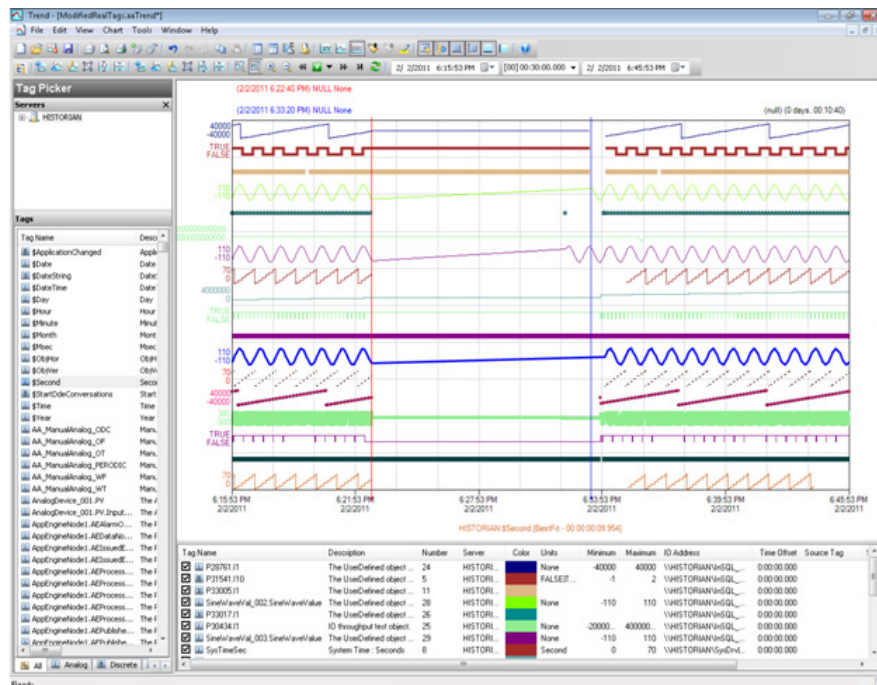
### Failover Due to Hardware failure

The failover occurs due to hardware failure, and it is simulated with power-off on the host server. Bandwidth used is 45 Mbps, which is simulated with a SoftPerfect Connection Emulator tool.

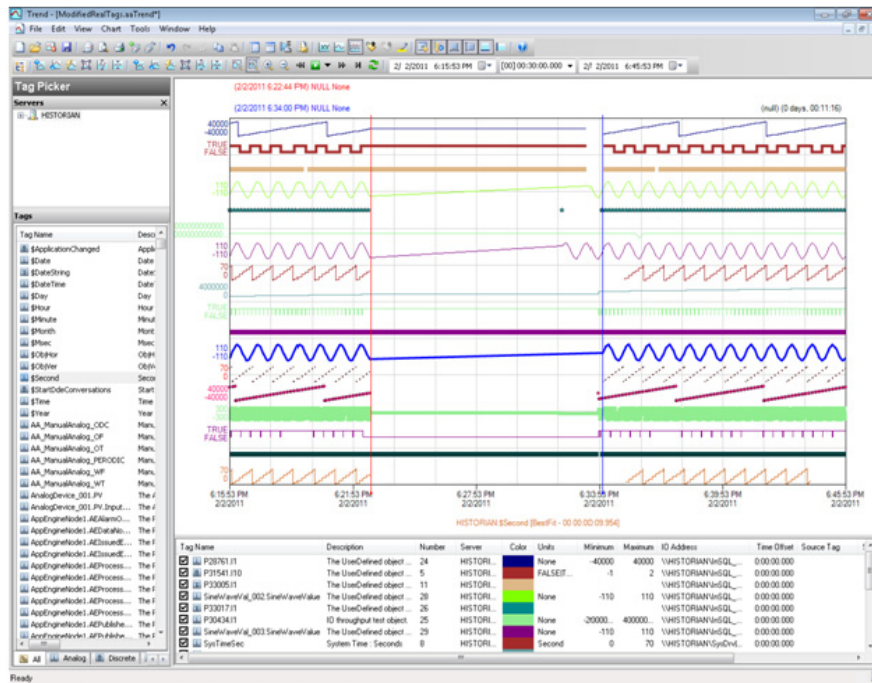
#### Trends:

#### AppEngine1

#### IAS Tag (Script)

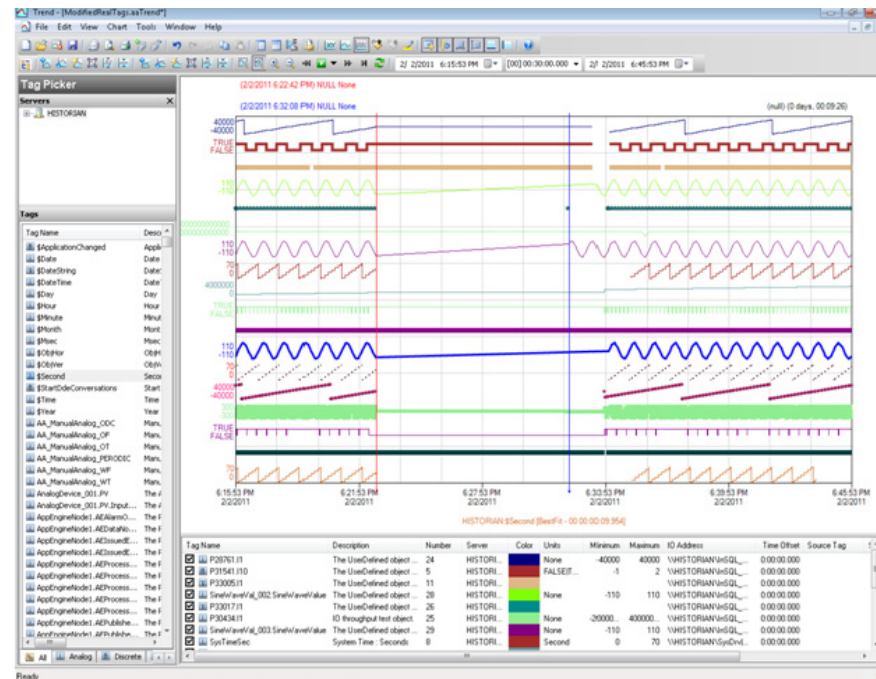


### IAS IO Tag (DASSiDirect)

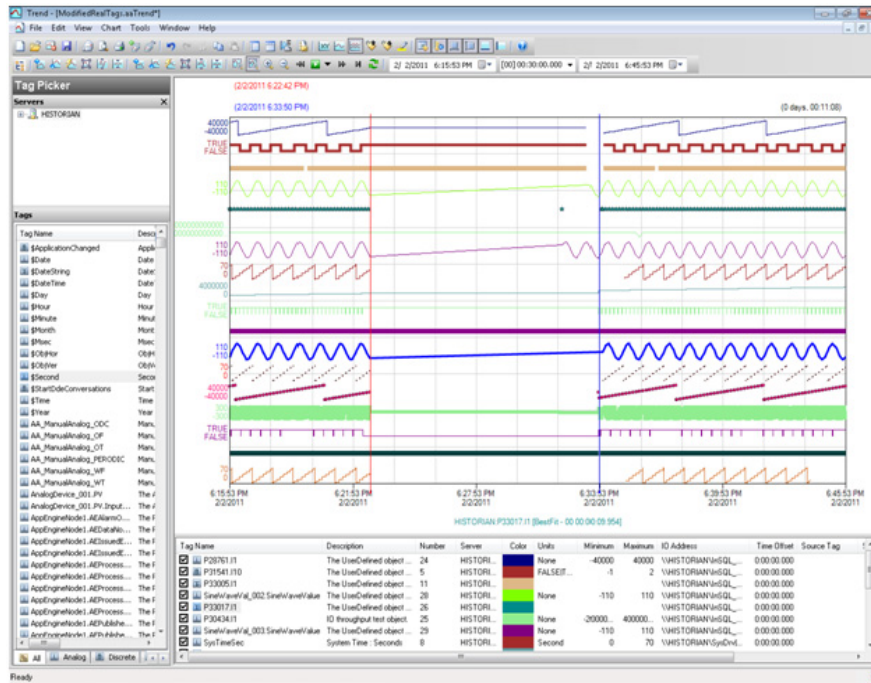


### AppEngine2

### IAS Tag (Script)

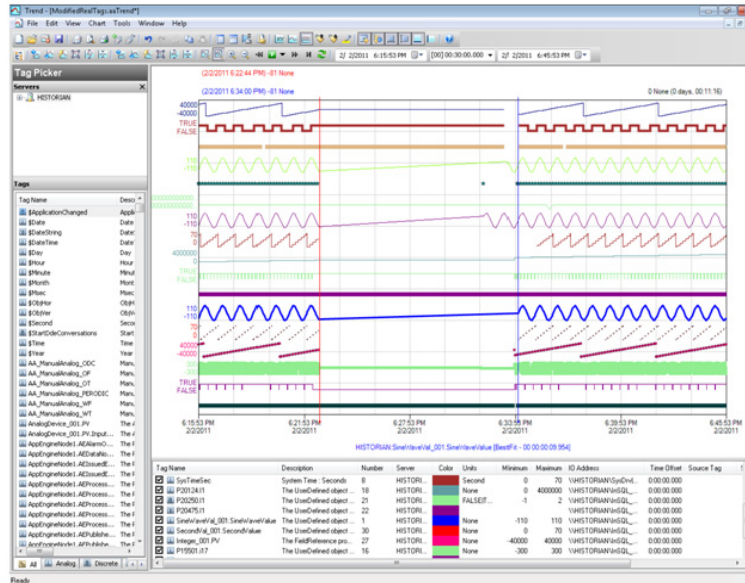


### IAS IO tag (DASSiDirect)

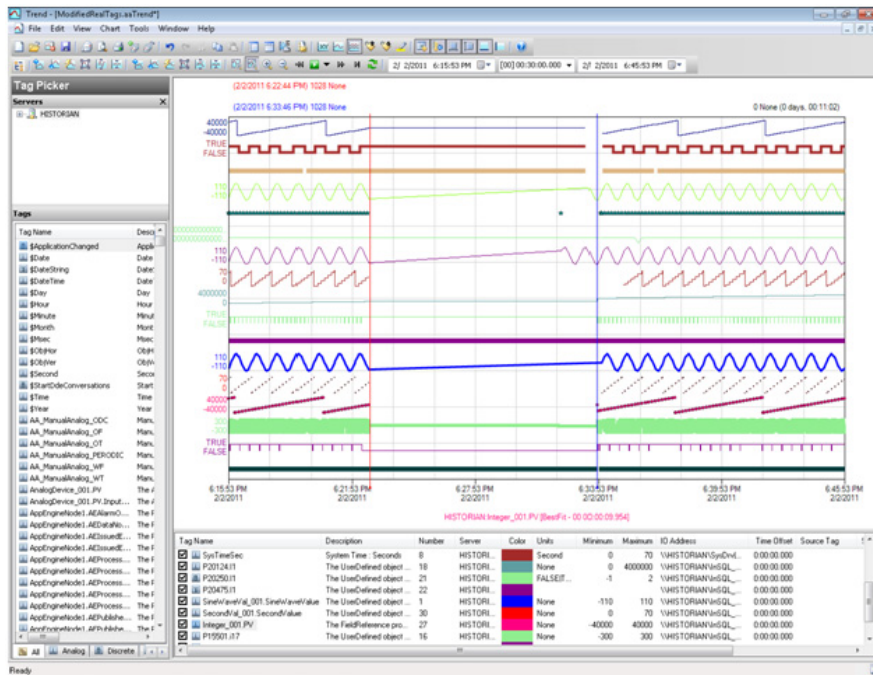


### GR

### IAS tag (Script)

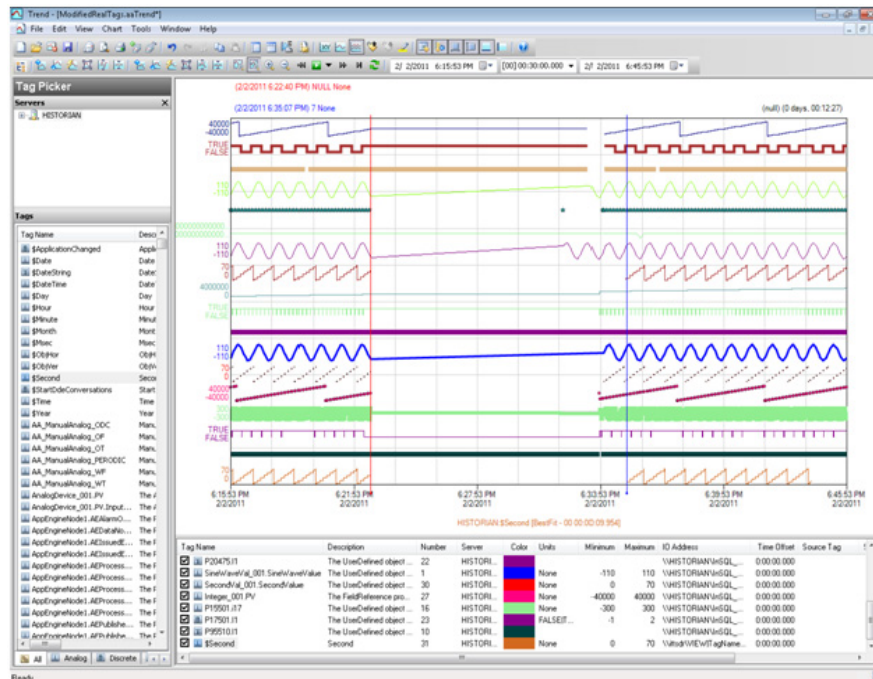


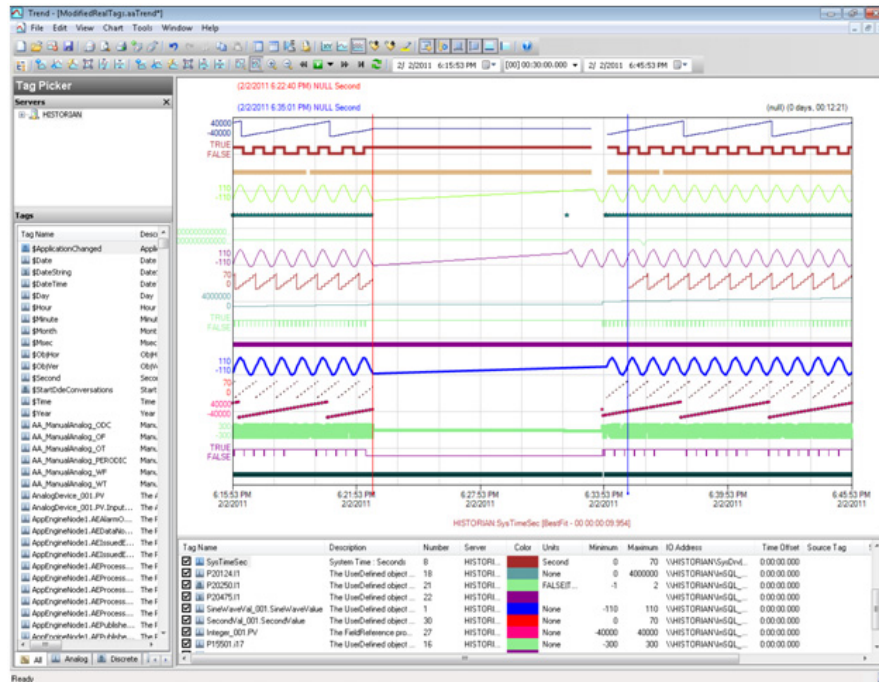
### IAS IO tag (DASSiDirect)



### Historian

### \$Second (InTouch)



**SysTimeSec (Historian)****Observations**

Error log after failover:

**GR Node**

```
394348452/2/20116:33:30 PM25082512WarningScriptRuntime
GR.privatebytes: Script timed out.aaEngine
```

**AppEngine1**

```
1018912922/2/20116:32:54 PM29442948WarningScriptRuntime
AppEngineNode1.privatebytes: Script timed out.aaEngine

1018914202/2/20116:33:20 PM30803084WarningScriptRuntime
Insert.InsertValuePeriodic: Script timed out.aaEngine

1018914662/2/20116:33:21 PM30803084WarningScriptRuntime
Insert.InsertValueOF: Script timed out.aaEngine

1018918082/2/20116:33:38 PM30803372WarningDCMConnectionMgr
Open() of DCMConnection failed: 'A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
accessible. Verify that the instance name is correct and that
SQL Server is configured...aaEngine

1018918122/2/20116:33:39 PM30803372WarningSQLDataRuntime3
SQLTestResults Command Failure - A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
```



accessible. Verify that the instance name is correct and that SQL Server is configured...aaEngine

1019127142/2/20116:53:52 PM26722448WarningInTouchProxyFailed to reconnect to data source aaEngine

1019235332/2/20117:04:27 PM30803084WarningScriptRuntime Insert.InsertValueWF: Script timed out.aaEngine

## AppEngine2

54719382/2/20116:31:18 PM2508332WarningEnginePrimitiveRuntime Eng:: m\_GDC->GetFile failed. Error 2 (0x00000002): The system cannot find the file specified

54721462/2/20116:32:29 PM2508332WarningHistorianPrimitive AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)

54721512/2/20116:33:29 PM2508332WarningHistorianPrimitive AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)

54721542/2/20116:34:29 PM2508332WarningHistorianPrimitive AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)

## Historian

232629982/2/20116:35:09 PM14722220WarningaahStoreSvcAttempt to store values in the future; timestamps were overwritten with current time (pipe name, TagName, wwTagKey, system time (UTC), time difference (sec)) (HISTORIAN\_mdas, GR.Engine.ProcessIODataBytes, 182, 2011/02/02 13:05:08.273, 1) [HISTORIAN; pipe...

232630402/2/20116:39:21 PM14722220WarningaahStoreSvcAttempt to store values in the future; timestamps were overwritten with current time (pipe name, TagName, wwTagKey, system time (UTC), time difference (sec)) (HISTORIAN\_mdas, GR.Engine.ProcessIODataBytes, 182, 2011/02/02 13:05:08.273, 1) [HISTORIAN; pipe...

232662142/2/20117:04:28 PM14722220WarningaahStoreSvcSnapshot write operation took longer than 10 seconds. Change your system settings to decrease size of snapshot or stop other applications which may affect this parameter (4, 1, 0, 9097524, 1214182, 18) [HISTORIAN; deltastore.cpp; 2669]

232662152/2/20117:04:28 PM14722220WarningaahStoreSvcSnapshot write operation took longer than 10 seconds. Change your system settings to decrease size of snapshot or stop other

applications which may affect this parameter (1024, 3, 1, 54846865, 2166577, 20) [HISTORIAN; deltastore.cpp; 2669]

## Scenario 3: Network Fails on Virtualization Server

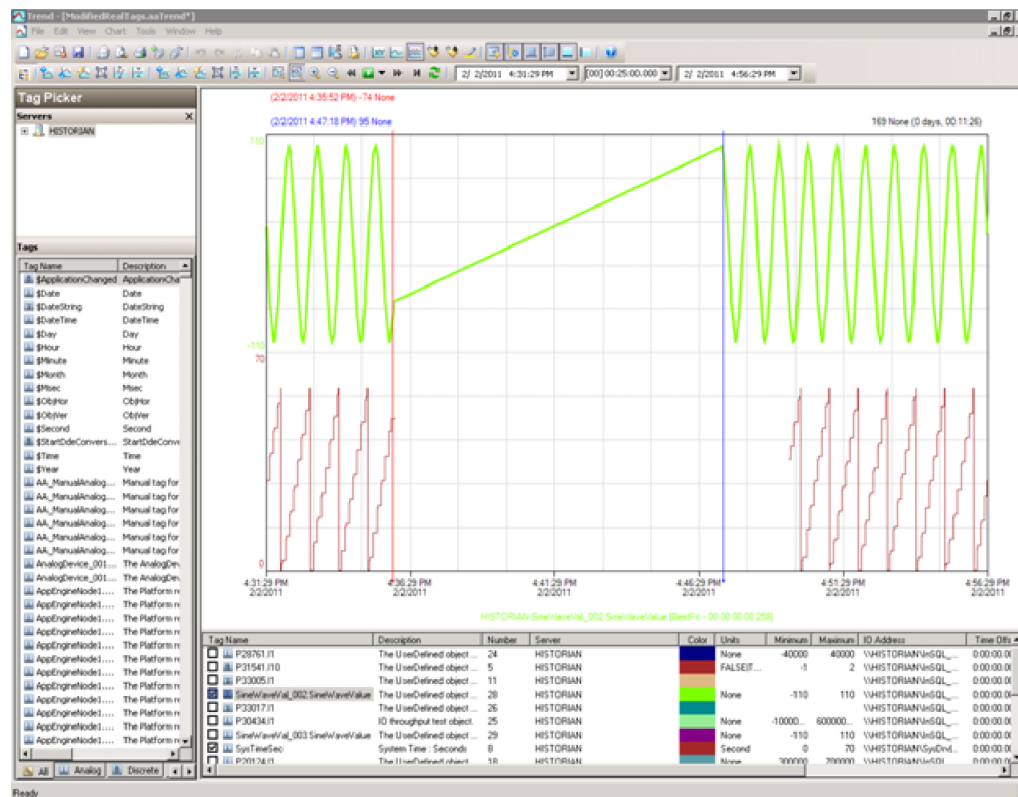
### Failover Due to Network Disconnect (Public)

The failure of network on the Virtualization Server results in failover due to network disconnect (Public). Bandwidth used is 45Mbps, which is simulated with a SoftPerfect Connection Emulator Tool.

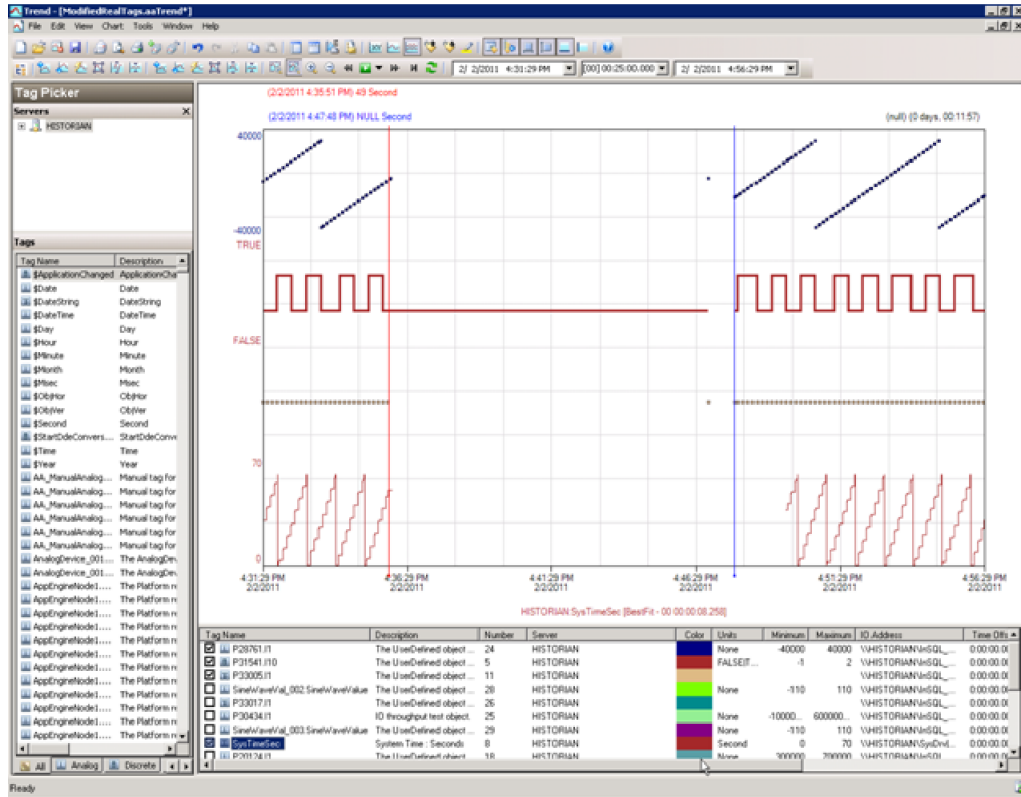
#### Trends:

#### AppEngine1

#### IAS tag (Script)

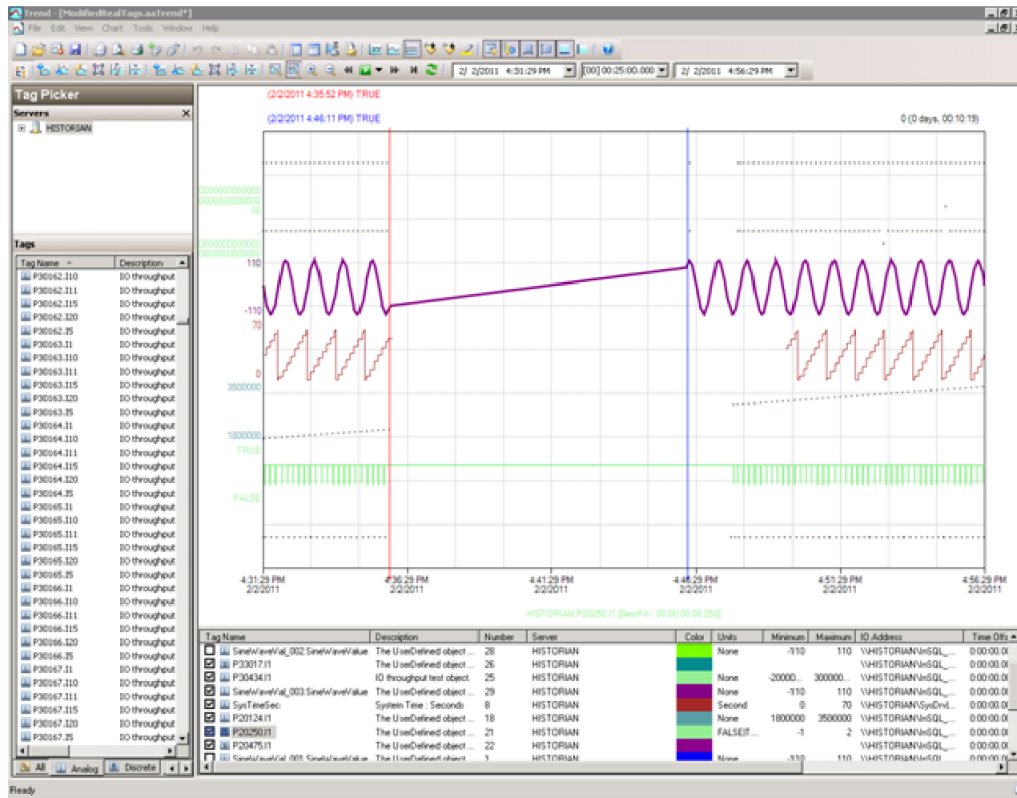


### IAS IO tag (DASSiDirect)

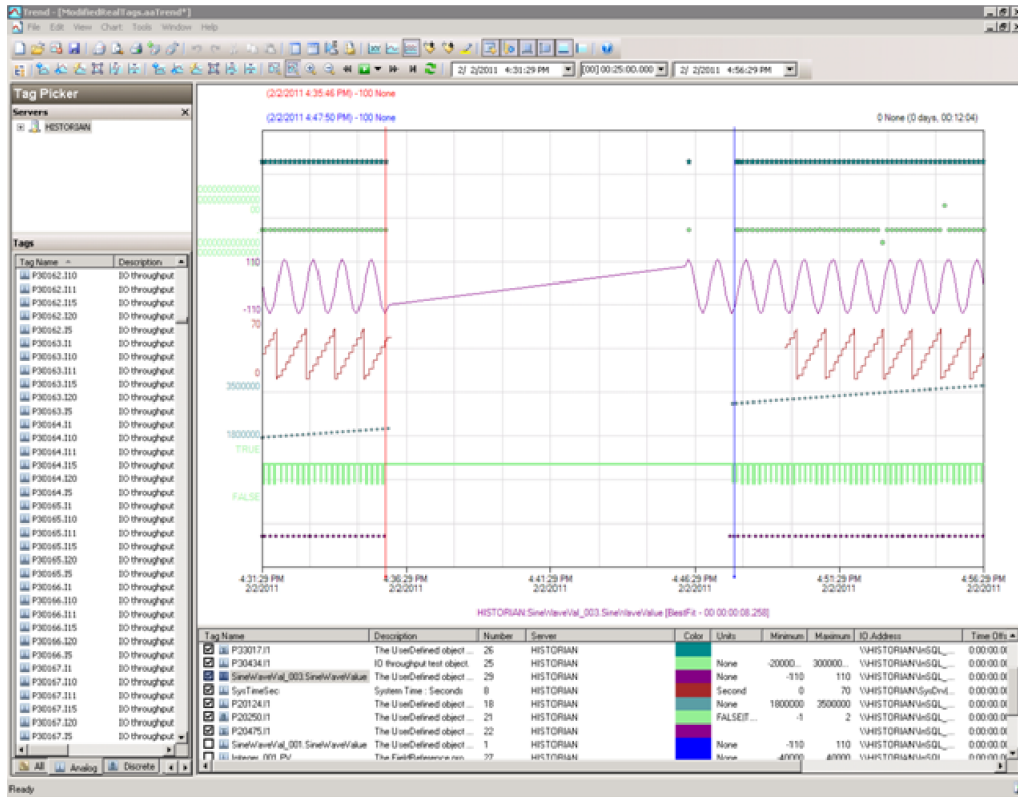


## AppEngine2

### IAS tag (Script)

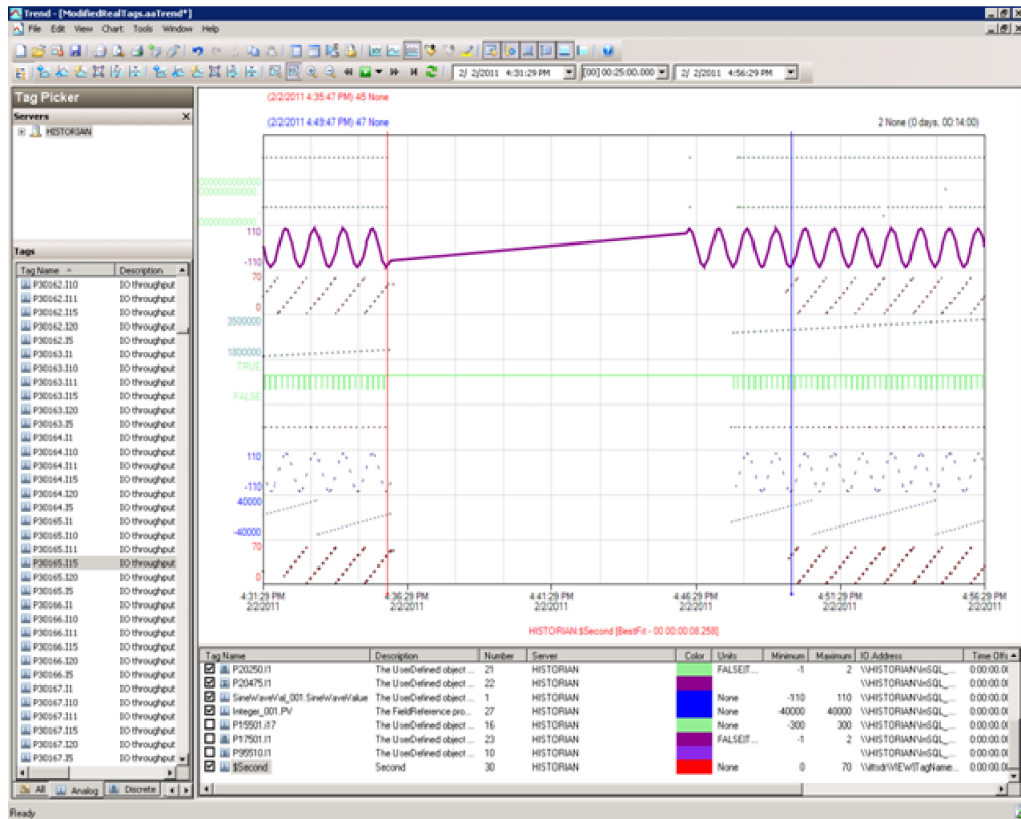


### IAS IO tag (DASSiDirect)



## Historian

### \$Second (Intouch)



## Observations

Error log after failover

### GR Node

```
393988582/2/20114:46:34 PM26602664WarningEnginePrimitiveRuntime
Eng:: m_GDC->GetFile failed. Error 2 (0x00000002): The system
cannot find the file specifiedaaEngine
```

```
393989522/2/20114:47:31 PM26602664WarningScriptRuntime
GR.privatebytes: Script timed out.aaEngine
```

### AppEngine1

```
1017936492/2/20114:46:34 PM29522956WarningScriptRuntime
AppEngineNode1.privatebytes: Script timed out.aaEngine
```

```
1017938352/2/20114:47:05 PM27002184WarningScriptRuntime
Insert.InsertValueDataChange: Script timed out.aaEngine
```

```
1017940012/2/20114:47:32 PM27003592WarningDCMConnectionMgr
```

```
Open() of DCMConnection failed: 'A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
```

accessible. Verify that the instance name is correct and that SQL Server is configured...aaEngine

1017940022/2/20114:47:33 PM27003592WarningSQLDataRuntime3  
SQLTestResults.Command.Failure - A network-related or instance-specific error occurred while establishing a connection to SQL Server. The server was not found or was not accessible. Verify that the instance name is correct and that SQL Server is configured...aaEngine

1017940192/2/20114:48:26 PM27004048WarningScriptRuntime  
InsertAsync.InsertValueWF: Script timed out.aaEngine

1017940322/2/20114:48:26 PM27002184WarningScriptRuntime  
Insert.InsertValueWF: Script timed out.aaEngine

1018040142/2/20114:58:02 PM20082652WarningInTouchProxyFailed to  
reconnect to data source aaEngine

1018047432/2/20114:58:43 PM20082652WarningInTouchProxyFailed to  
reconnect to data source aaEngine

## AppEngine2

54716472/2/20114:46:07 PM21721972WarningScriptRuntime  
HourVal\_003.GenerateHourValue: Script timed out.aaEngine

54716942/2/20114:46:29 PM2480672WarningHistorianPrimitive  
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)aaEngine

54717192/2/20114:49:29 PM2480672WarningHistorianPrimitive  
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does ArchestrA user account exist on Historian(InSQL) node or does Historian not exist?)aaEngine

## Historian

232207772/2/20114:33:29 PM15162260WarningaahStoreSvcValues in  
the past did not fit within the realtime window; discarding  
data (historian\_2, 23987, 2011/02/02 10:49:20.680, 2011/02/02  
10:59:15.351) [HISTORIAN; pipeserver.cpp; 2388; 535]aahCfgSvc

232400692/2/20114:49:41 PM15202800WarningaahStoreSvcAttempt to  
store values in the future; timestamps were overwritten with  
current time (pipe name, TagName, wwTagKey, system time (UTC),  
time difference (sec)) (HISTORIAN\_mdas,  
IncrementVal\_003.IncrementValue, 12307, 2011/02/02  
11:19:37.535, 1) [HISTORIAN; p...aahCfgSvc

232401232/2/20114:53:51 PM15202800WarningaahStoreSvcAttempt to  
store values in the future; timestamps were overwritten with  
current time (pipe name, TagName, wwTagKey, system time (UTC),  
time difference (sec)) (HISTORIAN\_mdas,

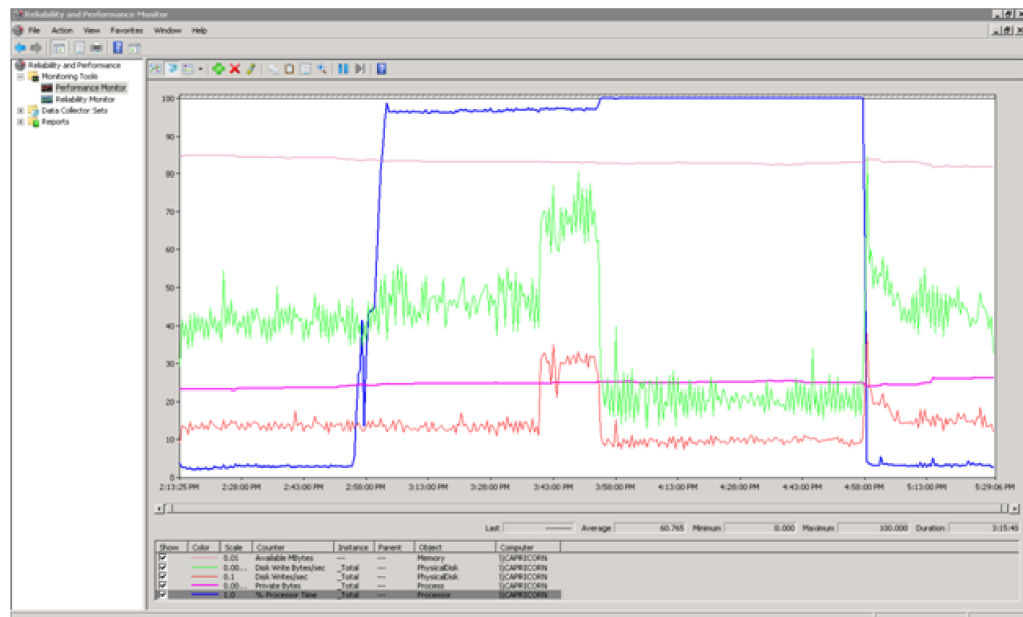
```
IncrementVal_003.IncrementValue, 12307, 2011/02/02
11:19:37.535, 1) [HISTORIAN; p...aahCfgSvc
```

## Scenario 4: Virtualization Server Becomes Unresponsive

### Hyper-V Virtual Machines with Static RAM and Reservations for Processors

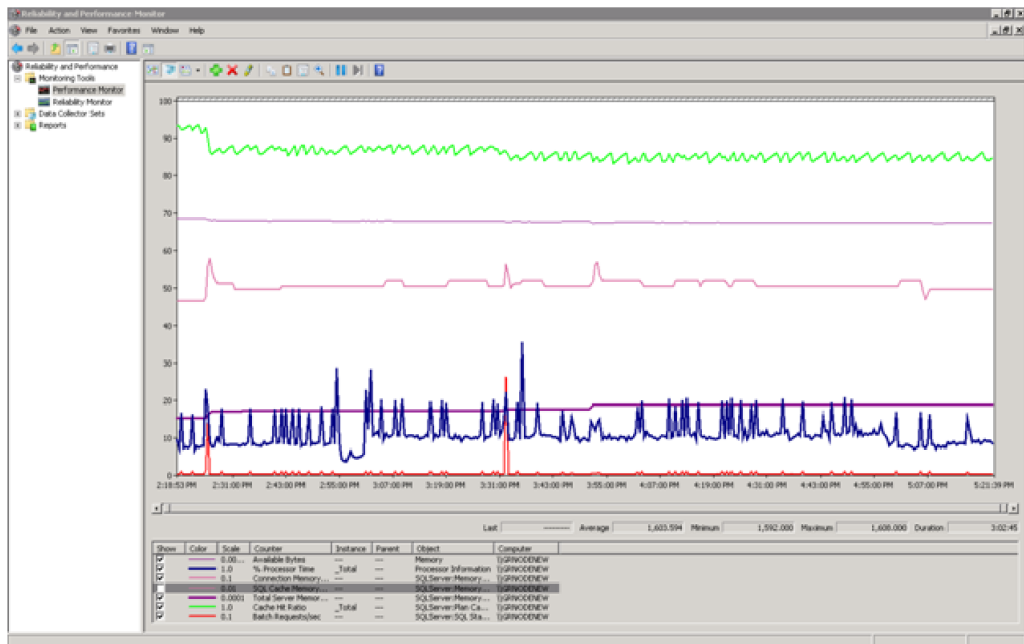
It has been observed that even when the Host Virtualization Server reaches 100% CPU utilization, there is no failover of the Hyper-V virtual machines running on it to the other Host Virtualization Server. However, the host server running at 100% CPU utilization fails to process all the network requirements of the Hyper-V virtual machines running on it. As a result, network disruptions on the Hyper-V virtual machines are observed that result in data loss.

### Host Virtualization server performance with CPU load at 100%

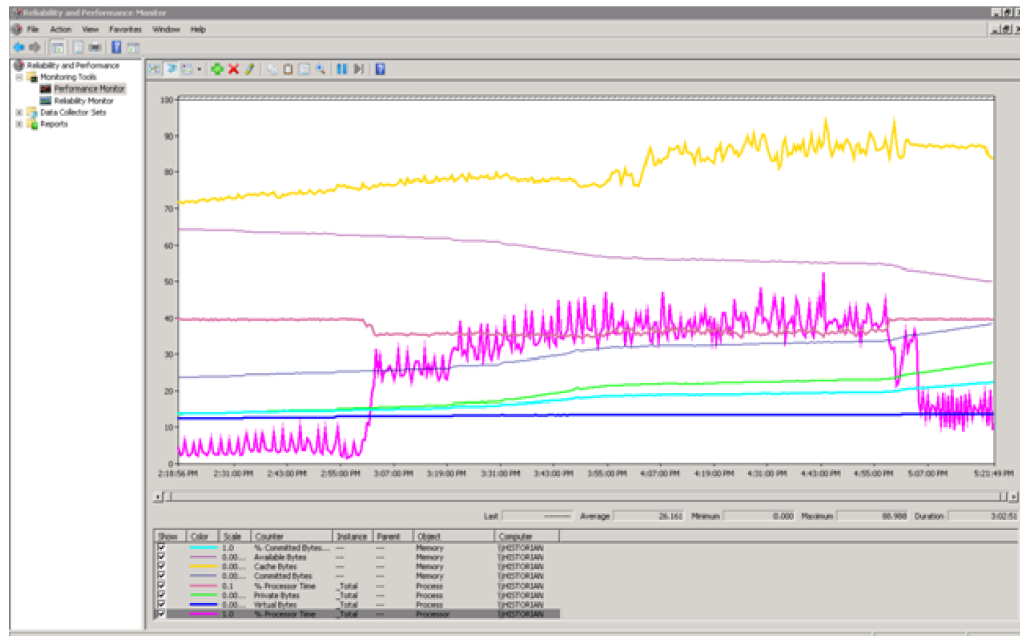




### GR Performance with host server running at 100% CPU load



### Historian performance with host server running at 100% CPU load



## Observations When CPU Load is 100% on host Virtualization Server

The virtual machines do not failover when CPU load stays at 100%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is at 100%.

The messages “Snapshot write operation took longer than 10 seconds” are expected when the virtual machines are running at high Processor time % (Historian at 89% and GR Node at 35%).

The execution of time sync utility is impacted and the time is not synchronized on the Historian, AppEngine nodes and GR node. As a result, the message “Values in the past did not fit within the realtime window” is observed.

### AppEngine1

```
2/4/20114:41:11 PMWarningaaEngine0:A50 Snapshot write operation
took longer than 10 seconds. Change your system settings to
decrease size of snapshot or stop other applications which may
affect this parameter (1024, 3, 0, 0, 7316, 11)
[minideltastore.cpp; 2211; 1]
```

```
2/4/20114:41:35 PMWarningaaEngine0:9D8 Values in the past did
not fit within the realtime window; discarding data (1481,
2011/02/04 11:11:02.029, 2011/02/04 11:11:35.041)
[aahMDASSF.cpp; 3709; 1]
```

### AppEngine2

```
2/4/20114:56:49 PMWarningaaEngine0:A08 Snapshot write operation
took longer than 10 seconds. Change your system settings to
decrease size of snapshot or stop other applications which may
affect this parameter (4, 6, 0, 0, 3288, 11)
[minideltastore.cpp; 2211; 1]
```

```
2/4/20114:58:21 PMWarningaaEngine0:9D4 Values in the past did
not fit within the realtime window; discarding data (11701,
2011/02/04 11:23:35.788, 2011/02/04 11:24:08.264)
[aahMDASSF.cpp; 3709; 4331]
```

### GR Node

```
2/4/20114:50:54 PMWarningaaEngine0:B34 Snapshot write operation
took longer than 10 seconds. Change your system settings to
decrease size of snapshot or stop other applications which may
affect this parameter (1, 2, 0, 0, 301, 10)
[minideltastore.cpp; 2211; 1]
```

```
2/4/20114:51:18 PMWarningaaEngine0:B34 Values in the past did
not fit within the realtime window; discarding data (23580,
2011/02/04 11:16:35.876, 2011/02/04 11:17:07.056)
[aahMDASSF.cpp; 3709; 10]
```

```
2/4/20114:51:20 PMWarningaaEngine0:D38 Values in the past did
not fit within the realtime window; discarding data (218,
2011/02/04 11:16:35.297, 2011/02/04 11:17:08.259)
[aahMDASSF.cpp; 3709; 132]
```

```
2/4/20114:52:12 PMWarningScriptRuntime
AsynchronousBuffer.script6: Script timed out.
```

Scripts on GR node time out

### Historian Node

```
2/4/20114:15:22 PMWarningaahStoreSvcValues in the past did not
fit within the realtime window; discarding data
(HISTORIAN_mdas, 182, 2011/02/04 10:40:24.919, 2011/02/04
10:41:07.901) [HISTORIAN; pipeserver.cpp; 2388; 4836]
```

```
2/4/20114:15:40 PMWarningaahStoreSvcSnapshot write operation
took longer than 10 seconds. Change your system settings to
decrease size of snapshot or stop other applications which may
affect this parameter (1, 2, 0, 17223628, 221525, 14)
[HISTORIAN; deltastore.cpp; 2669]
```

```
2/4/20114:15:40 PMWarningaahStoreSvcSnapshot write operation
took longer than 10 seconds. Change your system settings to
decrease size of snapshot or stop other applications which may
affect this parameter (1024, 3, 0, 369892038, 1896467, 26)
[HISTORIAN; deltastore.cpp; 2669]
```

```
2/4/20114:15:45 PMErroraahRetSvcERROR: Failed to open file
(C:\Historian\Data\Circular\A110204_015\stringD1024_2.sdt)
[HISTORIAN; retdelta.cpp; 4344]
```

```
2/4/20114:15:45 PMErroraahRetSvcERROR: Could not load delta data
from disk [HISTORIAN; retdelta.cpp; 726]
```

The error message "ERROR: Failed to open file  
(C:\Historian\Data\Circular\.." and "ERROR: Could not load  
delta data from disk" is expected when Historian client is used  
to retrieve data when %Processor Time is high.

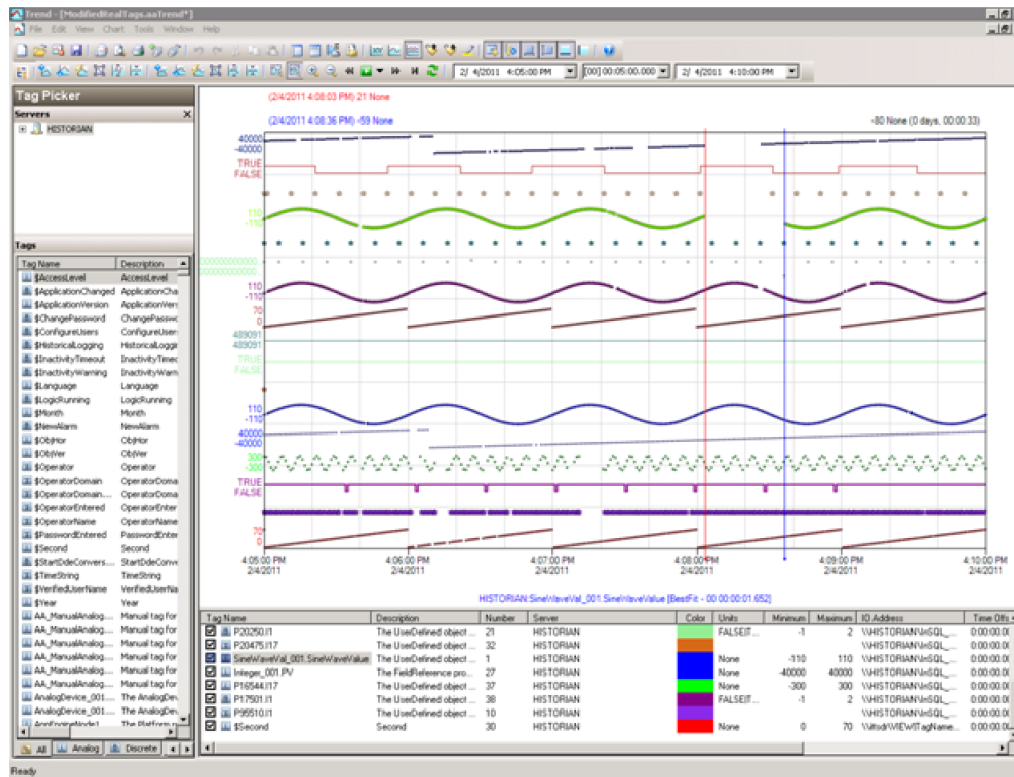
### WIS Node

```
2/4/20114:47:02 PMWarningArchestrA.Visualization.WCFServiceLMX
WCF service: Exception while PushBackData(sync mode): [The
operation has timed out.] at [
```

Server stack trace:

```
at
System.ServiceModel.Channels.InputQueue`1.Dequeue(TimeSpan
timeout)
at
System.ServiceModel.Channels.ServicePollingDuplexSessionCh...
```

## Trend when CPU Load is 100% on host Virtualization Server



From the above trend, it is observed that there is data loss for 33 seconds at a stretch IAS Script tags on GR node. It can also be noticed that there are frequent data losses for all types tags IO and Script generated from GR and AppEngine nodes.

## Observations When CPU Load is 96% on host Virtualization Server

The virtual machines do not failover when CPU load stays at 96%. All the virtual machines continue to run on the same Host Virtualization Server even though the CPU load is high.

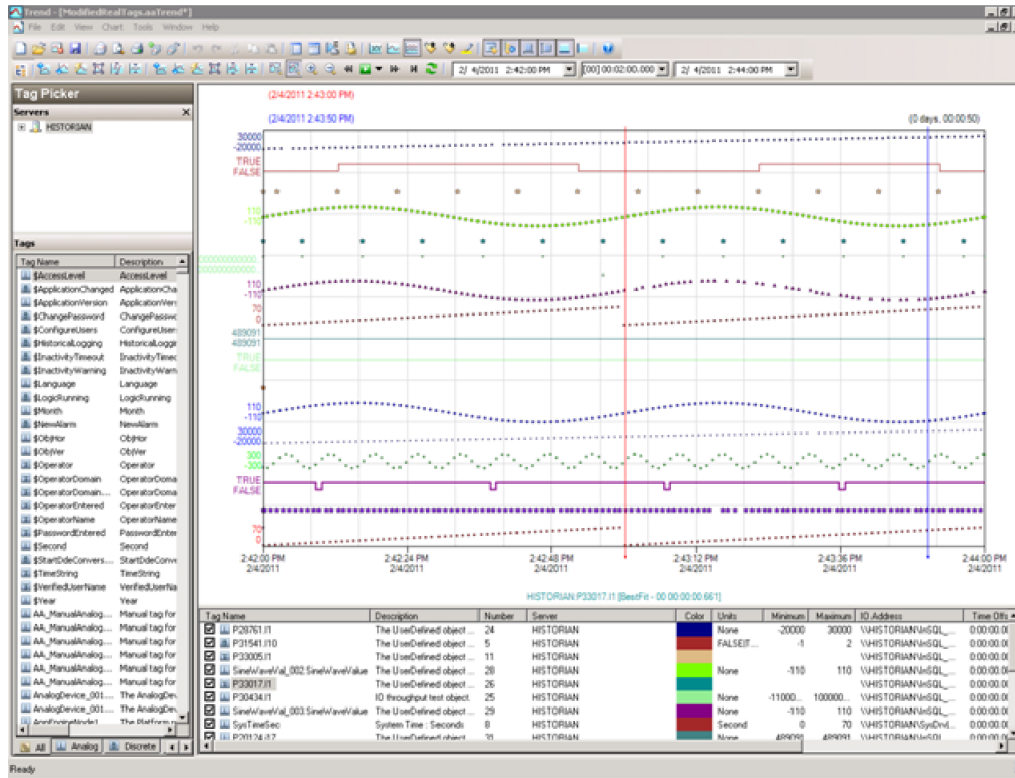
Only below warning message is observed when CPU load of host is 96%.

### WIS node

```
2/4/20113:12:32 PMWarningrdbhandler
```

```
!RdbHandlerListener::OnData() - Invalid Session (ID:3801155)
```

### Trend When CPU Load is 96% on host Virtualization Server



From the above trend, it is observed that there is data loss for IAS IO tags and Script tags on GR node and AppEngine Nodes.



## Chapter 4

# Working with High Availability and Disaster Recovery

This section introduces several High Availability and Disaster Recovery (HADR) virtualization solutions that improve the availability of System Platform Products. A HADR solution offsets the effects of a hardware or software failure across multiple sites during a disaster. It makes sure all applications are available in order to minimize the downtime during times of crisis.

## Recommendations and Best Practices

- Ensure that auto logon is set up for all Hyper-V virtual machines running the System Platform products. This is to ensure that these Hyper-V virtual machines start up automatically after the failover.
- Ensure the time on all the Hyper-V host servers, the virtual machines, and all other nodes, which are part of the Disaster Recovery environment are continuously synchronized. Otherwise, the Hyper-V virtual machines running on the host experience time drifts and discards data. You can add the time synchronization utility in the Start Up programs so that this utility starts automatically whenever the Hyper-V machine reboots.
- On the host servers, disable all the network cards that are not utilized by the System Platform environment. This is to avoid any confusion during the network selections while setting up the cluster.

- As per the topology described above for the High Availability and Disaster Recovery environment, only one network is used for all communications. If multiple networks are used, then make sure only the primary network used for communication between the Hyper-V Nodes is enabled for the Failover Cluster Communication. Disable the remaining cluster networks in Failover Cluster Manager.
- Ensure the virtual networks created in Hyper-V Manager have the same name across all the nodes, which are participating in the cluster. Otherwise, migration/failover of Hyper-V virtual machines will fail.
- Though this is a three-node failover topology, to achieve the required failover order, a fourth node is required for setting up the Node Majority in the failover cluster. The three nodes are used for virtual machine services and the fourth node is used for Quorum witness. The fourth node is not meant for failover of Hyper-V virtual machines running on the cluster. This fourth node should not be marked as the preferred owner while setting up the preferred owners for the Hyper-V virtual machines running on the cluster.

The following scenario is an explanation for the failover order.

Node 1 and Node 2 are in High Available site and Node 3 is in Disaster site. The failover sequence is Node 1 > Node 2 > Node 3.

- When all VMs are running on Node 1:
  - All three nodes are up. Now Node 1 goes down. The VMs running on Node 1 move to Node 2.
  - Node 1 and Node 3 are up and Node 2 is down. Now Node 1 goes down. The VMs running on Node 1 move to Node 3.
- When all VMs are running on Node 2:
  - Node 2 and Node 3 are up and Node 1 is down. Now Node 2 goes down. The VMs running on Node 2 move to Node 3.
  - All three nodes are up. Now Node 2 goes down. The VMs running on Node 2 move to Node 3.

### **Best Practices for SteelEye DataKeeper Mirroring:**

- While creating the SteelEye DataKeeper mirroring job, ensure the drive letters of the source and target drives to be mirrored are same.
- It is recommended to have zero latency in the network when SteelEye DataKeeper mirroring, failover/migration of virtual machines between host servers take place. In case of networks with latency, refer to the SteelEye DataKeeper documentation on network requirements.



- While designing the network architecture, particularly bandwidth between the hosts in the Disaster Recovery Environment, make sure to select the bandwidth based on the rate of data change captured from the Disk Write Bytes/Sec on the host server for all the mirrored volumes. To verify that you have sufficient network bandwidth to successfully replicate your volume, use the Windows Performance Monitoring and Alerts tool to collect Write Bytes/sec on the replicated volumes to calculate the rate of data change. Collect this counter every 10 seconds and use your own data analysis program to estimate your rate of data change. For more details, refer to SteelEye DataKeeper documentation on network requirements.

SteelEye DataKeeper can handle the following average rates of change, approximately:

<b>Network Bandwidth</b>	<b>Rate of Change</b>
1.5 Mbps (T1)	182,000 Bytes/sec (1.45 Mbps)
10 Mbps	1,175,000 Bytes/sec (9.4 Mbps)
45 Mbps (T3)	5,250,000 Bytes/sec (41.75 Mbps)
100 Mbps	12,000,000 Bytes/sec (96 Mbps)
1000 Mbps (Gigabit)	65,000,000 Bytes/sec (520 Mbps)

The following table lists the impact on CPU utilization and bandwidth at various compression levels.

- Medium Configuration Load: Approximately 50000 IO Points with approximately 20000 attributes being historized.
- Network: Bandwidth controller with bandwidth is 45Mbps and no latency.

These are readings when mirroring is continuously happening between the source and the destination storage SANs, when all the VMs are running on the source host server. The data captured shows that the % CPU utilization of the SteelEye DataKeeper mirroring process increases with increasing compression levels. Based on these findings, you are recommended to use Compression Level 2 in the Medium Scale Virtualization environment.

	<b>Impact on CPU of Source Host Server</b>		<b>Impact on Bandwidth</b>
	<b>% Processor Time (ExtMirrSvc) - SteelEye DataKeeper Mirroring process</b>	<b>% Processor Time (CPU) - Overall CPU</b>	<b>Total Bytes/Sec</b>
Compression 0	Min: 0 Max: 4.679 Avg: 0.157	Min: 0 Max: 28.333 Avg: 1.882	Min: 0 Max: 11,042,788 Avg: 2,686,598
Compression 1	Min: 0 Max: 4.680 Avg: 0.254	Min: 0 Max: 31.900 Avg: 1.895	Min: 0 Max: 10,157,373 Avg: 1,871,426
Compression 2	Min: 0 Max: 6.239 Avg: 0.402	Min: 0 Max: 37.861 Avg: 2.622	Min: 791.970 Max: 10,327,221 Avg: 1,199,242
Compression 9	Min: 0 Max: 13.525 Avg: 0.308	Min: 0 Max: 42.094 Avg: 3.244	Min: 0 Max: 7,066,439 Avg: 649,822

## System Platform Product-specific Recommendations and Observations

- During the preparation for Live and Quick migrations it is observed that the network freezes intermittently and then at the time of actual migration connectivity to the VM is lost. As a result, the System Platform node under migration experiences intermittent data loss during the preparation for Live and Quick migrations, and then has a data gap for the duration of actual migration.

### Historian

- In case of Live and Quick migration of Historian, you may notice that Historian logs values with quality detail 448 and there may be values logged twice with same timestamps. This is because the suspended Historian VM starts on the other cluster node with the system time it was suspended at before the migration. As a result, some of the data points it is receiving with the current time seem to be in the future to the Historian. This results in Historian modifying the timestamps to its system time and updating the QD to 448. This happens until the system time of the Historian node catches up with the real current time using the TimeSync utility, after which the problem goes away. So, it is recommended to stop the historian before the migration and restart it after the VM is migrated and its system time is synced up with the current time.
- Live and Quick migration of Historian should not be done when the block change over is in progress on the Historian node.
- If a failover happens (for example, due to a network disconnect on the source host Virtualization Server) while the Historian status is still “Starting”, the Historian node fails over to the target host Virtualization Server. In the target host, Historian fails to start. To recover from this state, kill the Historian services that failed to start and then start the Historian by launching the SMC.

### InTouch

- Ensure that InTouch Window Viewer is added to the Start Up programs so that the view is started automatically when the virtual machine reboots.

### **Application Server**

- If a failover happens (for example, due to a network disconnect on the source host Virtualization Server) while the Galaxy Migration is in progress, the GR node fails over to the target host Virtualization Server. In the target host, on opening the IDE for the galaxy, the templates do not appear in the Template toolbox and in Graphic toolbox. To recover from this state, delete the galaxy and create new Galaxy. Initiate the migration process once again.
- If a failover happens (for example, due to an abrupt power-off on the source host Virtualization Server) while a platform deploy is in progress, the Platform node fails over to the target host Virtualization Server. In the target host, some objects will be in deployed state and the rest will be in undeployed state. To recover from this state, redeploy the whole Platform once again.
- If a failover happens (for example, due to an abrupt power-off on the source host Virtualization Server) while a platform undeploy is in progress, the Platform node fails over to the target host Virtualization Server. In the target host, some objects will be in undeployed state and the rest will be in deployed state. To recover from this state, undeploy the whole Platform once again.

### **Data Access Server**

- In case of Live and Quick migration of I/O Server node (for example, DASSIDirect), InTouch I/O Tags acquiring data from that I/O server needs to be reinitialized after the I/O server node is migrated. To automatically acquire the data for these tags from the I/O server after migration, it is recommended to have an InTouch script which monitors the quality status of any of those tags and triggers reinitialize I/O once the quality goes to bad. Execute this script every 3 to 5 seconds until the tag quality becomes good.

## **Working with Medium Scale Virtualization Environment**

This section contains the following topics:

- Setting Up Virtualization Environment
- Expected Recovery Time Objective and Recovery Point Objective
- Snapshots of Data Trends and Observations

## Setting Up Virtualization Environment

The following procedures help you to set up and implement the high availability and disaster recovery for the medium scale virtualization environment.

### Planning for Virtualization Environment

The minimum recommended hardware and software requirements for the Host and Virtual machines used for this virtualization environment are provided in the table below:

#### Hyper-V Hosts

Processor	Two 2.79 GHz Intel Xeon Processor with 24 Cores
Operating System	Windows Server 2008 R2 Enterprise with Hyper-V enabled
Memory	48 GB
Storage	SAN with 1 TB storage disk

**Note:** For the Hyper-V Host to function optimally, the server should have the same processor, RAM, storage, and service pack level. Preferably, the servers should be purchased in pairs to avoid hardware discrepancies. Though the differences are supported, it impacts the performance during failovers.

#### Virtual Machines

Using the Hyper-V host specified above, seven virtual machines can be created in the environment with the configuration given below.

##### Virtual Machine 1: Historian Node

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	8 GB
Storage	200 GB
System Platform Products Installed	Historian

**Virtual Machine 2: Application Server Node and DAS SI**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	8 GB
Storage	100 GB
System Platform Products Installed	ArchestrA-Runtime and DAS SI

**Virtual Machine 3: InTouch TS Node**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	InTouch with TS enabled

**Virtual Machine 4: Application Server Runtime Node 1**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	InTouch and Application Server Runtime only

**Virtual Machine 5: Application Server Runtime Node 2**

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 R2 Standard
Memory	4 GB

---

Storage	80 GB
System Platform Products Installed	Application Server Runtime only

---

### **Virtual Machine 6: Information Server Node**

---

Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows Server 2008 Standard
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Information Server

---

### **Virtual Machine 7: Historian Client Node**

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Processor	Host Compatible Processor with 2-4 Cores
Operating System	Windows 7 Enterprise
Memory	4 GB
Storage	80 GB
System Platform Products Installed	Historian Client

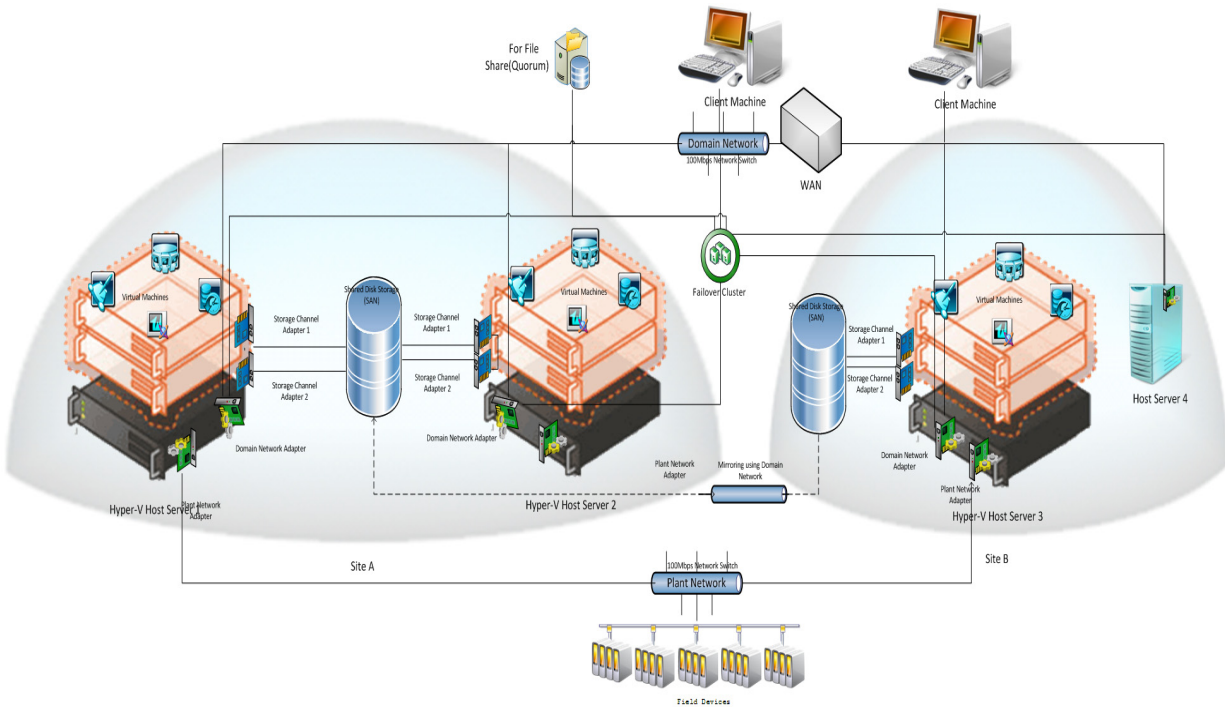
---

### **Network Requirements**

For this architecture, you can use one physical network card that needs to be installed on a host computer for both the domain and the process networks.

## Configuring Failover Cluster

The following diagram shows the recommended topology of the failover cluster for high availability and disaster recovery for the virtualization environment:



The following process will guide you on how to setup high availability and disaster recovery for medium scale virtualization environment.

This setup requires a minimum of three host servers and two storage servers with sufficient disk space to host the virtual machines on each disk. One storage server is shared across two servers on one site and another storage server is connected to the third host. Each disk created on the storage server is replicated in all the sites for disaster recovery. Node 4 is used for Node Majority in the failover cluster. Another independent node is used for configuring the quorum. For more information on configuring the quorum, refer to "Configuring Cluster Quorum Settings" on page 468.

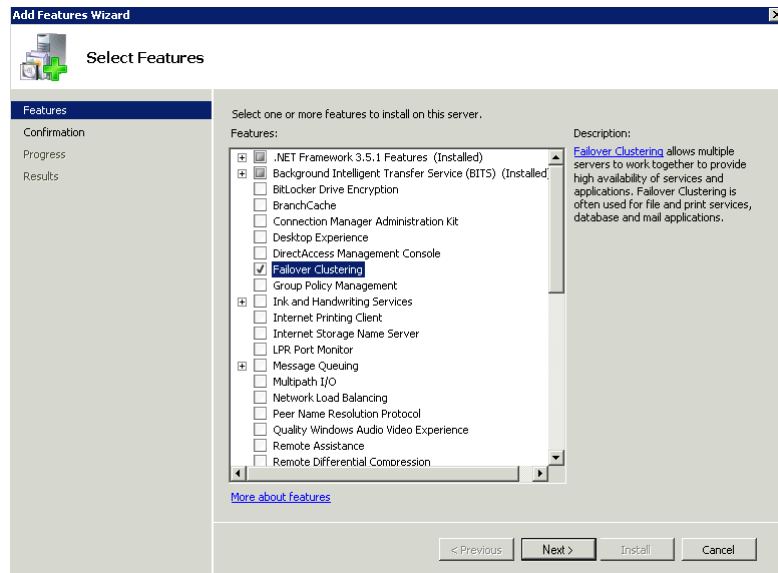


## Installing Failover Cluster

To install the failover cluster feature, you need to run Windows Server 2008 R2 Enterprise Edition on your server.

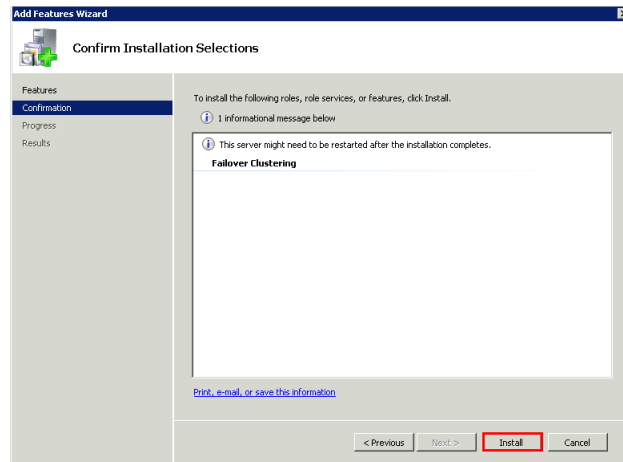
### To install failover cluster on a server

- 1 On the **Initial Configuration Tasks** window, under **Customize This Server**, click **Add features**. The **Add Features Wizard** window appears.

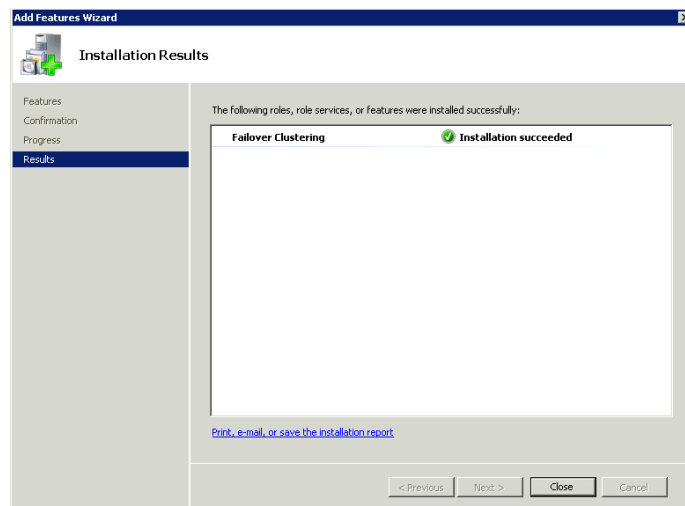


**Note:** The **Initial Configuration Tasks** window appears if you have already installed Windows Server 2008 R2. If it does not appear, open the **Server Manager** window, right-click **Features** and click **Add Features**.

- In the **Add Features Wizard** window, select the **Failover Clustering** check box, and then click **Next**. The **Confirm Installation Selections** area appears.



- Click **Install** to complete the installation. The **Installation Results** area with the installation confirmation message appears.



- Click **Close** to close the **Add Features Wizard** window.

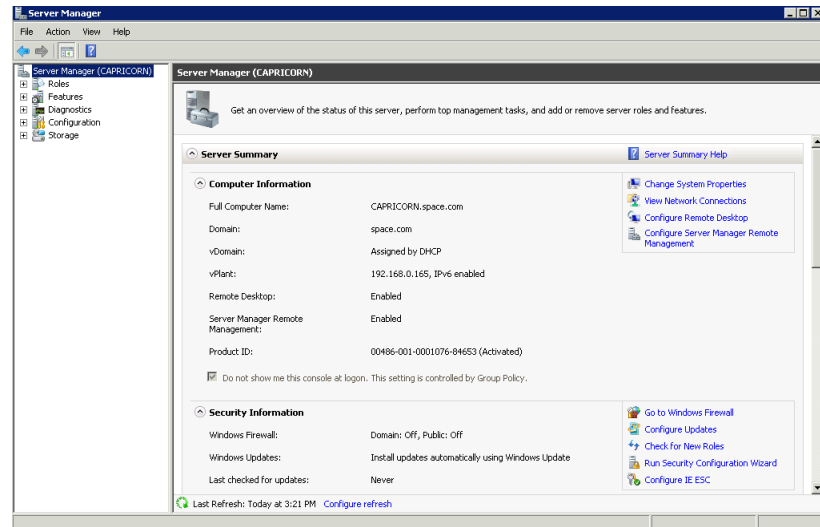
## Validating Cluster Configuration

Before creating a cluster, you must validate your configuration. Validation helps you to confirm that the configuration of your servers, network, and storage meet the specific requirements for failover clusters.

## To validate failover cluster configuration

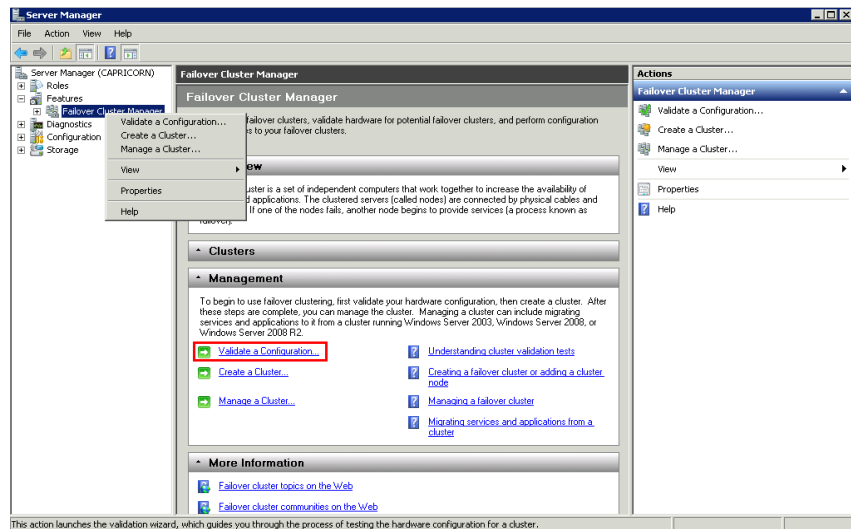
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

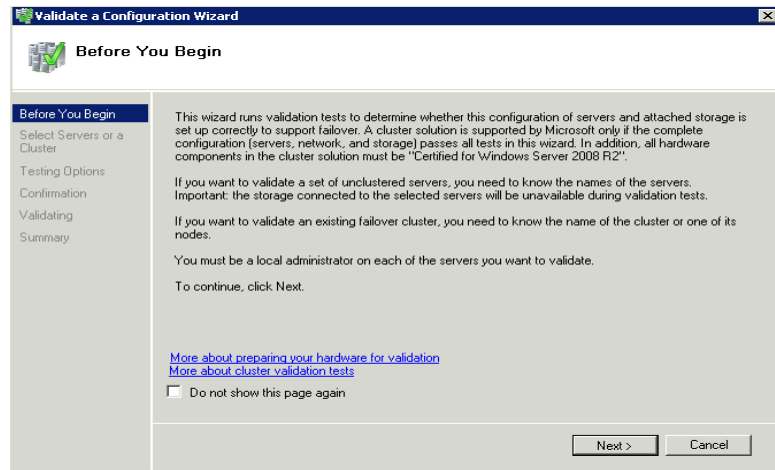


- 2 Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



- 3 Under **Management**, click **Validate a Configuration**. The **Validate a Configuration Wizard** window appears. Click **Next**.



- 4 In the **Select Servers or a Cluster** area, do the following:
  - a In the **Enter name** field, enter the relevant server name.

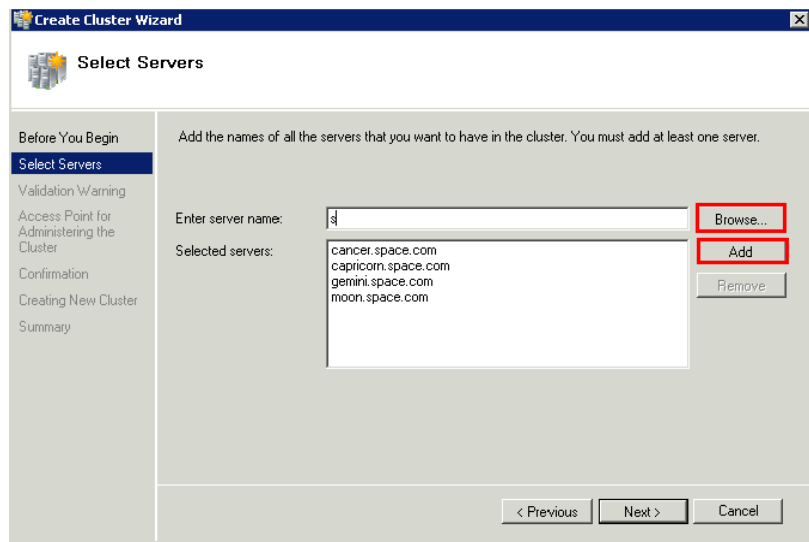
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**Note:** You can either enter the server name or click **Browse** and select the relevant server name.

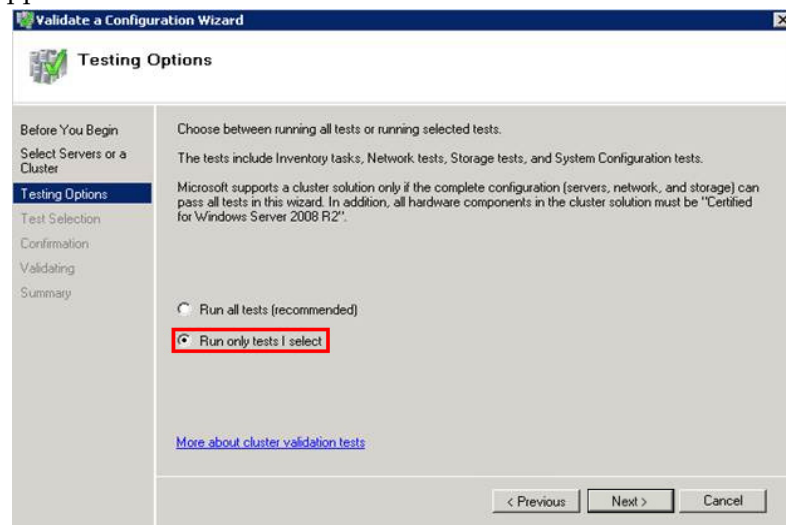
---

- b** In the **Selected Servers** list, click the required servers, and then click **Add**.
- c** Click **Next**. The **Testing Options** area appears.

**Note:** You can add one or more server names. To remove a server from the **Selected servers** list, select the server and click **Remove**.

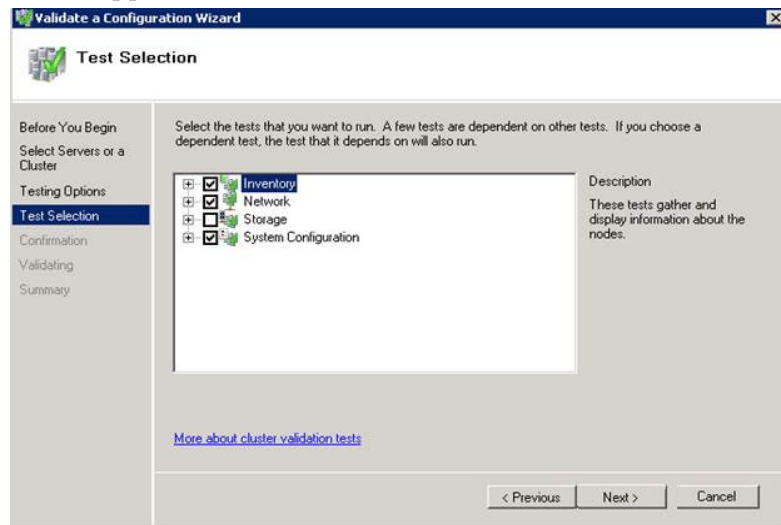


- 5** Click the **Run only the tests I select** option to skip the storage validation process, and click **Next**. The **Test Selection** screen appears.

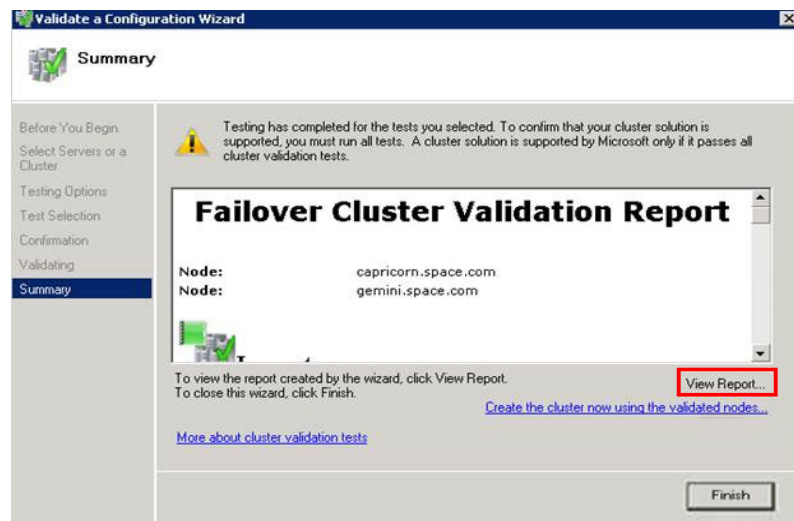


**Note:** Click the **Run all tests (recommended)** option to validate the default selection of tests.

- 6 Clear the **Storage** check box, and then click **Next**. The **Summary** screen appears.



- 7 Click **View Report** to view the test results or click **Finish** to close the **Validate a Configuration Wizard** window.



A warning message appears indicating that all the tests have not been run. This usually happens in a multisite cluster where the storage tests are skipped. You can proceed if there is no other error message. If the report indicates any other error, you need to fix the problem and re-run the tests before you continue. You can view the results of the tests after you close the wizard in `SystemRoot\Cluster\Reports\Validation Report date and time.html` where `SystemRoot` is the folder in which the operating system is installed (for example, `C:\Windows`).

To know more about cluster validation tests, click **More about cluster validation tests** on **Validate a Configuration Wizard** window.

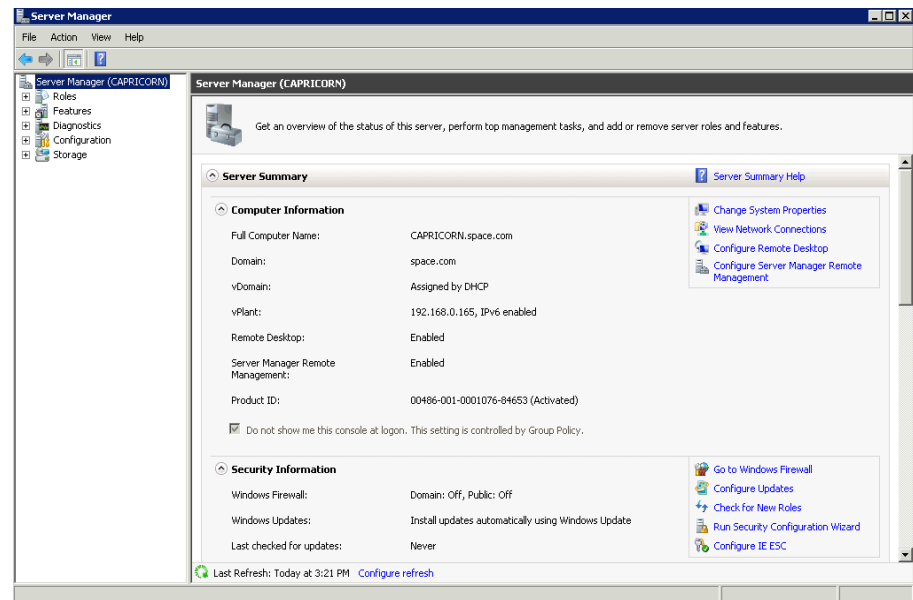
## Creating a Cluster

To create a cluster, you need to run the Create Cluster wizard.

### To create a cluster

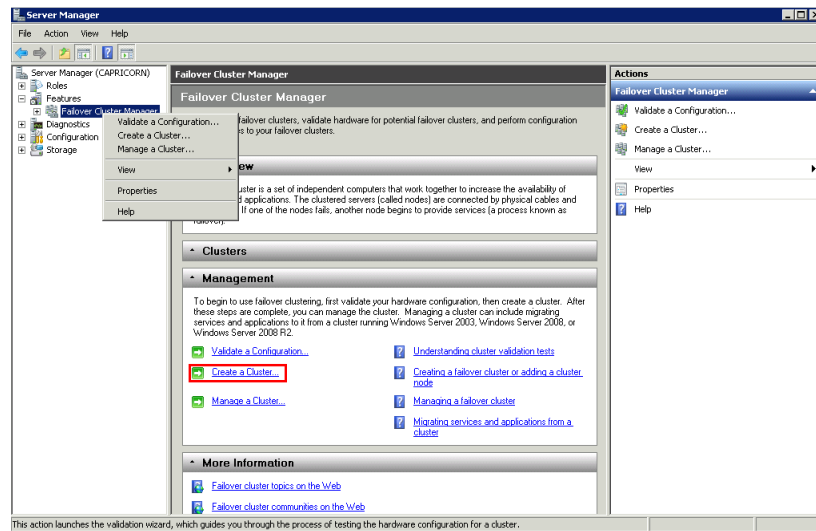
- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.



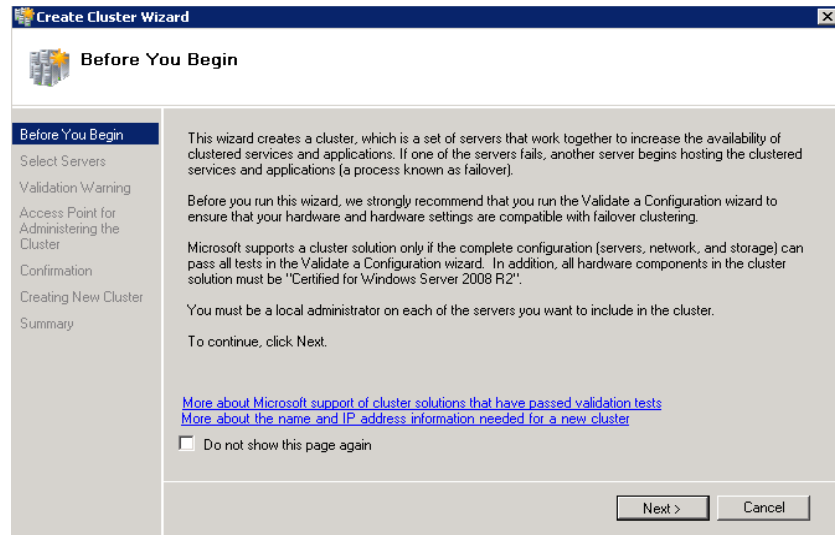
- 2 Expand **Features** and click **Failover Cluster Manager**. The **Failover Cluster Manager** pane appears.

**Note:** If the **User Account Control** dialog box appears, confirm the action you want to perform and click **Yes**.



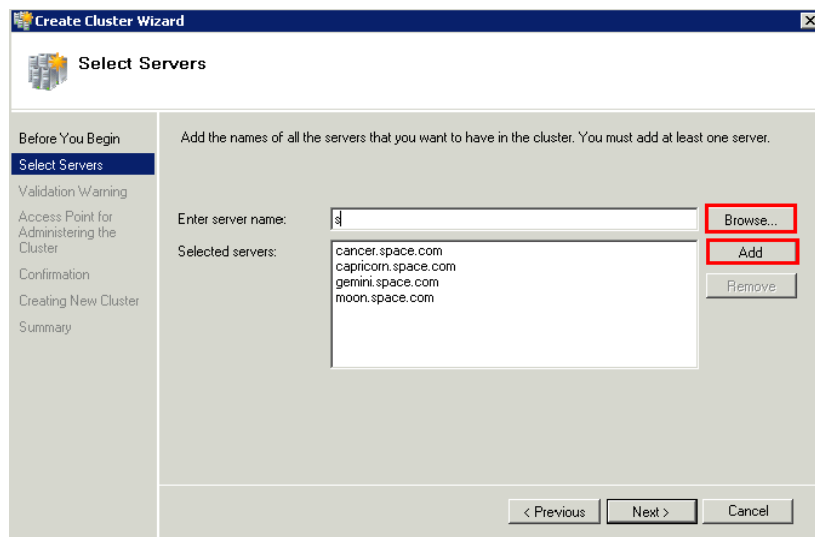


- 3 Under **Management**, click **Create a cluster**. The **Create Cluster Wizard** window appears. Click **Next**.

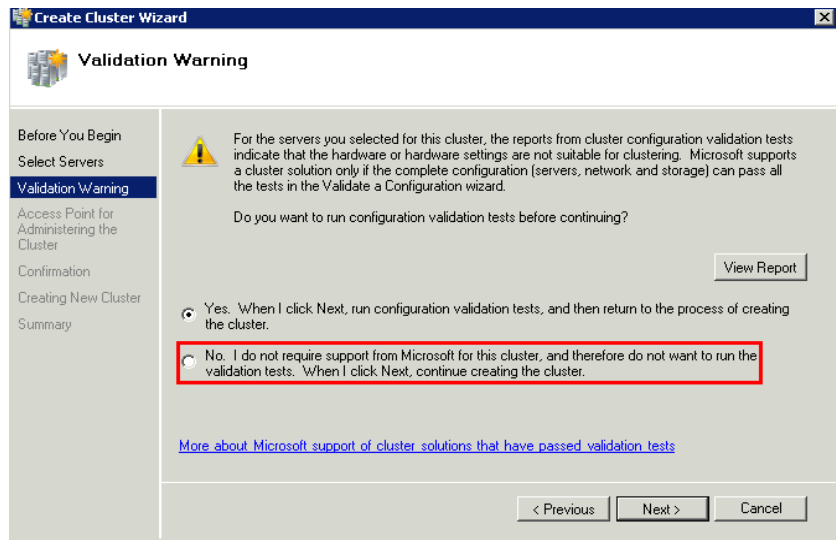


- 4 In the **Select Servers** screen, do the following:
- In the **Enter server name** field, enter the relevant server name and click **Add**. The server name gets added in the **Selected servers** box.

**Note:** You can either enter the server name or click **Browse** and select the relevant server name.

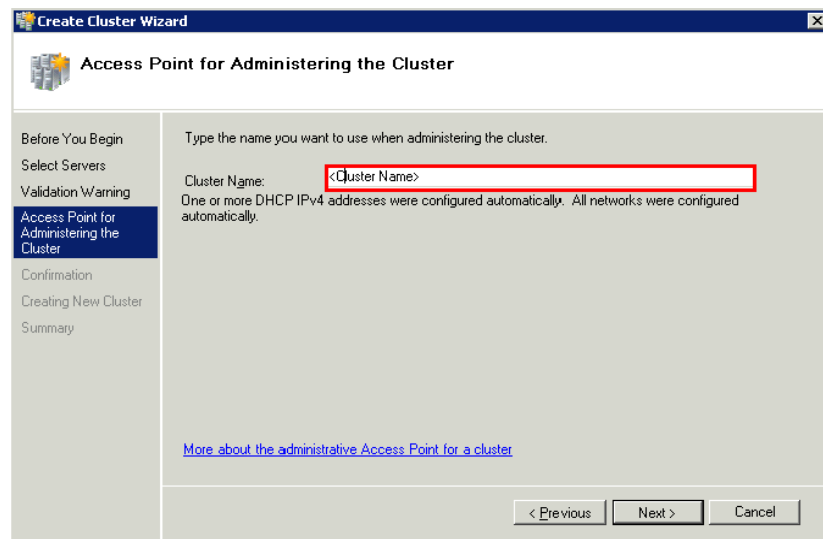


- 5 Click **Next**. The **Validation Warning** area appears.



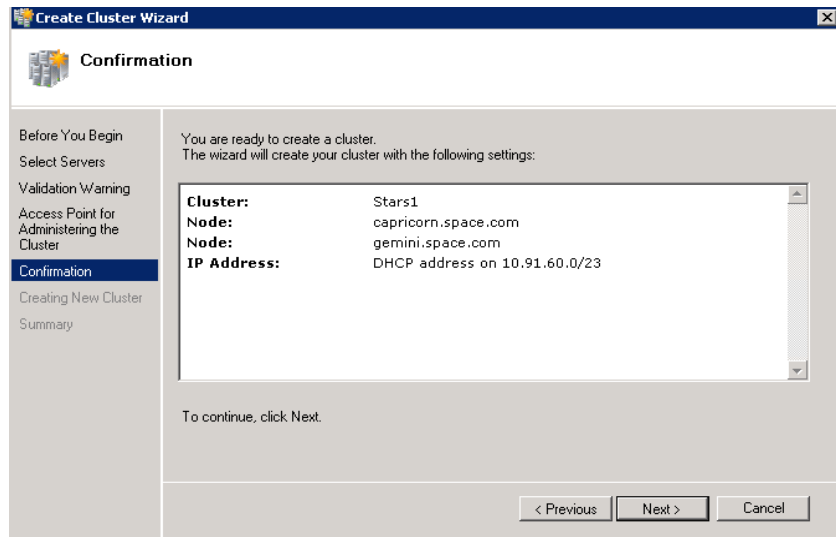
- 6 In the **Validation Warning** dialog box, click **No. I do not require support from Microsoft for this cluster, and therefore do not want to run the validation tests. When I click Next, continue creating the cluster** option and click **Next**. The **Access Point for Administering the Cluster** area appears.

**Note:** Click **Yes. When I click Next, run configuration validation tests, and then return to the process of creating the cluster** option if you want to run the configuration validation tests. Click **View Report** to view the cluster operation report.

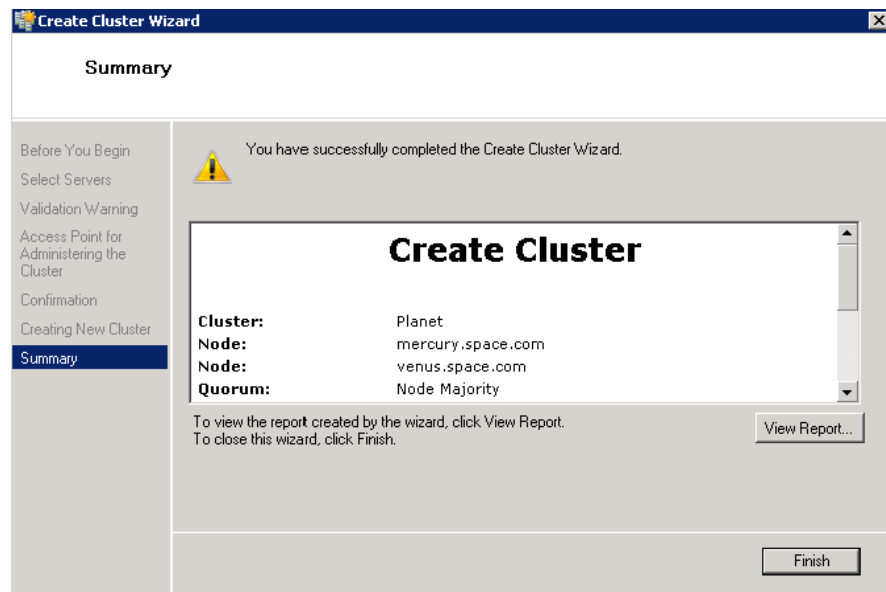


- 7 In the **Cluster Name** field, type the name of the cluster and click **Next**. The **Confirmation** area appears.

**Note:** Enter a valid IP address for the cluster to be created if the IP address is not configured through Dynamic Host Configuration Protocol (DHCP).



- 8 Click **Next**. The cluster is created and the **Summary** area appears.



- 9 Click **View Report** to view the cluster report created by the wizard or click **Finish** to close the **Create Cluster Wizard** window.

## Configuring Cluster Quorum Settings

Quorum is the number of elements that need to be online to enable continuous running of a cluster. In most instances, the elements are nodes. In some cases, the elements also consist of disk or file share witnesses. Each of these elements determines whether the cluster should continue to run or not.

All elements, except the file share witnesses, have a copy of the cluster configuration. The cluster service ensures that the copies are always synchronized. The cluster should stop running if there are multiple failures or if there is a communication error between the cluster nodes.

After both nodes have been added to the cluster, and the cluster networking components have been configured, you must configure the failover cluster quorum.

You must create and secure the file share that you want to use for the node and the file share majority quorum before configuring the failover cluster quorum. If the file share has not been created or correctly secured, the following procedure to configure a cluster quorum will fail. The file share can be hosted on any computer running a Windows operating system.

To configure the cluster quorum, you need to perform the following procedures:

- Create and secure a file share for the node and file share majority quorum
- Use the failover cluster management tool to configure a node and file share majority quorum

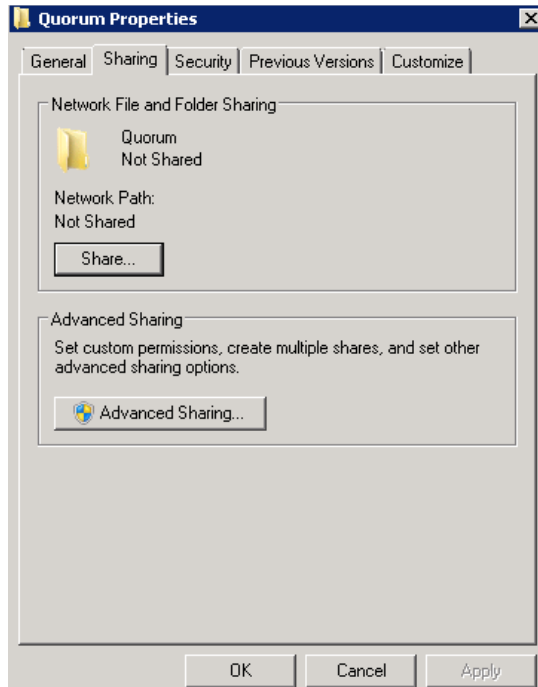
### To create and secure a file share for the node and file share majority quorum

- 1 Create a new folder on the system that will host the share directory.
- 2 Right-click the folder that you have created and click **Properties**. The **Quorum Properties** window for the folder you created appears.

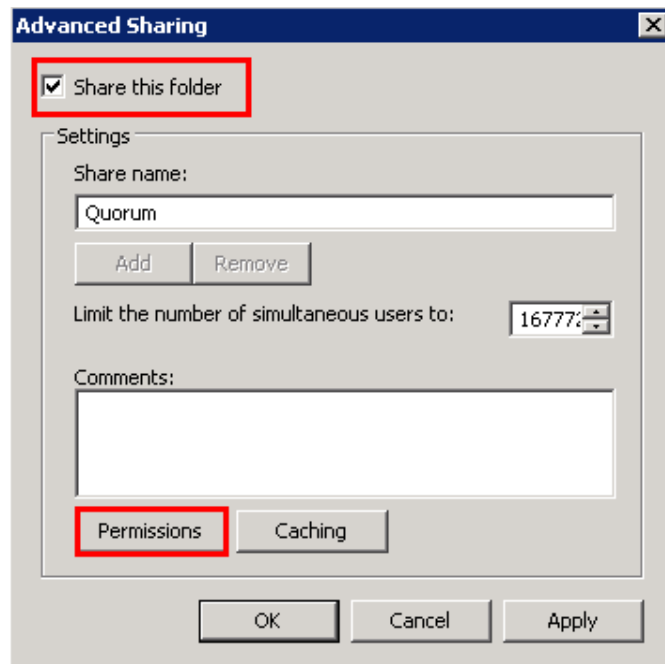
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**Note:** In the following procedure, Quorum is the name of the folder.

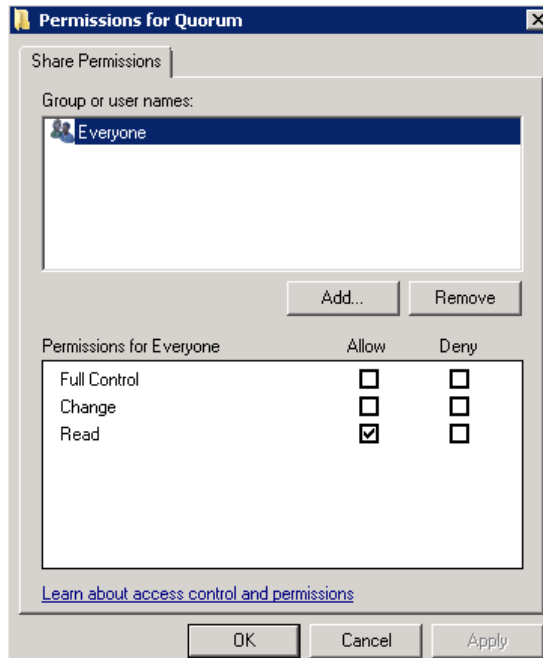
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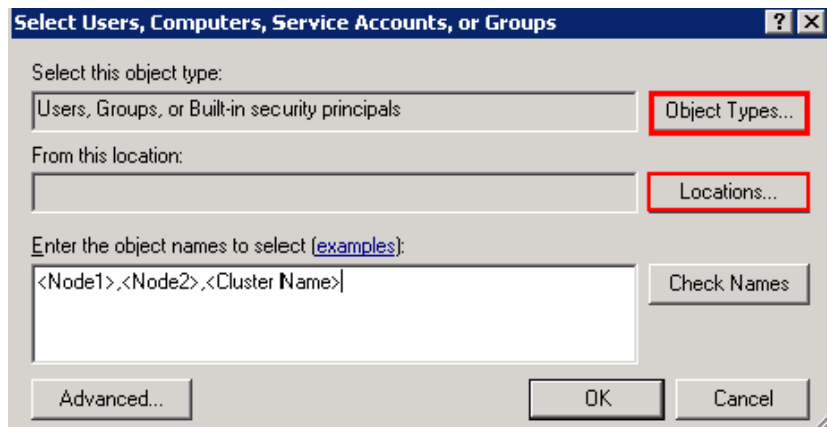
- 3 Click the **Sharing** tab, and then click **Advanced Sharing**. The **Advanced Sharing** window appears.



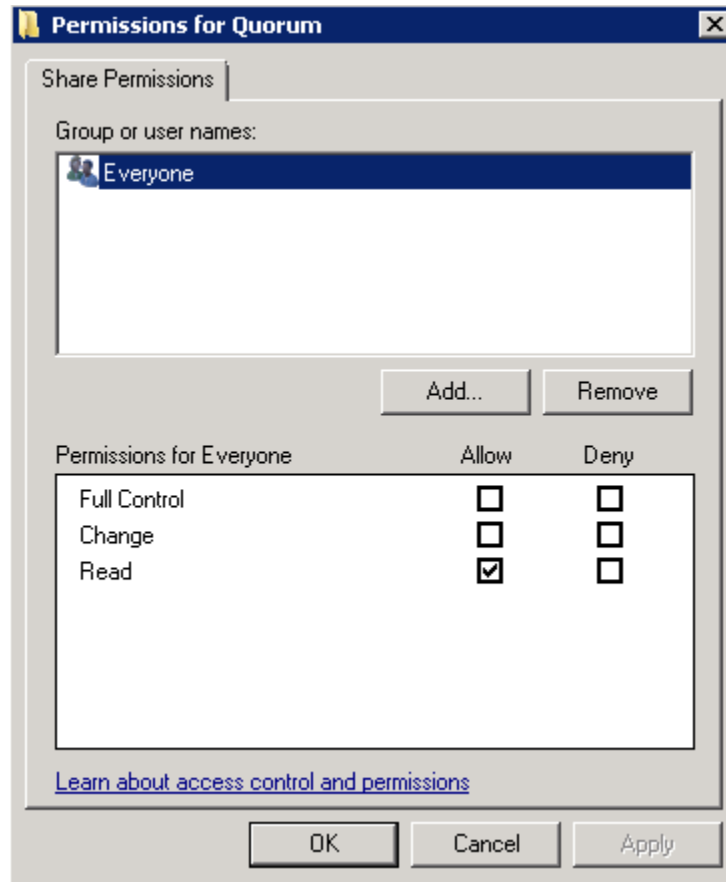
- 4 Select the **Share this folder** check box and click **Permissions**. The **Permissions for Quorum** window appears.



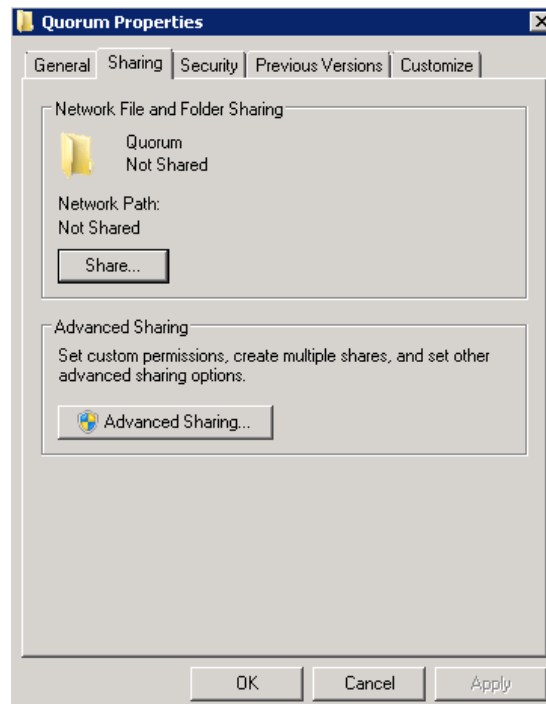
- 5 Click **Add**. The **Select Users, Computers, Service Accounts, or Groups** window appears.



- 6 In the **Enter the object name to select** box, enter the four node names used for the cluster in the high availability and disaster recovery configuration and click **OK**. The node names are added and the **Permissions for Quorum** window appears.



- 7 Select the **Full Control**, **Change**, and **Read** check boxes and click **OK**. The **Properties** window appears.



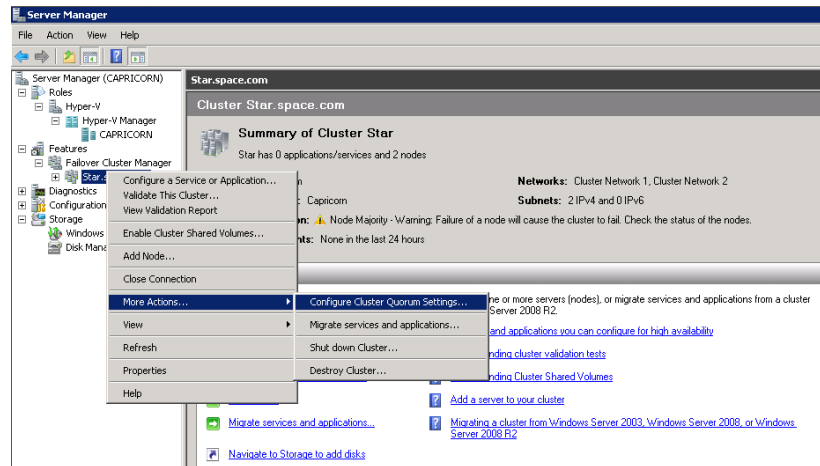
- 8 Click **Ok**. The folder is shared and can be used to create virtual machines.



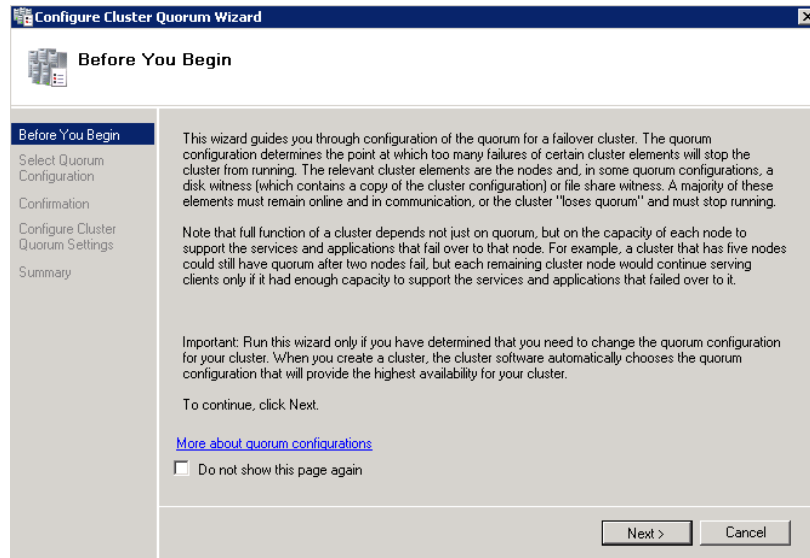
## To configure a node and file share majority quorum using the failover cluster management tool

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

**Note:** You can also access the **Server Manager** window from the **Administrative Tools** window or the **Start** menu.

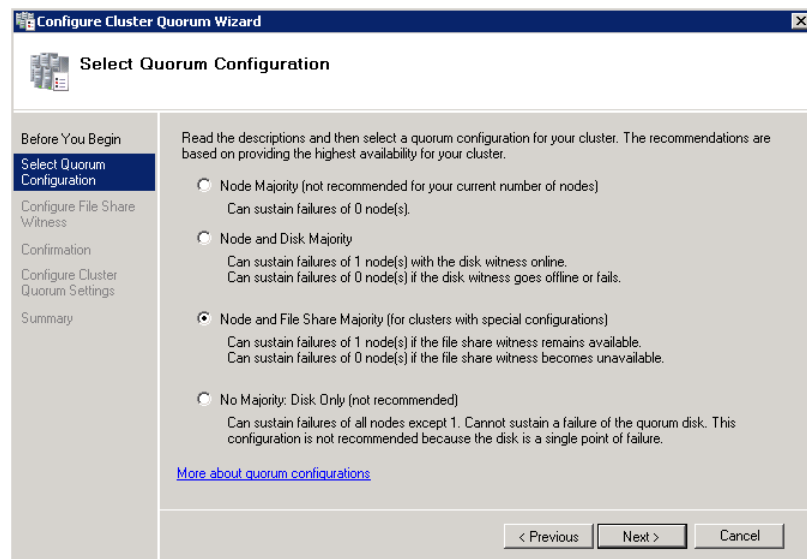


- Right-click the name of the cluster you have created and click **More Actions**. Click **Configure Cluster Quorum Settings**. The **Configure Cluster Quorum Wizard** window appears.



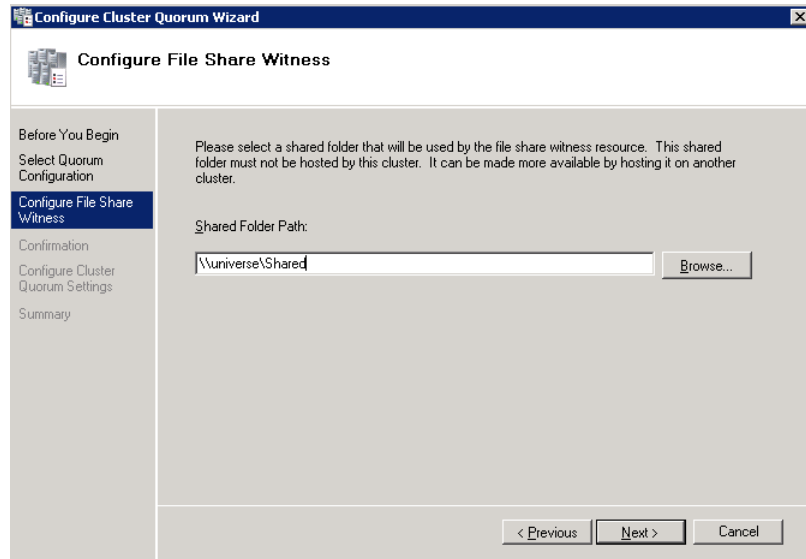
- View the instructions on the wizard and click **Next**. The **Select Quorum Configuration** area appears.

**Note:** The **Before you Begin** screen appears the first time you run the wizard. You can hide this screen on subsequent uses of the wizard.



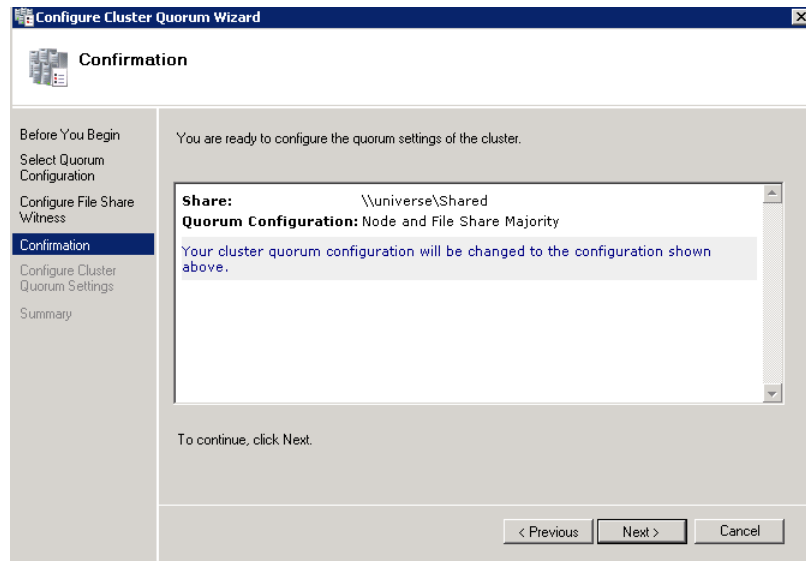
- You need to select the relevant quorum node. For special configurations, click the **Node and File Share Majority** option and click **Next**. The **Configure File Share Witness** area appears.

**Note:** Click the **Node Majority** option if the cluster is configured for node majority or a single quorum resource. Click the **Node and Disk Majority** option if the number of nodes is even and not part of a multisite cluster. Click the **No Majority: Disk Only** option if the disk is being used only for the quorum.

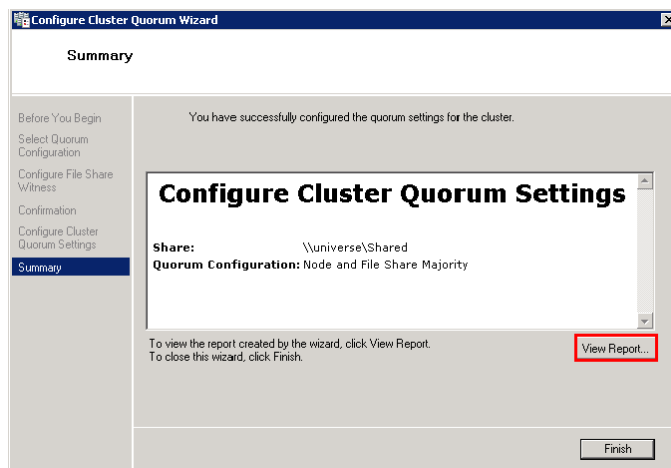


- 5 In the **Shared Folder Path** box, enter the Universal Naming Convention (UNC) path to the file share that you have created in the Configure Cluster Quorum Settings. Click **Next**. Permissions to the share are verified. If there are no problems with the access to the share, then the **Confirmation** screen appears.

**Note:** You can either enter the server name or click **Browse** to select the relevant shared path.



- 6 The details you have selected are displayed. To confirm the details, click **Next**. The **Summary** screen appears and the configuration details of the quorum settings are displayed.



- 7 Click **View Report** to view a report of the tasks performed, or click **Finish** to close the window.

After you configure the cluster quorum, you must validate the cluster. For more information, refer to [http://technet.microsoft.com/en-us/library/bb676379\(EXCHG.80\).aspx](http://technet.microsoft.com/en-us/library/bb676379(EXCHG.80).aspx).

## Configuring Storage

For any virtualization environment, storage is one of the central barriers to implementing a good virtualization strategy. However in Hyper-V, VM storage is kept on a Windows file system. You can put VMs on any file system that a Hyper-V server can access. As a result, you can build HA into the virtualization platform and storage for the virtual machines. This configuration can accommodate a host failure by making storage accessible to all Hyper-V hosts so that any host can run VMs from the same path on the shared folder. The back-end of this storage can be a local, storage area network, iSCSI or whatever is available to fit the implementation.

The following table lists the minimum storage recommendations for each VM in medium scale virtualization environment:

System	Storage Capacity
Historian Virtual Machine	200 GB
Application Server 1 (GR Node) Virtual Machine	100 GB
Application Engine 2 (Runtime Node) Virtual Machine	80 GB
InTouch Virtual Machine	80 GB
Information Server Virtual Machine	80 GB
Historian Client	80 GB

To build up High Availability and Disaster Recovery system, you must have a minimum of two SAN storage servers, each installed at different sites with the above storage recommendations.

The total storage capacity should be minimum recommended 1 TB.

## Configuring Hyper-V

Microsoft Hyper-V Server 2008 R2 helps in creating virtual environment that improves server utilization. It enhances patching, provisioning, management, support tools, processes, and skills. Microsoft Hyper-V Server 2008 R2 provides live migration, cluster shared volume support, expanded processor, and memory support for host systems.

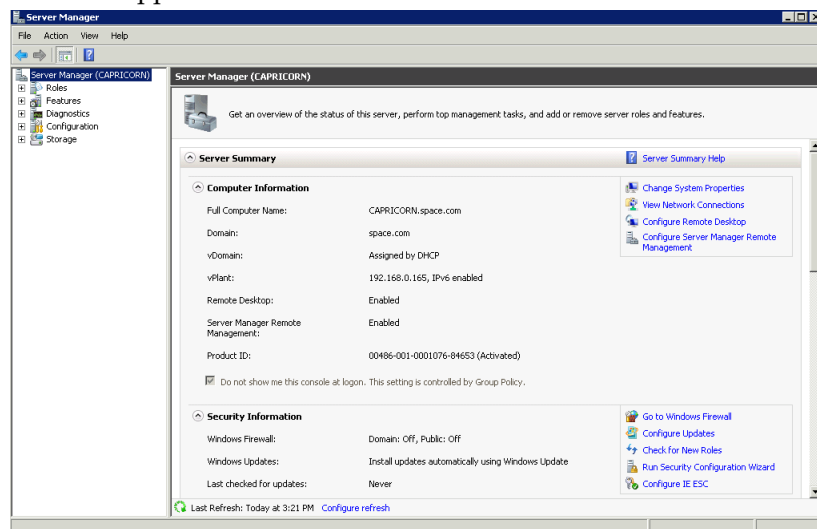
Hyper-V is available in x64-based versions of Windows Server 2008 R2 operating system, specifically the x64-based versions of Windows Server 2008 R2 Standard, Windows Server 2008 R2 Enterprise, and Windows Server 2008 Datacenter.

The following are the pre-requisites to set up Hyper-V:

- x64-based processor
- Hardware-assisted virtualization
- Hardware Data Execution Prevention (DEP)

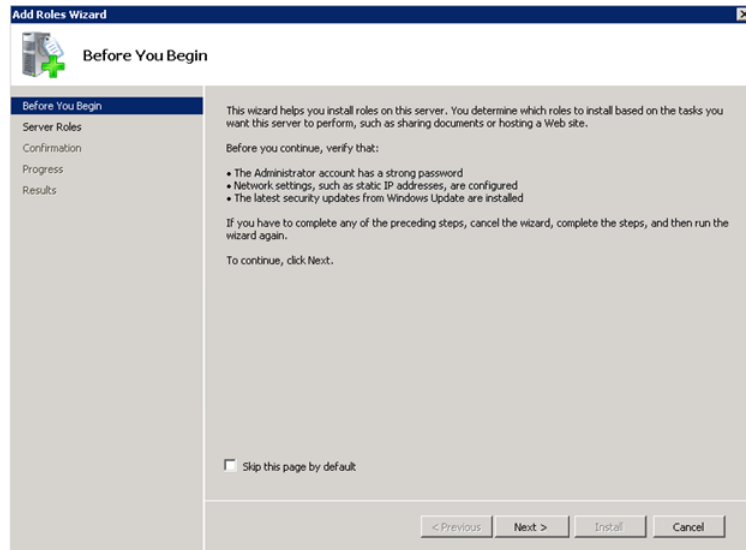
### To configure Hyper-V

- 1 Click the **Server Manager** icon on the toolbar. The **Server Manager** window appears.

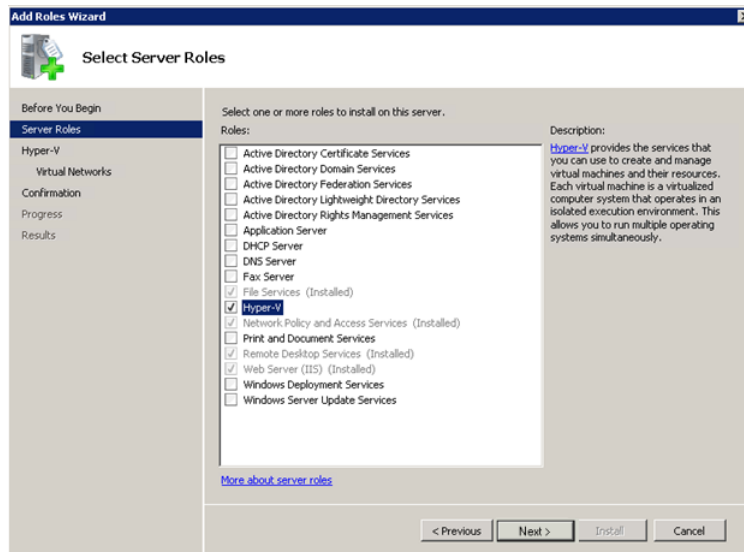


- 2 In the **Roles Summary** area, click **Add Roles**. The **Add Roles Wizard** window appears.

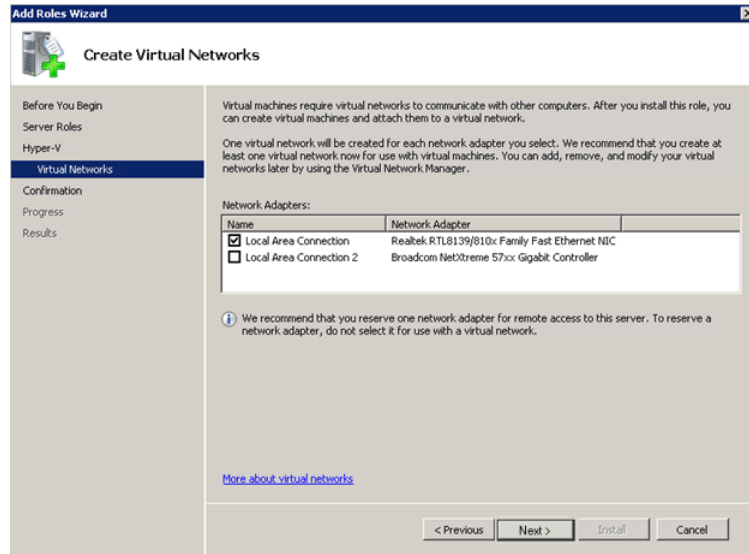
**Note:** You can also right-click **Roles**, and then click **Add Roles Wizard** to open the **Add Roles Wizard** window.



- 3 Read the instructions on the wizard and then click **Next**. The **Select Server Roles** area appears.

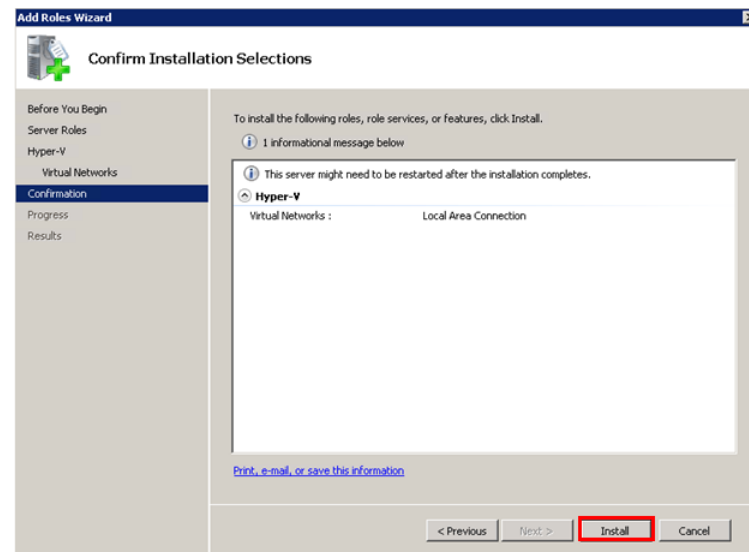


- 4 Select the **Hyper-V** check box and click **Next**. The **Create Virtual Networks** area appears.



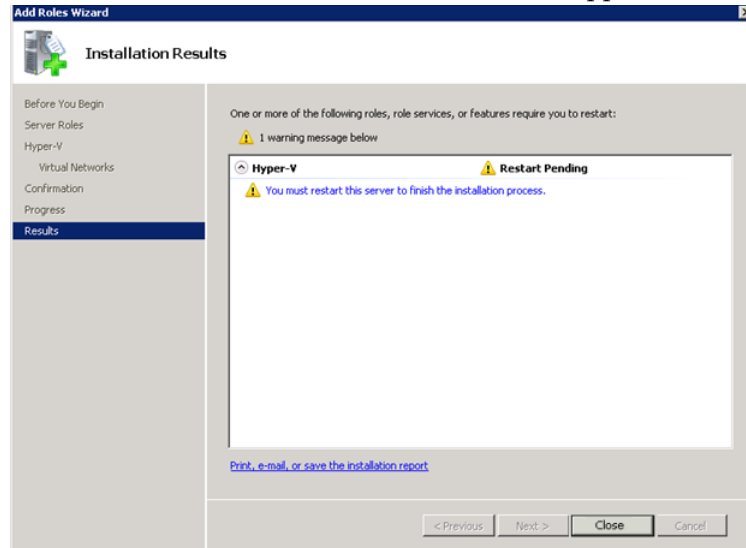
- 5 Select the check box next to the required network adapter to make the connection available to virtual machines. Click **Next**. The **Confirmation Installation Selections** area appears.

**Note:** You can select one or more network adapters.

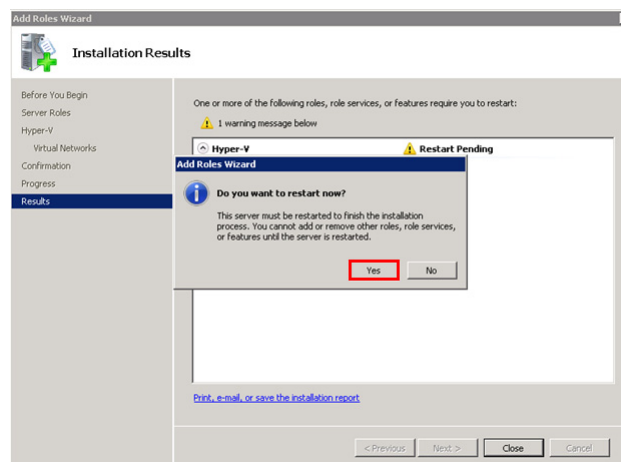




- 6 Click **Install**. The **Installation Results** area appears.

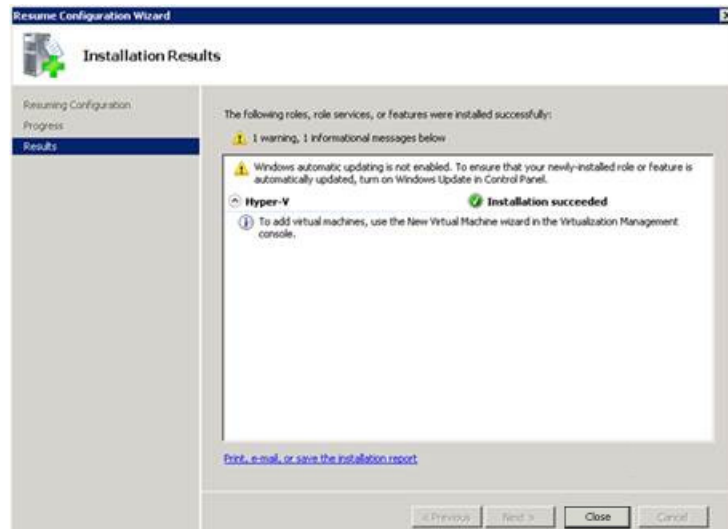


- 7 A message appears prompting you to restart the computer. Click **Close**. The **Add Roles Wizard** pop-up window appears.



- 8 Click **Yes** to restart the computer.

- 9 After you restart the computer, login with the same ID and password you used to install the Hyper-V role. The installation is completed and the **Resume Configuration Wizard** window appears with the installation results.



- 10 Click **Close** to close the **Resume Configuration Wizard** window.

## Configuring SIOS(SteelEye)DataKeeper Mirroring Jobs

SteelEye DataKeeper is a replication software for real-time Windows data. It helps replicate all data types, including the following:

- Open files
- SQL and Exchange Server databases
- Hyper-V .vhd files

SteelEye DataKeeper's ability to replicate logical disk partitions hosting the .vhd files for the Hyper-V virtual machines ensures that a mirrored disk image is available on the stand-by cluster host in case the primary cluster host fails. This helps provide disaster recovery (DR) solutions.

SteelEye DataKeeper Cluster Edition is a host-based replication solution, which extends Microsoft Windows Server 2008 R2 Failover Clustering (WSFC) and Microsoft Cluster Server (MSCS) features such as cross-subnet failover and tunable heartbeat parameters. These features make it possible to deploy geographically distributed clusters.

You can replicate .vhd files across LAN, WAN, or any Windows server through SIOS Microsoft Management Console (MMC) interface. You can run the DataKeeper MMC snap-in from any server. The DataKeeper MMC snap-in interface is similar to the existing Microsoft Management tools.

**Note:** For information on installing the SteelEye DataKeeper, refer to *SteelEye DataKeeper for Windows Server 2003/2008 Planning and Install Guide* and *SteelEye DataKeeper for Windows Server 2003/2008 Administration Guide* at <http://www.steeleye.com>. Ensure that the local security policies, firewall, and port settings are configured as per the details in these documents.

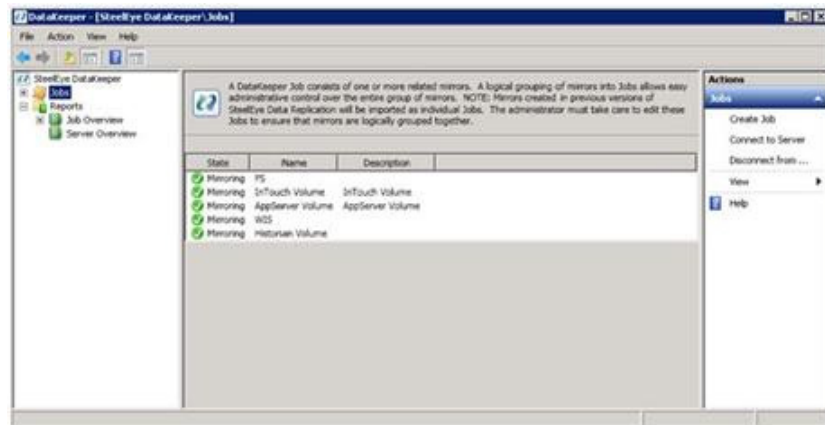
The following procedures help you set up a virtual machine in the Disaster Recovery environment.

## Creating a SteelEye DataKeeper Mirroring Job

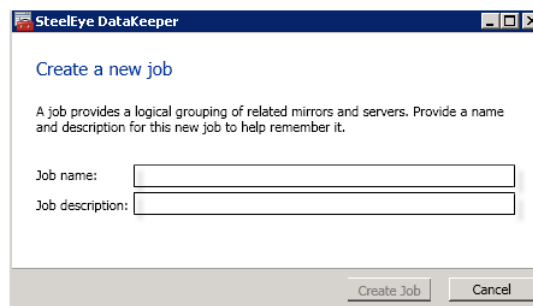
To set up a virtual machine in the Disaster Recovery environment you need to first create a SteelEye DataKeeper mirroring job.

### To create a SteelEye DataKeeper mirroring job

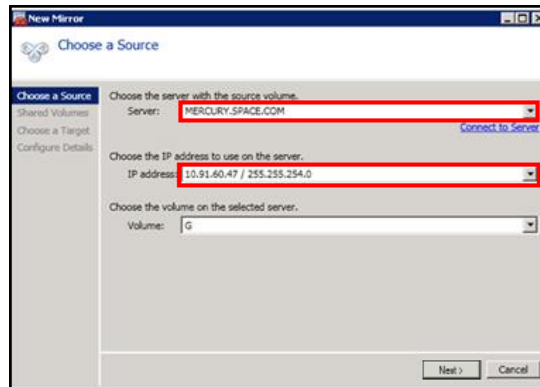
- 1 Click **Start**, and then from the **All Programs** menu, click **SteelEye DataKeeper MMC**. The **DataKeeper** window appears.



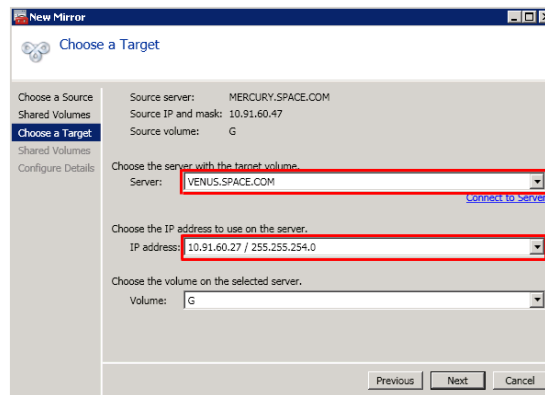
- 2 In the **Actions** pane, click **Create Job**. The **SteelEye DataKeeper** window appears.



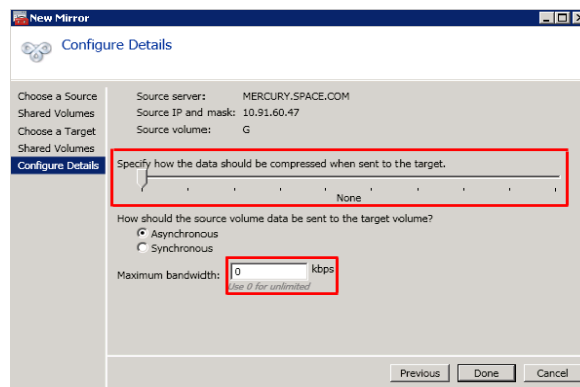
- 3 Type the relevant job name and description in the **Job name** and **Job description** boxes, and then click **Create Job**. The **New Mirror window** appears.



- 4 In the **Choose a Source** area, select the **Server**, **IP address**, and **Volume** and click **Next**. The **Choose a Target** area appears.



- 5 Select the destination **Server**, **IP address**, and **Volume** and click **Next**. The **Configure Details** area appears.



- 6 In the **Configure Details** area, do the following:
  - a Move the slider to select the level of data compression.
  - b Click the relevant option to indicate the mode in which you want to send the source volume data to the target volume.

- c** In the **Maximum** bandwidth field, type the network bandwidth to be used for data replication.

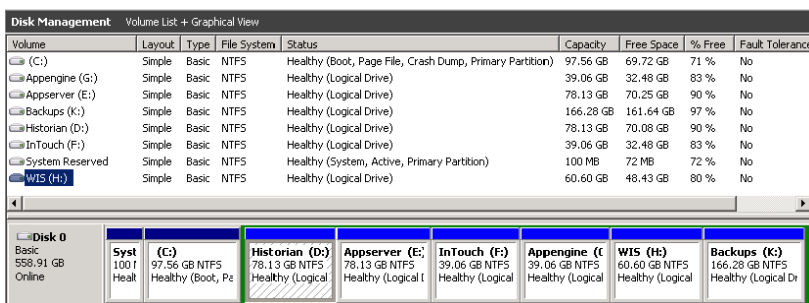
**Note:** Enter "0" to indicate that the bandwidth is unlimited.

- d** Click **Done**. The SteelEye DataKeeper mirroring job is created.

## Disk Management Topologies

After you have completed setting up SteelEye DataKeeper Mirroring jobs and created the datakeeper, you can view the following topologies:

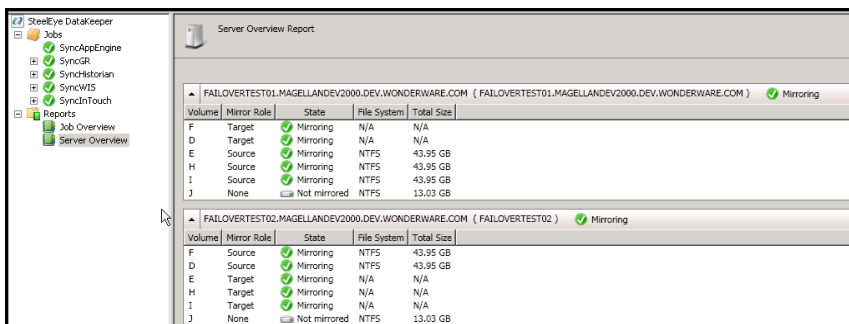
Open Disk Management to view all the disks which are replicated, by running the `diskmgmt.msc` from the command prompt.



Volume	Layout	Type	File System	Status	Capacity	Free Space	% Free	Fault Tolerance
(C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)	97.56 GB	69.72 GB	71 %	No
Appengine (G:)	Simple	Basic	NTFS	Healthy (Logical Drive)	39.06 GB	32.48 GB	83 %	No
Appserver (E:)	Simple	Basic	NTFS	Healthy (Logical Drive)	78.13 GB	70.25 GB	90 %	No
Backups (K:)	Simple	Basic	NTFS	Healthy (Logical Drive)	166.28 GB	161.64 GB	97 %	No
Historian (D:)	Simple	Basic	NTFS	Healthy (Logical Drive)	78.13 GB	70.08 GB	90 %	No
InTouch (F:)	Simple	Basic	NTFS	Healthy (Logical Drive)	39.06 GB	32.48 GB	83 %	No
System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)	100 MB	72 MB	72 %	No
WIS (H:)	Simple	Basic	NTFS	Healthy (Logical Drive)	60.60 GB	48.43 GB	80 %	No

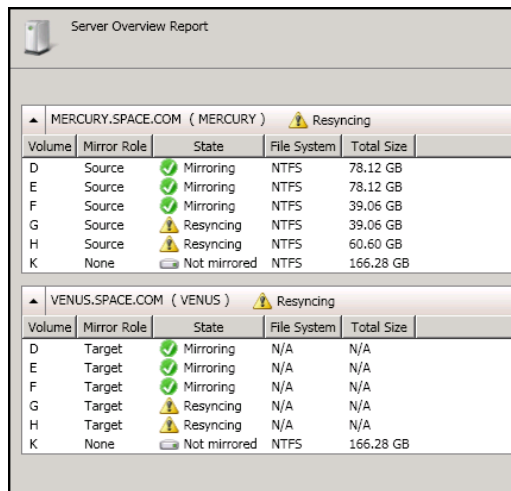
After creating all the Mirroring Jobs, open the SteelEye DataKeeper UI from the **All Programs** menu, click **SteelEye DataKeeper MMC**. The **DataKeeper** window appears.

You can navigate to **Job Overview** under **Reports** to view all the jobs in one place.



Volume	Mirror Role	State	File System	Total Size
FAILLOVERTEST01.MAGELLANDEV2000.DEV.WONDERWARE.COM ( FAILLOVERTEST01.MAGELLANDEV2000.DEV.WONDERWARE.COM ) ✓ Mirroring				
F	Target	✓ Mirroring	N/A	N/A
D	Target	✓ Mirroring	N/A	N/A
E	Source	✓ Mirroring	NTFS	43.95 GB
H	Source	✓ Mirroring	NTFS	43.95 GB
I	Source	✓ Mirroring	NTFS	43.95 GB
J	None	Not mirrored	NTFS	13.03 GB
FAILLOVERTEST02.MAGELLANDEV2000.DEV.WONDERWARE.COM ( FAILLOVERTEST02 ) ✓ Mirroring				
F	Source	✓ Mirroring	NTFS	43.95 GB
D	Source	✓ Mirroring	NTFS	43.95 GB
E	Target	✓ Mirroring	N/A	N/A
H	Target	✓ Mirroring	N/A	N/A
I	Target	✓ Mirroring	N/A	N/A
J	None	Not mirrored	NTFS	13.03 GB

You can navigate to **Server Overview** under **Reports** to view all the servers involved in job replication in one place.



MERCURY.SPACE.COM ( MERCURY ) ⚠ Resyncing				
Volume	Mirror Role	State	File System	Total Size
D	Source	✔ Mirroring	NTFS	78.12 GB
E	Source	✔ Mirroring	NTFS	78.12 GB
F	Source	✔ Mirroring	NTFS	39.06 GB
G	Source	⚠ Resyncing	NTFS	39.06 GB
H	Source	⚠ Resyncing	NTFS	60.60 GB
K	None	🚫 Not mirrored	NTFS	166.28 GB

VENUS.SPACE.COM ( VENUS ) ⚠ Resyncing				
Volume	Mirror Role	State	File System	Total Size
D	Target	✔ Mirroring	N/A	N/A
E	Target	✔ Mirroring	N/A	N/A
F	Target	✔ Mirroring	N/A	N/A
G	Target	⚠ Resyncing	N/A	N/A
H	Target	⚠ Resyncing	N/A	N/A
K	None	🚫 Not mirrored	NTFS	166.28 GB

## Configuring Virtual Machines

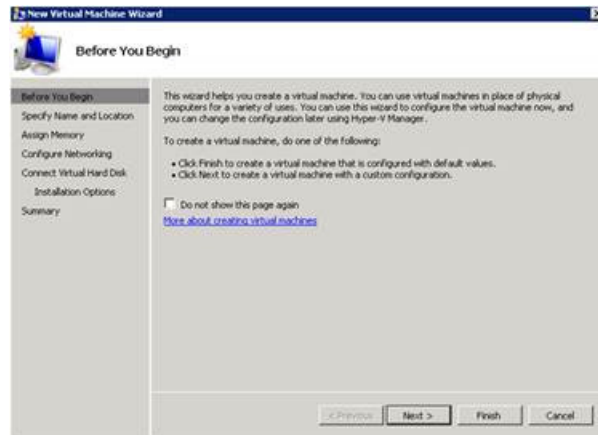
After creating a steel eye mirroring job, you need to create a virtual machine in the disk.

### To configure virtual machines

- 1 In the **Server Manager** window, right-click **Features** and then click **Failover Cluster Manager**. The **Failover Cluster Manager** tree expands.



- 2 Right-click **Services and applications**, then click **Virtual Machines**, and then click **New Virtual Machine**. The **New Virtual Machine Wizard** window appears.



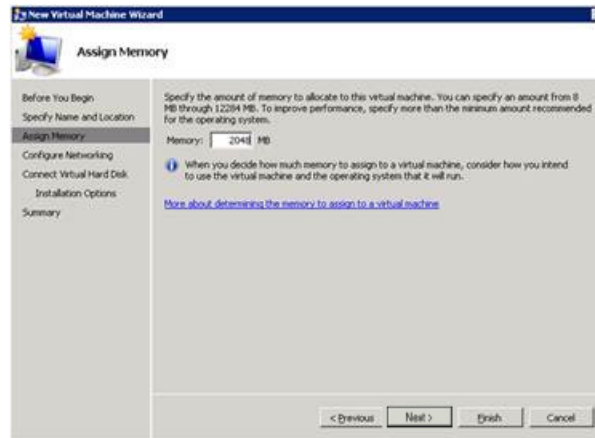
- 3 View the instructions in the **Before You Begin** area and click **Next**. The **Specify Name and Location** area appears.



- 4 In the **Specify Name and Location** area, do the following:
- a In the **Name** field, type a name for the virtual machine.
  - b Select the **Store the virtual machine in a different location** check box to be able to indicate the location of the virtual machine.
  - c In the **Location** field, enter the location where you want to store the virtual machine.

**Note:** You can either type the location or click **Browse** and select the location where you want to store the virtual machine.

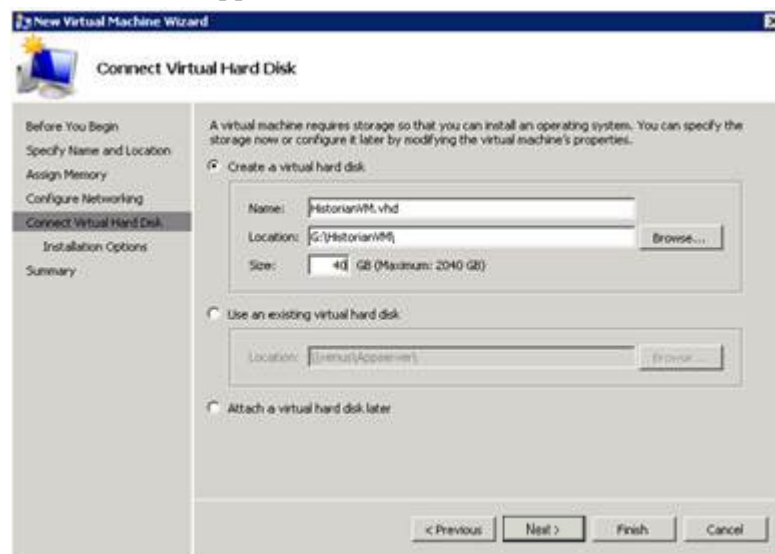
- d Click **Next**. The **Assign Memory** area appears.



- 5 Type the recommended amount of memory in the **Memory** field and click **Next**. The **Configure Networking** area appears.



- 6 Select the network to be used for the virtual machine from the **Connection** drop-down list, and click **Next**. The **Connect Virtual Hard Disk** area appears.



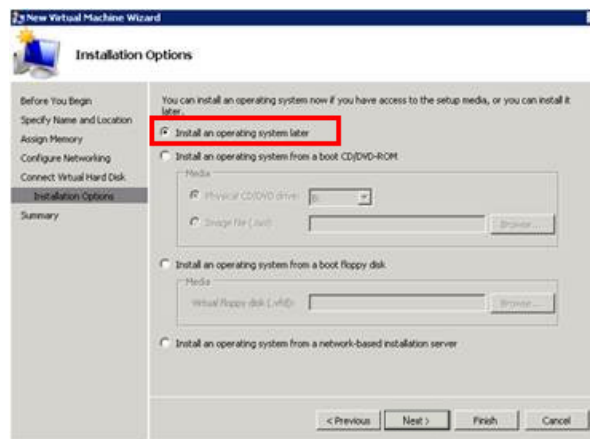


- 7 Click the **Create a virtual hard disk** option and then do the following:
  - a In the **Name** field, type the name of the virtual machine.
  - b In the **Location** field, enter the location of the virtual machine.

**Note:** You can either type the location or click **Browse** and select the location of the virtual machine.

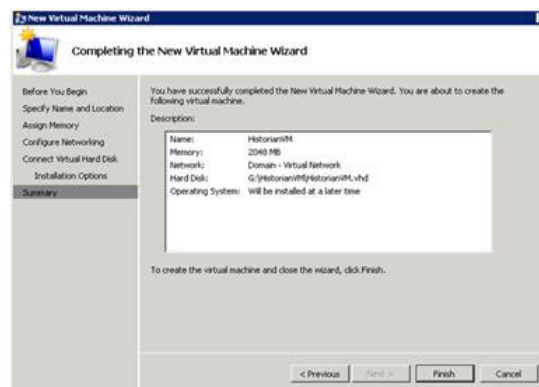
- c In the **Size** field, type the size of the virtual machine, and then click **Next**. The **Installation Options** area appears.

**Note:** You need to click the **Use an existing virtual hard disk or the Attach a virtual hard disk later** option, only if you are using an existing virtual hard disk or you want to attach a virtual disk later.



- 8 Click **Install an operating system later** option and click **Next**. The **Completing the New Virtual Machine Window** area appears.

**Note:** If you want to install an operating system from a boot CD/DVD-ROM or a boot floppy disk or a network-based installation server, click the relevant option.



- 9 Click **Finish**. The virtual machine is created with the details you have provided. As we have started this process from the Failover Cluster Manager, after completing the process of creating a virtual machine, the **High Availability Wizard** window appears.



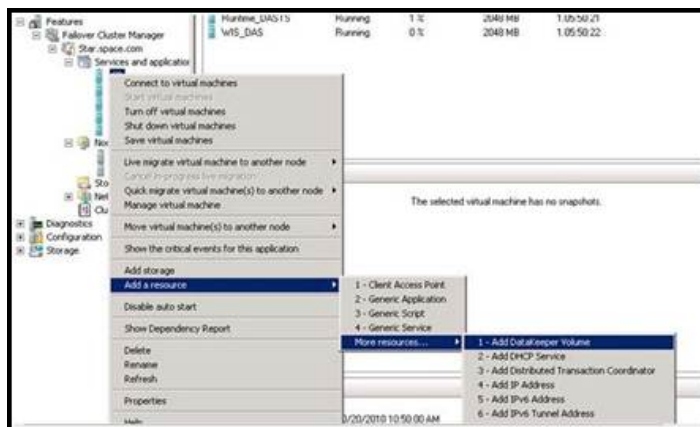
- 10 Click **View Report** to view the report or click **Finish** to close the **High Availability Wizard** window.

## Adding the Dependency between the Virtual Machine and the DataKeeper volume in the Cluster

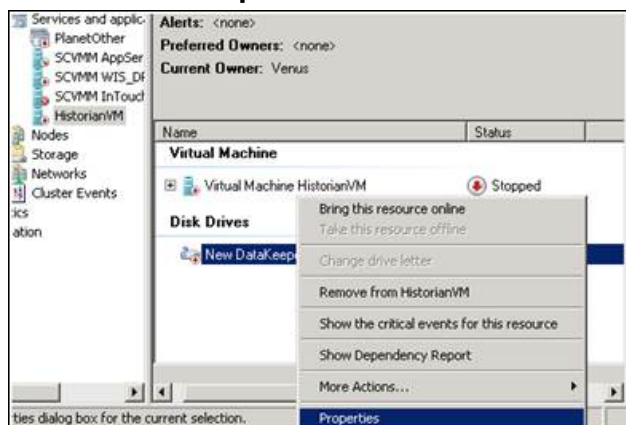
After creating the virtual machine, you need to add the dependency between the virtual machine and the datakeeper volume in the cluster. This dependency triggers the switching of the the source and target servers of the SteelEye DataKeeper Volume resource when failover of the virtual machines occurs in the Failover Cluster Manager.

### To add the dependency between the virtual machine and the datakeeper volume in the cluster

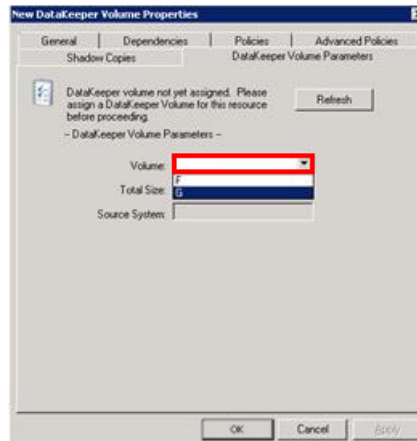
- 1 On the **Server Manager** window, right-click the virtual machine, that you have created and then point to **Add a resource, More Resources** and then click **Add DataKeeper Volumes**. The **Add a resource** menu appears.



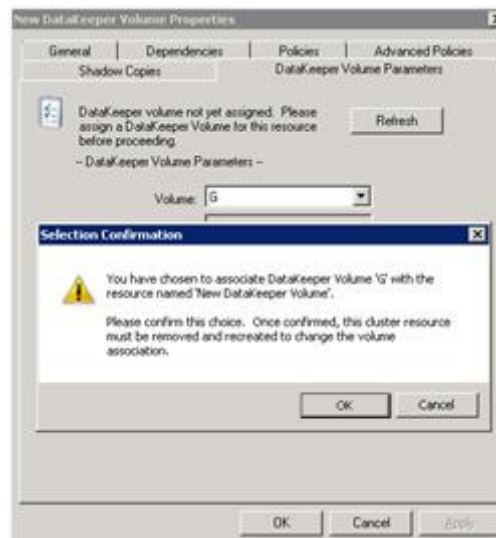
- 2 The **New DataKeeper Volume** is added under **Disk Drives**.



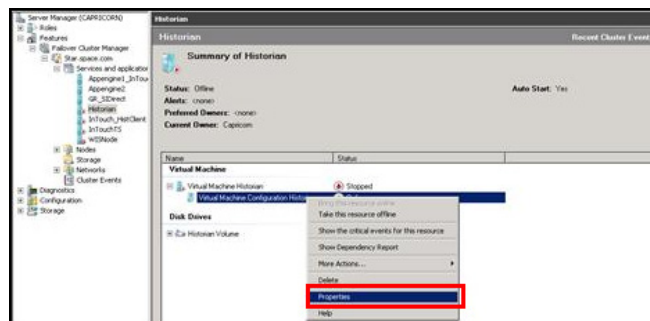
- 3 Right-click **New DataKeeper Volume**, and then click **Properties**. The **New DataKeeper Volume Properties** window appears.



- 4 Select the volume for creating a disk monitoring job and click **OK**. The **Selection Confirmation** window appears.

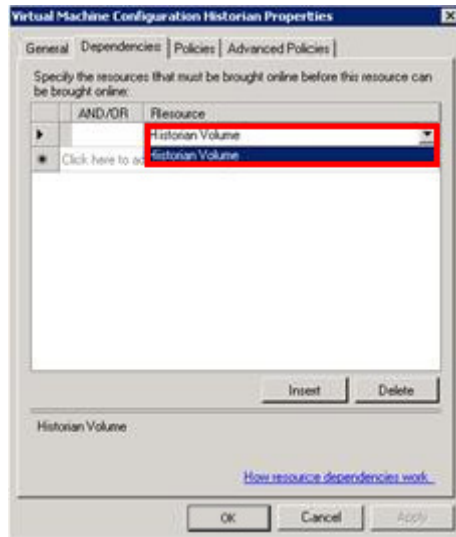


- 5 Click **OK** to validate the details that you have entered. The **Server Manager** window appears.

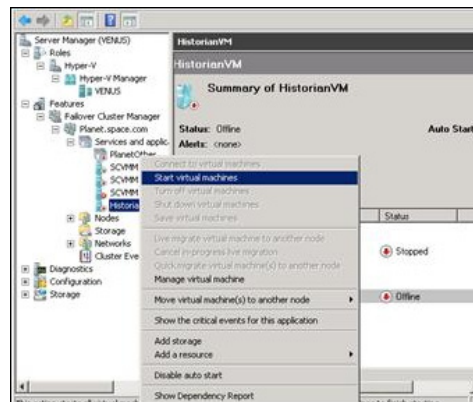


**Note:** To modify the selection, click **Cancel** and modify the detail as required in the **New DataKeeper Volume Properties** window, and then click **Apply**.

- 6 Under **Virtual Machine**, right-click the name of the virtual machine that you have created. Right-click **Virtual Machine Configuration** and click **Properties**. The **Virtual Machine Configuration Historian Properties** window appears.



- 7 Click the **Dependencies** tab. From **Resource** list, select the name of the DataKeeper Volume resource that you have created and then click **OK**.



- 8 On the **Server Manager** window, right-click the name of the virtual machine that you have created and then click **Start virtual machines** to start the virtual machine.

**Note:** You can use the above procedure to create multiple virtual machines with appropriate names and configuration.

## Expected Recovery Time Objective and Recovery Point Objective

This section provides the indicative Recovery Time Objectives (RTO) and Recovery Point Objectives (RPO) for the load of IO and Attributes historized as shown in Configuring System Platform Products in a Typical Medium Scale Virtualization in Chapter 3 and with the configuration of Host Virtualization Servers and Hyper-V virtual machines explained in the setting up Medium Scale Virtualization Environment. For more information refer to, "Setting Up Virtualization Environment" on page 453. In addition to these factors, the exact RTO and RPO depend on factors like storage I/O performance, CPU utilization, memory usage, and network usage at the time of failover/migration activity.

### RTO and RPO Observations - HADR Medium Configuration

Scenarios and observations in this section:

Scenario	Observation
HA-Scenario: Virtualization Server hardware fails	"HA-Scenario: Virtualization Server hardware fails" on page 495
DR-Scenario: Network fails on Virtualization Server	"DR-Scenario: Network fails on Virtualization Server" on page 497

The following tables display RTO and RPO Observations with approximately 50000 IO points with approximately 20000 attributes being historized:

**HA-Scenario: Virtualization Server hardware fails**

The failover occurs due to hardware failure, and it is simulated with power-off on the host server.

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	5 min 35 sec + time taken by the user to start the InTouchView	Data Loss for \$Second tag (Imported to Historian)	6 min 47 sec
		<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
GR	5 min 13 sec	IAS Tag (Script)	5 min 44 sec
		IAS IO Tag (DASSiDirect)	7 min 28 sec
AppEngine1	6 min 05 sec	IAS Tag (Script)	6 min 35 sec
		IAS IO Tag (DASSiDirect)	7 min 29 sec
AppEngine2	6 Min 12 sec	IAS Tag (Script)	6 Min 41 sec
		IAS IO Tag (DASSiDirect)	7 Min 20 sec

Products	RTO	RPO	
		Tags	Data Loss Duration
Historian	6 min 21 sec	SysTimeSec (Historian)	6 Min 33 sec
		\$Second (InTouch)	6 Min 47 sec
		<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
		IAS Tag (Script)	5 Min 45 sec
		IAS IO Tag (DASSiDirect)	7 Min 30 sec
DAS SIDirect	4 Min 25 sec	N/A	N/A
Historian Client	3 Min 34 sec + time taken by the user to start the Historian Client	N/A	N/A
Information Server	4 Min 15 sec + time taken by the user to start the Information Server	N/A	N/A



**DR-Scenario: Network fails on Virtualization Server**

There is a failover due to network disconnect (Public). In this case, the VMs restart after moving to the other host server.

Products	RTO	RPO	
		Tags	Data Loss Duration
InTouch	11 min 4 sec + time taken by the user to start the InTouchView	Data Loss for \$Second tag (Imported to Historian)	15 min 32 sec
		<b>Note:</b> RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.	
GR	12 min 20 sec	IAS Tag (Script)	13 min 11 sec
		IAS IO Tag (DASSiDirect)	13 min 01 sec
AppEngine1	11 min 35 sec	IAS Tag (Script)	12 min 26 sec
		IAS IO Tag (DASSiDirect)	13 min 05 sec
AppEngine2	11 min 48 sec	IAS Tag (Script)	11 min 24 sec
		IAS IO Tag (DASSiDirect)	13 min 19 sec

Products	RTO	RPO	
		Tags	Data Loss Duration
Historian	20 min 0 sec	SysTimeSec (Historian)	15 min 16 sec
		\$Second (InTouch)	15 min 32 sec RPO is dependent on the time taken by the user to start the InTouchView on the InTouch node and the RTO of the Historian node, which historizes this tag.
		IAS Tag (Script)	13 min 11 sec
		IAS IO Tag (DASSiDirect)	13 min 01 sec
DAS SIDirect	12 min 25 sec	N/A	N/A
Historian Client	5 min 32 sec + time taken by the user to start the Historian Client	N/A	N/A
Information Server	5 min 38 sec + time taken by the user to start the Information Server	N/A	N/A

## Snapshots of Data Trends and Observations

Scenarios and observations in this section:

Scenario	Observation
Scenario: Virtualization Server Hardware Fails	"Failover due to Hardware failure" on page 499
Scenario: Network Fails on Virtualization Server	"Failover due to Network Disconnect (Public)" on page 505

## Scenario: Virtualization Server Hardware Fails

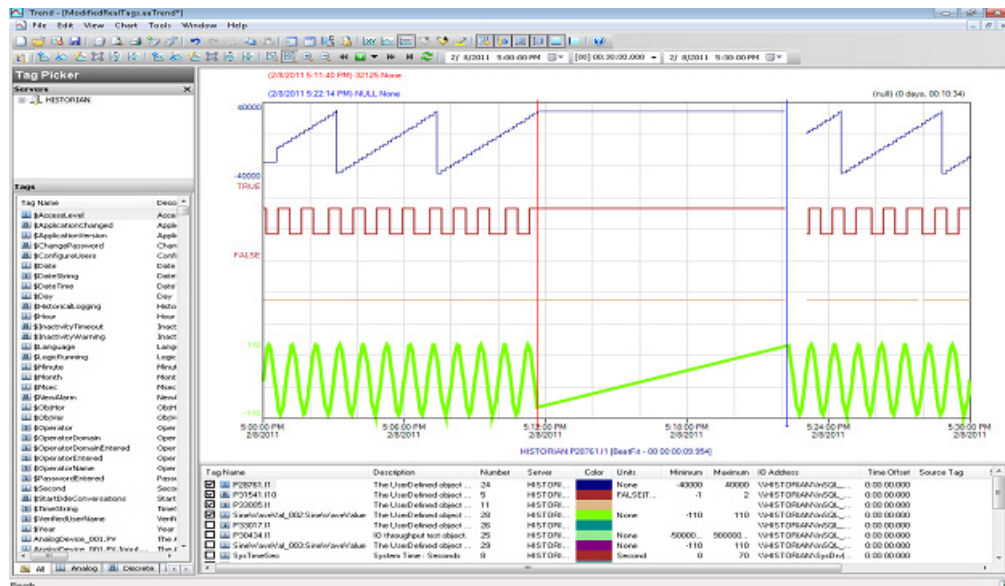
### Failover due to Hardware failure

The failover occurs due to hardware failure, and it is simulated with power-off on the host server.

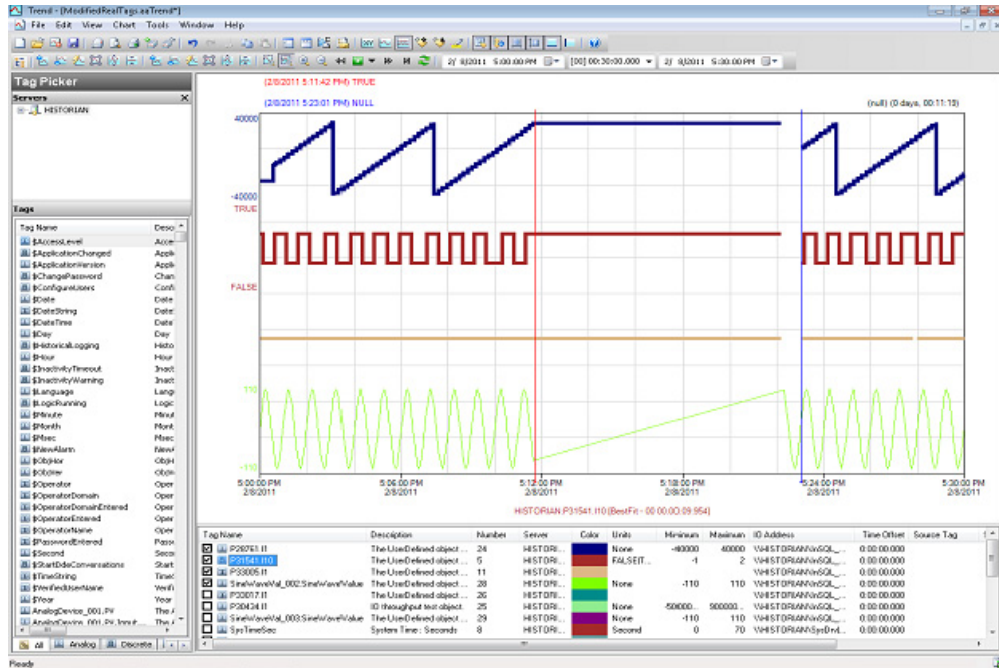
#### Trends:

### AppEngine1

### Industrial Application Server (IAS) Tag (Script)

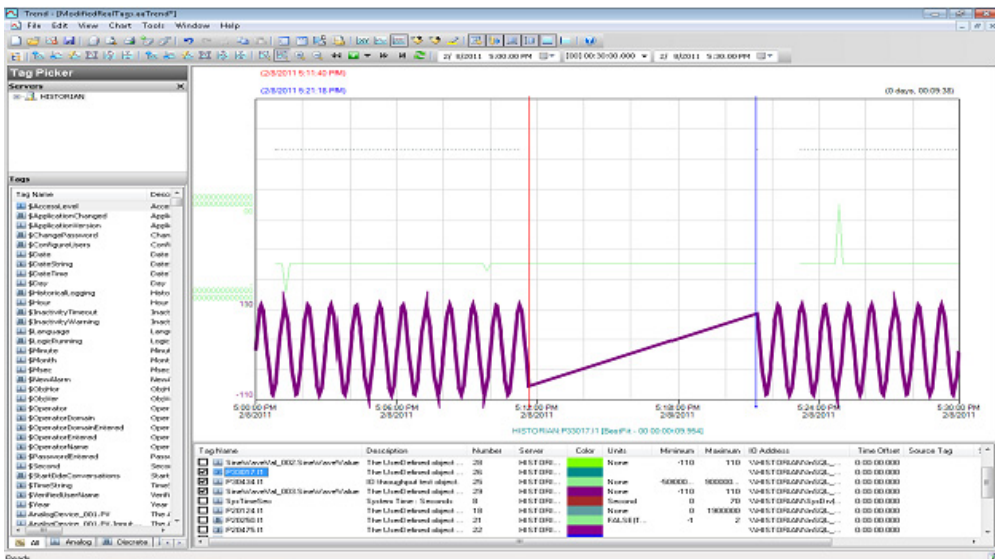


### IAS IO Tag (DASSiDirect)

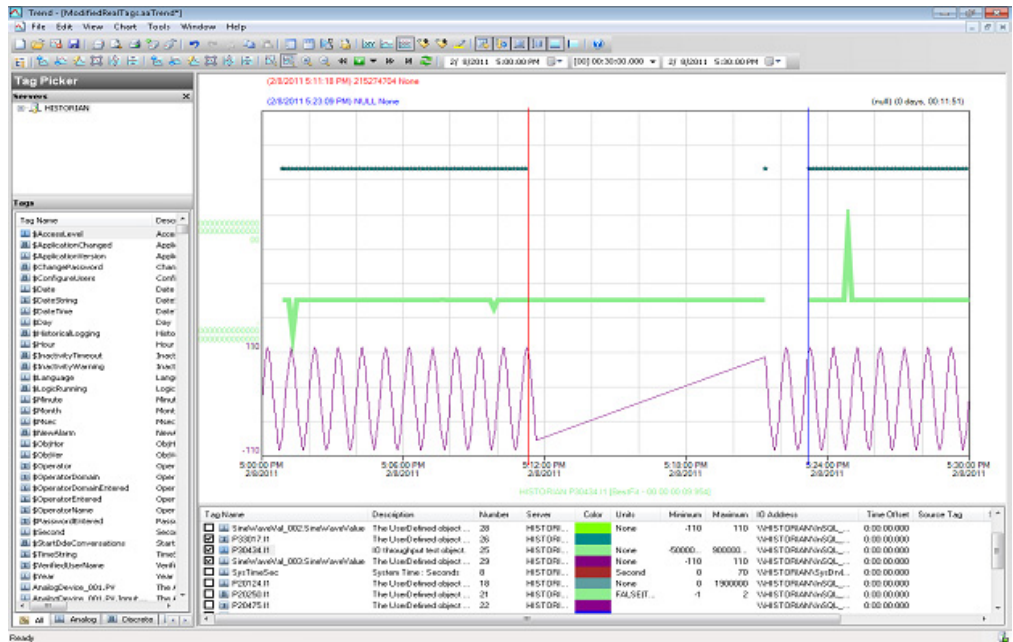


### AppEngine2

### Industrial Application Server (IAS) Tag (Script)

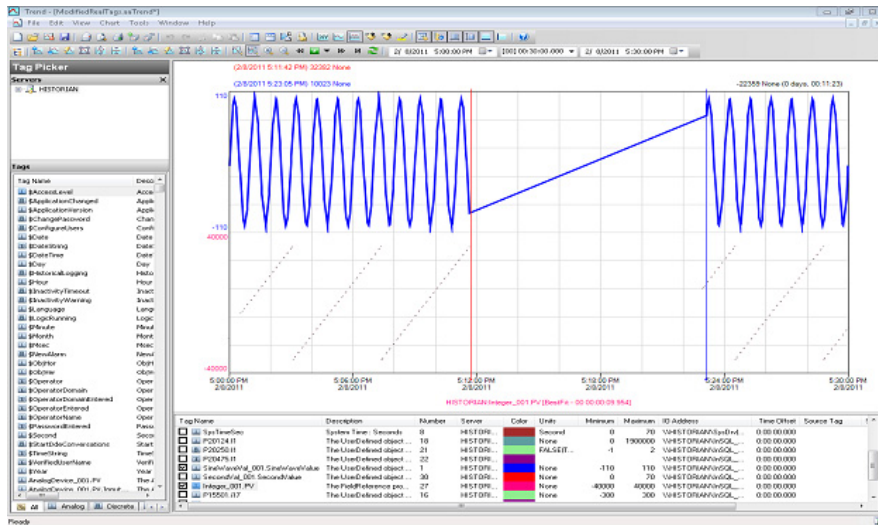


## Industrial Application Server (IAS) IO Tag (DASSiDirect)

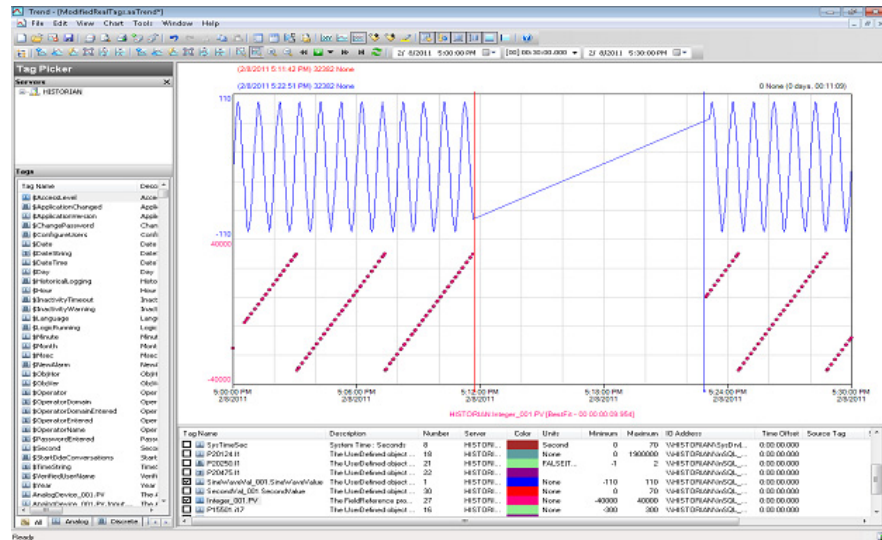


GR

## Industrial Application Server (IAS) Tag (Script)

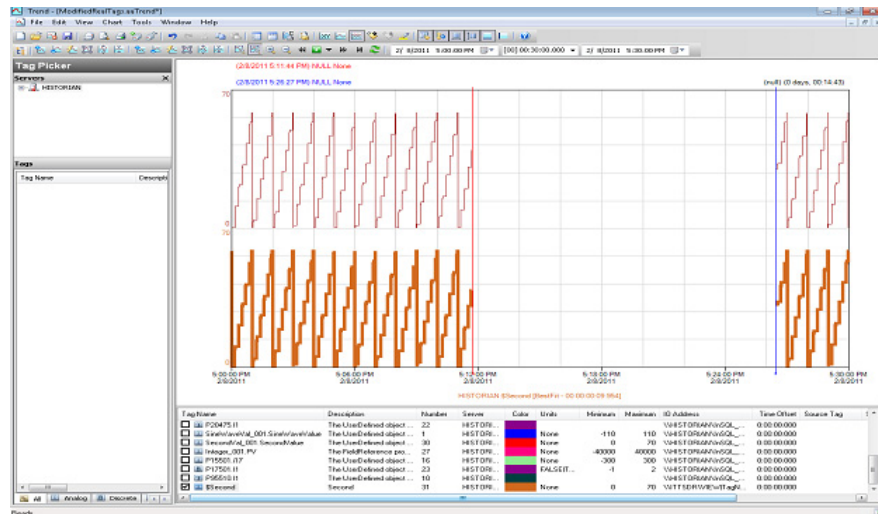


## Industrial Application Server (IAS) IO Tag (DASSiDirect)

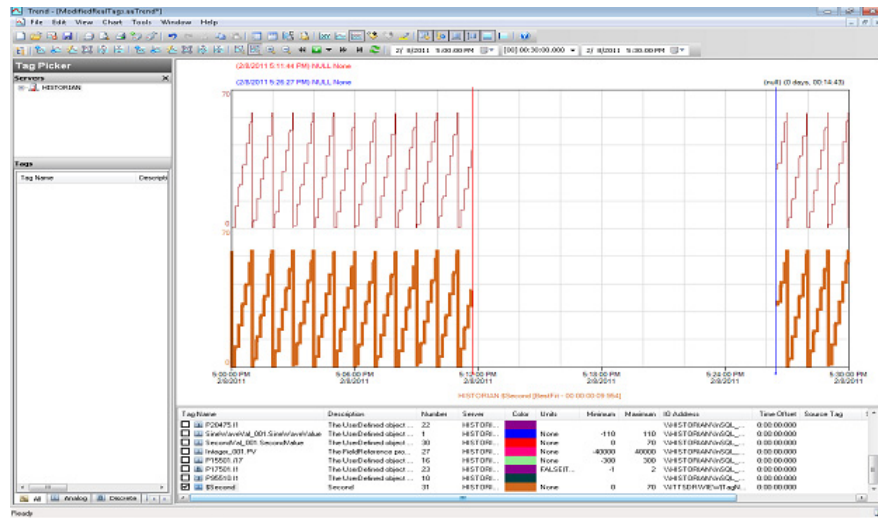


## Historian

### \$Second (InTouch)



## SysTimeSec (Historian)



### Observations

When the host server is turned off, all the VMs will shut down abruptly and restart after moving to the other host server.

- GR Node, AppEngine1, and AppEngine2 virtual nodes have SDK scripts to insert data to Historian. The scripts triggered during the power-off of host server also results in script timeout on AppEngine1, AppEngine2, and GR Nodes.
- As Historian will not be available to the other nodes, suddenly a network-related or instance-specific error can occur while establishing a connection to the SQL Server and failing to connect to Historian.

### Error Logs after Failover

#### GR Node

```
446553042/8/20115:22:30 PM29122916WarningEnginePrimitiveRuntime
Eng:: m_GDC->GetFile failed. Error 2 (0x00000002): The system
cannot find the file specifiedaaEngine
```

```
446553782/8/20115:22:44 PM29122916WarningScriptRuntime
GR.privatebytes: Script timed out.aaEngine
```

#### AppEngine1

```
1055862412/8/20115:21:51 PM28962900WarningScriptRuntime
AppEngineNode1.privatebytes: Script timed out.aaEngine
```

```
1055865962/8/20115:22:35 PM31122756WarningDCMConnectionMgr
Open() of DCMConnection failed: 'A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
```

accessible. Verify that the instance name is correct and that SQL Server is configured...aaEngine

```
1055865972/8/20115:22:35 PM31122756WarningSQLDataRuntime3
SQLTestResults Command Failure - A network-related or
instance-specific error occurred while establishing a
connection to SQL Server. The server was not found or was not
accessible. Verify that the instance name is correct and that
SQL Server is configured...aaEngine
```

## **AppEngine2**

```
54976222/8/20115:21:19 PM26842676WarningScriptRuntime
HourVal_003.GenerateHourValue: Script timed out.aaEngine
```

```
54976442/8/20115:21:37 PM1540496WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

```
54976522/8/20115:22:37 PM1540496WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

```
54976532/8/20115:23:38 PM1540496WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

```
54976542/8/20115:24:38 PM1540496WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

```
54976612/8/20115:25:38 PM1540496WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

## **Historian**

None



## Scenario: Network Fails on Virtualization Server

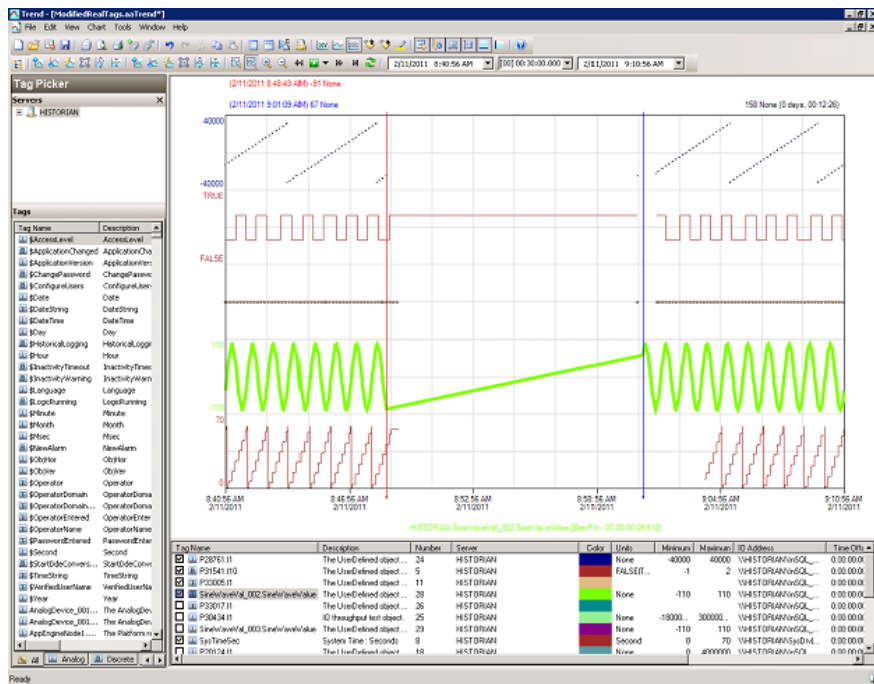
### Failover due to Network Disconnect (Public)

The failover occurs due to network disconnect (Public). Bandwidth used is 45 Mbps, which is simulated with a SoftPerfect Connection Emulator tool.

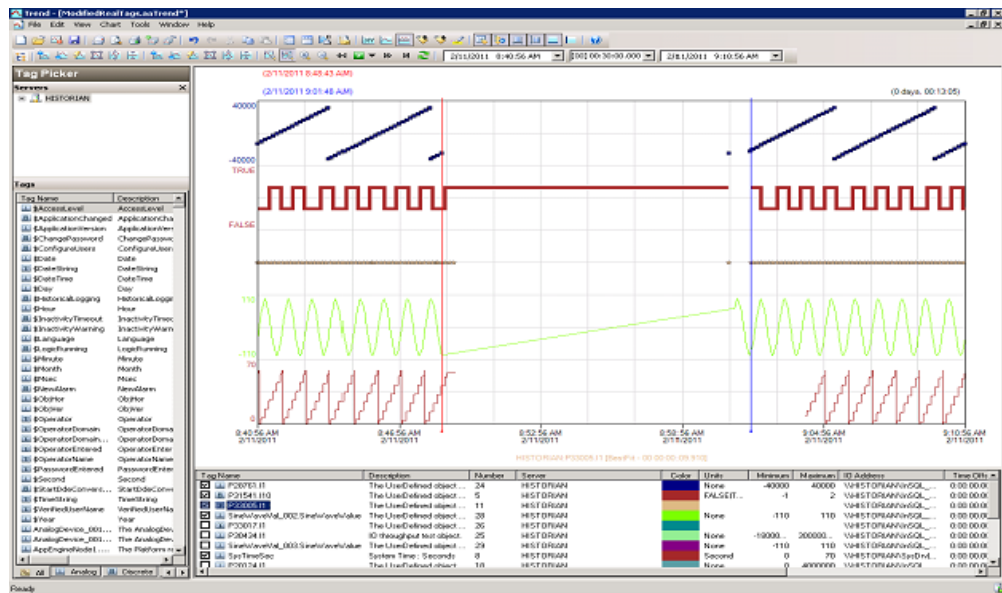
#### Trends:

### AppEngine1

### Industrial Application Server Tag (Script)

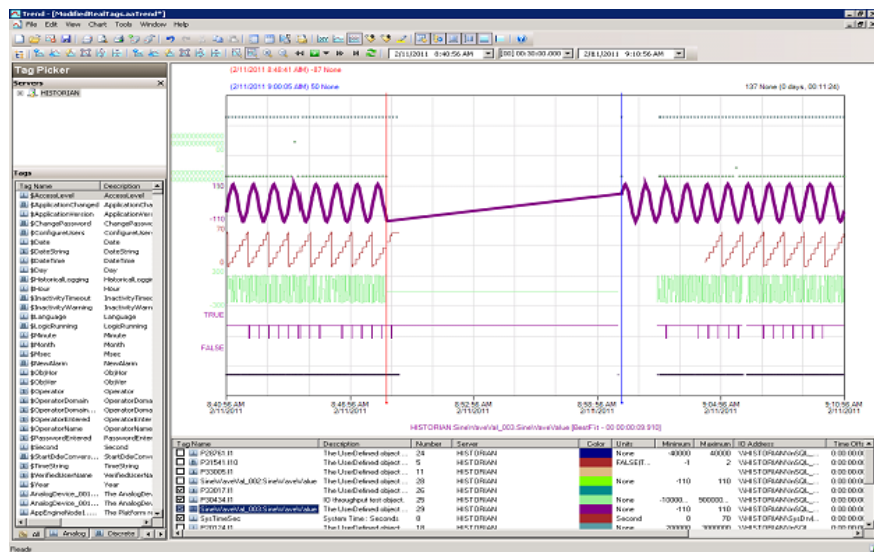


## Industrial Application Server (IAS) IO Tag (DASSiDirect)

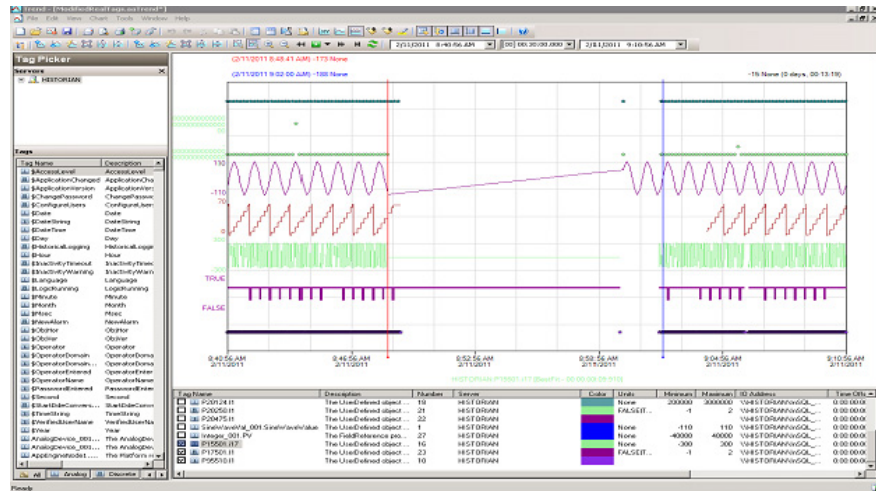


## AppEngine2

## Industrial Application Server (IAS) Tag (Script)

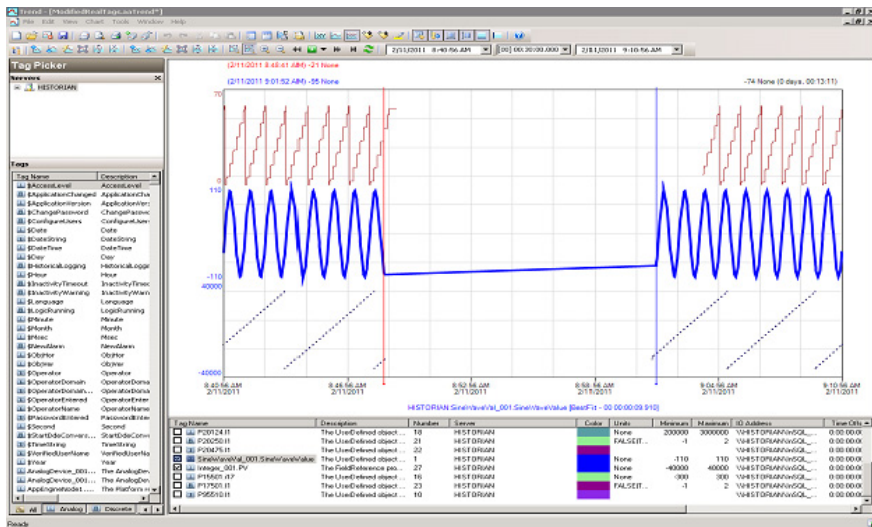


## Industrial Application Server (IAS) IO Tag (DASSiDirect)

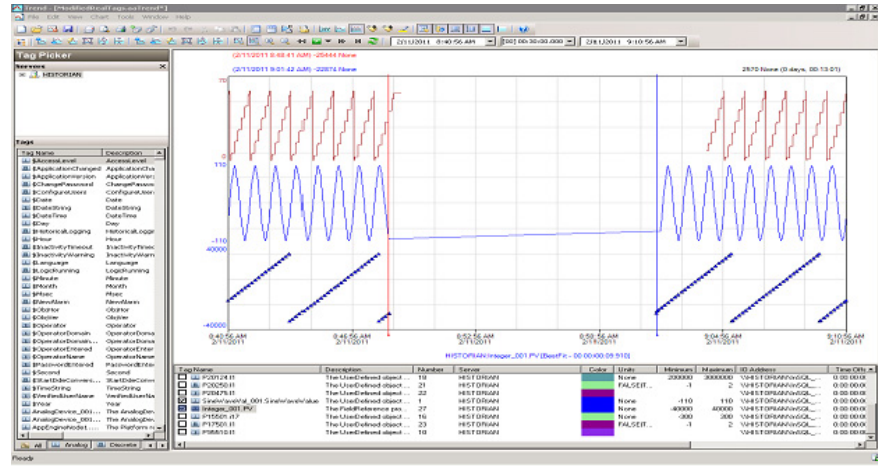


## GR

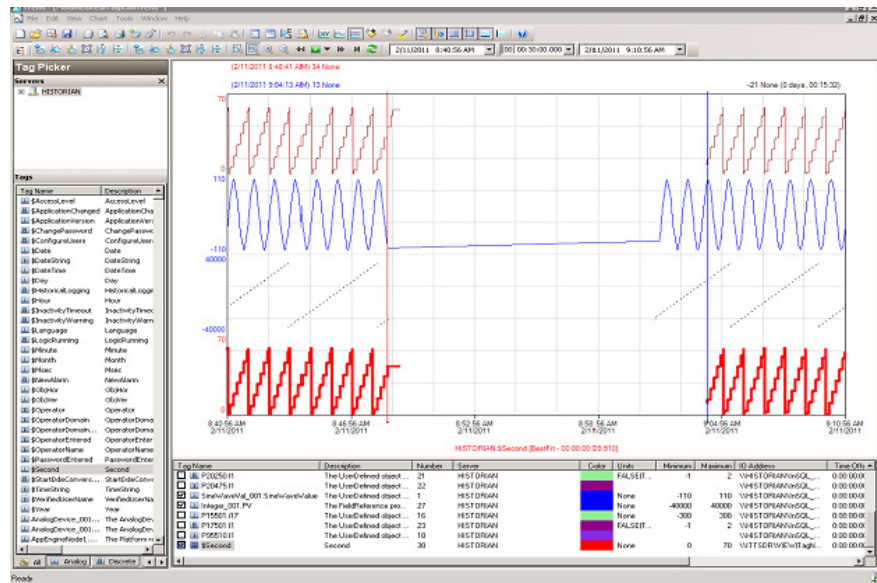
## Industrial Application Server (IAS) Tag (Script)



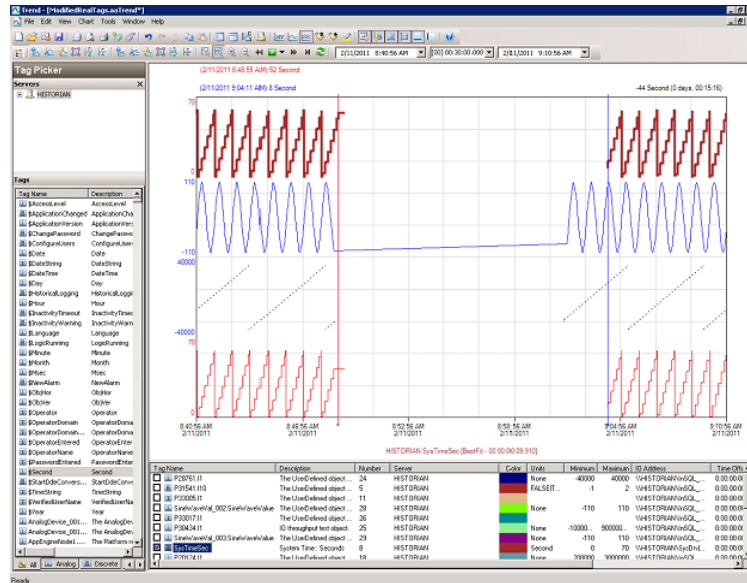
### IAS IO Tag (DASSiDirect)



### Historian \$Second (InTouch)



## SysTimeSec (Historian)



### Observations

When the host server is disconnected from the network, all the nodes shut down abruptly and restart after moving to the other host server, the following occurs:

- GR Node, AppEngine1, and AppEngine2 virtual nodes have SDK scripts to insert data to Historian. The scripts triggered during the time the host server is turned off also results in script timeout on AppEngine1, AppEngine2, and GR Nodes.
- As Historian is not available to the other nodes, suddenly a network-related or instance-specific error can occur while establishing a connection to the SQL Server and failing to connect to Historian.
- Some data sent from GR Node, AppEngine1, and AppEngine2 is discarded till the TimeSync utility is executed and the system time of Historian is synchronized.

### Error Logs after Failover:

#### GR Node

```
448592442/11/20119:00:06 AM27922940WarningNmxSvcInitial
connection packet received from platform 3, which is not in
platforms table.NmxSvc

448597652/11/20119:01:27 AM28482852WarningScriptRuntime
GR.privatembytes: Script timed out.aaEngine

448626762/11/20119:06:00 AM37163720WarningScanGroupRuntime2
Can't convert Var data type to MxDataTypepeaaEngine
```

```
448626772/11/20119:06:00 AM37163720WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypepeaaEngine
448626782/11/20119:06:00 AM37163720WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypepeaaEngine
448626792/11/20119:06:00 AM37163720WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypepeaaEngine
448626972/11/20119:06:00 AM37163720WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypepeaaEngine
448626982/11/20119:06:00 AM37163720WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypepeaaEngine
448626992/11/20119:06:00 AM37163720WarningScanGroupRuntime2
  Can't convert Var data type to MxDataTypepeaaEngine44862697
2/11/20119:06:00 AM37163720WarningScanGroupRuntime2Can't
  convert Var data type to MxDataTypepeaaEngine
```

### **AppEngine 1**

```
1059130762/11/20118:59:15 AM28602864Warning
  EnginePrimitiveRuntimeEng:: m_GDC->GetFile failed. Error 2
  (0x00000002): The system cannot find the file specified
  aaEngine
1059131592/11/20119:00:30 AM28602864WarningScriptRuntime
  AppEngineNode1.privatembytes: Script timed out.aaEngine
1059135022/11/20119:01:15 AM30324132WarningDCMConnectionMgr
  Open() of DCMConnection failed: 'A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...aaEngine
1059135032/11/20119:01:15 AM30324132WarningSQLDataRuntime3
  SQLTestResults Command Failure - A network-related or
  instance-specific error occurred while establishing a
  connection to SQL Server. The server was not found or was not
  accessible. Verify that the instance name is correct and that
  SQL Server is configured...aaEngine
```

### **AppEngine2**

```
55019182/11/20119:00:03 AM17241776WarningScriptRuntime
  HourVal_003.GenerateHourValue: Script timed out.aaEngine
55019542/11/20119:00:16 AM26642808WarningNmxSvcPlatform 1
  exceed maximum heartbeats timeout of 7500 ms.NmxSvc
55019742/11/20119:00:28 AM24882484WarningHistorianPrimitive
  AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
  ArchestrA user account exist on Historian(InSQL) node or does
  Historian not exist?)aaEngine
```

```
55019752/11/20119:01:29 AM24882484WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

```
55019762/11/20119:02:30 AM24882484WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

```
55019832/11/20119:03:30 AM24882484WarningHistorianPrimitive
AppEngineNode2 failed to connect to Historian HISTORIAN. (Does
ArchestrA user account exist on Historian(InSQL) node or does
Historian not exist?)aaEngine
```

## Historian

```
235194832/11/20119:05:27 AM30483692WarningaahStoreSvcAttempt to
store values in the future; timestamps were overwritten with
current time (pipe name, TagName, wwTagKey, system time (UTC),
time difference (sec)) (HISTORIAN_mdas,
SlowScanUDO.IncrementValue, 334, 2011/02/11 03:35:27.296, 1)
[HISTORIAN; pipeserv...aahCfgSvc
```

```
235195792/11/20119:09:42 AM30483692WarningaahStoreSvcAttempt to
store values in the future; timestamps were overwritten with
current time (pipe name, TagName, wwTagKey, system time (UTC),
time difference (sec)) (HISTORIAN_mdas,
SlowScanUDO.IncrementValue, 334, 2011/02/11 03:35:27.296, 1)
[HISTORIAN; pipeserv...aahCfgSvc
```





# Chapter 5

## Working with Windows Server 2008 R2 Features

This chapter describes how to use the features of Windows Server 2008 R2 to perform the following functions:

- Using VLAN for Communication Between System Platform Nodes
- Using VLAN for RMC Communication Between Redundant Application Server Nodes
- Accessing a System Platform Node with a Remote Desktop
- Accessing System Platform Applications as Remote Applications
- Displaying the System Platform Nodes on a Multi-Monitor with a Remote Desktop
- Working with Network Load Balancing
- Hardware Licenses in a Virtualized Environment

## About Windows Server 2008 R2 Hyper-V Features

A virtualized environment can run multiple virtual machines (VMs) on a single server, thereby reducing the number of physical servers required on the network. Hyper-V provides a virtualized computing environment on Windows Server 2008 R2. Hyper-V is a hardware-assisted virtualization platform that uses partitions to host VMs. One of the benefits that Hyper-V provides is isolation, which ensures that the child VMs execute in their individual partitions and exist on the host as separate machines. This allows multiple operating systems and conflicting applications to run on the same server.

Windows Server 2008 R2 Hyper-V provides support for using Virtual LANs (VLANs) on both parent and child partitions. By configuring VLAN, VMs can communicate over the specified VLAN using Virtual Network switch.

Microsoft introduced RemoteApp with the release of Windows 2008 Terminal Services. In the past, Windows 2008 TS Microsoft Terminal Services solutions only supported the publication of a full desktop using the RDP protocol. In Windows 2008, it was possible to start an application seamlessly from a Terminal Server making it appear as if were running locally on the client machine.

RemoteApp is an application that runs on from a Terminal Server running seamlessly to the client.

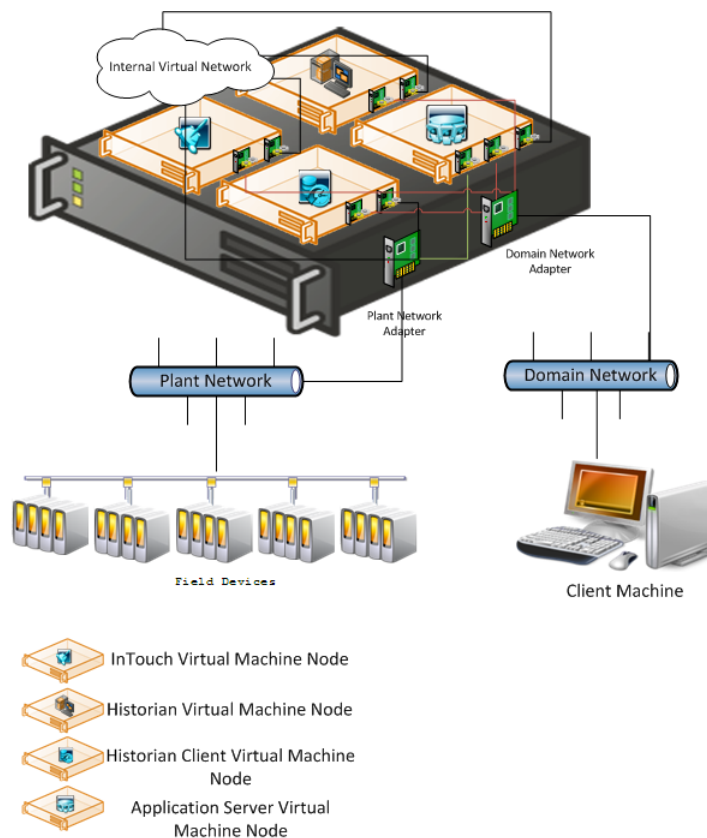
# Using VLAN for Communication Between System Platform Nodes

Virtual LANs perform traffic separation within a shared network environment. All released versions of Hyper-V support virtual local area networks (VLANs). Since the VLAN configuration is software-based, you can move a computer and still maintain the network configurations. For each virtual network adapter you connect to a virtual machine, you can configure a VLAN ID for the virtual machine.

You need the following network adapters to configure VLANs:

- A physical network adapter that supports VLANs
- A physical network adapter that supports network packets with VLAN IDs that are already applied

On the management operating system, you need to configure the virtual network to allow network traffic on the physical port. This enables you to use the VLAN IDs internally with the VMs. You can then configure the VM to specify the virtual LAN that the VM will use for all network communications.



## Configuring Virtual Network Switches on the Hyper-V Host Server and Adding Virtual Network Adapters on the VM Nodes

You can create virtual networks on a server running Hyper-V to define various networking topologies for VMs and the virtualization server. Following are the three types of virtual networks:

- Private network: Provides communication between VMs
- Internal network: Provides communication between the virtualization server and VMs
- External network: Provides communication between a VM and a physical network by associating to a physical network adapter on the virtualization server

On a Hyper-V host server, you can create the following virtual network adapter switches.

- External Network adapter switch to communicate with the external domain network.
- External Network adapter switch to communicate with the external plant network.
- Internal Network adapter switch to communicate between VM nodes created on Hyper-V host server.

For more information, refer to

[http://technet.microsoft.com/en-us/library/cc732470\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc732470(WS.10).aspx)

### Creating a Virtual Network Switch for Communication Between a VM Node and an External Domain or a Plant Network

A virtual network switch or a virtual switch is a virtual version of a physical network switch. A virtual network provides access to local or external network resources for one or more VMs. You need to create a virtual network switch to communicate with the external domain or plant network.

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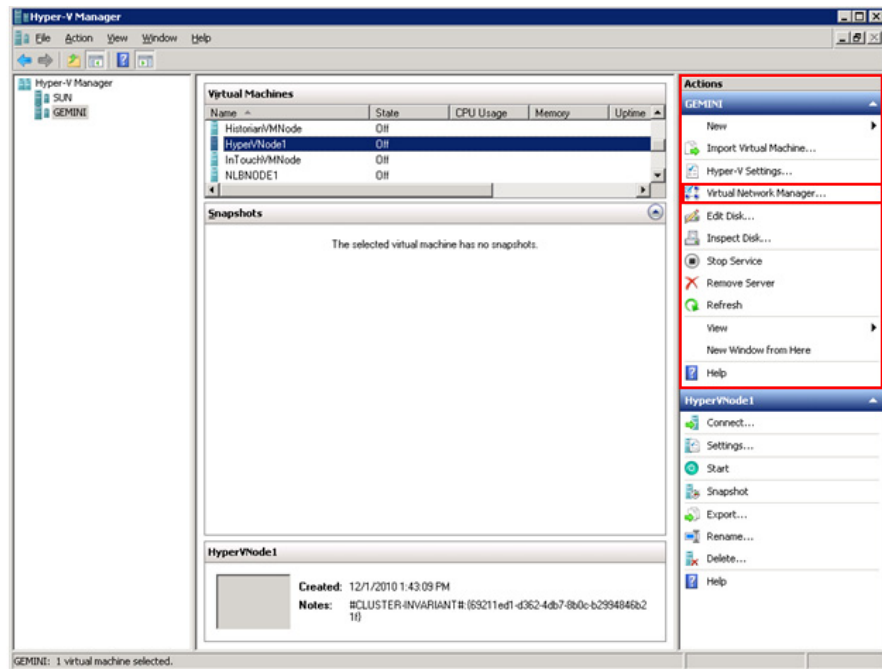
**Note:** A virtual network works like a physical network except that the switch is software based. After an external virtual network is configured, all networking traffic is routed through the virtual switch.

---

## To create a virtual network switch for communication between a VM node and an external domain network or a plant network

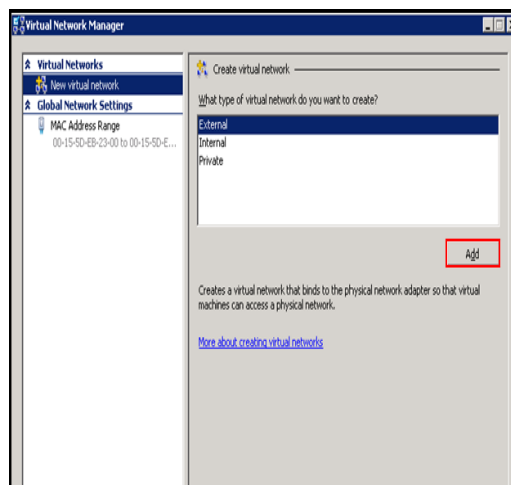
- 1 Open the Hyper-V Manager on a Hyper-V host.

On the **Start** menu, click **Hyper-V Manager**. The **Hyper-V Manager** window appears.

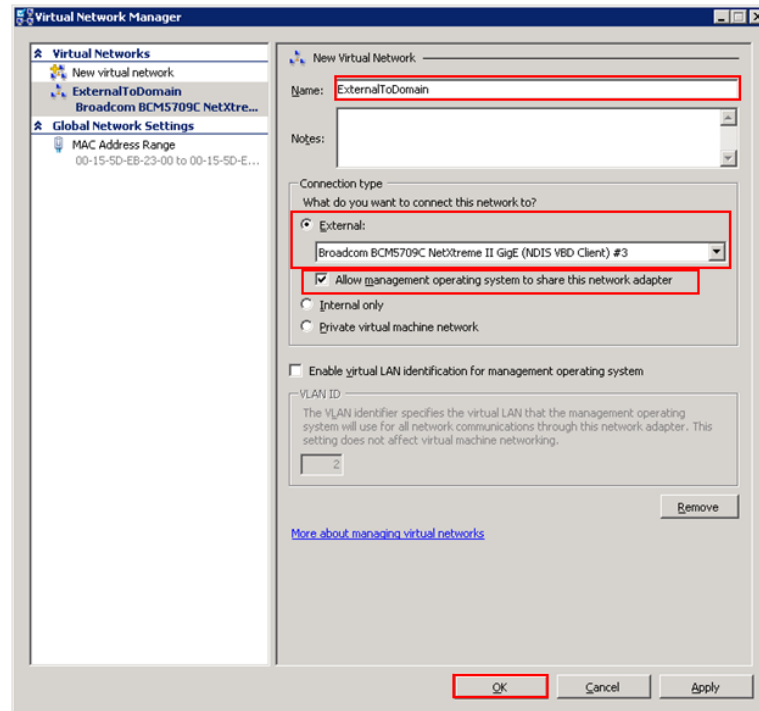


- 2 Go to the **Virtual Network Manager** window.

On the Actions menu, click **Virtual Network Manager**. The **Virtual Network Manager** window appears.



- 3 Add a new virtual network.
  - a Under **Virtual Networks**, click **New virtual network**.
  - b Under **Create virtual network**, click **External**.
  - c Click **Add**. The **New Virtual Network** section appears.



- 4 Enter the new virtual network details.
  - In the **Name** box, enter the Virtual Network name.
  - Click the **External** option, and then select the required external domain or plant network that you want to connect to.
  - Select the **Allow management operating system to share this network adapter** check box if you want to manage activities on the virtual network switch created.

**Note:** Do not select this check box if you are creating a virtual network for communication between VM nodes and a plant network.

- Click **OK** to close the **Virtual Network Manager** window or click **Apply** to create the virtual network and continue using Virtual Network Manager.

The external virtual network switch is created and can be used to communicate between the VM nodes and the domain or plant network.

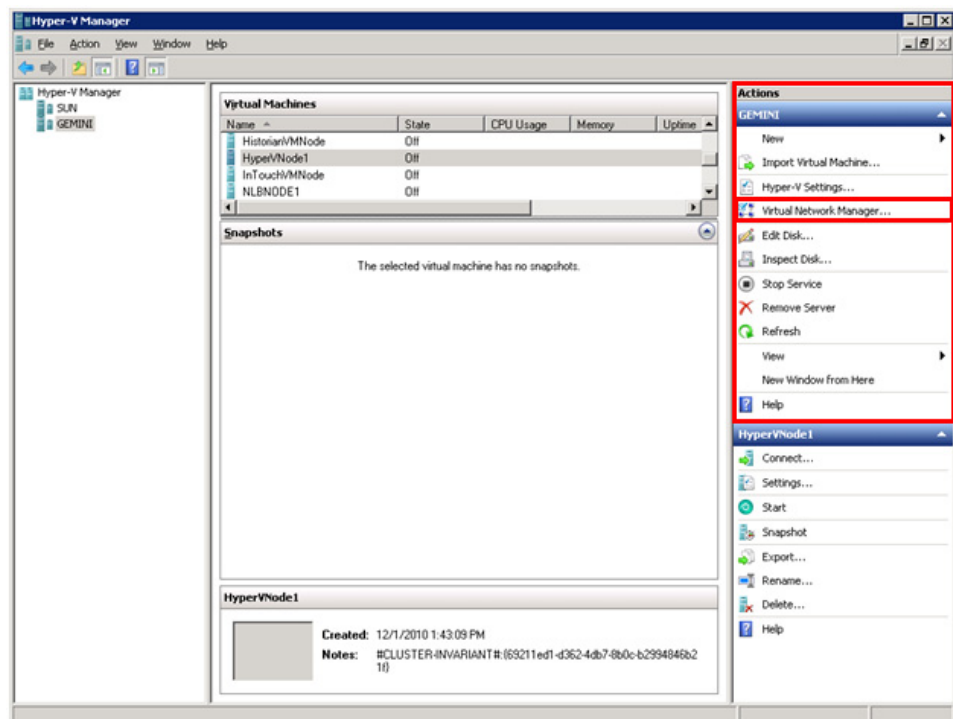
## Creating a Virtual Network Switch for Communication Between Internal VM Nodes

To communicate with the other VMs hosted on the Hyper-V host server, you need to create an internal virtual network switch.

### To create a virtual network switch for communication between internal VM nodes

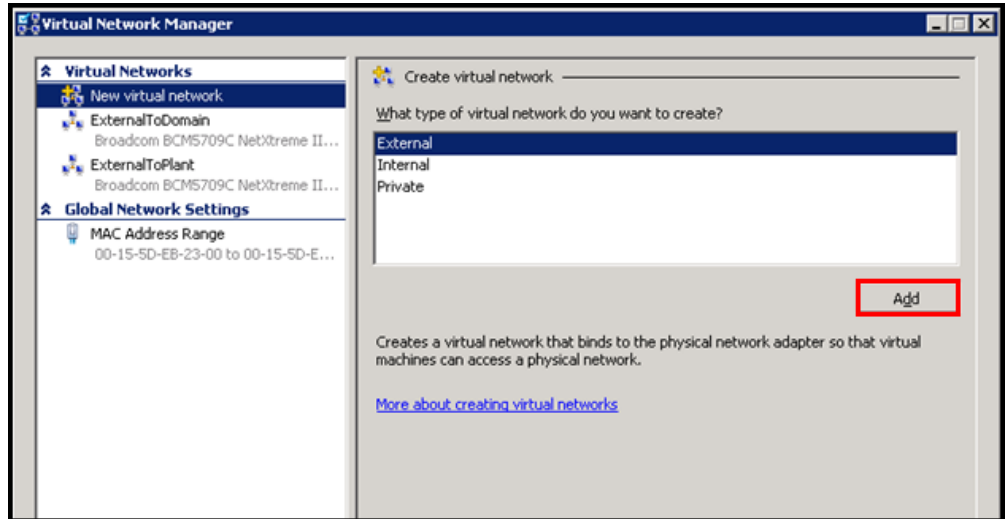
- 1 Open the Hyper-V Manager on a Hyper-V host.

On the **Start** menu, click **Hyper-V Manager**. The **Hyper-V Manager** window appears.



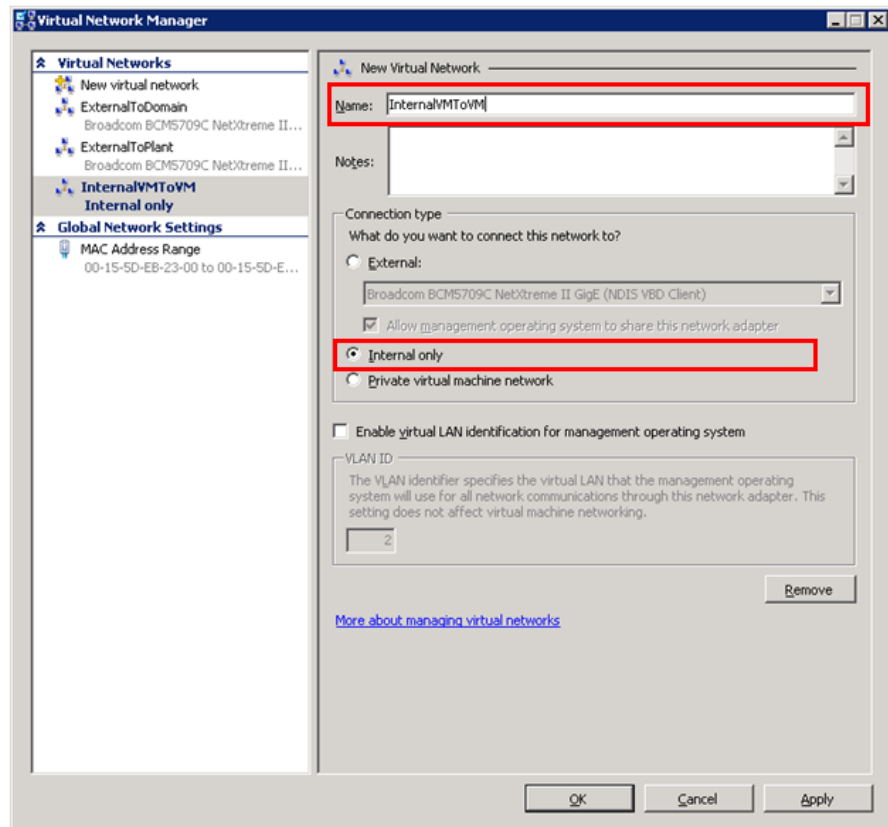
2 Go to the **Virtual Network Manager** window.

On the **Actions** menu, click **Virtual Network Manager**. The **Virtual Network Manager** window appears.





- 3 Add a new virtual network.
  - a Under **Virtual Networks**, click **New virtual network**.
  - b Under **Create virtual network**, click **Internal**.
  - c Click **Add**. The **New Virtual Network** section appears.



- 4 Enter the new virtual network details.
  - a In the **Name** box, enter the Virtual Network name.
  - b Click the **Internal only** option.
  - c Click **OK** to close the **Virtual Network Manager** window or click **Apply** to create the virtual network and continue using Virtual Network Manager.

The internal virtual network switch is created and will be used to communicate between the VM nodes on the host server.

## Adding an Internal Virtual Network Adapter to a VM Node for Communication Between VM Nodes

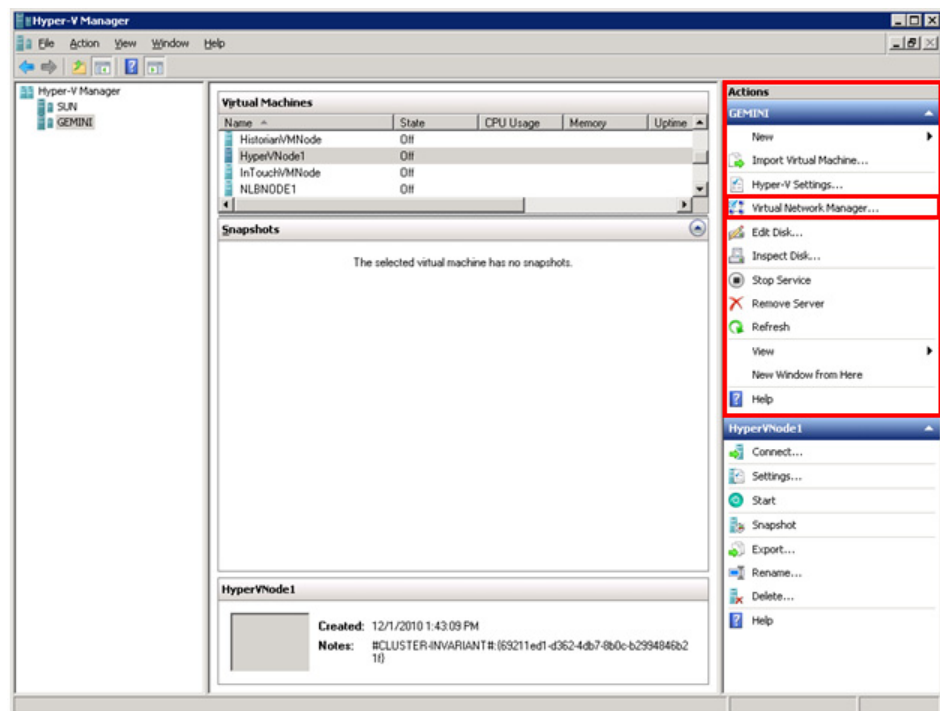
You can configure one or more virtual network adapters for a VM by creating or modifying the hardware profile of a VM.

If you connect a virtual network adapter configured for a VM to an internal network, you can connect to the VMs deployed on the same host and communicate over that internal network.

### To add an internal virtual network adapter to a VM node for communication between VM nodes

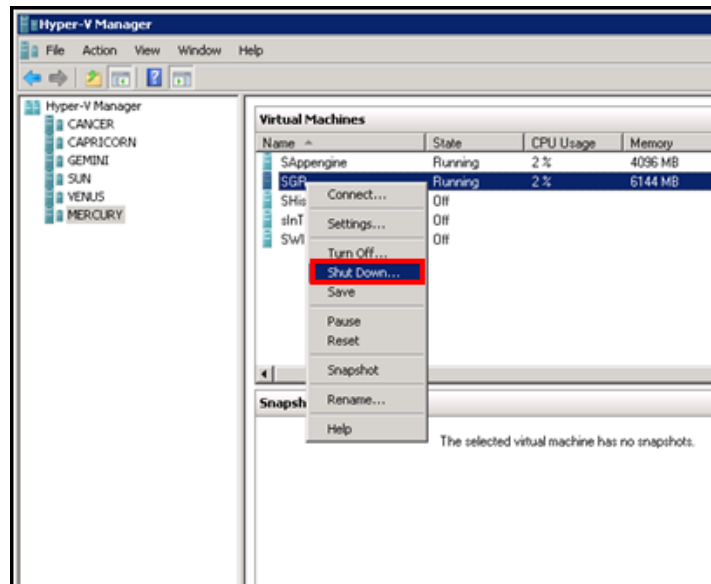
- 1 Open the Hyper-V Manager on a Hyper-V host.

On the **Start** menu, click **Hyper-V Manager**. The **Hyper-V Manager** window appears.



- 2 Shut down the VM node to which you want to add the network adapter.

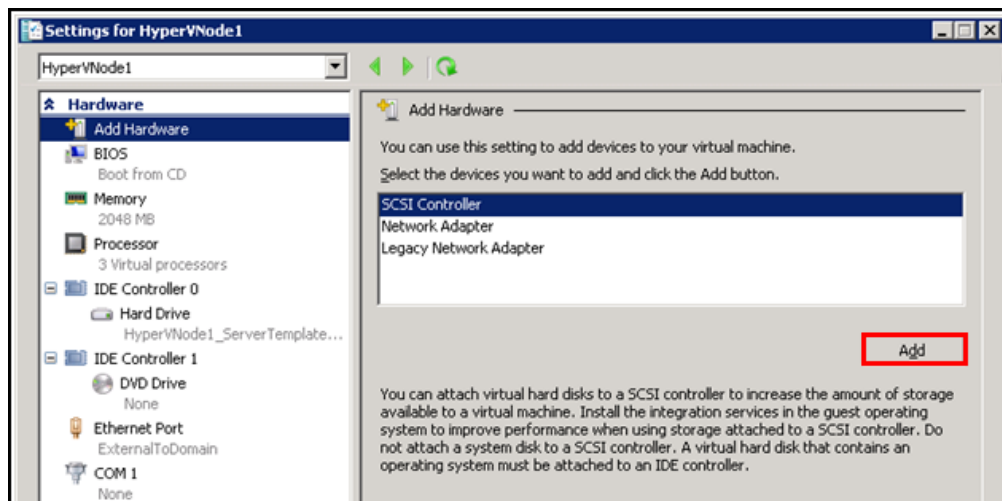
Right-click the required VM node. The VM menu appears.



Click **Shut Down**.

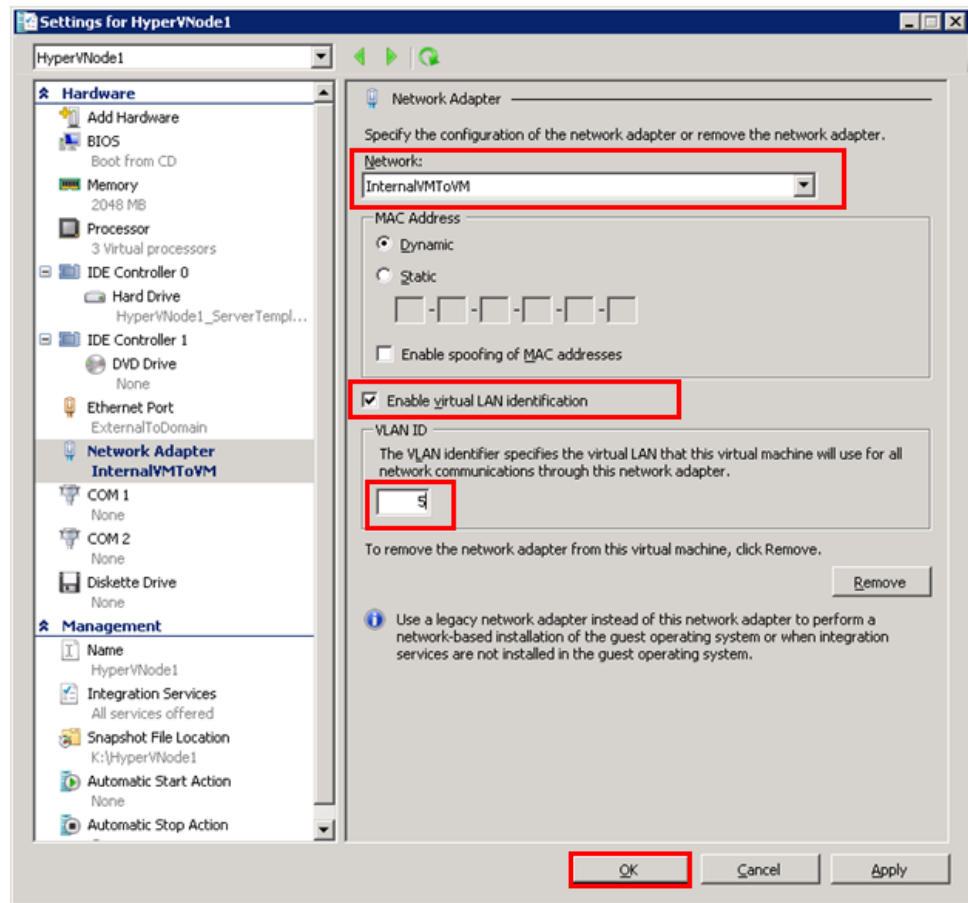
- 3 Go to the **Settings** window for the required VM node.

Right-click the VM node and click **Settings**. The **Settings** window for the VM node appears.



- 4 Select the hardware settings for the VM node.

- a With **Add Hardware** selected, click **Network Adapter**, and then click **Add**. The **Network Adapter** area appears.



- b** In the **Hardware** pane, click the relevant network adapter.
- c** Select the **Enable Virtual LAN** identification check box.
- d** In the **VLAN ID** box, enter the **VLAN ID**, and then click **OK** to close the window.

**Note:** All traffic for the management operating system that goes through the network adapter is tagged with the VLAN ID you enter.

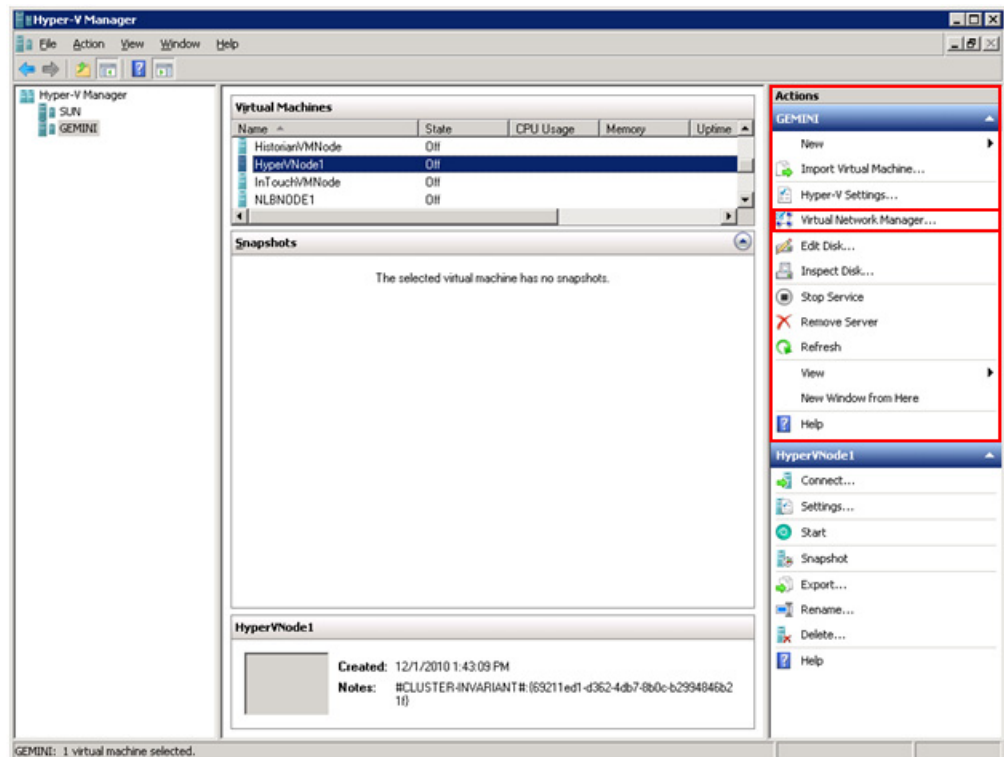
## Adding a Virtual Network Adapter to a VM Node for Communication Between a VM Node and a Plant Network

If you connect a virtual network adapter configured for a VM to a physical network adapter on the host on which the VM is deployed, the VM can access the network to which the physical host computer is connected and can function on the host's local area network (LAN) in the same way that physical computers connected to the LAN can function.

### To add a virtual network adapter to a VM node for communication between a VM node and a plant network

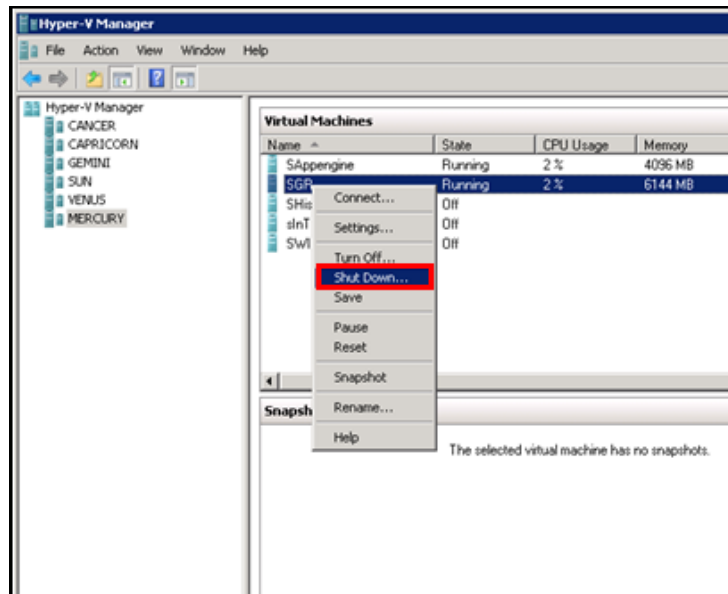
- 1 Open the **Hyper-V Manager** on a Hyper-V host.

On the **Start** menu, click **Hyper-V Manager**. The **Hyper-V Manager** window appears.



- 2 Shut down the VM node to which you want to add the network adapter.

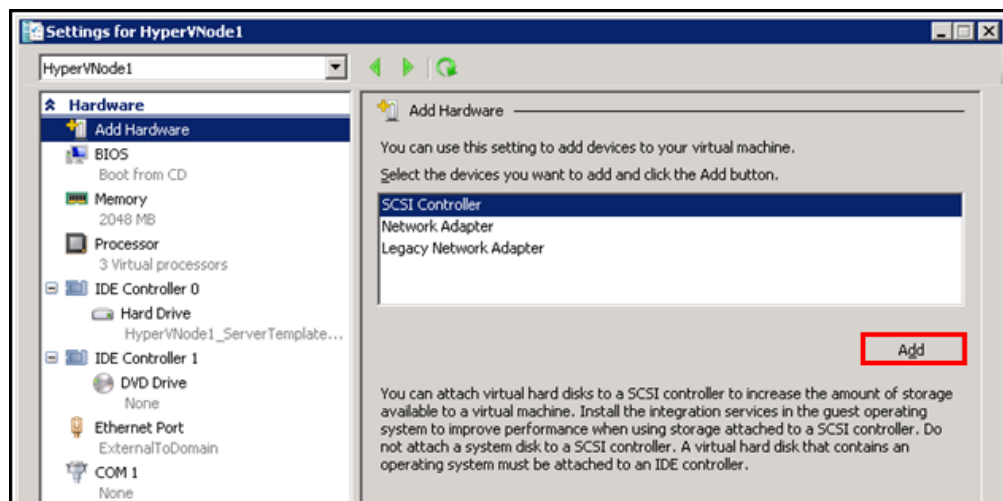
Right-click the required VM node. The VM menu appears.



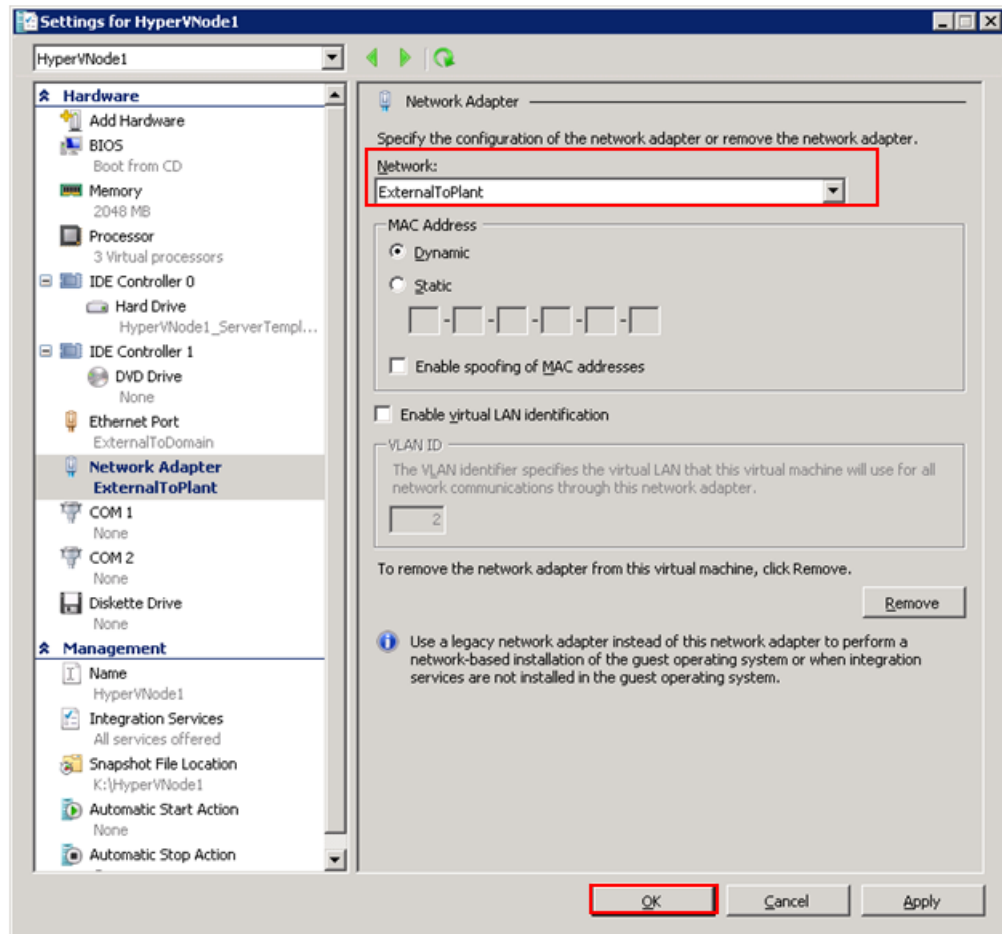
Click **Shut Down**.

- 3 Go to the **Settings** window for the required VM node.

Right-click the VM node and click **Settings**. The **Settings** window for the VM node appears.



- 4 Select the hardware settings for the VM node.
  - a With **Add Hardware** selected, click **Network Adapter**, and then click **Add**. The **Network Adapter** area appears.



- 5 In the **Hardware** pane, click the relevant network adapter, and then click **OK** to close the window.

## Configuring Network Adapters on the System Platform Virtual Machine (VM) Nodes

By default, one network adapter is added to the VM node when you create the VM nodes on a Hyper-V host server.

Based on the requirements, you can add multiple internal or external network adapters.

For the VM System Platform node to communicate with the external domain or external plant network, it needs to have external network adapter added.

For the VM System Platform node to communicate internally to the other VM System Platform nodes hosted by the Hyper -V server, it needs to have internal network adapter added.

You can create the following VM nodes on the virtualization server for which the VLAN communication needs to be set up:

- InTouch VM node
- Historian VM node
- Application Server VM node
- Historian Client VM node
- Wonderware Information Server VM node

VM nodes on Hyper-V host server have the following network adapters:

- An external network adapter to communicate with the external domain network
- An external network adapter to communicate with the external plant network. This is available if the VM node is acquiring the data from the IO Server connected to the external plant network
- An internal network adapter to communicate internally between the VM nodes configured on Hyper-V host server
- An internal network adapter to communicate between the Application Server nodes to use for Redundancy Message Channel (RMC) communication. Only the Application Server VM nodes configured for Redundant Application Engines have this network adapter.

Each System Platform node can have various combinations of the following network adapters, depending on your configuration:



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**Note:** It is assumed that the host virtualization server is configured with one external virtual network switch to communicate with the domain network, one external virtual network switch to communicate with the plant network, and one internal virtual network switch for the internal VM to VM communication.

---

Product node	Network adapters
InTouch	<ul style="list-style-type: none"> <li>● An external network adapter to communicate with the external domain network</li> <li>● An external network adapter to communicate with the external plant network (This is to acquire the data from the IOServer which is connected to the plant network.)</li> <li>● An internal network adapter to communicate between the other VM nodes configured on a Hyper-V host server (For example, to a Historian VM node)</li> </ul>
Historian	<ul style="list-style-type: none"> <li>● An external network adapter to communicate with the external domain network</li> <li>● An external network adapter to communicate with the external plant network (This is to acquire the data from the IOServer which is connected to the plant network.)</li> <li>● An internal network adapter to communicate between the other VM nodes configured on a Hyper-V host server (For example, an InTouch VM node.)</li> </ul>

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Product node	Network adapters
Historian Client	<ul style="list-style-type: none"> <li>● An external network adapter to communicate with the external domain network</li> <li>● An external network adapter to communicate with the external plant network (This is to acquire the data from the IO Server which is connected to the plant network.)</li> <li>● An internal network adapter to communicate between the other VM nodes configured on a Hyper-V host server (For example, a Historian VM node.)</li> </ul>
Wonderware Information Server (WIS)	<ul style="list-style-type: none"> <li>● An external network adapter to communicate with the external domain network</li> <li>● An internal network adapter to communicate between the other VM nodes configured on a Hyper-V host server (For example, to a Historian Client VM node.)</li> </ul>
Wonderware Application Server	<ul style="list-style-type: none"> <li>● An external network adapter to communicate with the external domain network</li> <li>● An external network adapter to communicate with the external plant network (This is to acquire the data from the IO Server which is connected to the plant network.)</li> <li>● An internal network adapter to communicate between the other VM nodes configured on a Hyper-V host server (For example, a Historian VM node.)</li> </ul>

In the following procedure, the VM nodes are created with the specified OS installed on all the nodes. One physical machine is configured in the workgroup with an IO Server installed and connected to a plant or private network.

### To configure virtual network adapters on VM node

- 1 Add an internal virtual network adapter to the required node, for example, an InTouch node. For more information on adding an internal virtual network adapter, refer to "Adding an Internal Virtual Network Adapter to a VM Node for Communication Between VM Nodes" on page 522.

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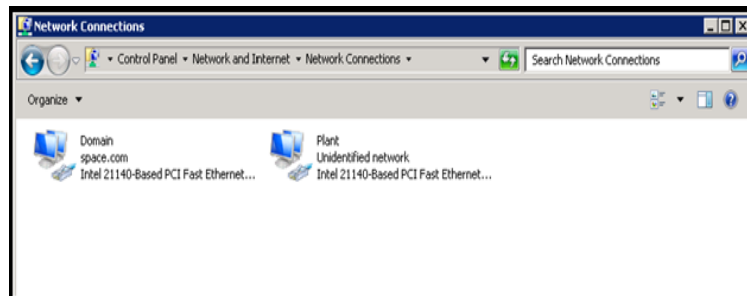
**Note:** You must provide the same VLAN ID that you provided for the first VM node you configured.

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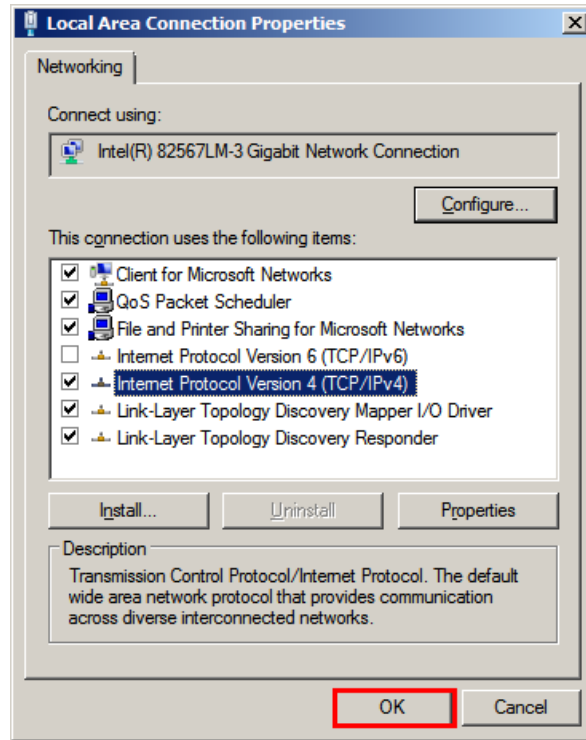
- 2 Add an external virtual network adapter to the required node, for example an InTouch node. For more information on adding an external virtual network, refer to "Adding a Virtual Network Adapter to a VM Node for Communication Between a VM Node and a Plant Network" on page 525.
- 3 Connect to the required VM node.
- 4 Open the **Network Connections** window.

In the start menu, click **Control Panel, Network and Internet, Network and Sharing Center** then **Change Adapter Settings**. The Network Connections area appears.

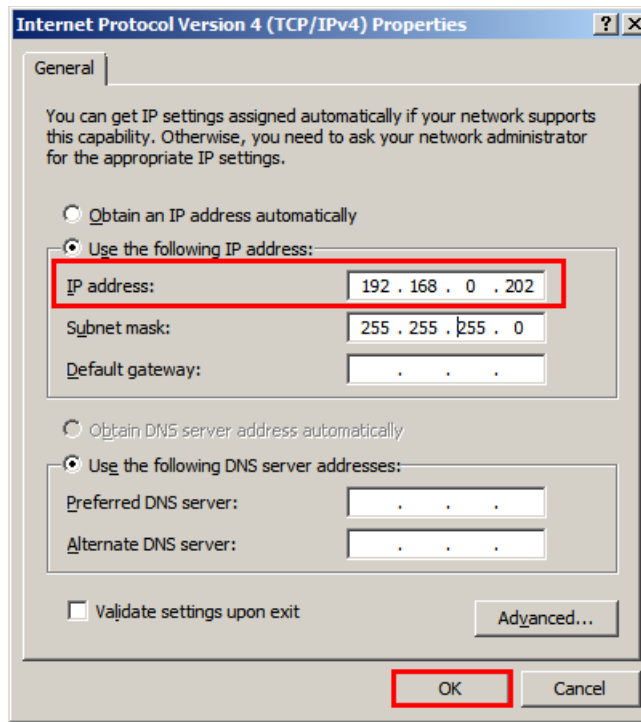
Note that the network adapters appear in the order they are added to the VM node.



- 5 Configure the required VM node.
  - a Right-click the required internal or external network adapter. The **Local Area Connection Properties** window appears.



- b** Select the **Internet Protocol Version 4** check box, and then click **OK**. The **Properties** window appears for the Internet protocol version you selected.



- c** Click the **Use the following IP address** option.
- d** In the **IP address** box, enter the IP address for the network adapter, and then click **OK**.
- For the internal network added for communication between VM nodes, enter the required IP address.
  - For external network adapter added for communication between a VM node and an external plant network communication, enter the required static IP address.

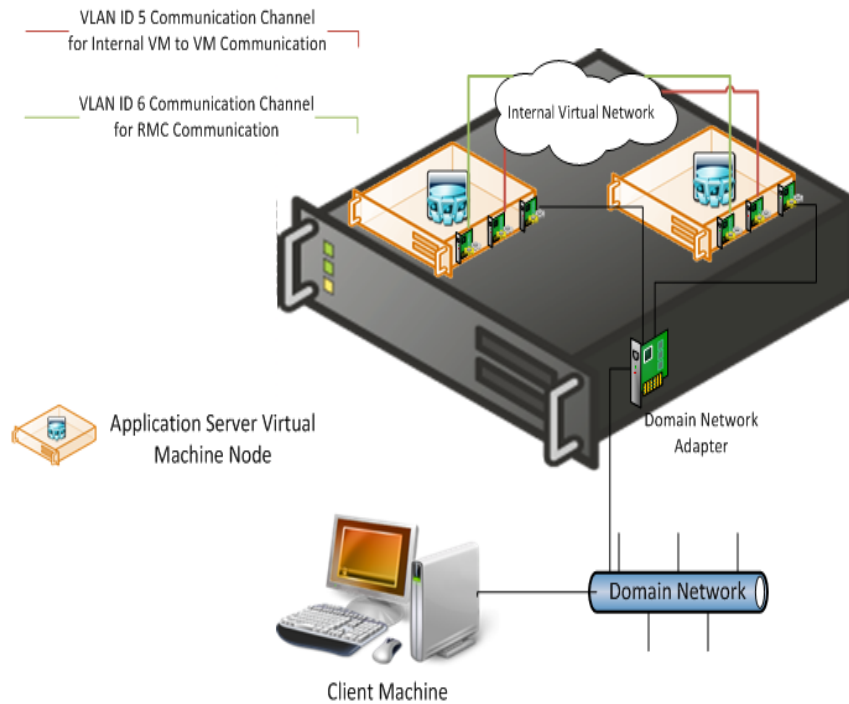
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**Note:** Configure the other VM nodes following the same steps.

---

## Using VLAN for RMC Communication Between Redundant Application Server Nodes

For successful communication between a redundant pair of Application Engines, each Application Engine must be assigned to a separate WinPlatform and a valid redundancy message channel (RMC) must be configured for each WinPlatform. You can configure an RMC using a virtual LAN.



## Configuring RMC for Redundant AppEngine over a VLAN

For a successful communication between a redundant pair of Application Engines, each Application Engine should configure a valid redundancy message channel (RMC). You can configure the RMC using Virtual LAN (VLAN). For configuring the RMC, Wonderware Application Server VM System Platform node requires the internal network adapters for communication:

- An internal network adapter to communicate between the other VM nodes configured on a Hyper-V host server, for example, a Historian VM node
- An internal network adapter to communicate with the other Wonderware Application Server VM nodes configured as Redundancy Application Engine to use as a RMC

### To configure RMC for a Redundant AppEngine node

- 1 Add an internal virtual network adapter to a Wonderware Application Server node.

For more information on adding an internal virtual network adapter, refer to "Adding an Internal Virtual Network Adapter to a VM Node for Communication Between VM Nodes" on page 522.

---

**Note:** In the **Settings** window, enter the same VLAN ID that you entered while configuring the InTouch and Historian Client nodes. This enables the VM nodes to communicate internally over the specified LAN ID.

---

- 2 Add an internal virtual network adapter to a Wonderware Application Server node to use as RMC communication.

---

**Note:** In the **Settings** window, enter the same VLAN ID you entered on both the Application Server nodes for virtual network adapter. This enables the Application Server VM node to communicate internally over the specified LAN ID as an RMC channel to communicate to another Application Server VM node.

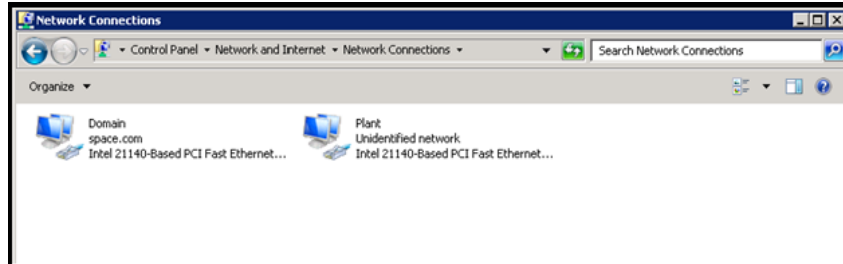
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- 3 Add an external virtual network adapter to a Wonderware Application Server node.

For more information on adding an external virtual network adapter, refer to "Adding a Virtual Network Adapter to a VM Node for Communication Between a VM Node and a Plant Network" on page 525.

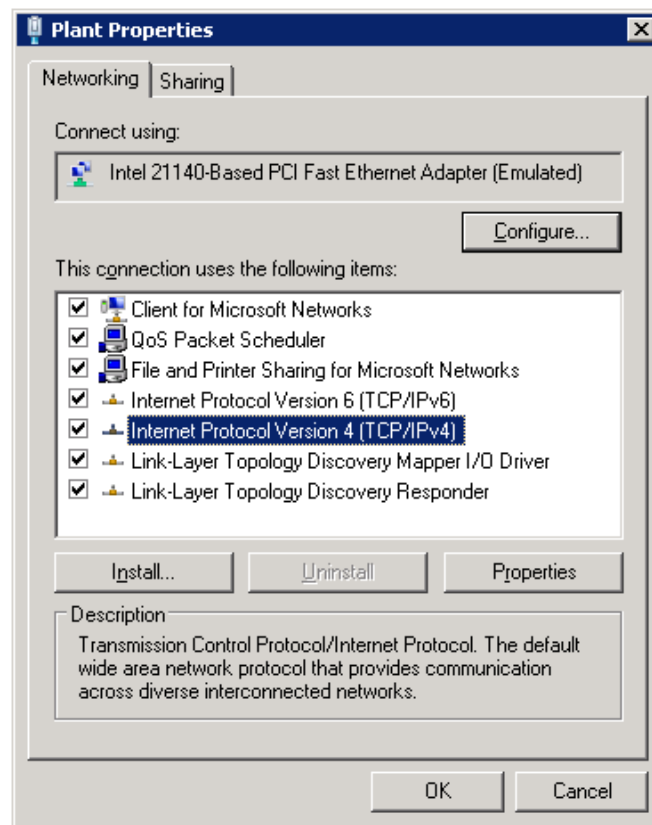
- 4 Connect to the required Wonderware Application Server VM node.
- 5 Open the Network Connections window.

In the start menu, click **Control Panel**, **Network and Internet**, **Network and Sharing Center** then **Change Adapter Settings**. The **Network Connections** area appears. Note that the network adapters appear in the order they are added to the VM node.



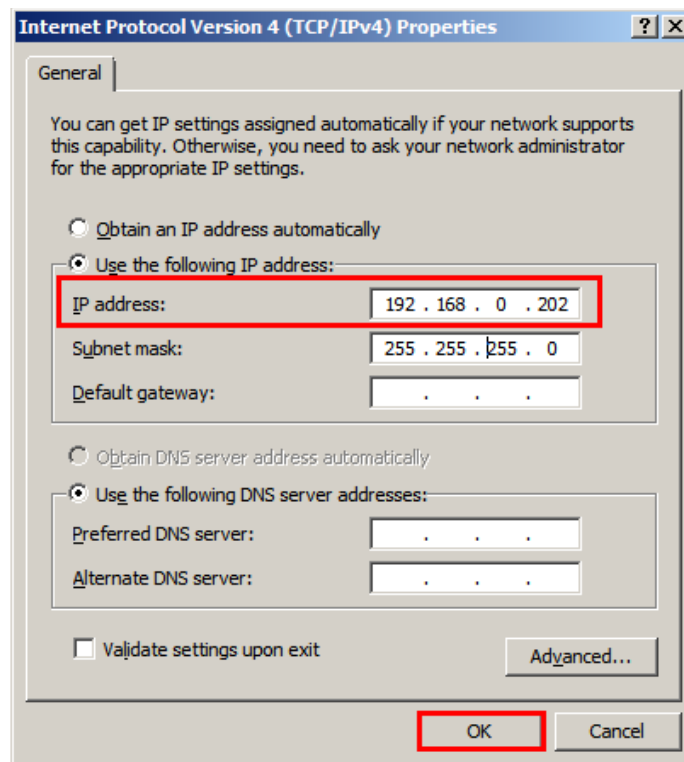
**6** Configure the node.

- a** Right-click the required internal or external network adapter. The **Local Area Connection Properties** window appears.





- b** Select the **Internet Protocol Version 4** check box, and then click **OK**. The **Properties** window appears for the Internet protocol version you selected.



- c** Click the **Use the following IP address** option.

- d** Enter the IP address for the network adapter, and then click **OK**.
  - For the internal and external networks added to the Wonderware Application Server node, enter the required IP address in the IP address box.
  - For the internal network adapter added to use as RMC, enter the required static IP address in the **IP address** box and subnet mask in the **Subnet mask** box.

For example:

- 10.0.0.1
  - 255.0.0.0
- 7** Follow the same steps to configure another Wonderware Application Server node for Redundant Application Server.

---

**Note:** While installing the Wonderware products, select the **Create Local Account** check box and provide the same user name and password to use as network account user.

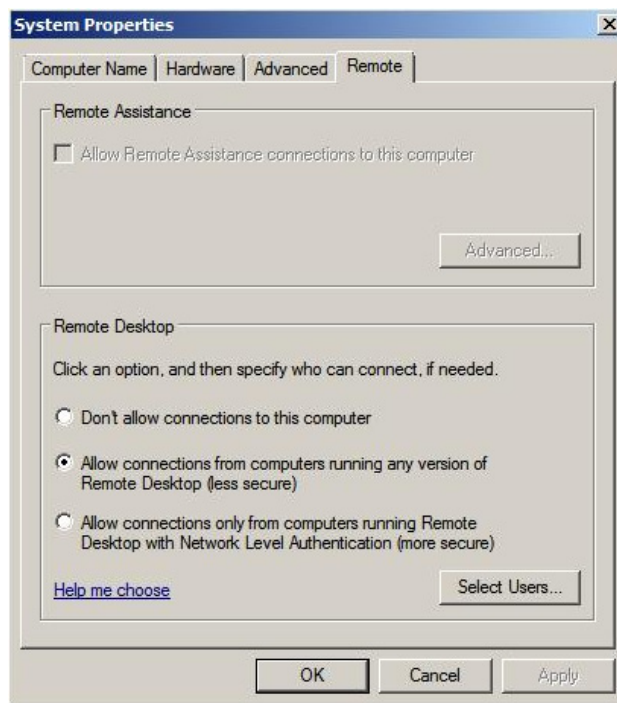
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## Accessing a System Platform Node with a Remote Desktop

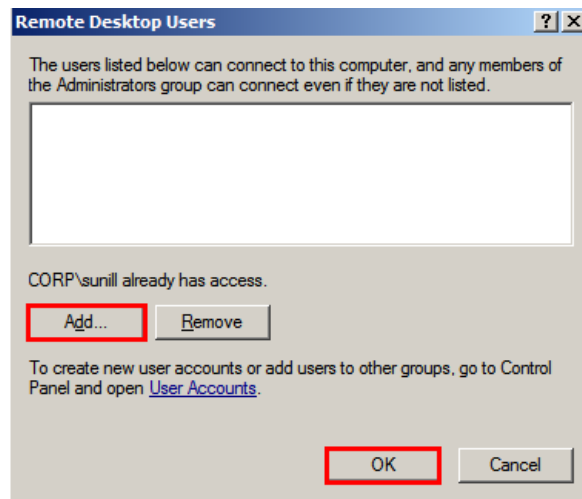
You can use Hyper-V to access a system platform node through a remote desktop. You can specify the required remote users, who will be able to access the VM running the system platform.

### To access a system platform node with a remote desktop

- 1 Log on to the system platform node as a member of the local administrators group.
- 2 Modify the remote settings of the system platform node.
  - a On the **Start** menu, click **Control Panel, System and Security, System** then **Remote settings**. The **System Properties** window appears.



- b Under **Remote Desktop**, click the relevant option to specify the remote desktop versions you want to allow access to.
- 3 Select users to provide access to the system.
    - a Click **Select Users**. The **Remote Desktop Users** window appears.



- b** Select the users you want to allow access to, click **Add**, and then click **OK** to close the window.

# Accessing System Platform Applications as Remote Applications

Remote Desktop Services (RDS) Remote Applications enables you to deploy RemoteApp programs to users. With RemoteApp, the remote session connects with a specific application rather than with the entire desktop. You can access the RemoteApp programs remotely through Remote Desktop Service. A RemoteApp program appears as if it is running on your local computer. Instead of being present on the desktop of the remote terminal server, the RemoteApp program is integrated with the client's desktop, running in its own resizable window with its own entry in the task bar.

## Prerequisites for accessing Remote Applications

- A virtual machine node or physical node with Windows Server R2 which has Remote Desktop Session Host server installed
- Remote Applications, part of the Windows Server 2008 Terminal Services role that are available on Windows Server 2008 Standard and Enterprise Editions
- VM nodes (Remote Desktop Session Host server) running IOM Products, such as InTouch and Historian Client need to be on Windows Server 2008 R2 where Remote Desktop Services are available
- Client node with a browser (any operating system)

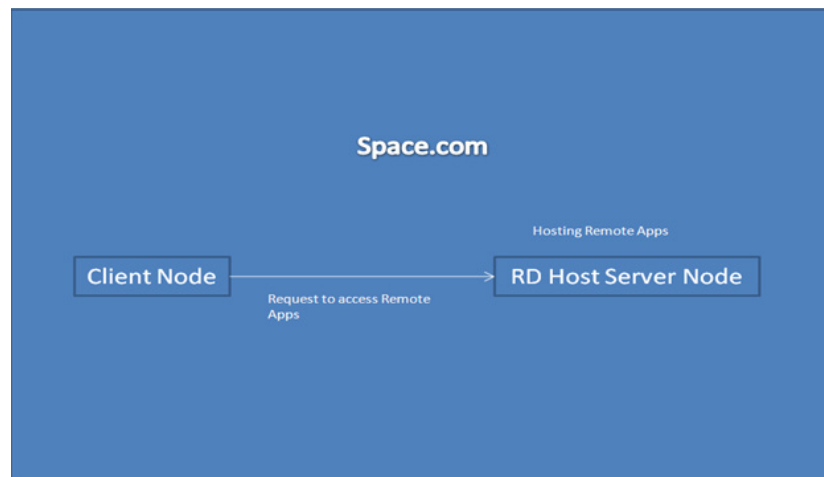
---

**Note:** To access RemoteApp programs through Remote Desktop-Web Access, the client computer must be running RDC 6.1. RDC 6.1 is included with Windows Server 2008 operating systems, Windows Vista SP1 or later, and Windows XP SP 3. Use **About** dialog box to verify which version of RDC your system has.

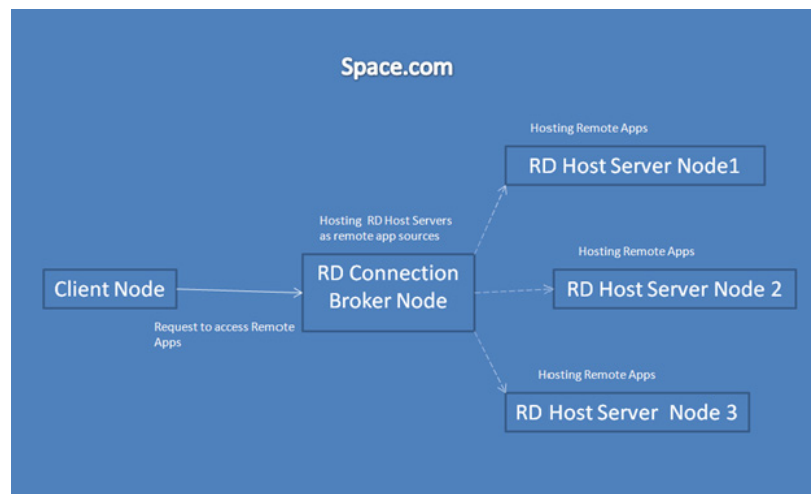
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- The client node and the Remote Desktop Session Host server should be able to communicate.

The following figure illustrates how RemoteApps configured at Remote Desktop Host Server node can be accessed:



The following figure illustrates how RemoteApps configured at multiple Remote Desktop Host Server nodes through Remote Desktop Connection Broker server can be accessed:



You need to perform the following procedures to deploy remote application programs through a remote desktop Web access:

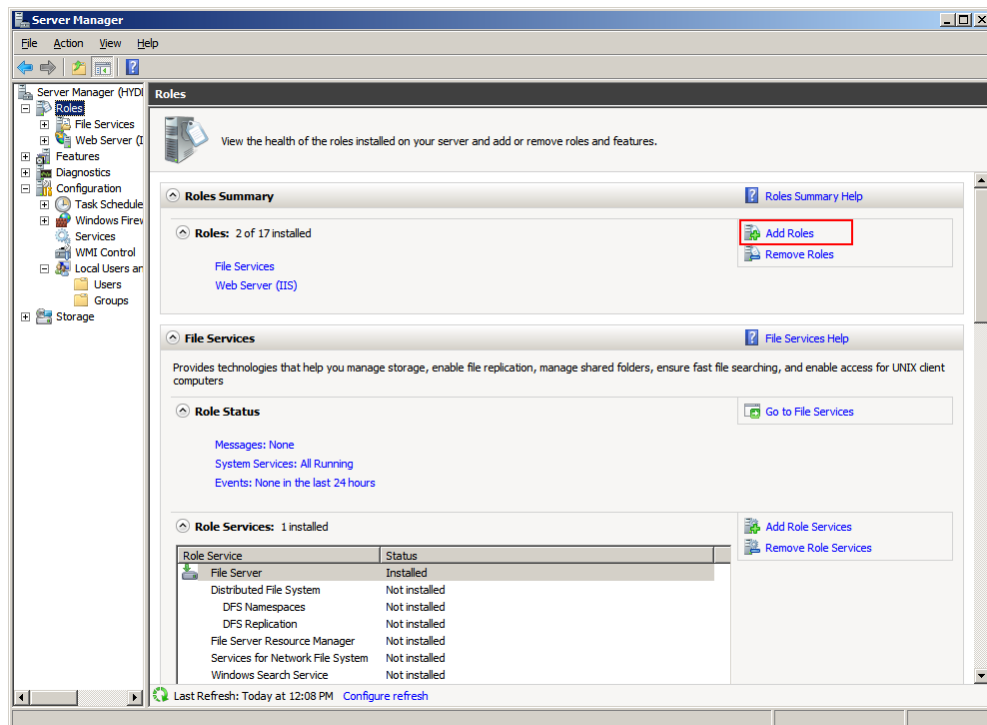
- Install and configure the Remote Desktop Web access role service at an Remote Desktop Session Host server node installed with Window 2008 R2.
- Configure remote applications at a server node.
- Access the remote applications from a client node.

## Installing and Configuring the Remote Desktop Web Access Role Service at a Remote Desktop Session Host Server Node

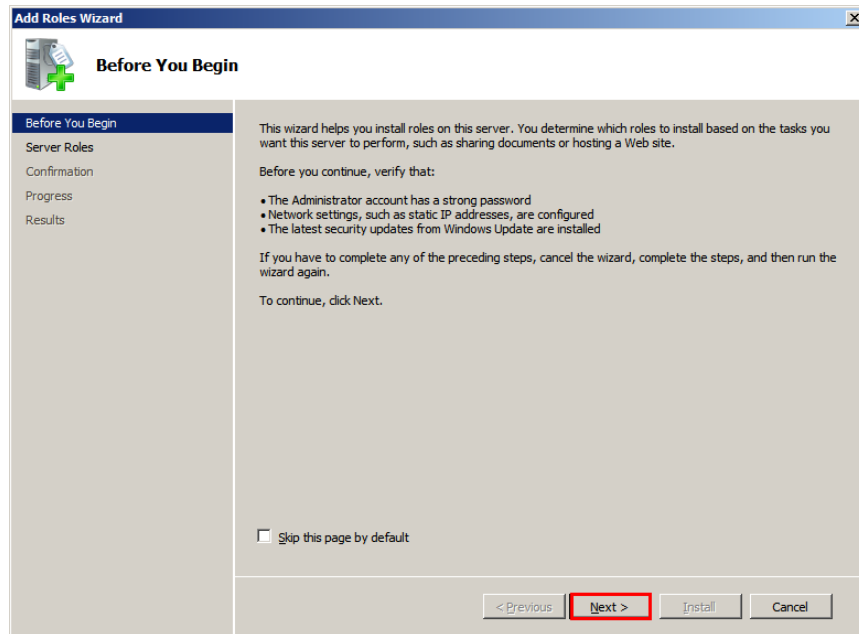
Remote Desktop Web Access service and Remote Desktop Host service (Remote Application) allow you to deploy a single Web site to run programs, access the full remote desktop, or connect remotely to the desktop of any computer in the internal network where you have the required permissions.

### To install and configure the Remote Desktop web access role service at an Remote Desktop Session Host server node

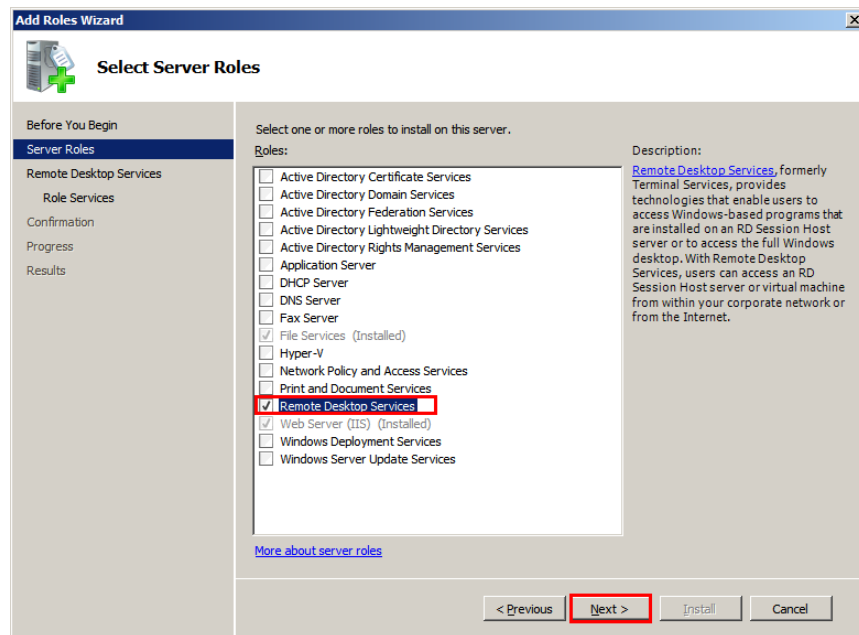
- 1 Log on to the Remote Desktop Session Host server node with local administrator privileges.
- 2 Open the **Server Manager** window.
  - a Click **Start**, and then click **Run**.
  - b Enter **ServerManager.msc**, and then click **OK**. The **Server Manager** window appears.



- 3 Add roles and the required role services.
  - a In the **ROLES SUMMARY** section, click **Add Roles**. The **Before You Begin** screen in the **Add Roles Wizard** window appears.

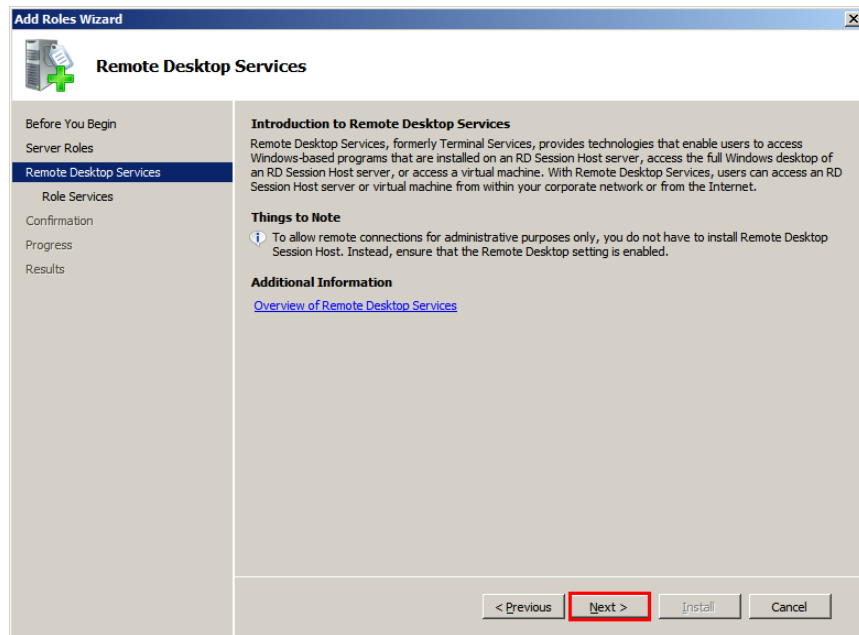


**b** Click **Next**. The **Select Server Roles** screen appears.

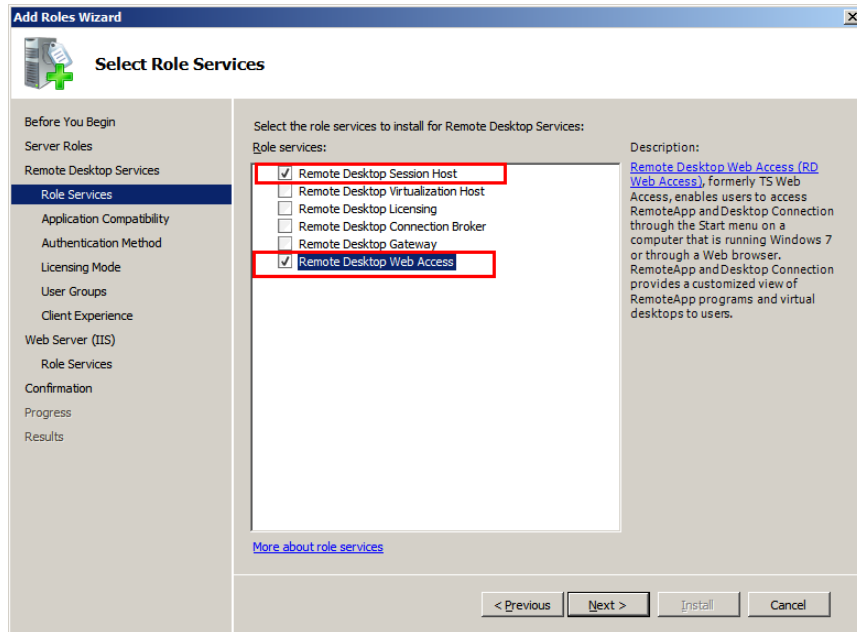




- c Select the **Remote Desktop Services** check box, and then click **Next**. The **Remote Desktop Services** screen appears.

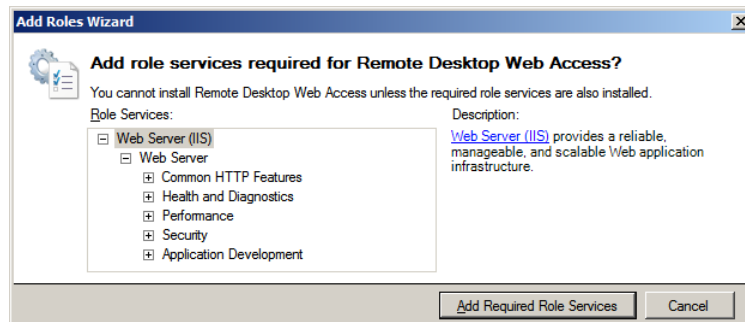


- d Click **Next**. The **Select Role Services** screen appears.

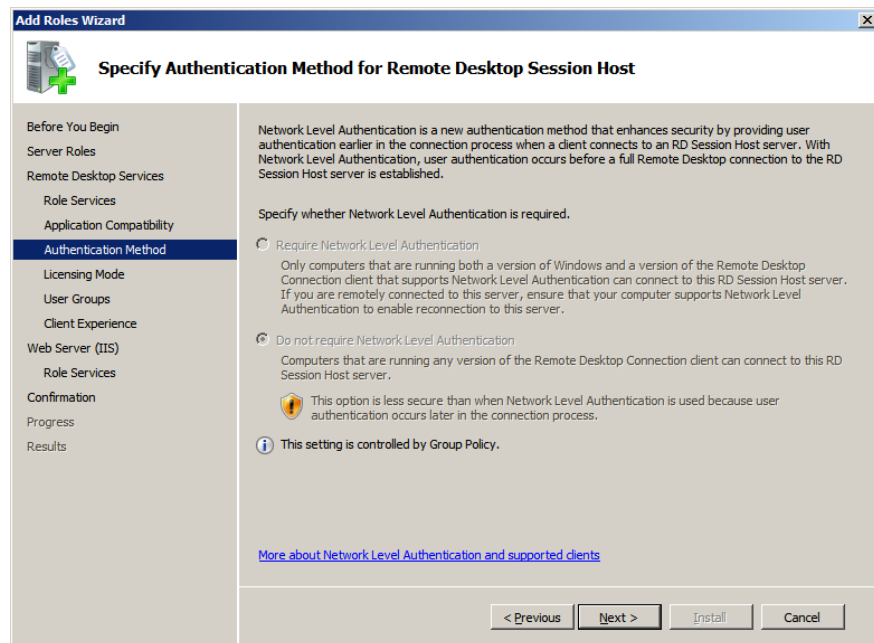


- e Select the **Remote Desktop Session Host** and **Remote Desktop Web Access** check boxes. The **Add Roles Wizard** window appears.

**Note:** These are the role services that are being installed in this procedure. You can select other role services, as required.

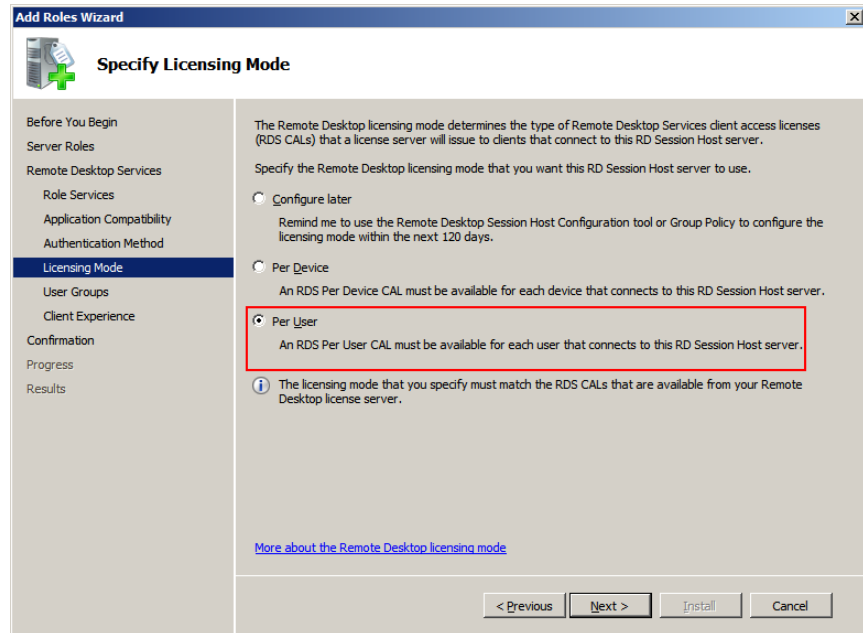


- f Click **Add Required Role Services**. Any missing required role services or features for Remote Desktop Web Access role service is added.
- 4 Specify the authentication method for the remote desktop session host.
    - a Click **Next**. The **Specify Authentication Method for Remote Desktop Session Host** screen appears.

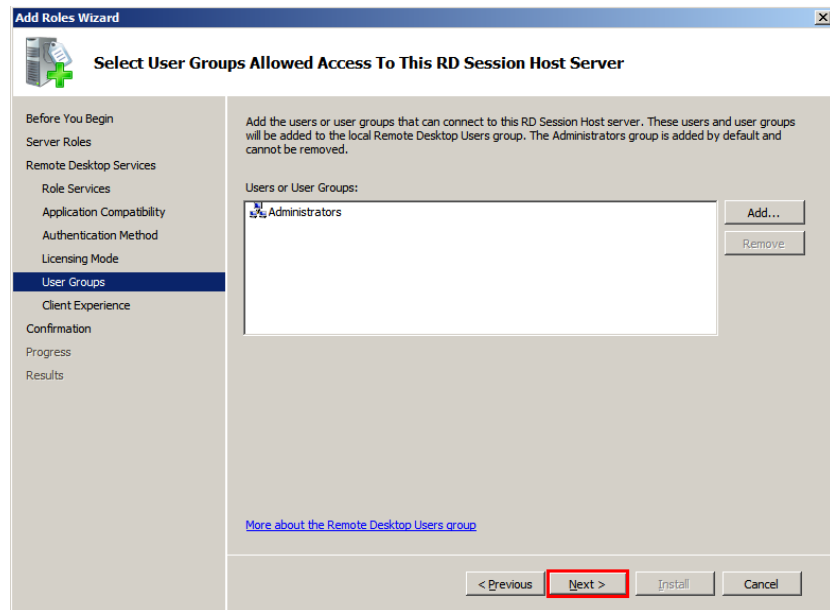


- b** Click an option to specify the required authentication method, and then click **Next**. The **Specify Licensing Mode** screen appears.

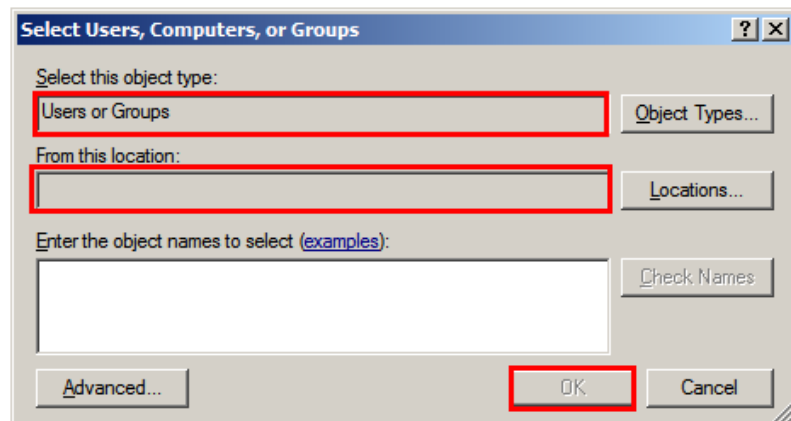
**Note:** Click the **Require Network Level Authentication** option for a secure authentication method.



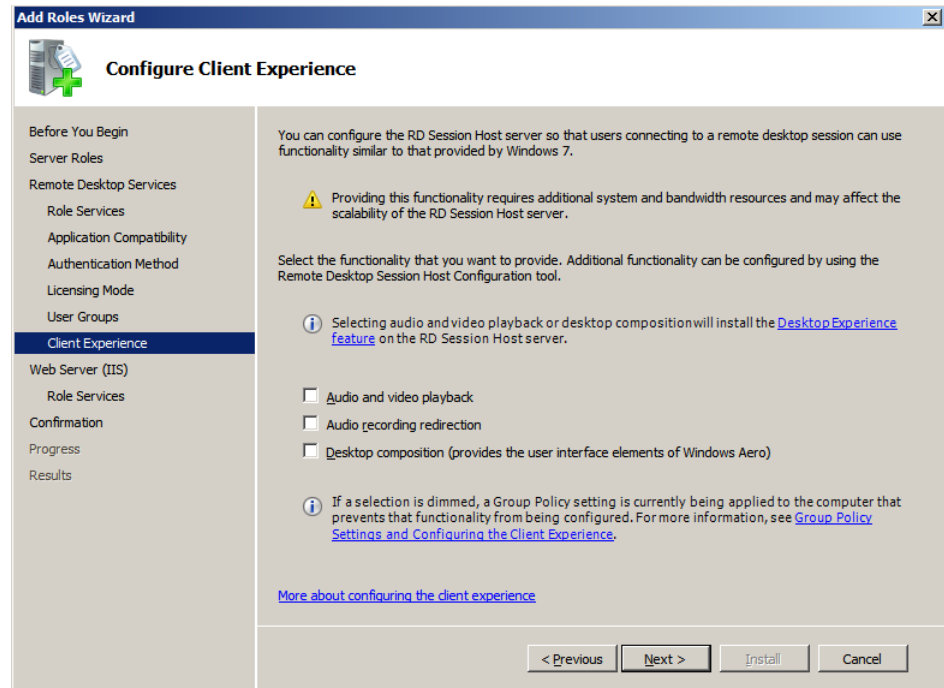
- c Click an option to specify the required licensing mode, and then click **Next**. The **Select User Groups Allowed Access To This RD Session Host Server** screen appears.



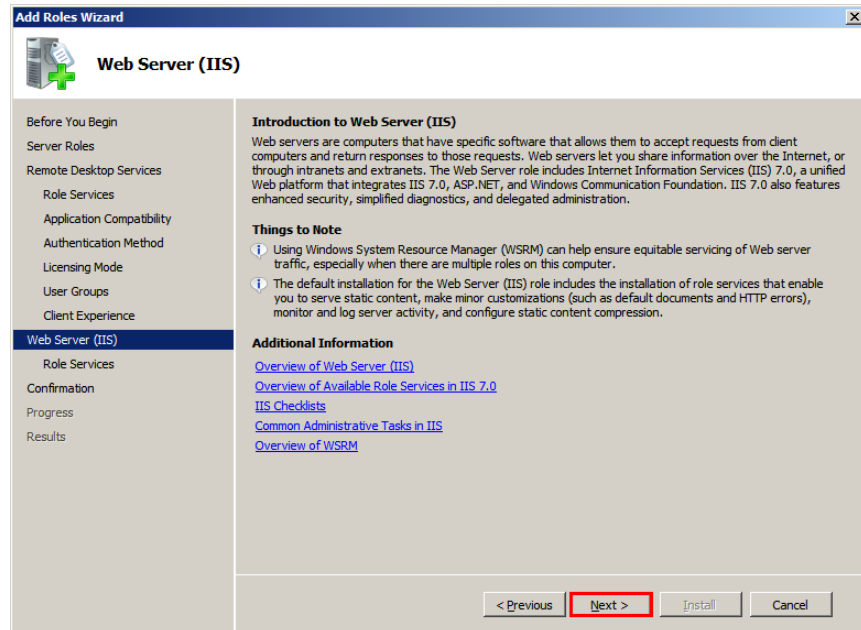
- 5 Select the required user group.
  - a Click **Add**. The **Select Users, Computers, or Groups** window appears.



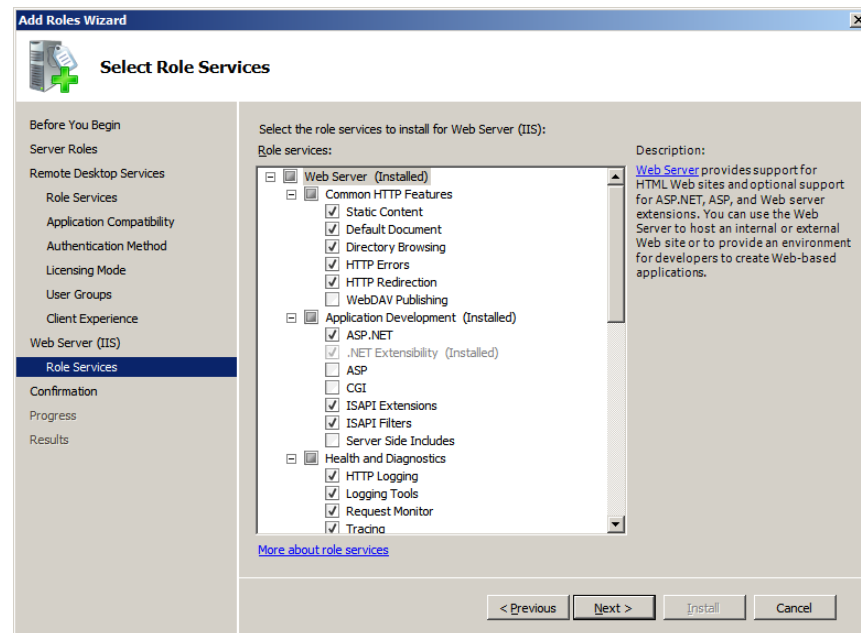
- b** Select a user or user group you want to allow access to the Remote Desktop Session Host server, and then click **OK** to close the window.
- c** On the **Select User Groups Allowed Access To This RD Session Host Server** screen, click **Next**. The **Configure Client Experience** screen appears.



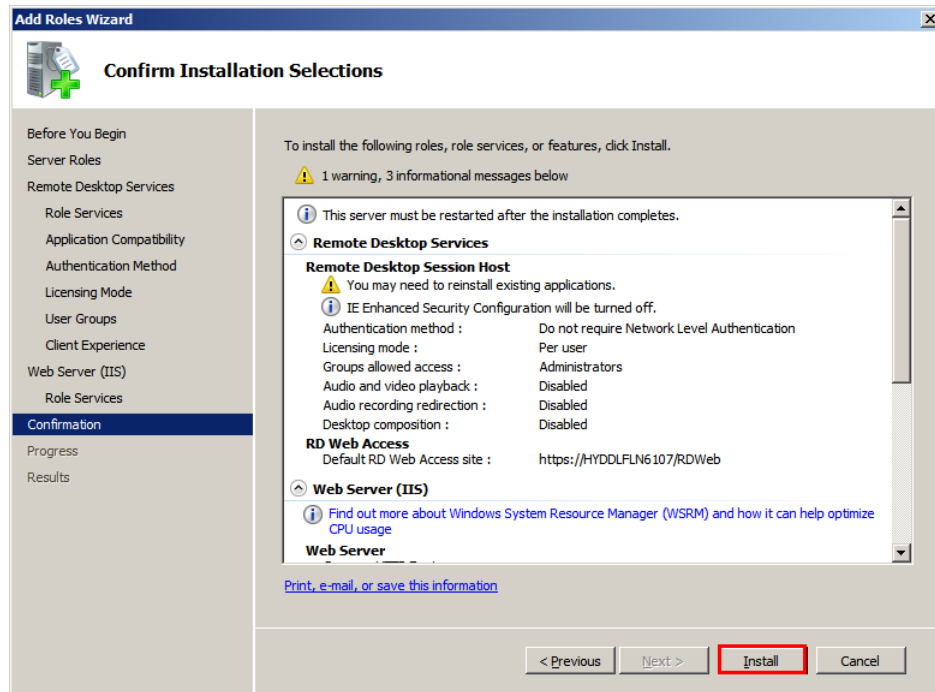
- 6 Go to the **Confirm Installation Selections** screen and install the Remote Desktop Web Access role service.
- a On the **Configure Client Experience** screen, click **Next**. The **Web Server (IIS)** screen appears.



- b Click **Next**. The **Select Role Services** screen appears.



- c Click **Next**. The **Confirm Installation Selections** screen appears.



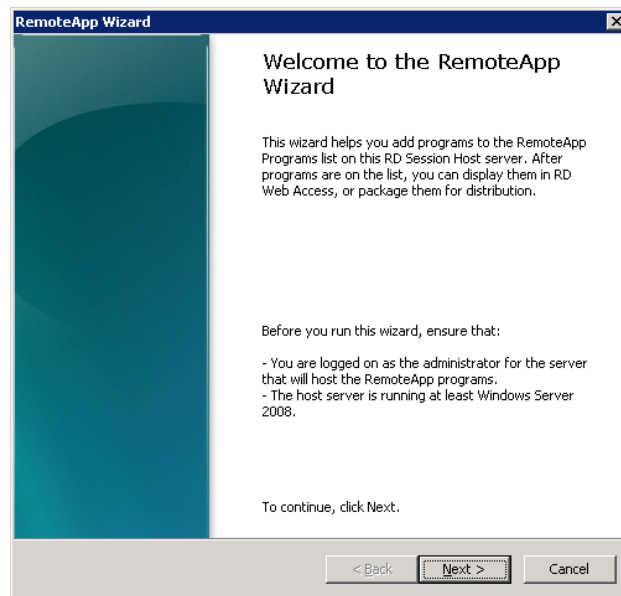
**d** Review the details you selected, and then click **Install**.

You will be prompted to restart your computer once the installation is complete. After the machine restarts, close the **Installation Results** screen.

## Configuring Remote Applications at Remote Desktop Session Host Server Node

After the Remote Desktop Web Access role is installed and configured, you can configure the remote applications at Remote Desktop Session Host server node.

- 1** Open the **Server Manager** window.
  - a** Click **Start**, and then click **Run**.
  - b** Enter “ServerManager.msc”, and then click **OK**. The **Server Manager** window appears.
- 2** Add the required remote programs.
  - a** Expand **Roles**, click **Remote Desktop Services**, and then click **RemoteApp Manager**.
  - b** In the **Actions** pane, click **Add RemoteApp Programs**. The **RemoteApp Wizard** window appears.

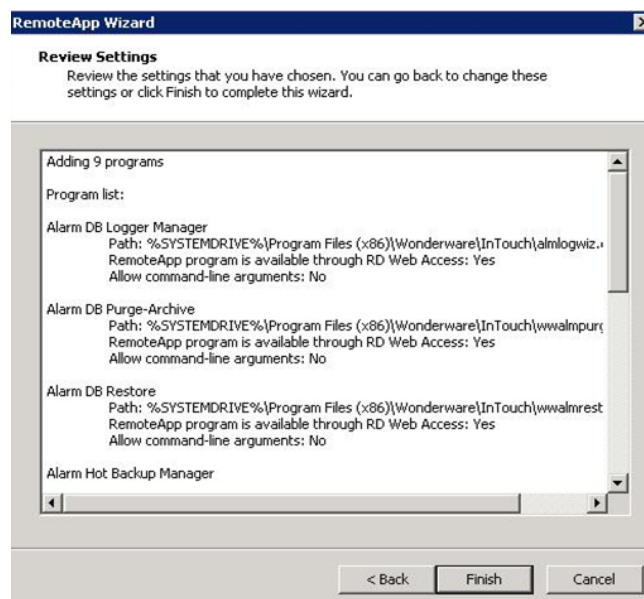




- c Click **Next**. The **Choose Programs to add to the RemoteApp Programs List** screen appears.



- d Select the programs you want to add to the RemoteApps list, and then click **Next**. The **Review Setting** screen appears.



- 3 Review your selections, then click **Finish** to close the window.

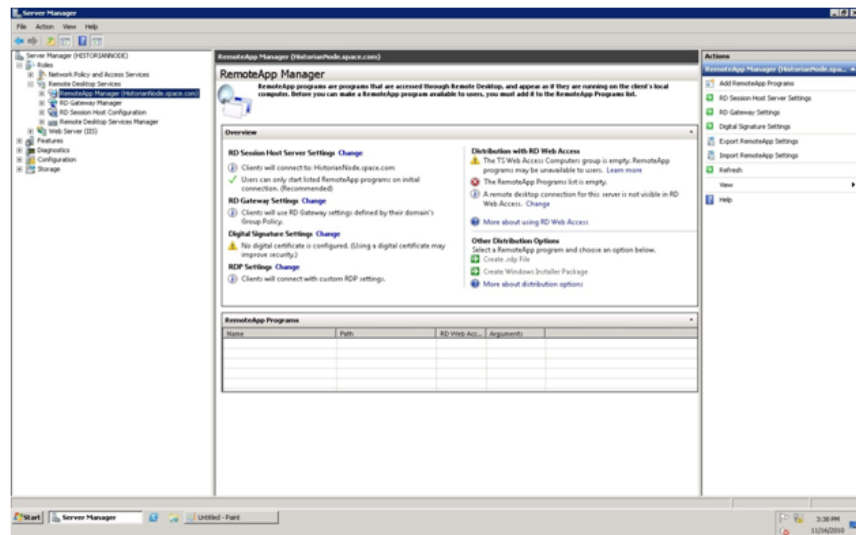
## Allowing Application Access to Specific Users

After the remote applications are configured, you can define users or user groups who can access the applications at the client node, if required.

### To allow application access to specific users

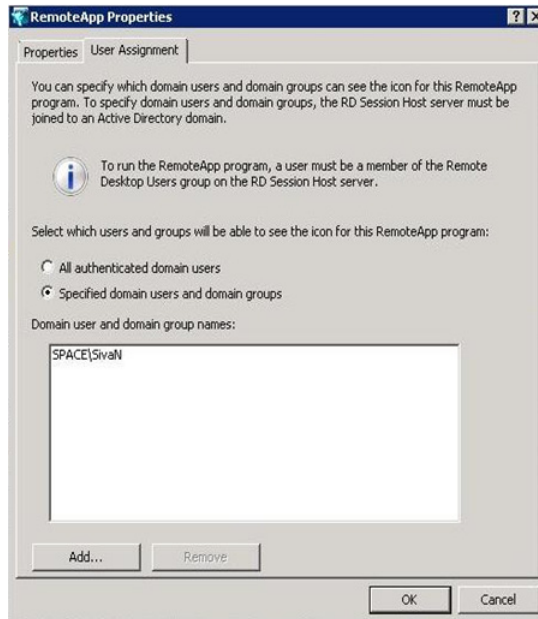
#### 1 Configure remote applications.

For more information on configuring remote applications, refer to "Configuring Remote Applications at Remote Desktop Session Host Server Node" on page 552.



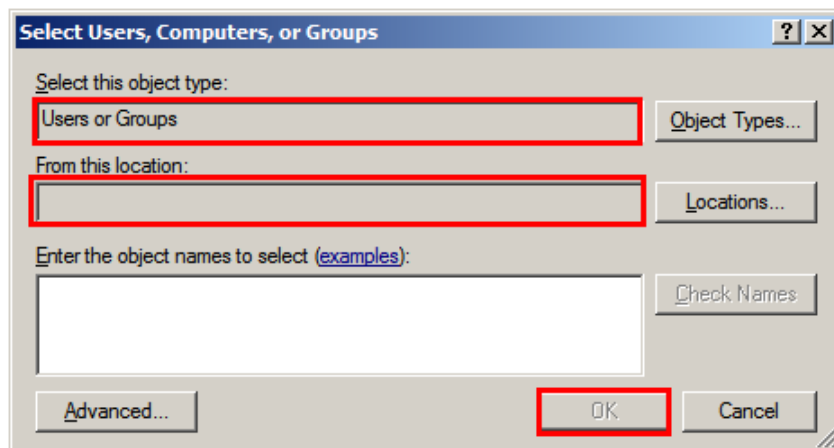
**2** Select the required remote application.

In the **Server Manager** window, select the required remote application, and then click **Properties** in the **Action** pane. The **RemoteApp Properties** window appears.



**3** Add users.

- a** Click the **User Assignment** tab.
- b** Click the **Specified domain users and domain groups** option.
- c** Click **Add**. The **Select Users, Computers, or Groups** window appears.



- d Select the names of the users or user groups you want to provide access to the application, and then click **OK** to close the window. On the **RemoteApp Properties** window, the user names appear in the **Domain user** and **domain group** names box. Click **OK** to close the window.

The added users or user groups can now access the application at the client node.

## Accessing the Remote Applications from a Client Node

At the client node, you can access the configured remote applications in the following ways:

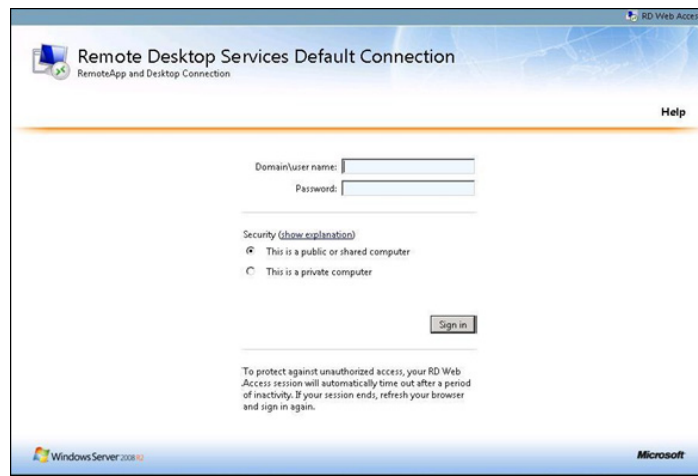
- Access a program on a Web site using Remote Desktop Web Access
- Access a program on a Web site using Remote Desktop Web Access with Remote Desktop Connection Broker

## Accessing a Program on a Web Site Using Remote Desktop Web Access

### To access a program using Remote Desktop Web Access

- 1 Connect to the Remote Desktop Web Access Web site.

At the client node, open **Internet Explorer** and connect to the Remote Desktop Web Access Web site using the following URL: [https://<Remote Desktop Session Host Server\\_IP>/rdweb](https://<Remote Desktop Session Host Server_IP>/rdweb). The **Remote Desktop Services Default Connection** screen appears.



- 2 Log on with a domain account of the Remote Desktop Session Host server's administrators group. Enter the relevant details in the **Domain/user name** and **Password** boxes, and then click **Sign in**. All applications configured at Remote Desktop Session Host server are displayed.



- 3 Click an icon to access the required application.

**Note:** Any application launched from Remote Desktop Connection Broker appears as it were running on your local computer.

## **Accessing a Program using Remote Desktop Web Access with Remote Desktop Connection Broker**

You can also access the configured remote applications from a client through another Remote Desktop Connection Broker Server node.

Remote Desktop Connection Broker (RD Connection Broker), earlier known as Terminal Services Session Broker (TS Session Broker), provides access to remote applications and desktop connections. Accessing the remote applications and a desktop connection you can get a single, personalized, and aggregated view of RemoteApp programs, session-based desktops, and virtual desktops. Remote Desktop Connection Broker also supports load balancing and reconnection to existing sessions on virtual desktops, Remote Desktop sessions, and RemoteApp programs and aggregates RemoteApp sources from multiple Remote Desktop Session host (RD Session Host) servers that host different RemoteApp programs.

Remote Desktop Connection Broker extends the TS Session Broker capabilities included in Windows Server 2008 by creating a unified administrative experience for traditional session-based remote desktops and VM-based remote desktops. A VM-based remote desktop can be either a personal virtual desktop or part of a virtual desktop pool.

In case of a personal virtual desktop, there is a one-to-one mapping of VMs. You are assigned a personal virtual desktop that can be personalized and customized. These changes are available to you each time you log on to your personal virtual desktop. For a virtual desktop pool, a single image is replicated across many VMs. Virtual desktop pool is to provide users with a virtual desktop that is dynamically assigned from a pool of identically configured virtual machines. As you connect to the shared virtual desktop pool, you are dynamically assigned a virtual desktop. You may not be assigned the same virtual desktop when you connect the next time. This means that any personalization and customization made by you are not saved. If you use a virtual desktop pool and want to save any customization, you can use roaming profiles and folder redirection.

---

**Note:** The improvements to the Remote Desktop Connection Broker role service are particularly useful while implementing a Virtual Desktop Infrastructure (VDI) or deploying session-based desktops or RemoteApp programs. These improvements further enhance the Remote Desktop Services.

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### **Add a Remote Desktop Session Host Server in RemoteApp Sources of Remote Desktop Connection Broker Server**

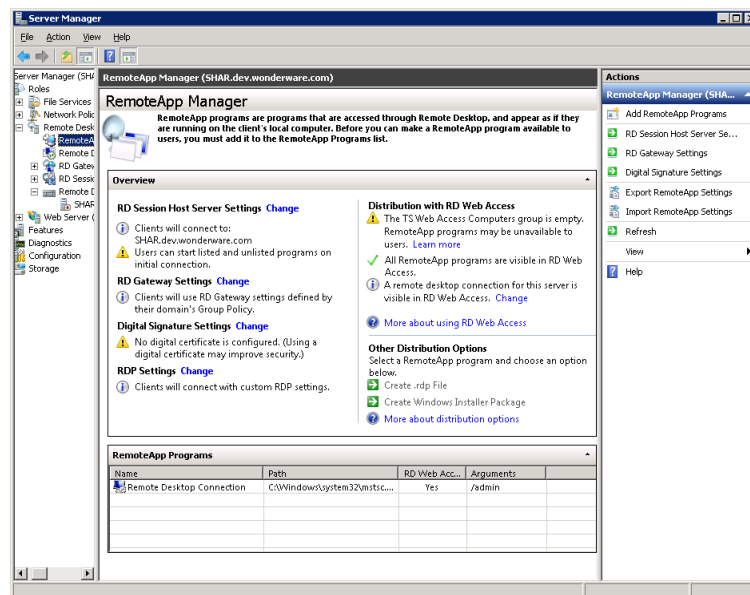
You must add the Remote Desktop Connection Broker role service on a computer running Windows Server 2008 R2, and then use Remote Desktop Connection Manager to identify the RemoteApp programs and virtual desktops that are available through RemoteApp and Desktop Connection.

You need to prepare another node where Remote Desktop role service is installed and Remote Desktop Connection Broker service is enabled. For more information, refer to "Installing and Configuring the Remote Desktop Web Access Role Service at a Remote Desktop Session Host Server Node" on page 543

## To add Remote Desktop Session Host server in RemoteApp sources of Remote Desktop connection broker server

### 1 Open the **Server Manager** window.

Click the **Server Manager** icon on the task bar of the Remote Desktop Session Host server. The **Server Manager** window appears.



### 2 Go to the **Add RemoteApp Source** window.

**a** Expand **Roles**, and then click **Remote Desktop Services**, **Remote Desktop Connection Manager**, then **RemoteApp Sources**.

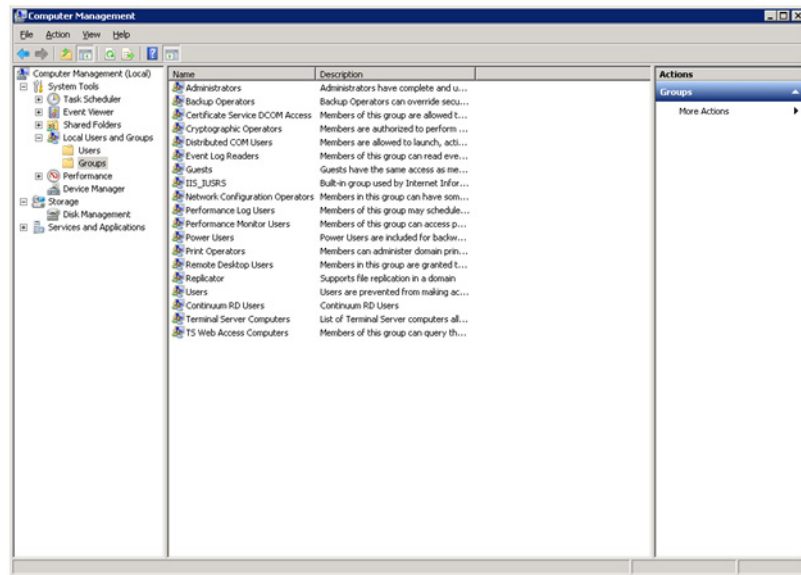
**b** In the **Actions** pane, click **Add RemoteApp Source**. The **Add RemoteApp Source** window appears.

### 3 Add the Remote Desktop Session Host server name.

In the **RemoteApp Source Name** box, enter the Remote Desktop Session Host Server name and click **Add**. The server name is added under **RemoteApp Sources**.

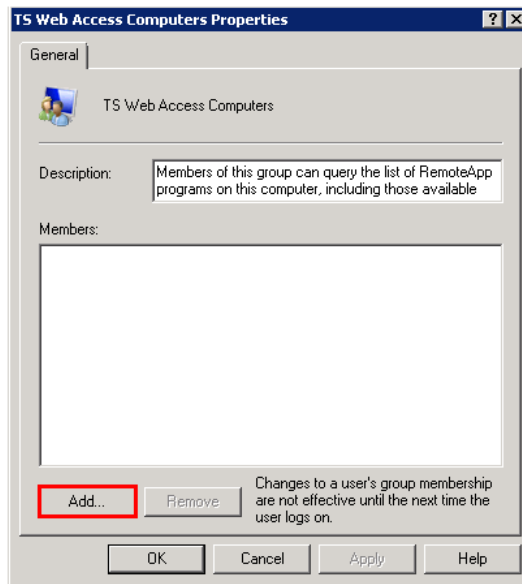


- 4 Add the Remote Desktop Connection Broker Server name in the TS Web Access Computers security group.
  - a On the Remote Desktop Session Host server, click **Start**, point to **Administrative Tools**, and then click **Computer Management**. The **Computer Management** window appears.

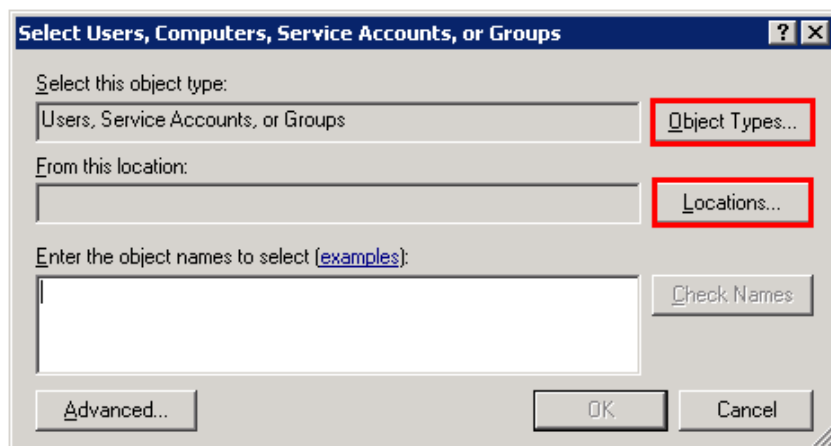


- b Expand **Local Users and Groups**, and then click **Groups**.
  - c Double-click **TS Web Access Computers**. The **TS Web Access Computers Properties** window appears.



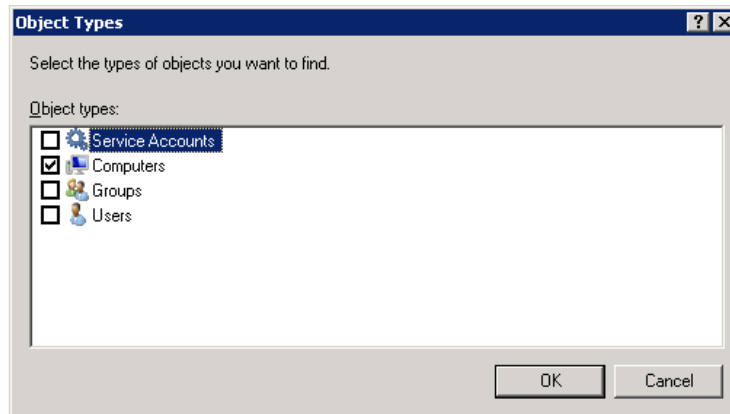


**d** Click **Add**. The **Select Users, Computers, or Groups** window appears.



**e** Click **Object Types**. The **Object Types** window appears.

**Note:** Enable Network Discovery on the NLB Cluster nodes and RD Connection Broker node so that nodes can be able to see each other and other network computers and devices and allows people on other network computers to see your computer.



- f** Select the **Computers** check box, and then click **OK** to close the window. The **Select Users, Computers, or Groups** window appears.
  - g** In the **Enter the object names to select** box, enter the computer account of the **Remote Desktop Web Access server**, and then click **OK**.
  - h** Click **OK** to close the **TS Web Access Computers Properties** dialog box.
- 5** Add the client node name in TS Web Access Computers security group on the Remote Desktop Connection Broker Server name.  
Follow steps **a** to **h** of point 4 to add the client name.

### To access RemoteApps configured at a Remote Desktop Session Host server from a client node

- 1** Connect to the Remote Desktop Web Access Web site.  
At the client node, open Internet Explorer and connect to [https://<Remote Desktop Session Host Server\\_IP>/rdweb](https://<Remote Desktop Session Host Server_IP>/rdweb).
- 2** Open the **Enterprise Remote Access** window.
  - a** Click **Start**, and then click **Control Panel**. The **Control Panel** window appears.
  - b** Click **Administrative Tool, Remote Desktop Services**,
  - c** then **Remote Desktop Web Access Configuration**. The **Enterprise Remote Access** window appears.



- 3 Log on with a domain account of the local administrators group in all the nodes (Remote Desktop Connection Broker Server and Remote Desktop Session Host server).

Enter the relevant details in the **Domain/user name** and **Password** boxes, and then click **Sign in**. The **Configuration** area appears



- 4 Connect to the required Remote Desktop Connection Broker Server.
  - a Click the **An RD Connection Broker Server** option.
  - b In the **Source Name** box, enter the Remote Desktop Connection Broker Server IP, and then click **OK**. All applications configured at Remote Desktop Session Host server are displayed.



5 Click an icon to access the required application.

**Note:** Any application launched from the RD Connection Server Broker appears as if it were running on your local computer. You can connect to the client machine through the VPN and access the RemoteApps.

The following table lists the applications which can be accessed as RemoteApp of the different System Platform nodes.

In Touch	Historian	Historian Client	Application Server	Common Utilities
Alarm DB Logger Manager	ITTagImporter	Trend	Archestra IDE	Archestra License Manager
Alarm DB Purge – Archive	Import InTouch Historical Data	Query	Object Viewer	Change Network Account
Alarm DB Restore	aahDBdump			Historian Configurator
Alarm Hot Backup Manager	ITHistImporter			License Utility
Alarm Printer	aahHistorianCfg			SMC
Alarm Suite History Migration				
InTouch				
Window Maker				
Window Viewer				

# Displaying the System Platform Nodes on a Multi-Monitor with a Remote Desktop

## **Prerequisites for the client node where the remote desktop is invoked**

- Graphics card that supports multi-monitor and associated drivers
- Client Machine with an operating system (OS) that has RDP 7.0
- Client Machine with the following operating systems:
  - Windows XP SP3 Professional (32-bit)
  - Windows 7 Professional Edition (64-bit WOW)
  - Windows Server 2003 R2 SP2 Standard Edition (32-bit)
  - Windows Server 2008 R2 Standard Edition (64-bit WOW)

---

**Note:** RDP 7.0 features are available for computers that are running Windows XP Service Pack 3 (SP3), Windows Vista Service Pack 1 (SP1), and Windows Vista Service Pack 2 (SP2). To use Windows XP SP3, Windows Vista SP1 and Windows Vista SP2 client machine must be updated with the RDP 7.0.

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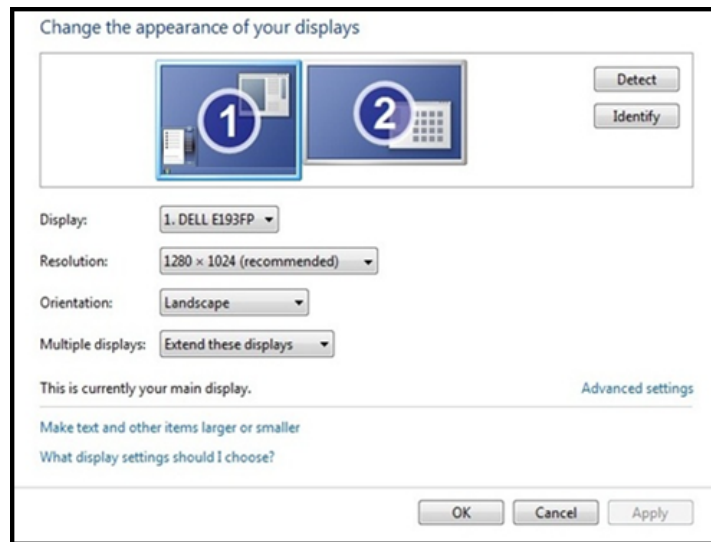
**Note:** Windows Server 2003 does not support RDP 7.0. To use Windows XP, the client machine must be updated with RDP 7.0.

---

After the client machine is prepared, you can display the system platform on a multi-monitor with a remote desktop.

## **To display the system platform nodes on a multi-monitor with a remote desktop**

- 1** Ensure that the client machine is able to detect plugged-in secondary monitors. On the **Start** menu, click **Control Panel**, **Display**, **Change Display Settings**, then **Detect**. This ensures that all plugged-in monitors are detected.
- 2** Modify the display settings.
  - a** On the **Control Panel** window, click **Display Change**, then **Display settings**. The **Change the appearance of your displays** area appears.



- b** From the **Multiple displays** list, select **Extend these displays**, and then click **OK**.

## Verifying the Display of System Platform Nodes on a Multi-Monitor with a Remote Desktop

### Prerequisites for VMs running on the host Virtualization Server:

- VM nodes with OS that has RDP 7.0
- VM nodes running products such as InTouch

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**Note:** The host virtualization server runs on Windows 2008 R2.

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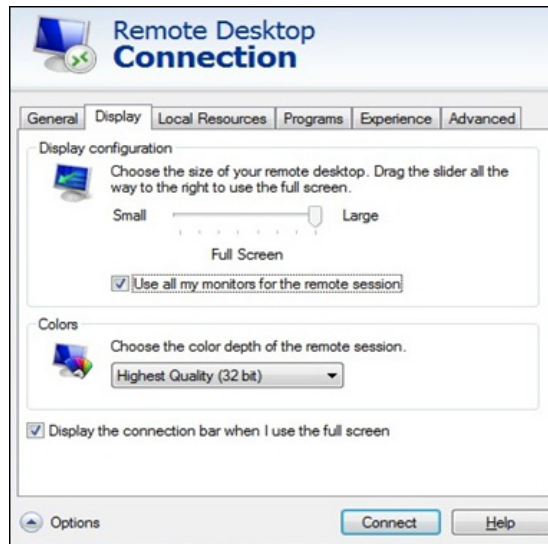
### To verify system platform nodes display on a multi-monitor with a remote desktop

- 1** Access any VM node installed with an IOM product from the client machine.
- 2** Open the **Remote Desktop Connection** window. Go to **Run**, and then enter “mstsc /admin”. The **Remote Desktop Connection** window appears.

---

**Note:** Enter mstsc /console if you are using Windows XP.

---



- 3 Verify the System Platform nodes.
  - a Click **Display**, and select the **Use all my monitors for the remote session** check box and then click **Connect**. The VM node opens.

---

**Note:** If the client machine does not have RDP 7.0, this option will not be available to you.

---

- b Launch the IOM product and test the application. Drag and drop to move the application between the different monitors.

## Using the Multi-Monitors as a Single Display

The multiple monitors configured on the client node, from where the remote desktop session is invoked, are used as independent displays when the remote session is used to connect to the System Platform products except InTouch installed, on the VM nodes. In case of InTouch, the multi-monitors can be used either as independent displays or as a single display.

### To use the multi-monitors as a single display

- 1 On an InTouch VM node, go to the path where win.ini exists and open win.ini. For example, the path is C:\User\\AppData\Local\Wonderware, where <User\_Name> is the user login with which the remote session from the client connects to this VM node.
- 2 Enter the following parameters under the **InTouch** section and save it.
  - MultiScreen – Enter “1” to enable the multi-monitor mode. Enter “0” to disable the multi-monitor mode.
  - MultiScreenWidth – Enter the width of a single screen in pixels.
  - MultiScreenHeight – Enter the height of a single screen in pixels. For example, if you want to show your InTouch application with a screen resolution of 2560 x 1024 on two horizontal monitors, enter the following:
    - “[InTouch]
    - MultiScreen=1
    - MultiScreenWidth=1280
    - MultiScreenHeight=1024”
- 3 Verify the settings. On the **Start** menu, click **All Programs**, **Wonderware**, then **InTouch**. The **InTouch Application Manager** window appears. Note that the window appears across all monitors as a single display.

Refer to the TechNote on multi-monitors for InTouch at <https://wdnresource.wonderware.com/support/kbcd/html/1/T001115.htm>



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# Working with Network Load Balancing

Network Load Balancing (NLB) distributes traffic across several servers by using the TCP/IP networking protocol. You can use NLB with a terminal server farm to scale the performance of a single terminal server by distributing sessions across multiple servers.

## About the Network Load Balancing Feature

The NLB feature in Windows Server 2008 R2 enhances the availability and scalability of Internet server applications such as those used on Web, FTP, firewall, proxy, virtual private network (VPN), and other mission-critical servers. A single computer running Windows Server 2008 R2 provides a limited level of server reliability and scalable performance. However, by combining the resources of two or more computers running one of the products in Windows Server 2008 R2 into a single virtual cluster, an NLB can deliver the reliability and performance that Web servers and other mission-critical servers need.

## About Remote Desktop Connection Broker

Remote Desktop Connection Broker keeps track of user sessions in a load-balanced Remote Desktop Session Host server farm. The Remote Desktop Connection Broker database stores session information, (including the name of the Remote Desktop Session Host server where each session resides), the session state for each session, the session ID for each session; and the user name associated with each session. Remote Desktop Connection Broker uses this information to redirect a user who has an existing session to the Remote Desktop Session Host server where the user's session resides.

Remote Desktop Connection Broker is also used to provide users with access to RemoteApp and Desktop Connection. RemoteApp and Desktop Connection provide a customized view of RemoteApp programs and virtual desktops. Remote Desktop Connection Broker supports load balancing and reconnection to existing sessions on virtual desktops accessed by using RemoteApp and Desktop Connection. To configure the Remote Desktop Connection Broker server to support RemoteApp and Desktop Connection, use the Remote Desktop Connection Manager tool. For more information, see the Remote Desktop Connection Manager Help in Windows Server 2008 R2.

Remote Desktop Connection Broker that is used in an NLB setup is included in Windows Server® 2008 R2 Standard, Windows Server 2008 R2 Enterprise and Windows 2008 R2 Datacenter.

The NLB feature is included in Windows Server 2008 R2. You do not require a license to use this feature.

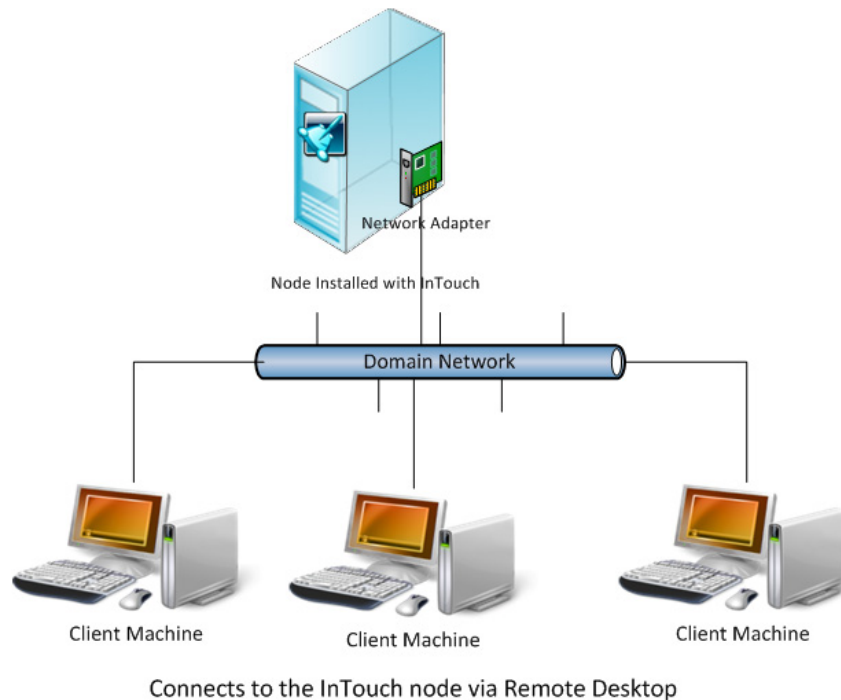
You need a Microsoft TS license for managing the remote desktop terminal server sessions.

## About Managed InTouch application with Network Load Balancing

The features provided by Remote Desktop are made available through the Remote Desktop Protocol (RDP). RDP is a presentation protocol that allows a Windows-based terminal (WBT), or other Windows-based clients, to communicate with a Windows-based Terminal Server. RDP is designed to provide remote display and input capabilities over network connections for Windows-based applications running on your Windows XP Professional desktop.

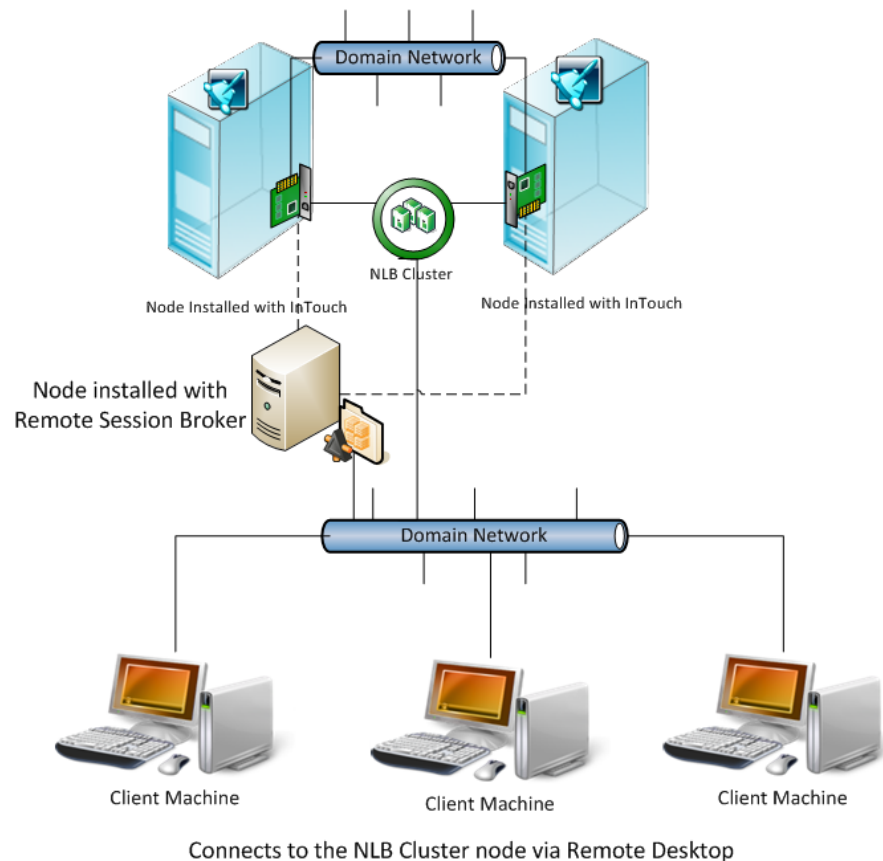
In this topology, clients can access the InTouch System Platform node via Remote Desktop. Whenever a new connection is requested to the InTouch System Platform Node, a new session is created. So all the traffic goes to the system platform node and degrades the performance of the InTouch node.

The following figure displays a topology without Network Load Balancing (NLB):



Network Load Balancing distributes IP traffic to multiple copies (or instances) of a TCP/IP service, such as a Web server, each running on a host within the cluster. Network Load Balancing transparently partitions the client requests among the hosts and enables the client to access the cluster using one or more "virtual" IP addresses. The cluster appears to be a single server that answers these client requests.

The following figure displays a topology with Networking Load Balancing:



**Note:** The Remote Desktop Connection Broker shown, as a separate node in the above topology, can be configured on one of the NLB cluster nodes itself.

You can leverage the load balancing for InTouch-managed applications.

### To configure an NLB for managed InTouch application

- 1 Configure one VM or Physical machine with Wonderware Application Server
- 2 On both the NLB cluster nodes, install InTouch TS with terminal server license.
- 3 Configure an NLB cluster as explained below.

- 4 On Wonderware Application Server node, develop managed InTouch application and deploy it on each of the NLB Cluster node.

Configuring an NLB for InTouch System Platform nodes, allows you to combine application servers to provide a level of scaling and availability that is not possible with an individual server.

NLB distributes incoming client requests to InTouch System Platform nodes among the servers in the cluster to more evenly balance the workload of each InTouch System Platform server and prevent overload on any InTouch System Platform server. To client computers, the NLB cluster appears as a single server that is highly scalable and fault tolerant.

## Setting Up Network Load Balancing Cluster

### **To setup an NLB:**

- 1 Prepare two VM nodes that are remote desktop-enabled and have Windows Server 2008 R2 Operating System.
- 2 Assign static IPs to both nodes.

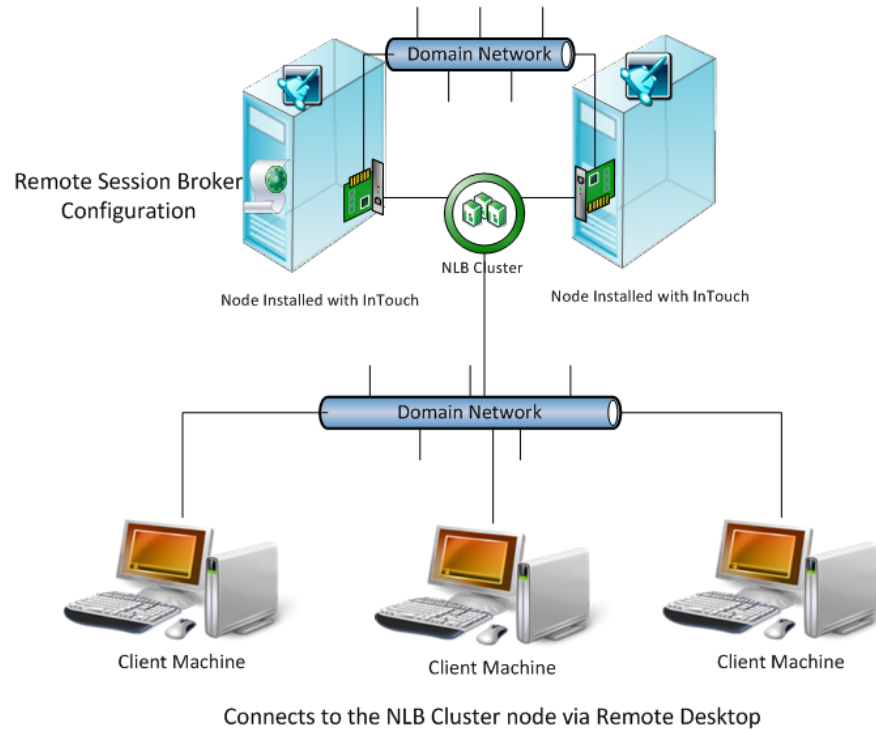
---

**Note:** NLB disables Dynamic Host Configuration Protocol (DHCP) on each interface it configures, so the IP addresses must be static.

---

## Topology 1: Leveraging Network Load Balancing by Configuring Remote Desktop Connection Broker on One of the NLB Cluster Nodes

You can configure an NLB cluster configuring the Remote Desktop Connection Broker on one of the NLB cluster nodes.



**To configure NLB with Topology 1**

- 1** On each of the cluster nodes install Remote Desktop Services. For more information, refer to "Installing Remote Desktop Services" on page 576.

---

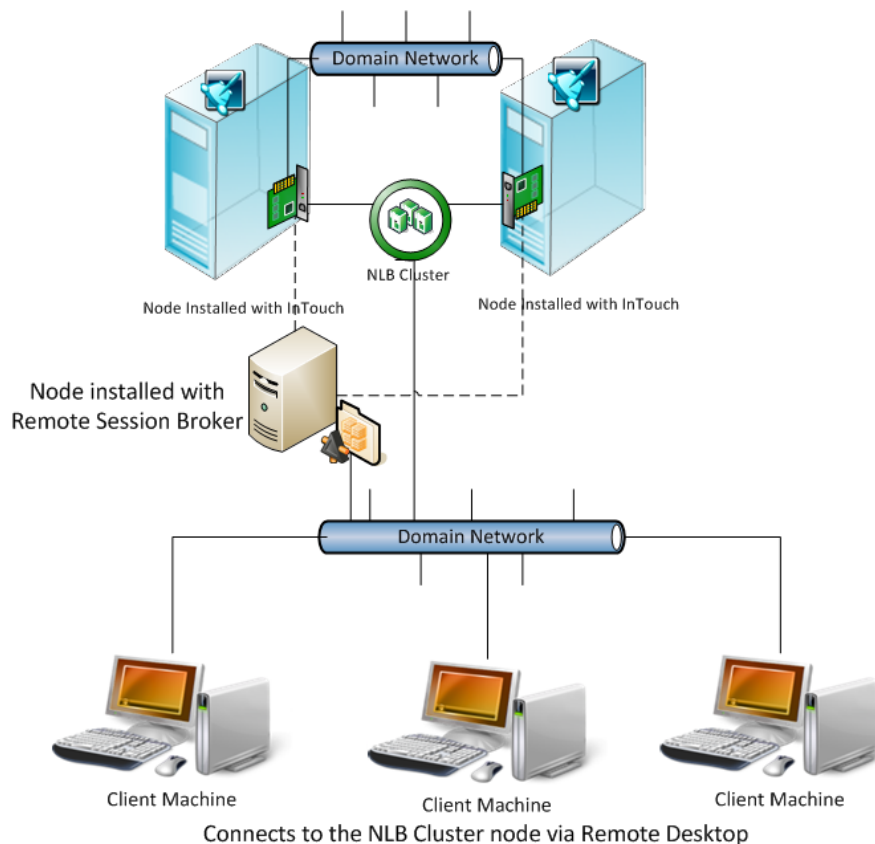
**Note:** On the **Select Role Services** screen, select Remote Desktop Session Host and Remote Desktop Connection Broker on one of the Cluster Nodes to configure it as NLB Cluster node as well as RD connection broker node. On the other NLB Cluster node, select only Remote Desktop Session Host.

---

- 2** On each of the cluster nodes, install Network Load Balancing. For more information, refer to "Installing Network Load Balancing" on page 583.
- 3** On the NLB cluster node which is configured as RD connection broker as well, add a Remote Desktop Session Host Server. For more information, refer to "Adding a Remote Desktop Session Host Server" on page 585.
- 4** On each of the cluster nodes, create a Network Load Balancing Cluster. For more information, refer to "Creating a Network Load Balancing Cluster" on page 587.
- 5** On each of the cluster nodes, configure Remote Desktop Connection Broker Settings. For more information, refer to "Configuring Remote Desktop Connection Broker Settings" on page 596.

## Topology 2 : Leveraging Network Load Balancing by Configuring Remote Desktop Connection Broker on a Separate Node

Instead of configuring the Remote Desktop Connection Broker on one of the NLB cluster nodes, you can also configure the Remote Desktop Connection Broker on a separate node.



### To configure NLB with Topology 2

On the NLB Cluster nodes, do the following:

- 1 Install Remote Desktop Services. For more information refer to "Installing Remote Desktop Services" on page 576.

---

**Note:** In **Select Role Services** screen, select **Remote Desktop Session Host** on the NLB Cluster nodes.

---

- 2 Install Network Load Balancing. For more information, refer to "Installing Remote Desktop Services" on page 576.
- 3 Create a Network Load Balancing Cluster. For more information, refer to "Creating a Network Load Balancing Cluster" on page 587.
- 4 Configure remote desktop connection broker settings. For more information, refer to "Configuring Remote Desktop Connection Broker Settings" on page 596.

On the Remote Desktop Connection Broker Node do the following:

- 1 Install Remote Desktop Services. For more information, refer to "Installing Remote Desktop Services" on page 576.

---

**Note:** On the **Select Role Services** screen, select only Remote Desktop Connection Broker on the Remote Desktop Connection Broker Node.

---

- 2 Add a Remote Desktop Session Host Server. For more information, refer to "Adding a Remote Desktop Session Host Server" on page 585.

## Installing Remote Desktop Services

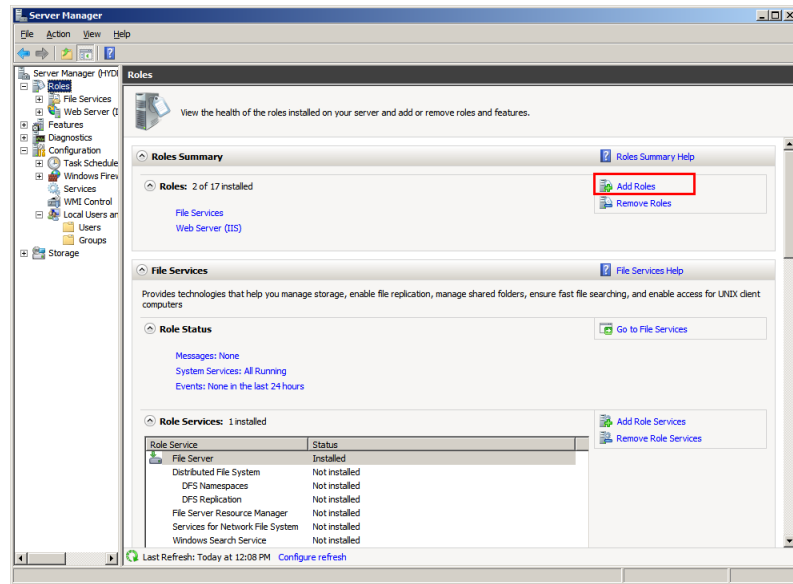
Remote Desktop Services, earlier called Terminal Services, provides technologies that enable access to session-based desktops, VM-based desktops, or applications in the datacenter from both within a corporate network and the Internet. Remote Desktop Services enables a rich-fidelity desktop or application experience, and helps to securely connect remote users from managed or unmanaged devices.

### To install Remote Desktop Services

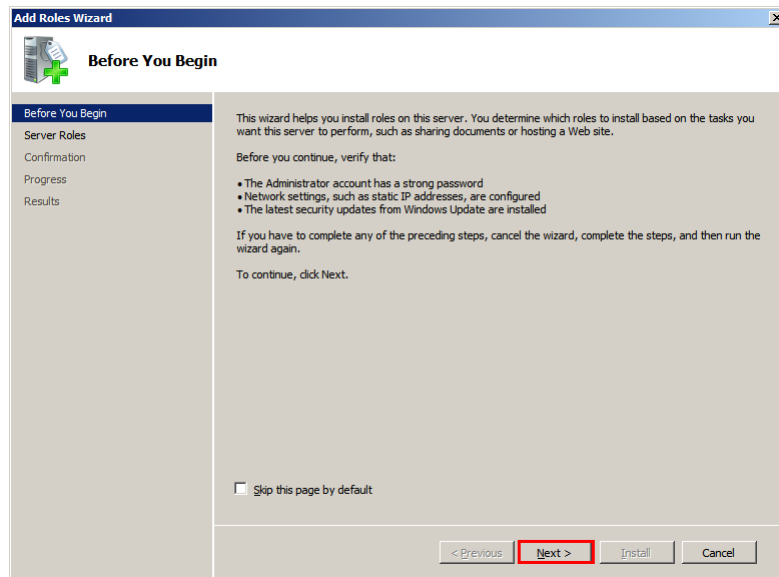
- 1 Open the **Server Manager** window.

On node 1, click **Start**, point to **Administrative Tools**, and then click **Server Manager**. The **Server Manager** window appears.

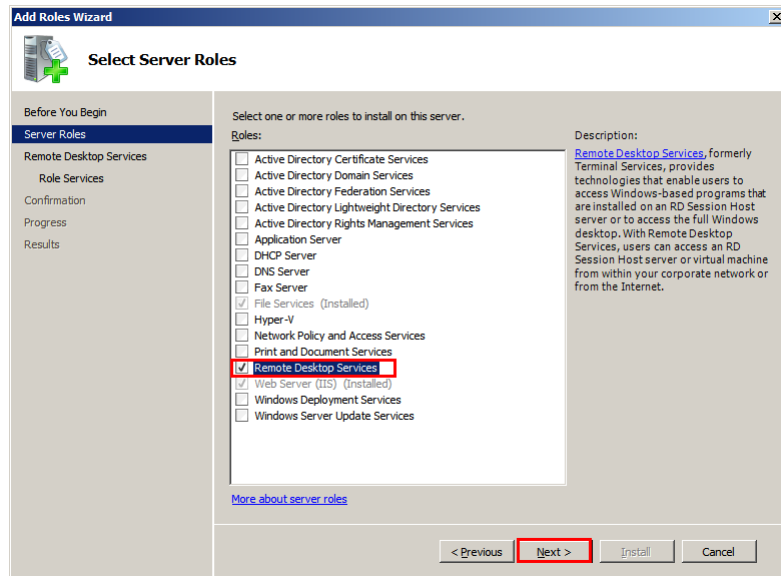




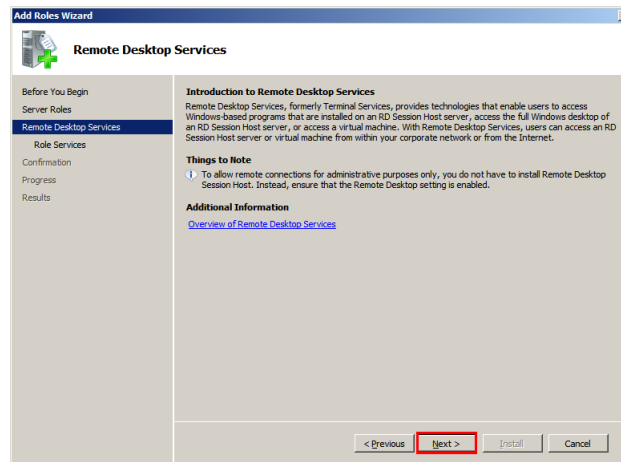
- 2 Add the required role services.
  - a On the **Server Manager** window, click **Roles**. The **Roles** area appears.
  - b Click **Add Roles**. The **Before You Begin** screen in the **Add Features Wizard** window appears.



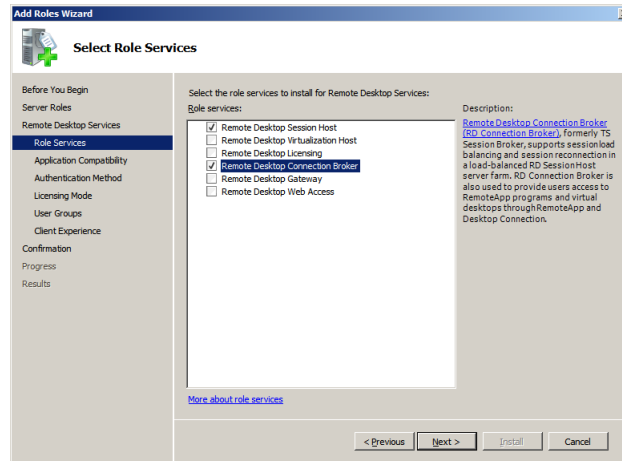
c Click **Next**. The **Select Server Roles** screen appears.



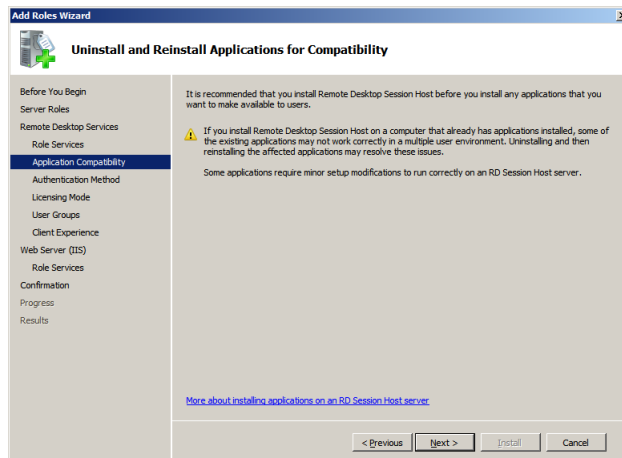
d Select the **Remote Desktop Services** check box, and then click **Next**. The **Remote Desktop Services** screen appears.



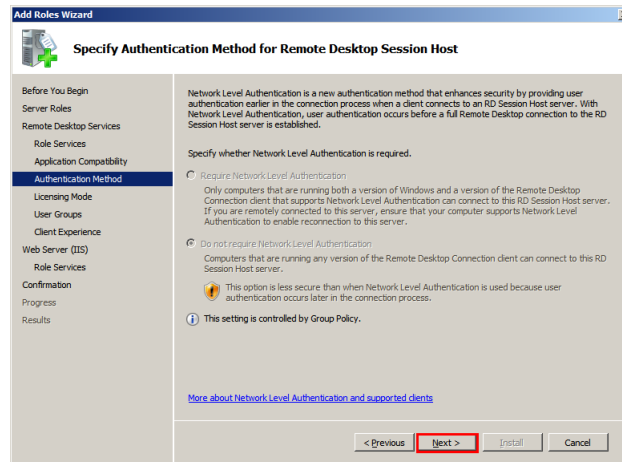
e Click **Next**. The **Select Role Services** screen appears.



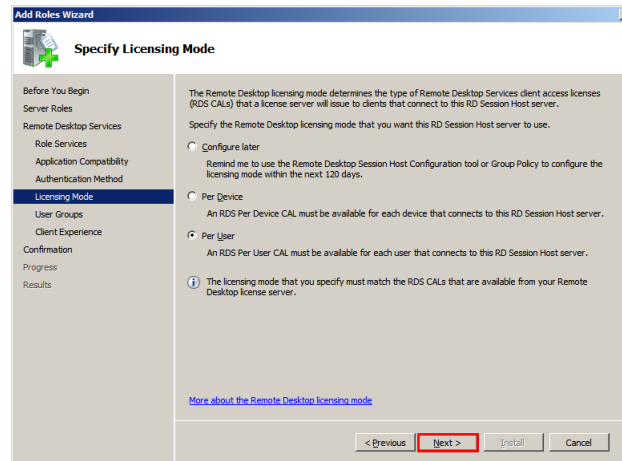
f Select the **Remote Desktop Session Host** and **Remote Desktop Connection Broker** check boxes, and then click **Next**. The **Uninstall and Reinstall Applications for Compatibility** screen appears.



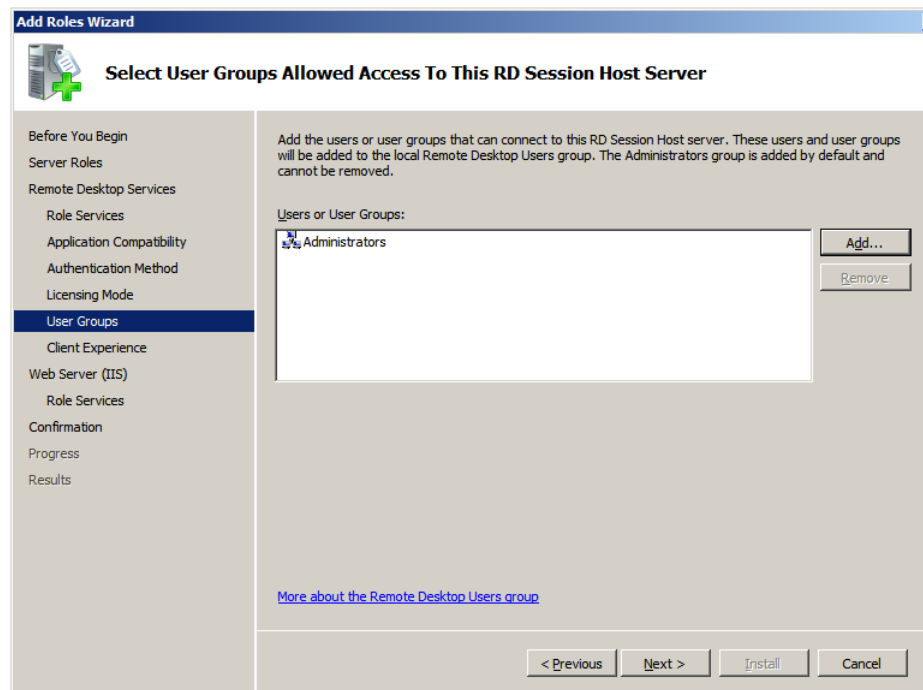
- g** Click **Next**. The **Specify Authentication Method for Remote Desktop Session Host** screen appears.



- h** Click the **Do not require Network Level Authentication** option, and then click **Next**. The **Specify Licensing Mode** screen appears.

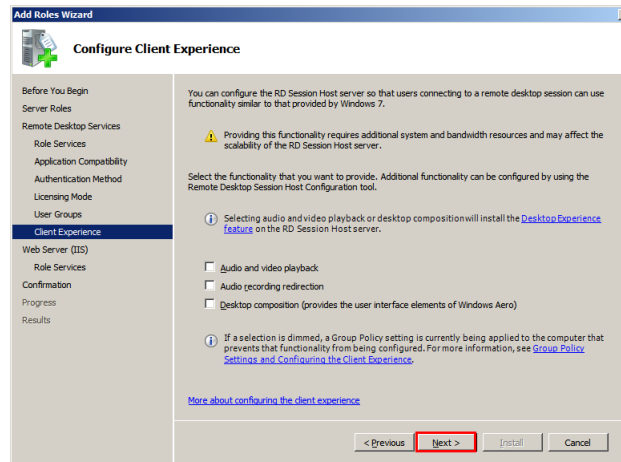


- i** Click the **Per User** option or **Per Device** option based on license availability, and then click **Next**. The **Select User Groups Allowed Access To This Remote Desktop Session Host Server** screen appears.

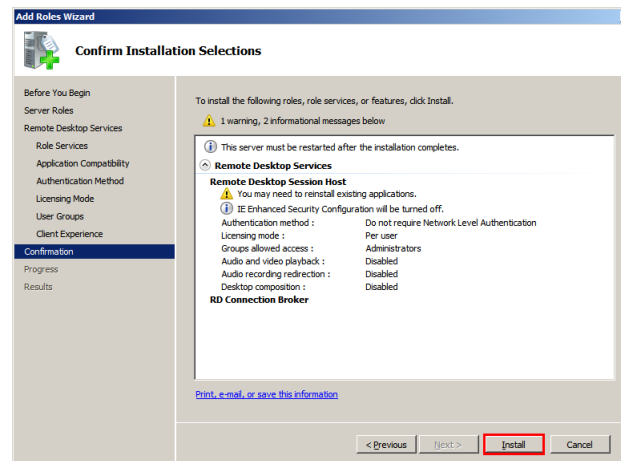


**Note:** There are two types of Windows Client Access Licenses from which to choose: device-based or user-based, also known as Windows Device CALs or Windows User CALs. This means you can choose to acquire a Windows CAL for every device (used by any user) accessing your servers, or you can choose to acquire a Windows CAL for every named user accessing your servers (from any device).

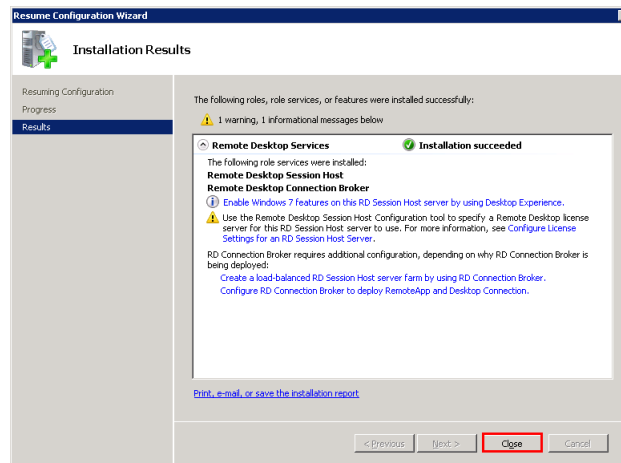
- 3 Confirm the details you entered, and install the services.
  - a On the **Select User Groups Allowed Access To This Remote Desktop Session Host Server** screen, click **Next**. The **Configure Client Experience** screen appears.



- b Click **Next**. The **Confirm Installation Selections** screen appears.



- c Click **Install**. The **Installation Results** screen appears.



After the installation, restart the node. To complete the installation restart the node.

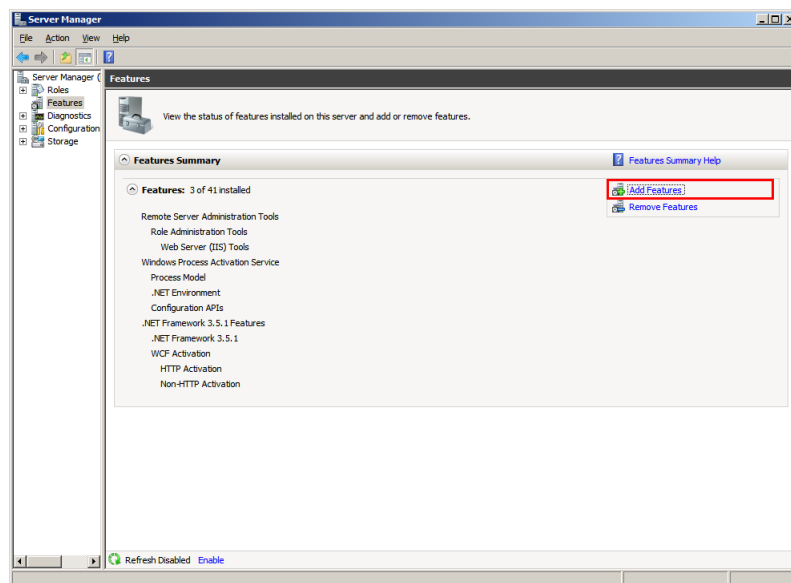
## Installing Network Load Balancing

You need to install an NLB on the network adapter that you want to use for the Remote Desktop Protocol (RDP) connection..

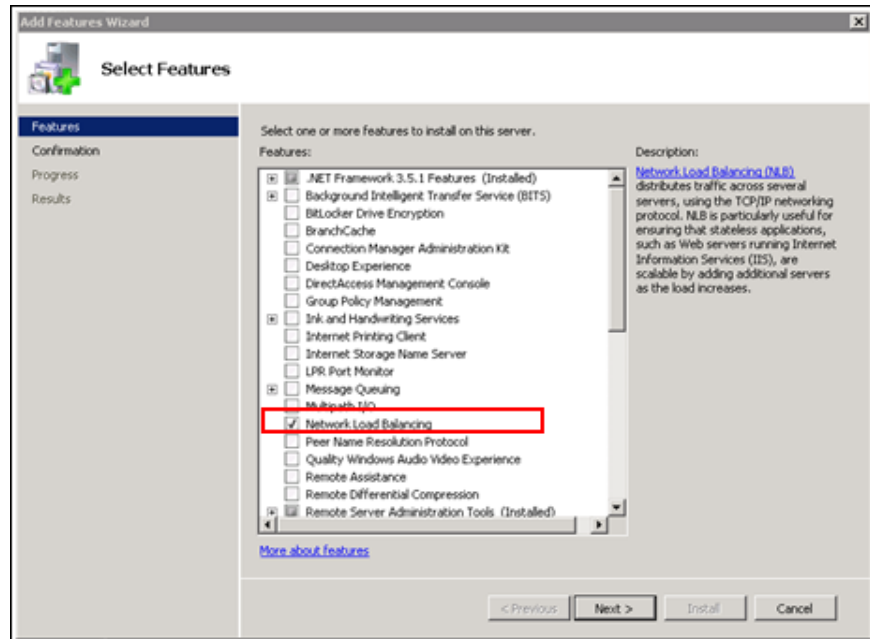
### To install an NLB

- 1 Open the **Server Manager** window.

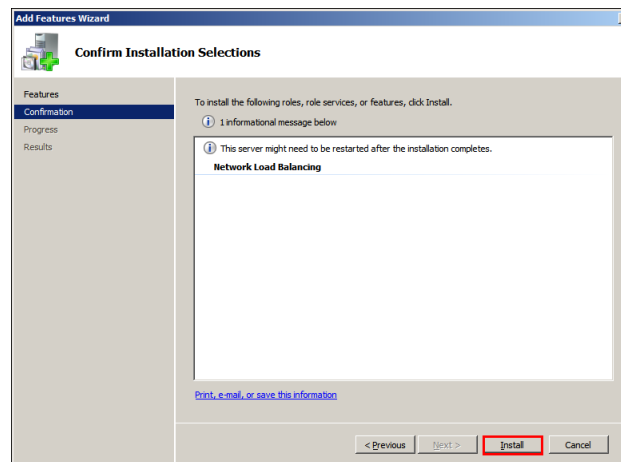
Click **Start**, point to **Administrative Tools**, and then click **Server Manager**. The **Server Manager** window appears.



- 2 Add the required features.
  - a On the **Server Manager** window, click **Features**. The **Features** area appears.
  - b Click **Add Features**. The **Select Features** screen in the **Add Features Wizard** window appears.



- c Select the **Network Load Balancing** check box, and then click **Next**. The **Confirm Installation Selections** screen appears.



- d Click **Install**. NLB is installed



## Adding a Remote Desktop Session Host Server

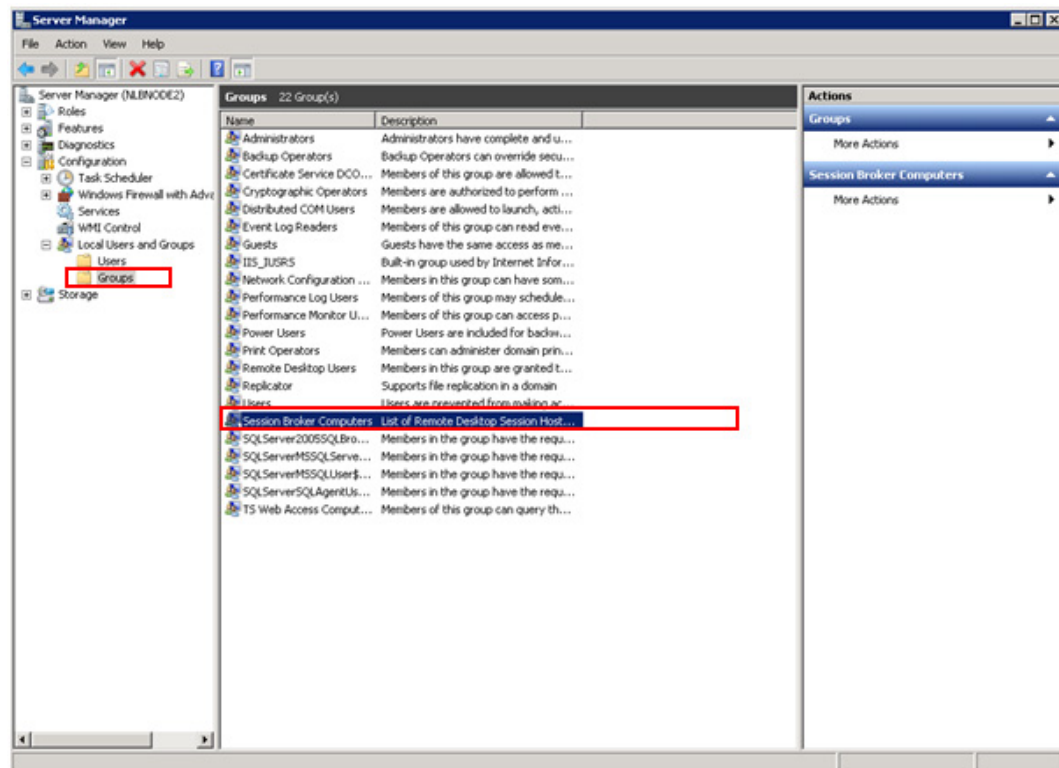
A Remote Desktop Session host (RD Session Host) server hosts Windows-based programs or the full Windows desktop for Remote Desktop services client. You can connect to an Remote Desktop Session Host server to run programs, save files, and use network resources on this server. You can access an Remote Desktop Session Host server by using Remote Desktop Connection or RemoteApp.

You can add a Remote Desktop Session Host server to the connection broker computers' local group.

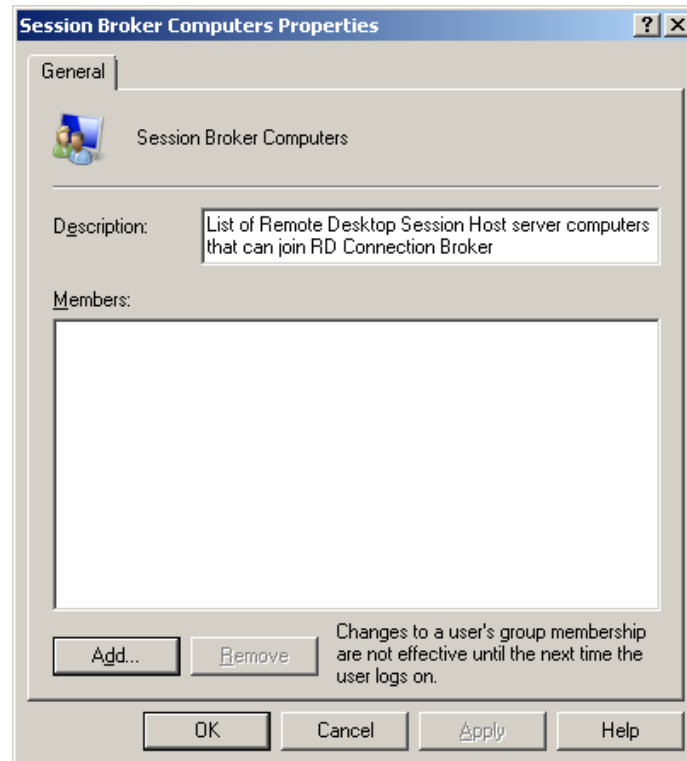
### To add an RD Session Host server

- 1 Open the **Server Manager** window.

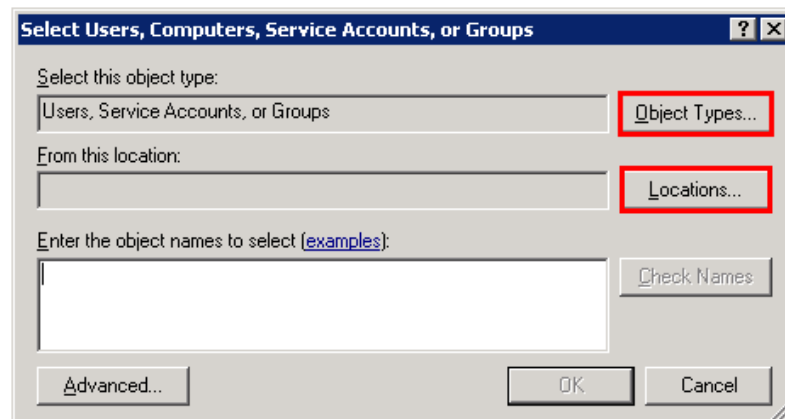
Click **Start**, point to **Administrative Tools**, and then click **Server Manager**. The **Server Manager** window appears.



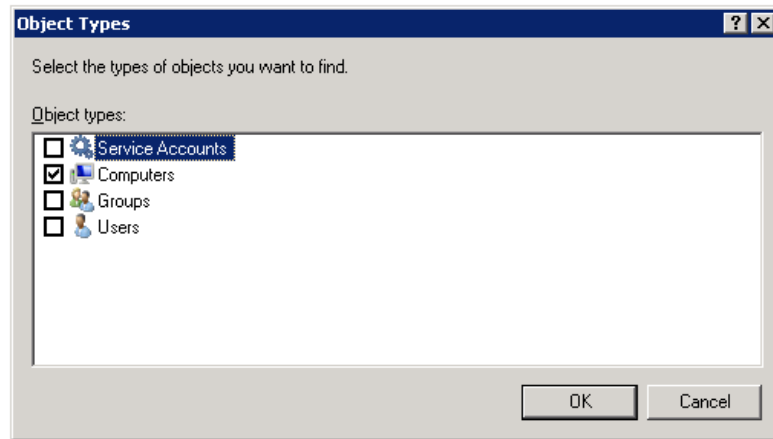
- 2 Select the required group to add to the Remote Desktop Session Host server.
  - a On the **Server Manager** window, expand **Configuration**, then **Local Users and Groups**. Click **Groups**. The **Groups** area appears.
  - b Right-click the **Session Broker Computers** group, and then click **Properties**. The Properties window for the selected group appears.



- c Click **Add**. The **Select Users, Computers, or Groups** window appears.



- d** Click **Object Types**. The **Object Types** window appears.



- e** Select the **Computers** check box, and then click **OK**. The node names of the computer appear in the **Select Users, Computers, or Groups** window.
- f** Click **OK** to add the computer account for the Remote Desktop Session Host server.

## Creating a Network Load Balancing Cluster

To configure an NLB cluster, you need to configure the following parameters:

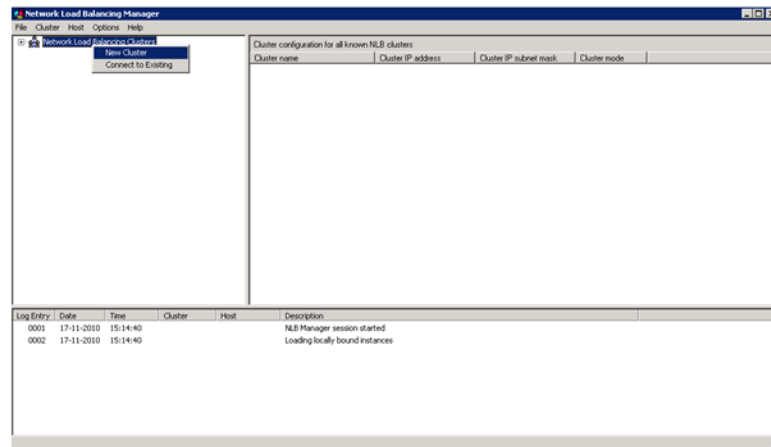
- Host parameters that are specific to each host in an NLB cluster.
- Cluster parameters that apply to an NLB cluster as a whole.
- Port rules

**Note:** You can also use the default port rules to create an NLB cluster.

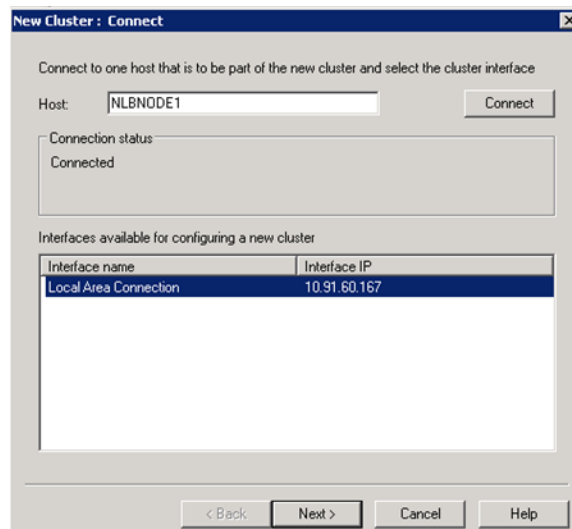
## To create an NLB cluster

- 1 Open the **Network Load Balancing Manager** window.

On node 1 of the required VM with NLB, click **Start**, point to **Administrative Tools**, and then click **Network Load Balancing Manager**. The **Network Load Balancing Manager** window appears.



- 2 Connect the required host to a new cluster.
  - a Right-click **Network Load Balancing Clusters**, and then click **New Cluster**. The **New Cluster** window appears.



- b In the **Host** box, enter the name of the host (node 1), and then click **Connect**.
- c Under **Interfaces available for configuring a new cluster**, select the interface to be used with the cluster, and then click **Next**. The **Host Parameters** section in the **New Cluster** window appears.

**New Cluster: Host Parameters**

Priority (unique host identifier): 1

Dedicated IP addresses	
IP address	Subnet mask
10.91.60.167	255.255.254.0

Initial host state  
 Default state: Started  
 Retain suspended state after computer restarts

< Back   Next >   Cancel   Help

- 3 Enter relevant details and create the new cluster.
  - a In the **Priority** list, click the required value, and then click **Next**. The **Cluster IP Addresses** section in the **New Cluster** window appears.

**Note:** The value in the **Priority** box is the unique ID for each host. The host with the lowest numerical priority among the current members of the cluster handles the entire cluster's network traffic that is not covered by a port rule. You can override these priorities or provide load balancing for specific ranges of ports by specifying the rules on the **Port rules** tab of the **Network Load Balancing Properties** window.

**New Cluster: Cluster IP Addresses**

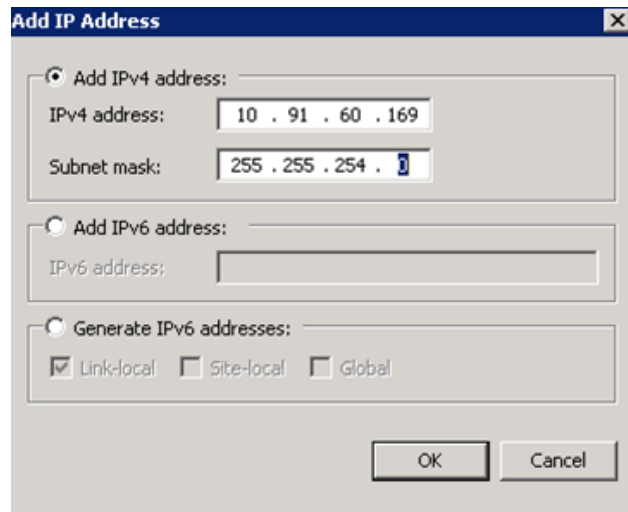
The cluster IP addresses are shared by every member of the cluster for load balancing. The first IP address listed is considered the primary cluster IP address and used for cluster heartbeats.

Cluster IP addresses:

IP address	Subnet mask
------------	-------------

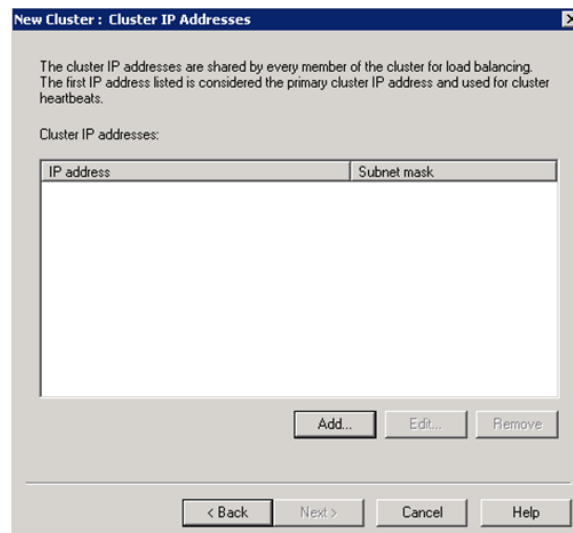
< Back   Next >   Cancel   Help

- b Click **Add** to add a cluster IP address. The **Add IP Address** window appears



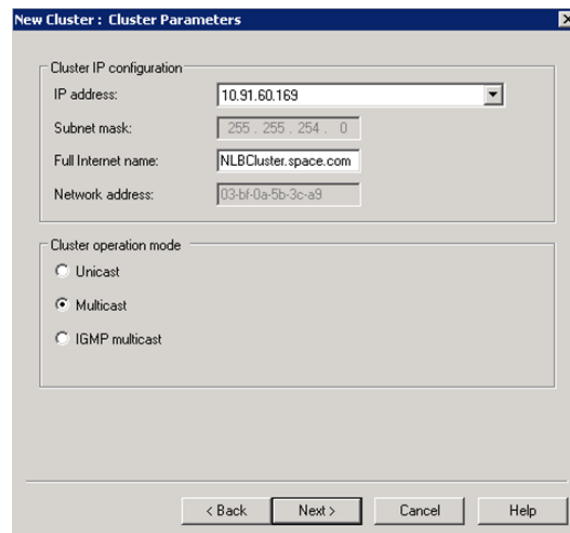
The "Add IP Address" dialog box is shown with the "Add IPv4 address" option selected. The IPv4 address field contains "10 . 91 . 60 . 169" and the Subnet mask field contains "255 . 255 . 254 . 0". The "Add IPv6 address" and "Generate IPv6 addresses" options are unselected. The "Generate IPv6 addresses" section has "Link-local" checked and "Site-local" and "Global" unchecked. "OK" and "Cancel" buttons are at the bottom right.

- c In the **IPv4 Address** box, enter the new cluster static IP address and in the **Subnet mask** box, enter the subnet mask. Click **OK** to close the window. The IP address appears on the **Cluster IP Addresses** section of the **New Cluster** window.



The "New Cluster : Cluster IP Addresses" dialog box displays instructions: "The cluster IP addresses are shared by every member of the cluster for load balancing. The first IP address listed is considered the primary cluster IP address and used for cluster heartbeats." Below this, the "Cluster IP addresses:" section contains a table with two columns: "IP address" and "Subnet mask". The table is currently empty. At the bottom of the table area are "Add...", "Edit...", and "Remove" buttons. At the very bottom of the dialog are "< Back", "Next >", "Cancel", and "Help" buttons.

- d Click **Next**. The **Cluster Parameters** section for the **New Cluster** window appears.



- e In the **Full Internet name** box, enter the name of the new cluster.
- f Click the **Multicast** option, and then click **Next**. The Port Rules section in the New Cluster window appears.

---

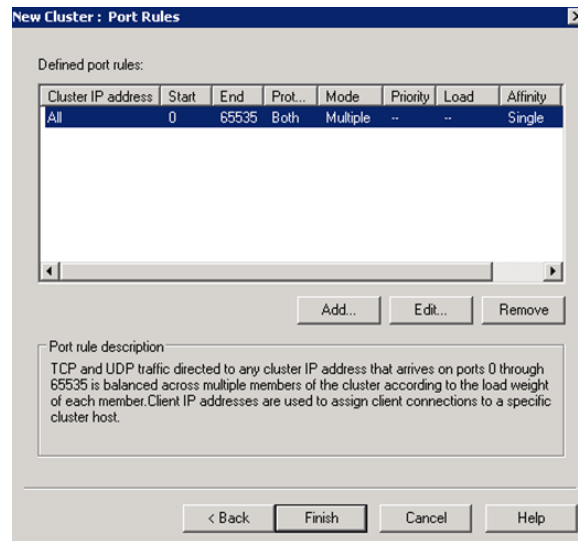
**Note:** If you click the **Unicast** option, NLB instructs the driver that belongs to the cluster adapter to override the adapter's unique, built-in network address and change its MAC address to the cluster's MAC address. Nodes in the cluster can communicate with addresses outside the cluster subnet. However, no communication occurs between the nodes in the cluster subnet.

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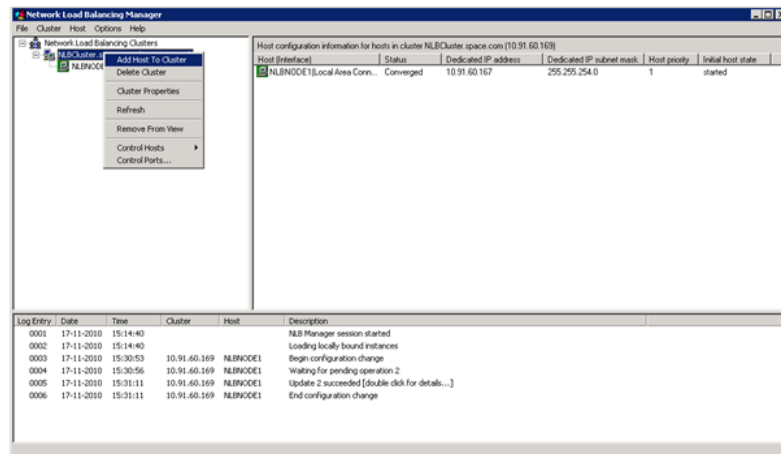
**Note:** If you click the **Multicast** option, both network adapter and cluster MAC addresses are enabled. Nodes within the cluster are able to communicate with each other within the cluster subnet, and also with addresses outside the subnet.

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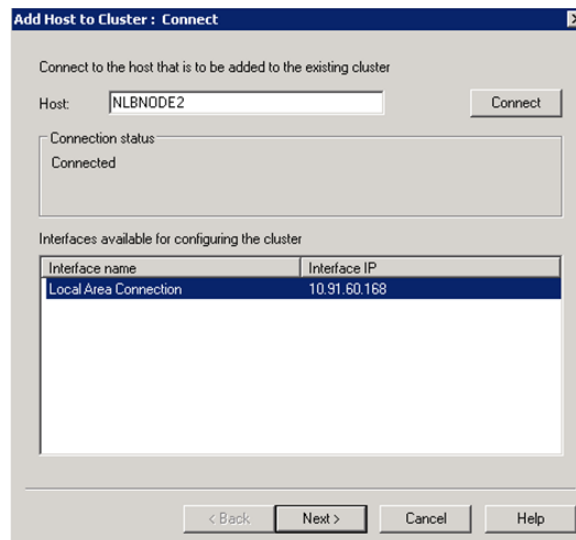




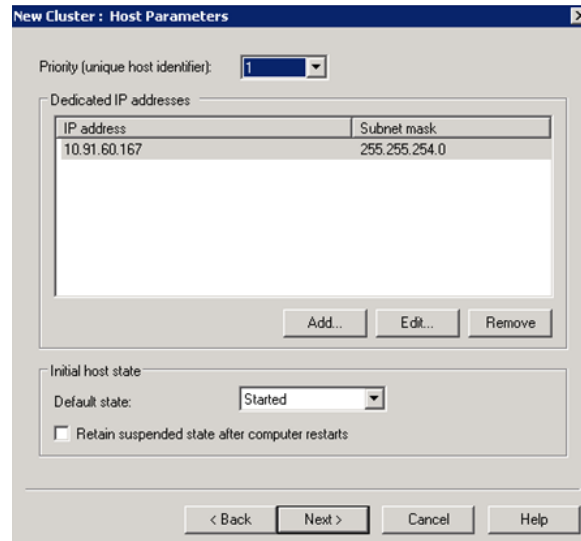
- g** Click **Finish** to create the cluster and close the window. The **Network Load Balancing Manager** window appears.



- 4** Add another host to the cluster.
- a** Right-click the newly-created cluster, and then click **Add Host to Cluster**. The **Connect** section of the **Add Host to Cluster** window appears.



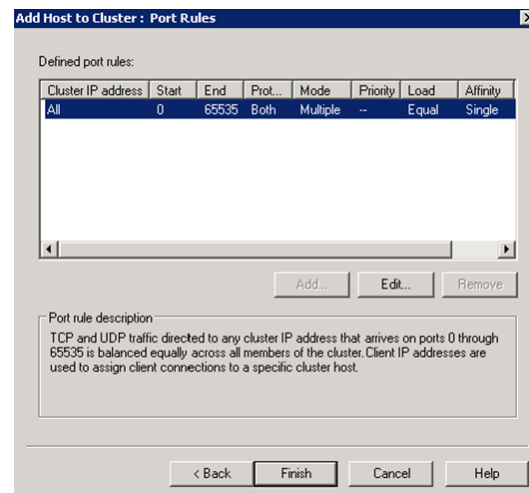
- b** In the **Host** box, enter the name of node 2, then click **Connect**.
- c** Under **Interfaces available for configuring a new cluster**, select the interface to be used with the cluster, and then click **Next**. The **Host Parameters** section in the **New Cluster** window appears.



The "New Cluster: Host Parameters" dialog box is shown. It features a "Priority (unique host identifier)" dropdown menu set to "1". Below this is a "Dedicated IP addresses" section with a table containing one row: IP address "10.91.60.167" and Subnet mask "255.255.254.0". There are "Add...", "Edit...", and "Remove" buttons below the table. The "Initial host state" section has a "Default state" dropdown set to "Started" and a checkbox for "Retain suspended state after computer restarts" which is unchecked. At the bottom are "< Back", "Next >", "Cancel", and "Help" buttons.

IP address	Subnet mask
10.91.60.167	255.255.254.0

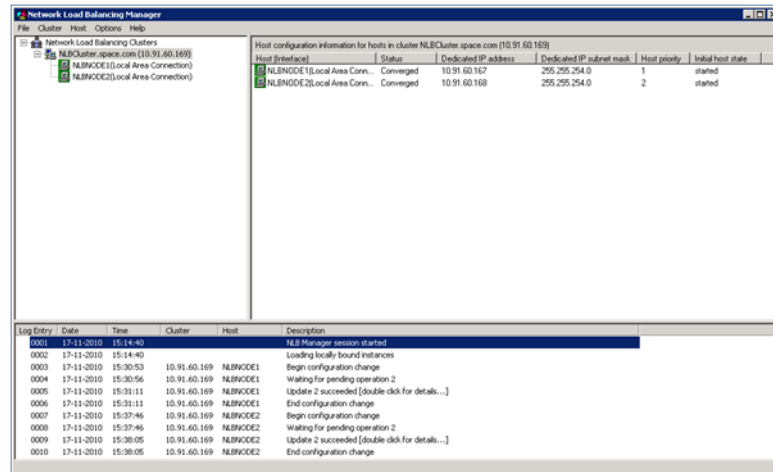
- d In the **Priority** box, enter the required value, and then click **Next**. The **Port Rules** section of the **Add Host to Cluster** window appears.



The "Add Host to Cluster: Port Rules" dialog box is shown. It features a "Defined port rules:" section with a table containing one row: Cluster IP address "All", Start "0", End "65535", Prot... "Both", Mode "Multiple", Priority "--", Load "Equal", and Affinity "Single". There are "Add...", "Edit...", and "Remove" buttons below the table. The "Port rule description" section contains the text: "TCP and UDP traffic directed to any cluster IP address that arrives on ports 0 through 65535 is balanced equally across all members of the cluster. Client IP addresses are used to assign client connections to a specific cluster host." At the bottom are "< Back", "Finish", "Cancel", and "Help" buttons.

Cluster IP address	Start	End	Prot...	Mode	Priority	Load	Affinity
All	0	65535	Both	Multiple	--	Equal	Single

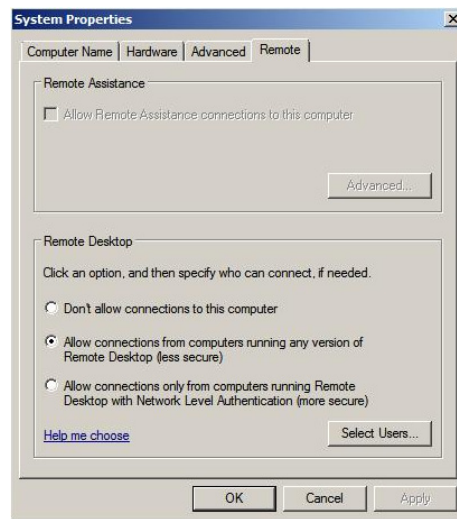
- e Click **Finish** to add the host and close the window. The **Network Load Balancing Manager** window appears.



The statuses of both the hosts are displayed.

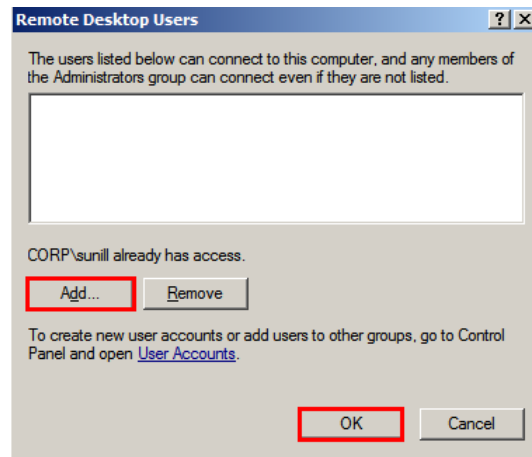
## To add users to the Remote Desktop Users group to access Network Load Balancing Cluster

- 1 On the **Start** menu, click **Control Panel, System and Security** then **System Remote** settings. The **System Properties** window appears



- 2 Under **Remote Desktop**, click the relevant option to specify the remote desktop versions you want to allow access to.

- 3 Select users to provide access to the system
  - a Click **Select Users**. The **Remote Desktop Users** window appears



- 4 Select the users you want to allow access to, click **Add**, and then click **OK** to close the window.

---

**Note:** The users can be local users and need not be domain users/administrators. If the users are local users they should be added on both the NLB cluster nodes with same user name and password.

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## Configuring Remote Desktop Connection Broker Settings

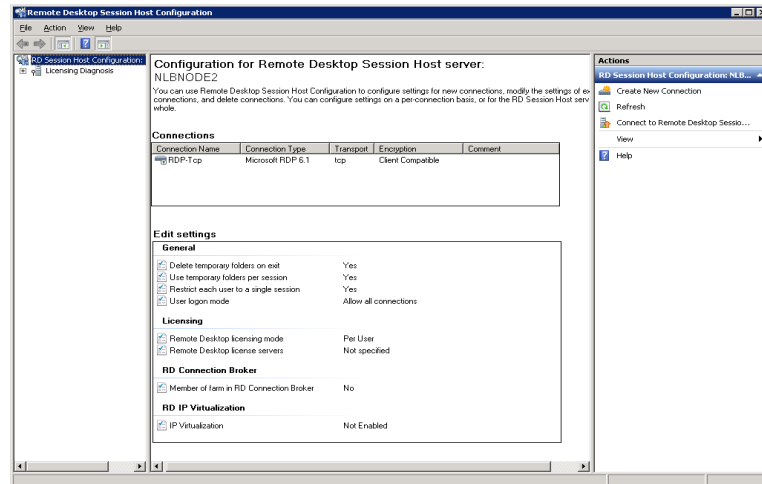
Remote Desktop Connection Broker, earlier called Terminal Services Session Broker (TS Session Broker), is a role service that enables you to do the following:

- Reconnect to existing sessions in a load-balanced Remote Desktop Session Host server farm. You cannot connect a different Remote Desktop Session Host server with a disconnected session and start a new session
- Evenly distribute the session load among Remote Desktop Session Host servers in a load-balanced Remote Desktop Session Host server farm.
- Access virtual desktops hosted on Remote Desktop Virtualization host servers and RemoteApp programs hosted on Remote Desktop Session Host servers through RemoteApp and Desktop Connection.

## To configure Remote Desktop connection broker settings

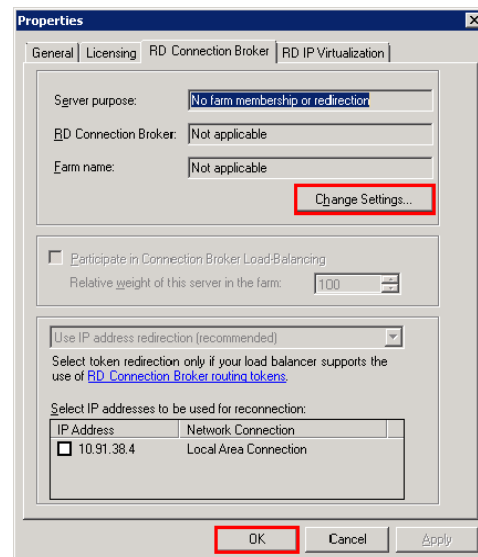
- 1 Open the **Remote Desktop Session Host Configuration** window.

Click **Start, Administrative Tools, Remote Desktop Services, then Remote Desktop Session Host Configuration**. The **Remote Desktop Session Host Configuration** window appears.

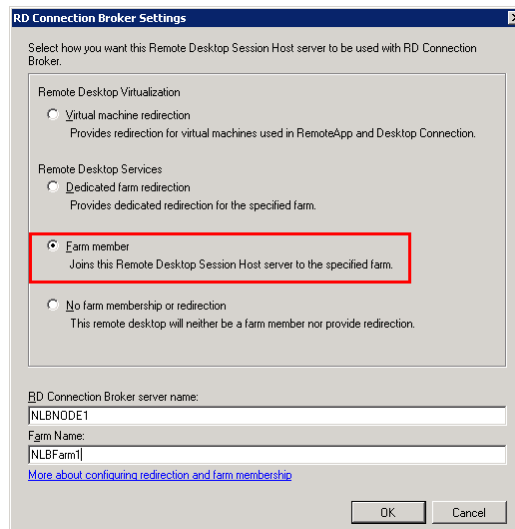


- 2 Edit settings.

- a In the **Edit settings** area, under **Remote Desktop Connection Broker**, double-click **Member of farm in RD Connection Broker**. The **Properties** window appears.

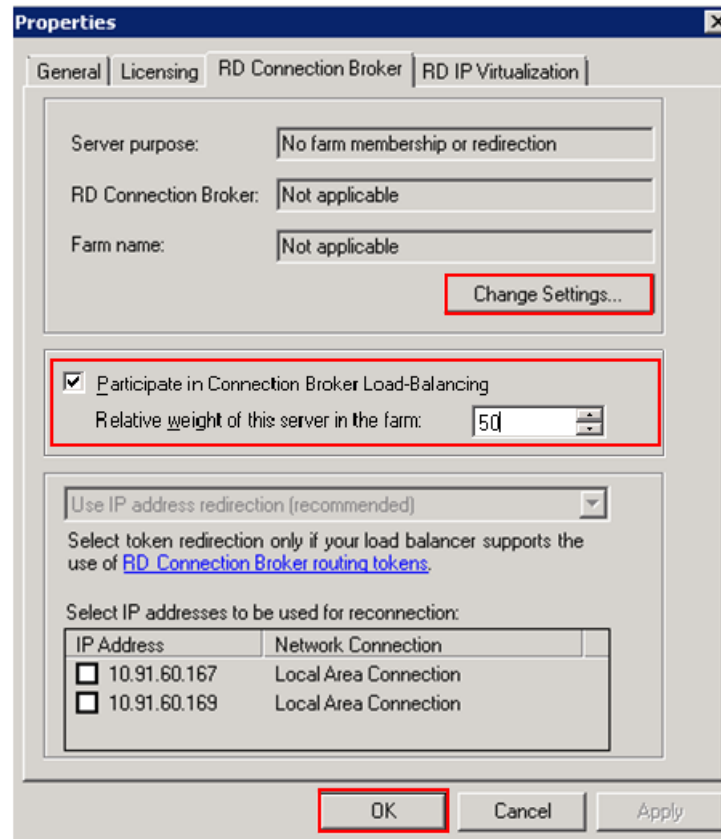


- b** Click **Change Settings**. The **RD Connection Broker Settings** window appears.



- c** Click the **Farm member** option.

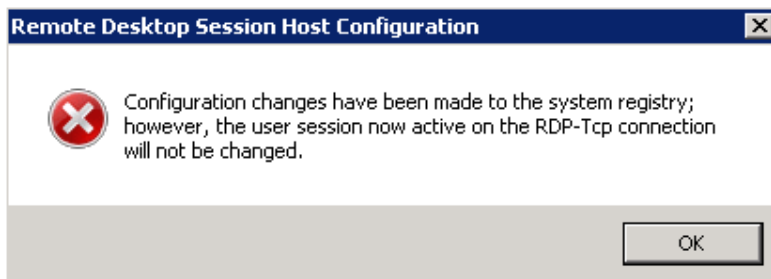
- d In the **RD Connection Broker server name** box, enter the name of the node where RD Connection Broker is installed.
- e In the **Farm Name** box, enter the name of the farm that you want to join in the Remote Desktop Session Broker, and then click **OK** to close the window.



- f In the **Properties** window, select the **Participate in Connection Broker Load Balancing** check box.
- g In the **Relative weight of this server in the farm** box, enter the required weight of the server.

**Note:** By assigning a relative weight value, you can distribute the load between more powerful and less powerful servers in the farm. By default, the weight of each server is "100". You can modify this value, as required.

- h** Under **Select IP addresses to be useful for reconnection**, select the check box next to the IP address you provided while creating the cluster, and then click OK. A warning message appears.



Click **OK** to close the window. The settings are configured.

**Note:** Repeat this procedure on node 2. Ensure that you enter the same details in each step for node2 as you did for node 1. In **Farm Name** box, enter the same Farm Name used while configuring the node 1.

## Disconnecting from and Connecting to a Remote Desktop Session

If you disconnect from a session (whether intentionally or because of a network failure), the applications you were running will continue to run. When you reconnect, the Remote Desktop Connection Broker is queried to determine whether you had an existing session, and if so, on which Remote Desktop Session Host server. If there is an existing session, Remote Desktop Connection Broker redirects the client to the Remote Desktop Session Host server where the session exists.

With Remote Desktop Connection Broker Load Balancing, if you do not have an existing session and you connect to an Remote Desktop Session Host server in the load-balanced Remote Desktop Session Host server farm, you will be redirected to the Remote Desktop Session Host server with the fewest sessions. If you have an existing session and you reconnect, you will be redirected to the Remote Desktop Session Host server where your existing session resides. To distribute the session load between more powerful and less powerful servers in the farm, you can assign a relative server weight value to a server.

## Viewing Connected Sessions

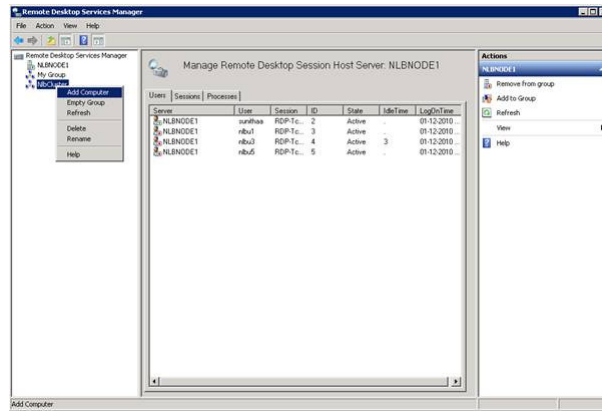
You can use Remote Desktop Services Manager to view sessions connected to each node of the NLB cluster, and view information and monitor users and processes on Remote Desktop Session host (RD Session Host) servers.



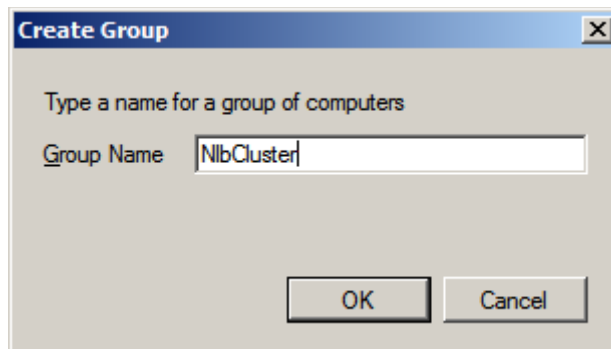
## To view sessions connected to each node of the cluster

- 1 On any node of NLB, open the Remote Desktop Services Manager window.

Click **Start**, point to **Administrative Tools**. On the **Administrative Tools** menu, point to **Remote Desktop Services**, and then click **Remote Desktop Services Manager**. The **Remote Desktop Services Manager** window appears.



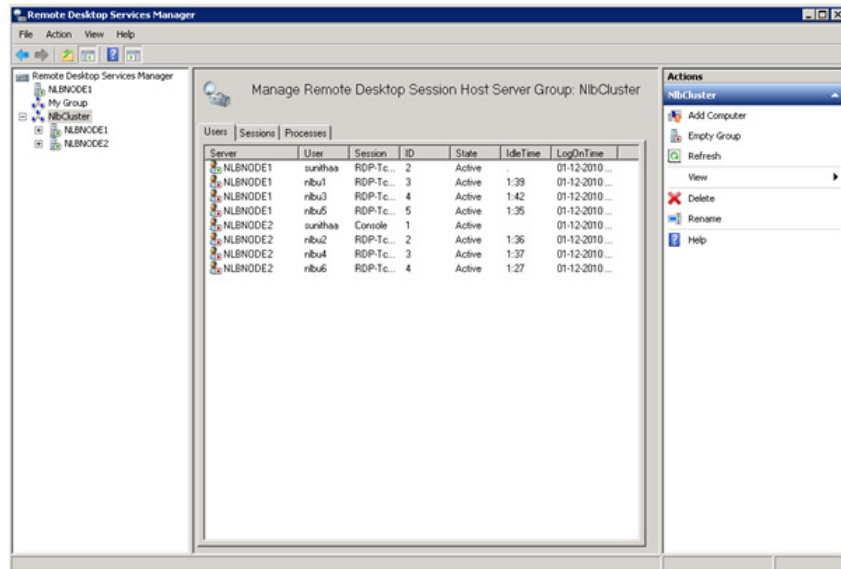
- 2 Create a new group.
  - a In the left pane, right-click **Remote Desktop Services Manager**, and select **New Group**. The **Create Group** window appears.



- b** In the **Group Name** box, enter the name of the group, and then click **OK** to close the window.

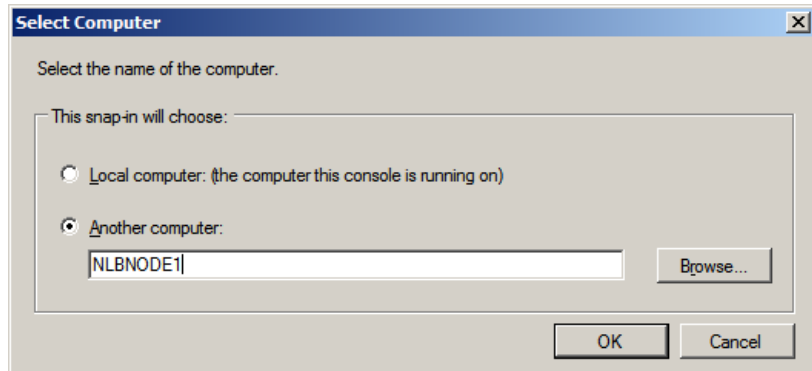
**Note:** The group name need not be the same as the cluster name.

- c** Repeat steps c and d of point 3 to add other node names of the cluster to the newly-created group.



You can now select the newly-created group name in the left pane and view the sessions connected to each node of the cluster.

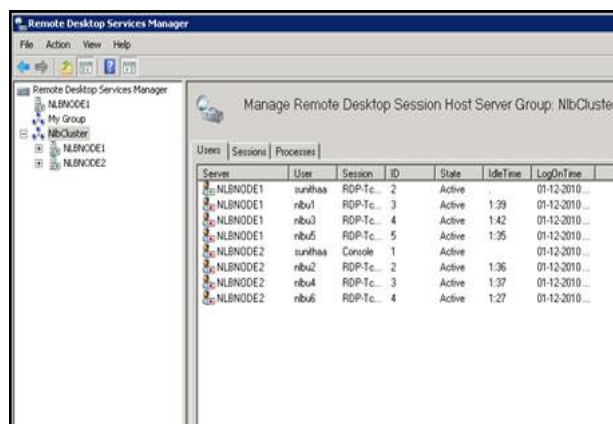
- 3 Add the required computers to the group.
  - a In the left pane, right-click the newly created group, and then click **Add Computer**. The **Select Computer** window appears.



- 4 Enter name of the new computer.
  - a Click the **Another Computer** option.
  - b In the **Another Computer** box, enter the node 1 name of the cluster, and then click **OK** to close the window. The **Remote Desktop Services Manager** window appears.

**Note:** You can either type or click **Browse** to select the required node name.

- c Repeat steps 3c and 3d of point 3 to add other node names of the cluster to the newly-created group.



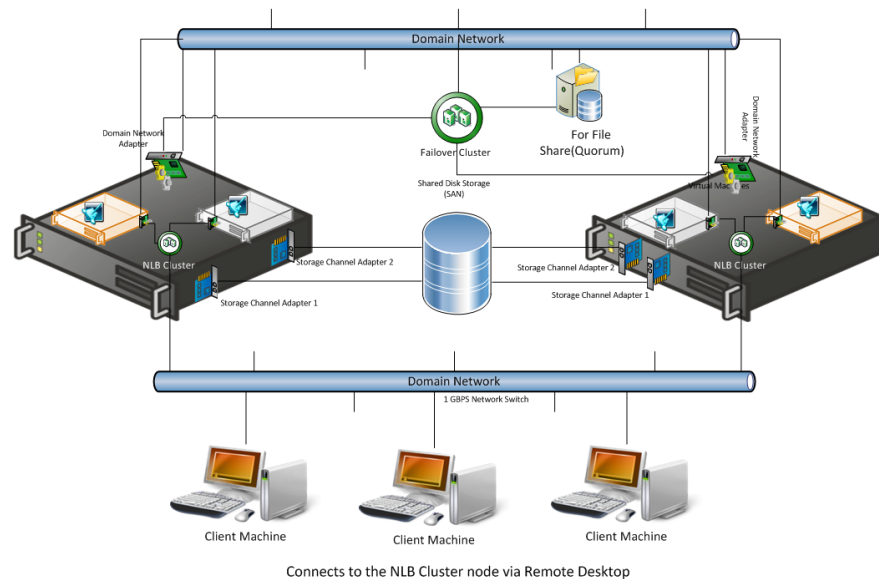
You can now select the newly-created group name in the left pane and view the sessions connected to each node of the cluster.

## Configuring Network Load Balancing Cluster on Microsoft Failover Cluster

Windows Server® 2008 R2 provides two clustering technologies: failover clusters and NLB. Failover clusters primarily provide high availability; NLB provides scalability and, at the same time, helps increase availability of Web-based services.

By using a failover cluster, you can ensure that there is nearly constant access to important server-based resources. A failover cluster is a set of independent computers that work together to increase the availability of services and applications. The clustered servers (called nodes) are connected by physical cables and by software. If one of the nodes fails, another node begins to provide service through a process known as failover.

NLB that is configured in a failover cluster offers high performance in environments in which each request from a client is stateless, and there is no in-memory application state to maintain



### To configure NLB cluster on Microsoft failover cluster

- 1 Set up Microsoft Failover Cluster out of two Hyper-V host servers.
- 2 Configure two VM nodes one on each Hyper-V server.

- 3 Configure the NLB cluster out of two VM nodes hosted by each Hyper-V host server following the procedures in Leveraging NLB by Configuring Remote Desktop Session Broker on a NLB Cluster Node explained in topology 1. For more information, refer to "Topology 1: Leveraging Network Load Balancing by Configuring Remote Desktop Connection Broker on One of the NLB Cluster Nodes" on page 573.

## Understanding the Behavior of NLB Cluster in Microsoft Failover Cluster

- 1 During a live migration of one of the NLB cluster nodes, there are no disruptions in the active sessions connected to the cluster node. The Reconnect window will not appear on the NLB cluster node as there is no disruption of the active session. After the live migration is complete all sessions connected to the NLB cluster node are retained.
- 2 During a quick migration, when one of the Hyper-V host servers (Microsoft Failover Cluster Node) is shut down or switched off and the failover is completed, all active sessions on the NLB cluster node hosted by the Microsoft failover cluster node are automatically connected and all sessions on the NLB cluster node are retained.

## Observation while using NLB for Managed InTouch System Platform node Observations:

- The NLB feature is qualified for InTouch managed application. InTouch TSE license is required on each of the NLB cluster nodes.
- Local InTouch Tag Alarms are local to the session. Local InTouch Tag alarms updated in a session remain local to that session only.
- ArcestrA Alarms are common across all sessions. ArcestrA Alarms updated in one of the sessions get reflected across all the sessions.
- For IO tags poking in one session, the data reflects across all the sessions. However, while poking local InTouch tags, data does not get updated across all sessions since it is local to the session.
- When you lose the NLB cluster node with the active sessions, all the active sessions on the NLB cluster node closes. To retain all the active sessions, configure the NLB Cluster in a Microsoft Failover Cluster in a Hyper-V environment. The NLB cluster nodes are VM nodes hosted by Hyper-V host servers and Hyper-V host. For more information, refer to "Configuring Network Load Balancing Cluster on Microsoft Failover Cluster" on page 604.

## Hardware Licenses in a Virtualized Environment

Hardware licenses are not supported in the Hyper-V virtualized environment with the release of Windows Server 2008 R2. You may want to verify support under later server editions.

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# Chapter 6

## Creating Virtual Images

### About Virtual Images

A virtual image is a software implementation of a machine or computer that executes programs as though it were a physical machine. It is an isolated software container that runs its own operating systems and applications and contains its own virtual or software-based CPU, RAM, hard disk, and network interface card.

There is no functional difference between a virtual and a physical machine. However, a virtual machine offers the following advantages over a physical machine:

- Multiple operating system (OS) environments can exist on the same computer, in isolation from each other
- A virtual machine provides an Instruction Set Architecture (ISA) that is somewhat different from a real machine
- A virtual machine enables application provisioning, maintenance, high availability, and disaster recovery

In a Microsoft virtual environment, you can create and manage virtual images with either System Center Virtual Machine Manager 2008 R2 (SCVMM) or Microsoft® Hyper-V Manager.

SCVMM has specific advantages over Hyper-V Manager, and is used in creating and managing the virtual machines.

SCVMM is a stand-alone server application for managing a virtual environment running on Windows Server 2008 Hyper-V, Microsoft Virtual Server, and VMware hosts. By using SCVMM, you can centrally manage physical and virtual machine infrastructures through a single console.

You can create and configure virtual machines in SCVMM by using the SCVMM library, and manage virtual machine hosts by creating host groups.

## **SCVMM Features**

### **Virtual Machine and Host Management**

This feature is used to create and manage virtual machines. If you add a host running Windows Server 2008, which is not Hyper-V enabled, SCVMM 2008 automatically enables the Hyper-V role on the host.

### **Intelligent Placement**

When a virtual machine is deployed, SCVMM 2008 analyzes performance data and resource requirements for both the workload and the host. By using this analysis, you can modify placement algorithms to get customized deployment recommendations.

### **Library Management**

The SCVMM library contains file-based resources and hardware profiles that you can use to create standardized virtual machines.

### **Physical to Virtual (P2V) and Virtual to Virtual (V2V) Conversion**

SCVMM 2008 helps improve the P2V experience by integrating the P2V conversion process and using the Volume Shadow Copy Service (VSS) of Windows Server.

SCVMM 2008 also provides a wizard that converts VMware virtual machines to virtual hard disks (VHDs) through an easy and speedy V2V transfer process.

### **Existing Storage Area Network (SAN)**

Virtual machine images are often very large and are slow to move across a local area network (LAN). You can configure SCVMM 2008 to use the application in an environment that has a fiber channel or a SAN, so that you can perform SAN transfers within SCVMM.

After VMM 2008 is configured, the application automatically detects and uses an existing SAN infrastructure to transfer virtual machine files. This transfer facilitates the movement of large virtual machine files at the fastest possible speed, and reduces the impact on LAN.

### **Virtual Machine Self-Service Portal**

You can designate self-service to users and grant them controlled access to specific virtual machines, templates, and other SCVMM 2008 resources through a Web-based portal. This controlled access helps users, such as testers and developers, to allot new virtual machines to themselves. The users can allot the virtual machines according to the controls you set by using the self-service policies.



### **Automation with Windows PowerShell**

For increased automation and control, you can use Windows PowerShell to run remote scripted services against multiple virtual machines. This lets you avoid the manual processes that are performed in a graphical user interface (GUI). You can also manage host systems by using Windows PowerShell.

### **Centralized Monitoring and Reporting**

Server virtualization enables multiple operating systems to run on a single physical computer as virtual machines. By using the server virtualization technology and VMM, you can consolidate workloads of underutilized servers on to a smaller number of fully-utilized servers and provision new virtual machines. Fewer physical computers lead to reduced costs because of lower hardware, energy, and management overheads.

For more information on SCVMM, refer to "Microsoft System Center Virtual Machine Manager 2008 R2 Reviewer's Guide".

For more information on installation, refer to <http://msdn.microsoft.com/en-us/library/dd380687.aspx#SCVMM>.

You can create a virtual image (VM) from the following sources:

- **Operating system ISO image**

You can create a VM from an operating system with either an existing ISO file on a network location or an extracted ISO file available on a CD or DVD.

In this process, you can use an ISO on the network location or on a CD, and then modify the hardware configuration. You can then create and generate a VM and store it.

For more information, refer to "Preparing a Virtual Image from an Operating System (OS) Image" on page 610.

- **Physical machine**

You can perform a P2V conversion online or offline.

To start a P2V conversion, SCVMM temporarily installs an agent on the physical source computer that you want to convert. In an online P2V conversion, SCVMM uses VSS to copy data, while the server continues to work with user requests. In this conversion, the source computer does not restart. In an offline P2V conversion, the source computer restarts into the Windows Pre-installation Environment (Windows PE) before SCVMM converts the physical disks to VHDs.

For more information, refer to "Preparing a Virtual Image from a Physical Machine" on page 633.

- **Another VM image**

SCVMM allows you to copy existing virtual machines and create Hyper-V virtual machines.

A V2V conversion process converts virtual machines to VHDs. You can use a V2V conversion to convert either an entire virtual machine or its disk image file to the Microsoft virtual machine format.

**To perform a V2V conversion**

- a** Add the host server-based virtual machine files to a SCVMM library.
- b** Select the **Convert Virtual Machine** option in the Library view in the SCVMM administrator console.

For more information, refer to "Preparing a Virtual Image from Another Virtual Image" on page 658.

- **Ghost backup**

You can create VMs from images supported by third-party vendors, such as Norton (Norton Ghost).

SCVMM allows you to create a virtual machine using VHD images. The VHD images are created using a ghost backup.

**To create a virtual machine from a ghost backup**

- a** Create a ghost backup (.GHO).
- b** Convert a ghost backup (.GHO) to a virtual hard disk (.VHD).
- c** Create a virtual machine from .VHD.

For more information, refer to "Preparing a Virtual Image from a Ghost Backup" on page 676.

For more information on creating VMs, refer to <http://technet.microsoft.com/en-us/library/cc764227.aspx>.

The following sections describe how to create virtual images using SCVMM.

## Preparing a Virtual Image from an Operating System (OS) Image

You can create virtual images (VMs) from an operating system ISO image. An ISO image (International Organization for Standardization) is an archive file or a disk image of an optical disk. The image is composed of data contents of all the written sectors of an optical disk, including the optical disk file system. VMs can be created from either an existing ISO file on your network location or an extracted ISO file available on a CD or DVD.

## Creating a Virtual Image with an ISO File on the Network Location

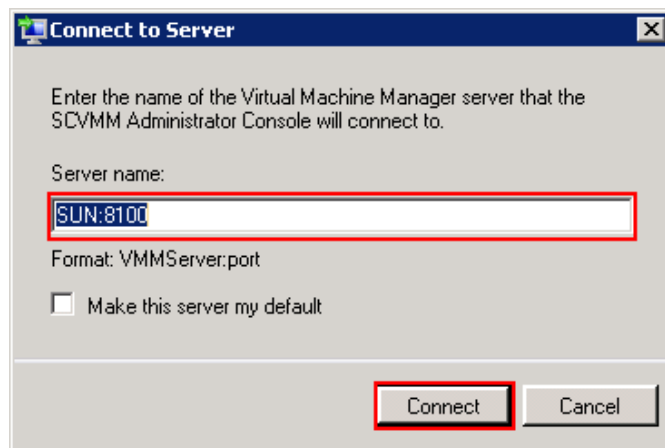
You need to place the ISO file that is available in your network location in the SCVMM library. You can then use the ISO file to create a virtual machine.

### To create a virtual image with an ISO file on the network location

- 1 Copy the required ISO files to the library.

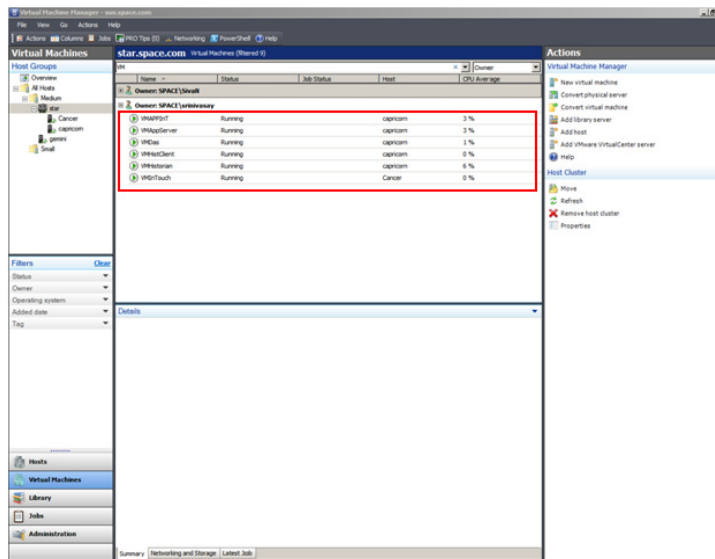
On the library server, copy the ISO files to the required library. For more information, refer to <http://technet.microsoft.com/en-us/library/cc956015.aspx>.

- 2 Open System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



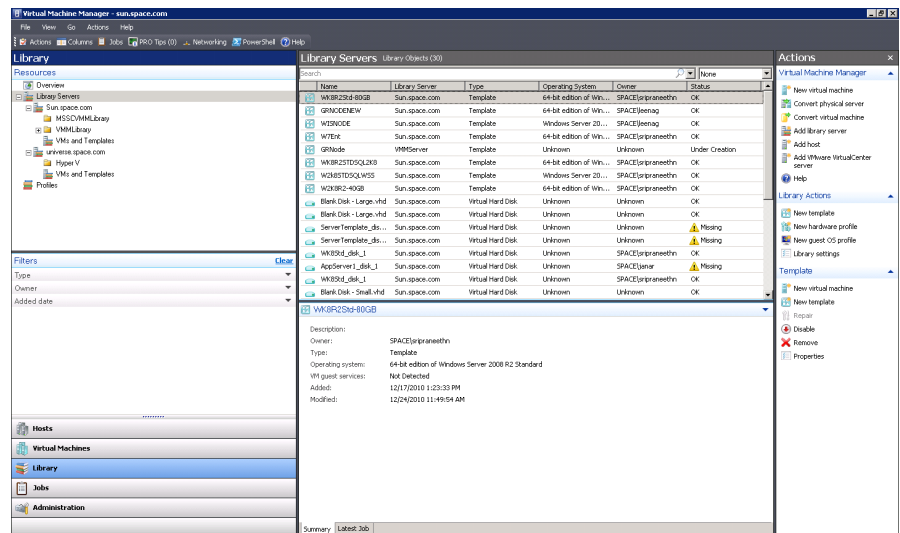
- b In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it in the SCVMM Server configuration, if required.



### 3 Add ISO files in the SCVMM library.

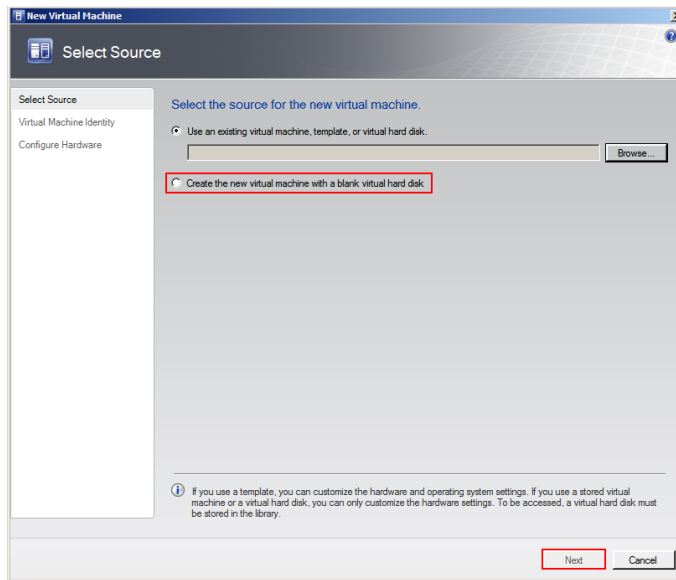
- c** On the **Virtual Machine Manager** window, click **Go**. On the menu, click **Library**. The library servers are displayed.



- d** In the **Resources** pane, right-click the library share where you have copied the files, and then click **Refresh**. The files on the share are indexed in the **Virtual Machine Manager** window and displayed in the **Library Servers** list.

**4** Open the **New Virtual Machine** window.

On the **ACTIONS** menu of the **Virtual Machine Manager** window, point to **Virtual Machine Manager**, and then click **New Virtual Machine**. The **Select Source** screen on the **New Virtual Machine** window appears.



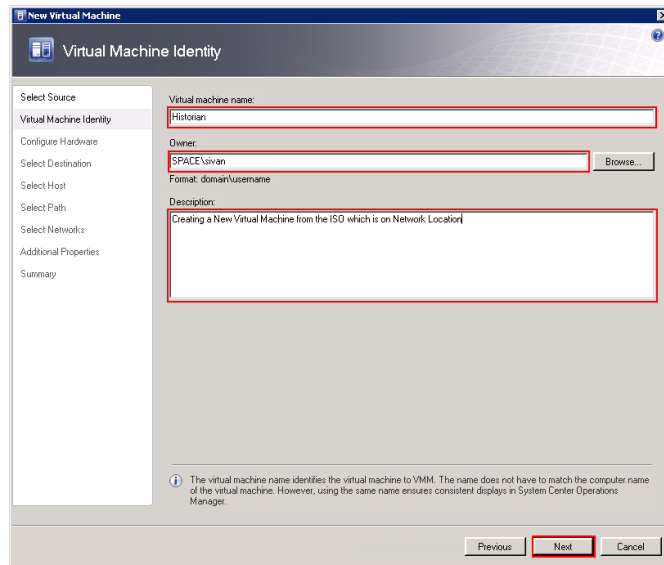
- 5 Select the source machine or hard disk you want to use for the new VM.

On the **Select Source** screen, click the **Create the new virtual machine with a blank virtual hard disk** option, and then click **Next**. The **Virtual Machine Identity** screen appears.

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**Note:** By default, the **Use an existing virtual machine, template, or virtual hard disk** option is selected.

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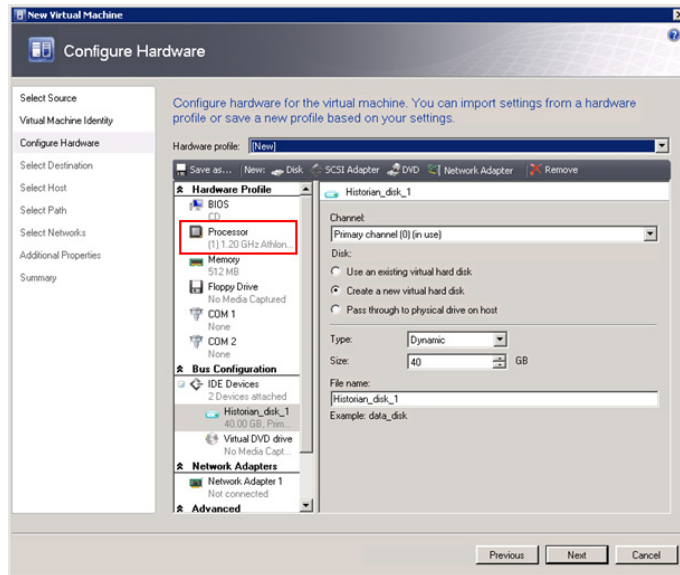
- 6 Enter the details of the new VM.

Enter the virtual machine name, owner name, and description name, and then click **Next**. The **Configure Hardware** screen appears.

---

**Note:** You can either type or click **Browse** to select the relevant owner name.

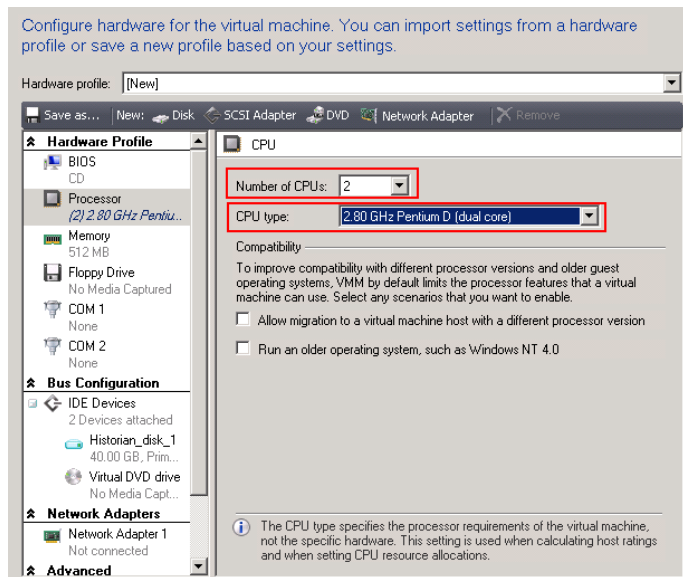
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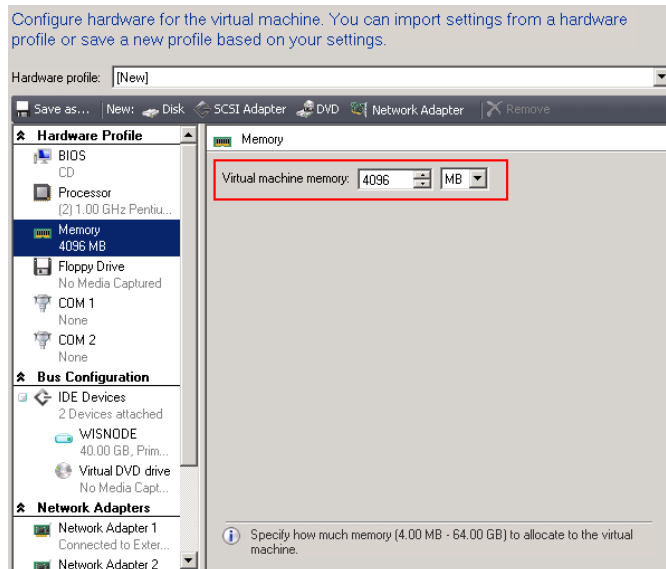
7 Enter the hardware details for the new VM.

**Note:** In the **Configure Hardware** screen, ensure that there is at least one network adapter listed under **Network Adapters**.

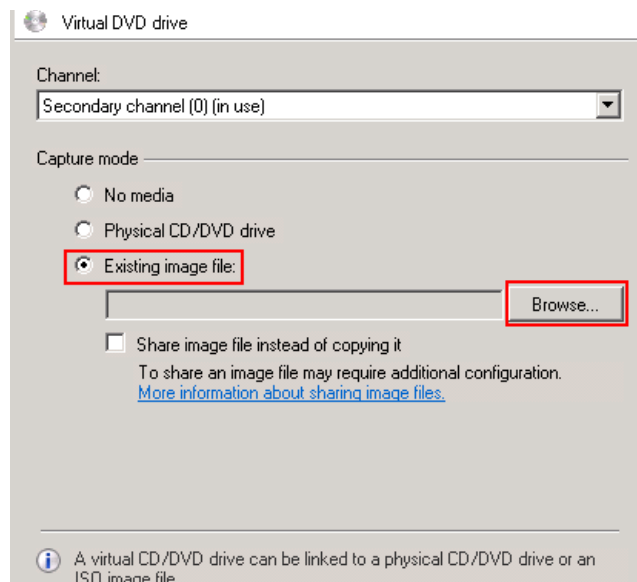
- a In the **Configure Hardware** screen, click **Processor**. The **CPU** area appears.



- b In the **Number of CPUs** and **CPU type** lists, click the relevant details, and then click **Memory**. The **Memory** area appears.



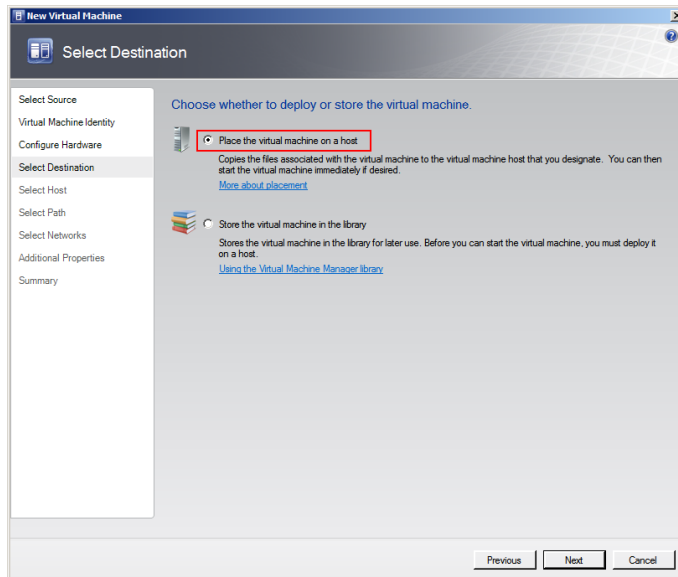
- c In the **Virtual machine memory** boxes, configure the memory to “4096 MB”. Under **Bus Configuration**, click **Virtual DVD drive**. The **Virtual DVD drive** area appears.



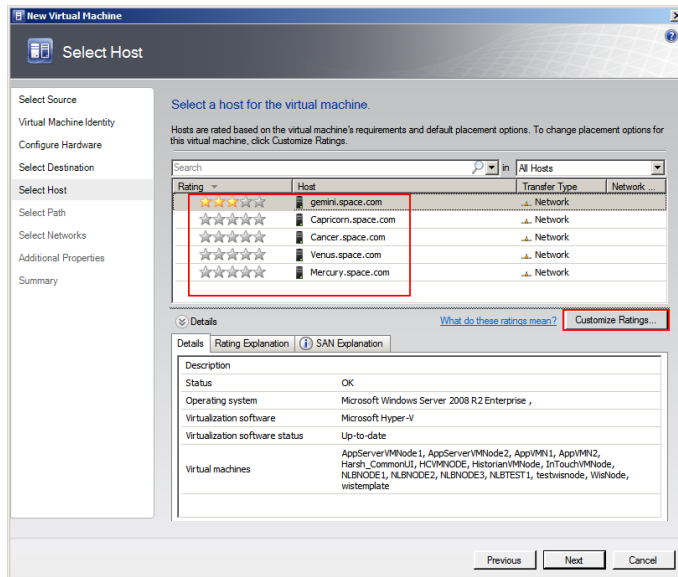
- d Click the **Existing image file** option, and then click **Browse** to select the required ISO image file from the **Select ISO** window. The file name appears in the **Existing image file** box.



e Click **Next**. The **Select Destination** screen appears.



f Click the **Place the Virtual Machine on a host** option, and then click **Next**. The **Select Host** screen appears.



- 8 Select a host for the new VM.
  - a View the rating of each host.
  - b Select a suitable host to deploy the VM.

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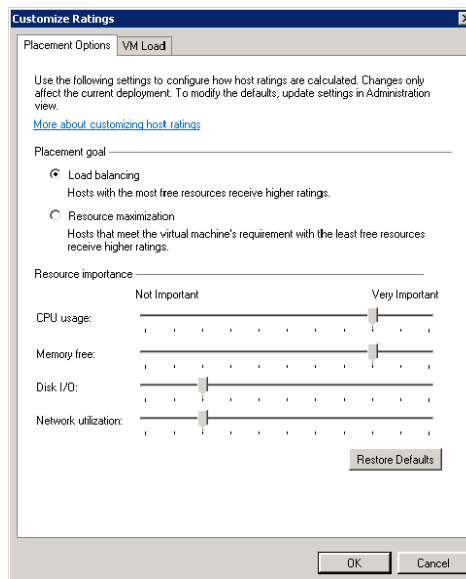
**Note:** All hosts that are available for placement are given a rating of 0 to 5 stars based on their suitability to host the virtual machine. The ratings are based on the hardware, resource requirements, and expected resource usage of the virtual machine. The ratings are also based on placement settings that you can customize for the VMM or for individual virtual machine deployments. However, the ratings are recommendations. You can select any host that has the required disk space and memory available.

---

**Important:** In SCVMM 2008 R2, the host ratings that appear first are based on a preliminary evaluation by SCVMM. The ratings are for the hosts that run Windows Server 2008 R2 or ESX Server. Click a host to view the host rating based on a more thorough evaluation.

---

- c To view the placement settings used by the VMM to rate the hosts, click **Customize Ratings**. The **Customize Ratings** window appears.



You can modify the settings if required.

- d To view additional information about a host rating, select the host and click the following tabs:
  - Details

Details		Rating Explanation	SAN Explanation
Description			
Status	OK		
Operating system	Microsoft Windows Server 2008 R2 Enterprise , Service Pack 1, v.721		
Virtualization software	Microsoft Hyper-V		
Virtualization software status	Up-to-date		
Virtual machines	AppServerVMNode1, AppServerVMNode2, Harsh_CommonUI, HCVMNODE, HistorianVMNode, InTouchVMNode, NLBNODE1, NLBNODE2, NLBNODE3		

This tab displays the status of the host and lists the virtual machines that are currently deployed on it.

- Ratings Explanation

Details		Rating Explanation	SAN Explanation
This host meets all of the requirements of this virtual machine.			

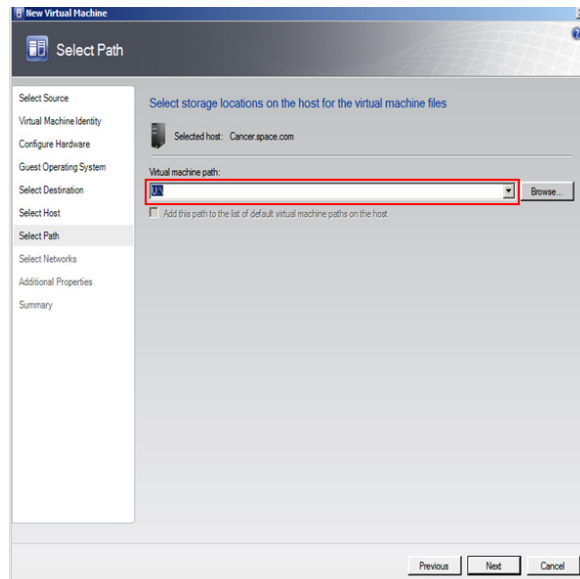
This tab lists the conditions that cause a host to receive a zero rating.

- SAN Explanation

Details		Rating Explanation	SAN Explanation
The server gemini.space.com does not contain any host bus adapter (HBA) ports. Fibre Channel SAN transfer cannot be used.			
The server gemini.space.com does not have the Microsoft iSCSI Initiator installed. iSCSI SAN transfer cannot be used.			
The server gemini.space.com does not have an HBA which supports NPIV.			

This tab lists the conditions that prevent a Storage Area Network (SAN) transfer used to move the virtual machine's files to the host.

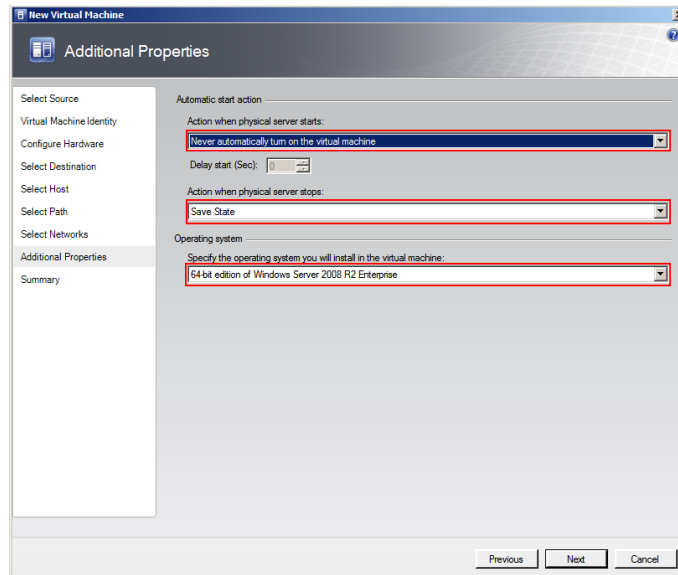
- e Click **Next**. The **Select Path** screen appears.



- 9 Select the storage location for the VM files.

In the **Select Path** screen, enter the path to store the VM files, and then click **Next**. The **Additional Properties** screen appears.

**Note:** This path refers to the drives that are free to allocate the host machine. One drive is allocated to one virtual machine. You can either type or click **Browse** to select the relevant path.



**10** Specify any additional properties of the VM.

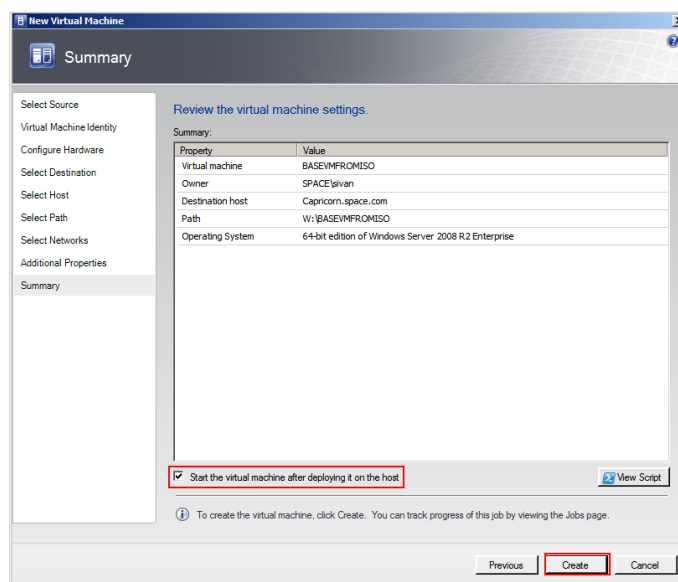
- a** In the **Action when physical server starts** list, click **Never automatically turn on the virtual machine**.
- b** In the **Action when physical server stops** list, click **Save State**.

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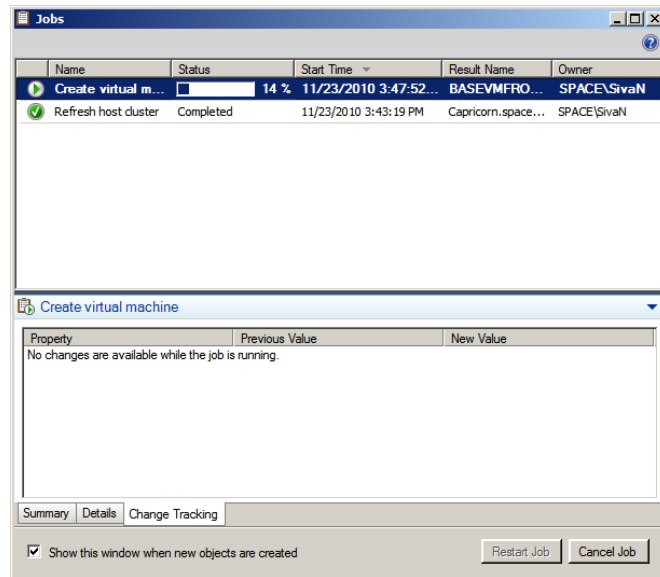
**Note:** You can configure the details as required.

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- c** From the **Specify the operating system you will install in the virtual machine** list, select the operating system based on the ISO selected, and then click **Next**. The **Summary** screen appears.

**11** Create the new VM.

Select the **Start the Virtual machine after deploying it on the host** check box if required, and then click **Create**. The virtual machine is created and the **Jobs** window appears.



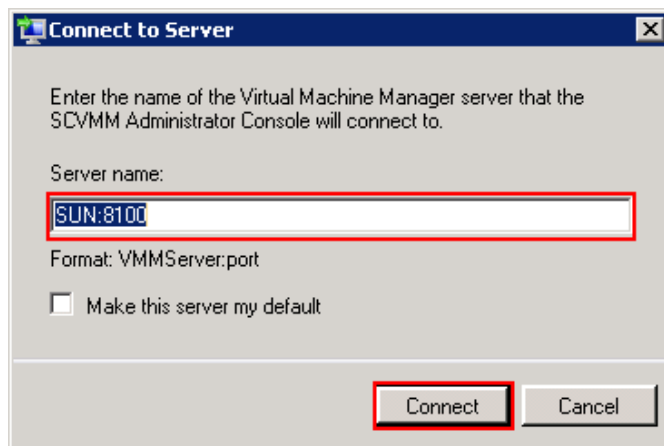
## 12 Verify the VM.

Verify if there are any errors logged. The completed status confirms that the VM has been created successfully.

## Creating a Virtual Image from Extracted ISO Available on CD or DVD

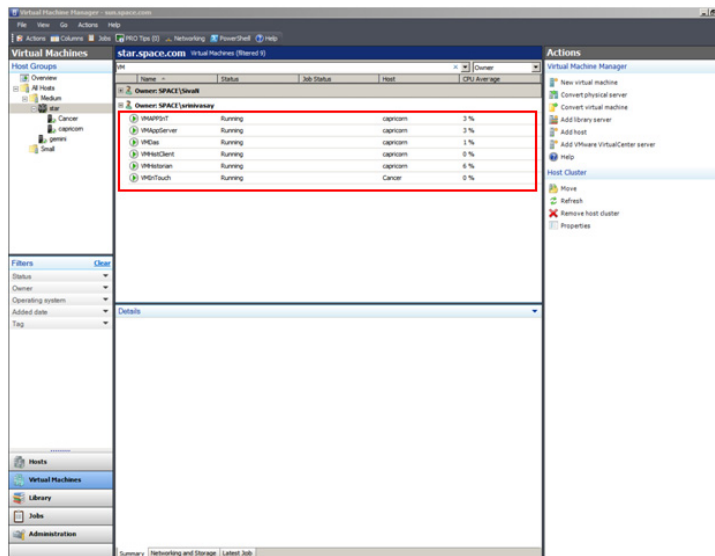
If you do not have an ISO file available on your network location you can use an ISO file available on a CD or DVD.

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



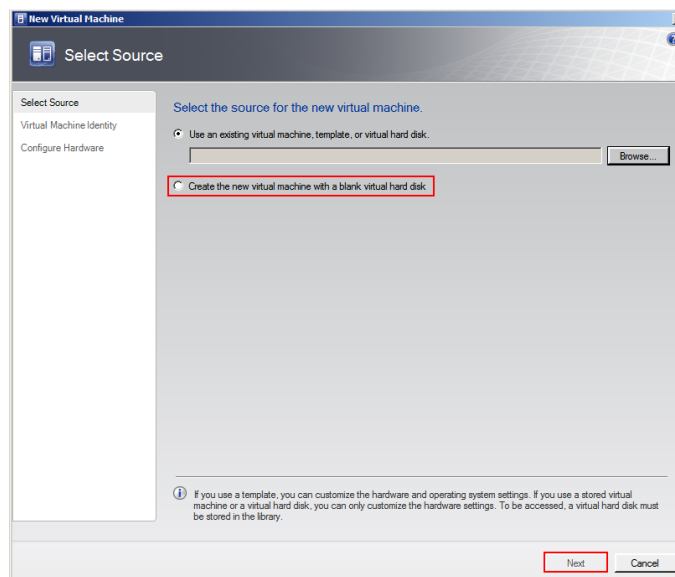
- b** In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it in the SCVMM server configuration, if required.



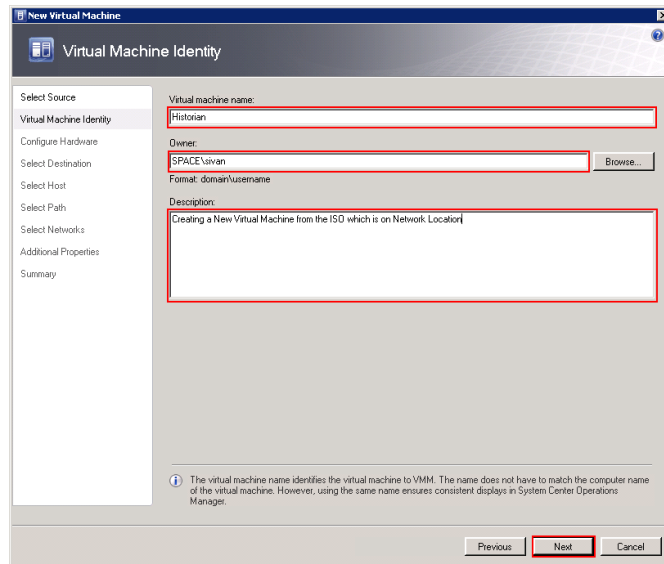
- 2** Open the **New Virtual Machine** window.

On the **Actions** menu of the **Virtual Machine Manager** window, point to **Virtual Machine Manager**, and then click **New Virtual Machine**. The **Select Source** screen on the **New Virtual Machine** window appears.



- 3 Select the source machine or hard disk you want to use for the new VM.

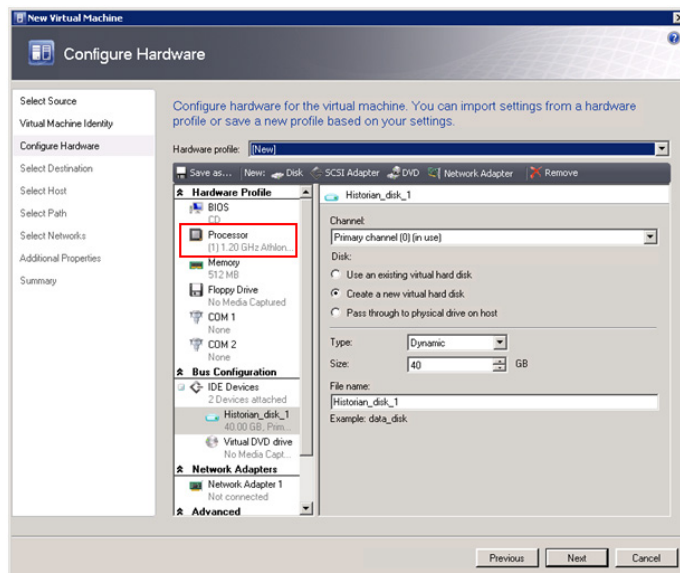
On the **Select Source** screen, click the **Create the new virtual machine with a blank virtual hard disk** option, and then click **Next**. The **Virtual Machine Identity** screen appears.



- 4 Enter the details of the new VM.

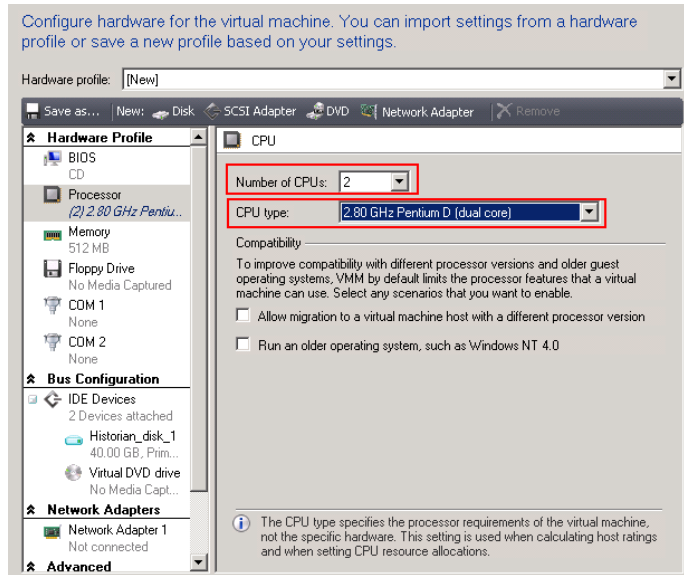
Enter the virtual machine name, owner name, and description name, and then click **Next**. The **Configure Hardware** screen appears.

**Note:** You can either type or click **Browse** to select the relevant owner name.

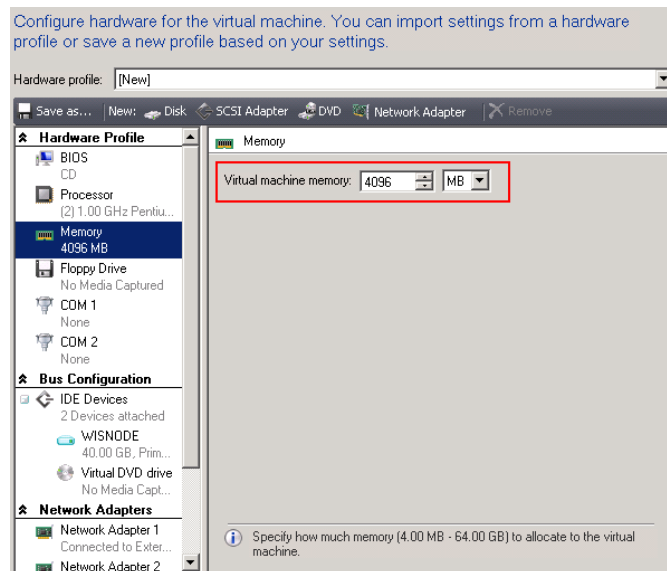




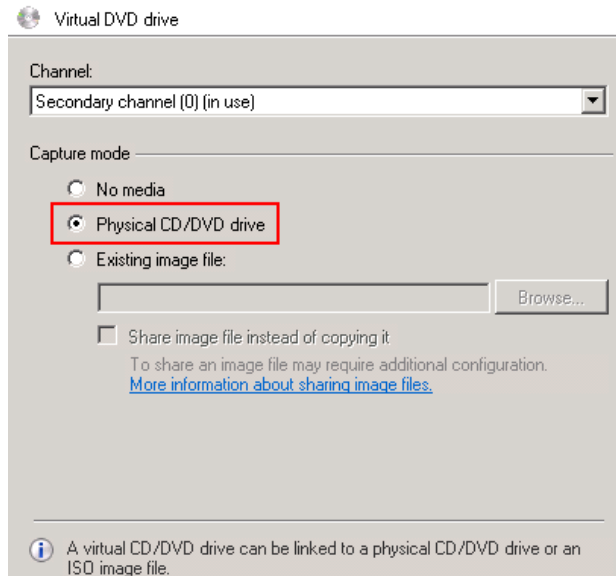
- 5 Enter the hardware details for the new VM.
  - a On the **Configure Hardware** screen, click **Processor**. The **CPU** area appears.



- b In the **Number of CPUs** and **CPU type** lists, click the relevant details, and then click **Memory**. The **Memory** area appears.

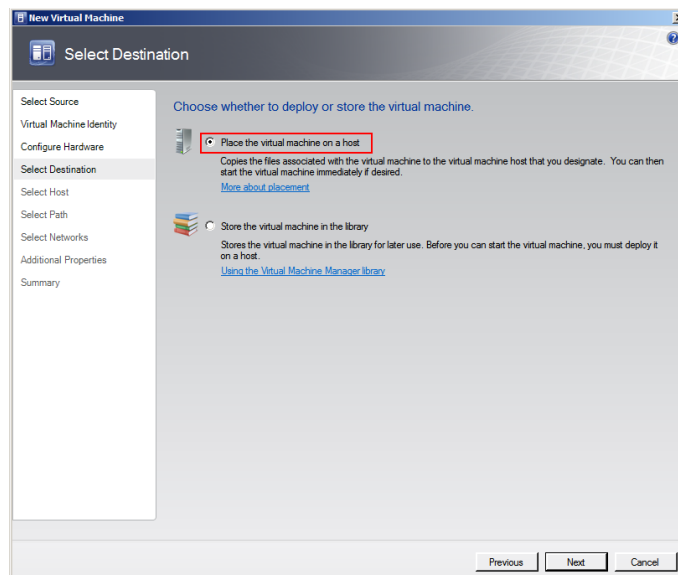


- c In the **Virtual machine memory** boxes, configure the memory to “4096 MB”. Under **Bus Configuration**, click **Virtual DVD drive**. The **Virtual DVD drive** area appears.

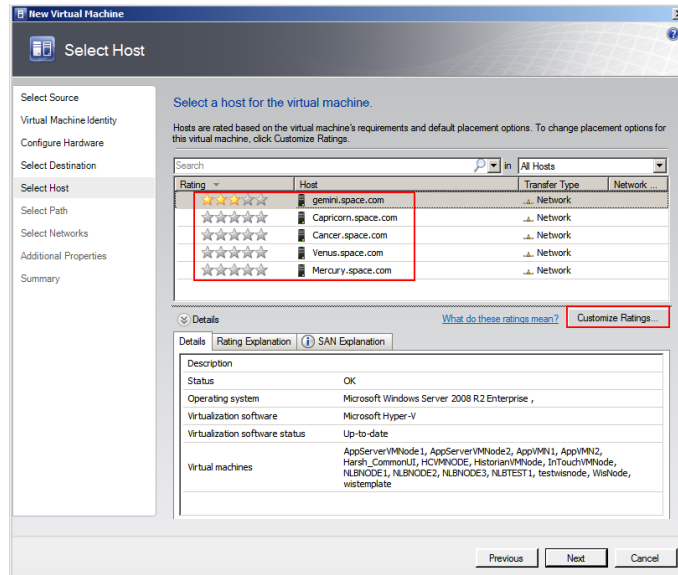


- d Click the **Physical CD/DVD drive** option, and then click **Next**. The **Select Destination** screen appears.

**Note:** You need to insert the bootable OS in the CD/DVD drive of the host server machine when you need to create the virtual machine.



- e Click the **Place the virtual machine on a host** option, and then click **Next**. The **Select Host** screen appears.

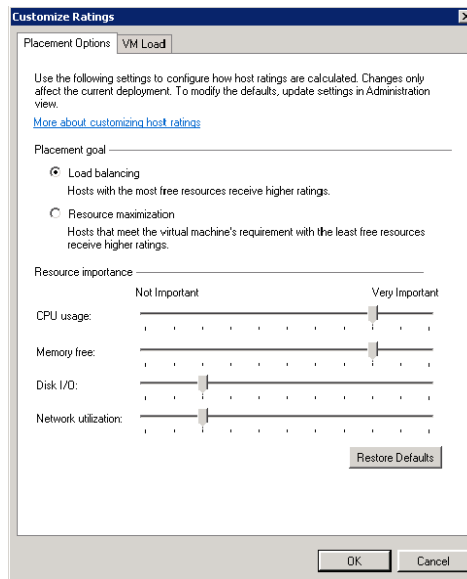


- 6 Select a host for the new VM.
- View the rating of each host.
  - Select a suitable host to deploy the VM.

**Note:** All hosts that are available for placement are given a rating of 0 to 5 stars based on their suitability to host the virtual machine. The ratings are based on the hardware, resource requirements, and expected resource usage of the virtual machine. The ratings are also based on placement settings that you can customize for the VMM or for individual virtual machine deployments. However, the ratings are recommendations. You can select any host that has the required disk space and memory available.

**Important:** In SCVMM 2008 R2, the host ratings that appear first are based on a preliminary evaluation by SCVMM. The ratings are for the hosts that run Windows Server 2008 R2 or ESX Server. Click a host to view the host rating based on a more thorough evaluation.

- c To view the placement settings used by the VMM to rate the hosts, click **Customize Ratings**. The **Customize Ratings** window appears.



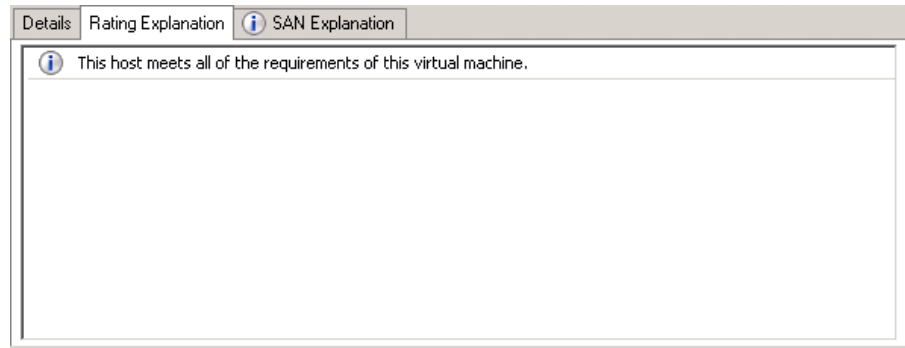
You can modify the settings if required.

- d To view additional information about a host rating, select the host and click the following tabs:
  - Details

Details	
Rating Explanation	SAN Explanation
Description	
Status	OK
Operating system	Microsoft Windows Server 2008 R2 Enterprise , Service Pack 1, v.721
Virtualization software	Microsoft Hyper-V
Virtualization software status	Up-to-date
Virtual machines	AppServerVMNode1, AppServerVMNode2, Harsh_CommonUI, HCVMNODE, HistorianVMNode, InTouchVMNode, NLBNODE1, NLBNODE2, NLBNODE3

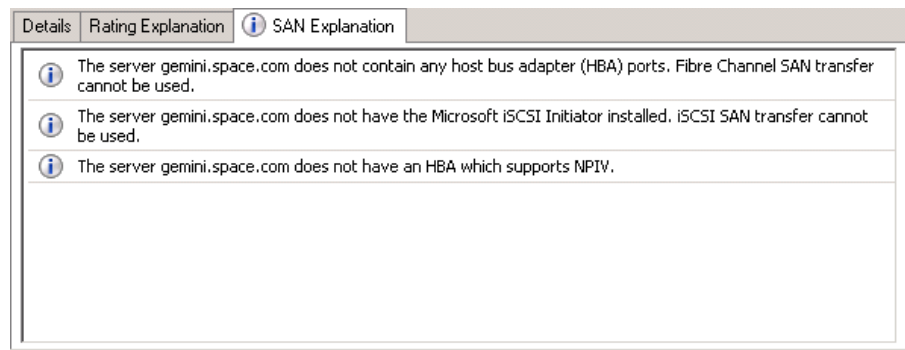
This tab displays the status of the host and lists the virtual machines that are currently deployed on it.

● Ratings Explanation



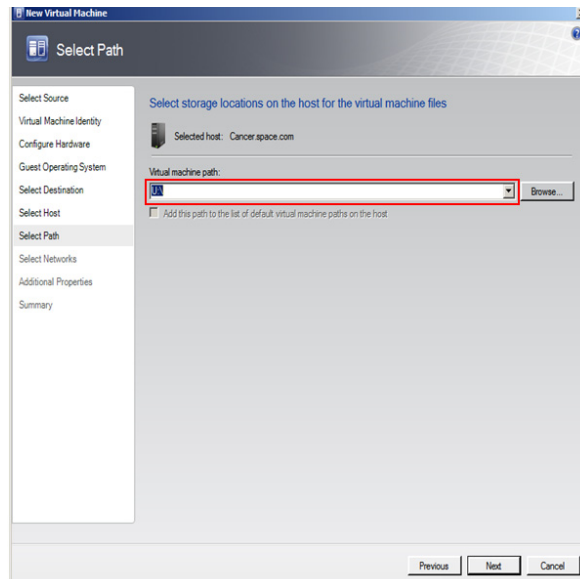
This tab lists the conditions that cause a host to receive a zero rating.

● SAN Explanation



This tab lists the conditions that prevent a Storage Area Network (SAN) transfer used to move the virtual machine's files to the host.

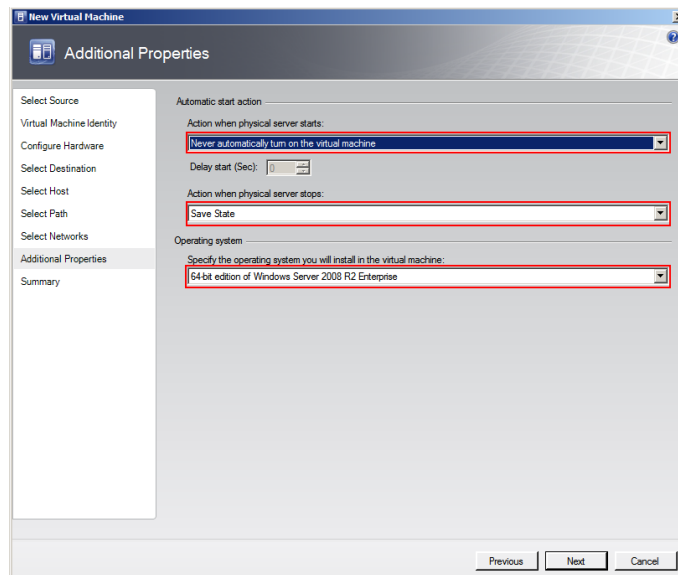
- e Click **Next**. The **Select Path** screen appears.



- 7 Select the storage location for the VM files.

On the **Select Path** screen, enter the path to store the VM files, and then click **Next**. The **Additional Properties** screen appears.

**Note:** This path refers to the drives which are free to allocate the host machine. One drive is allocated to one virtual machine. You can either type or click **Browse** to select the relevant path.



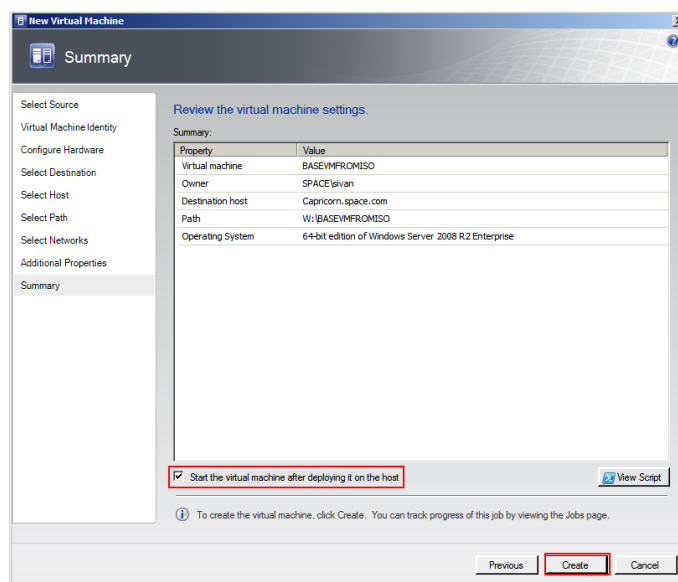
- 8 Specify any additional properties of the VM.
  - a In the **Action when physical server starts** list, click **Never automatically turn on the virtual machine**.
  - b In the **Action when physical server stops** list, click **Save State**.

---

**Note:** You can configure the details as required.

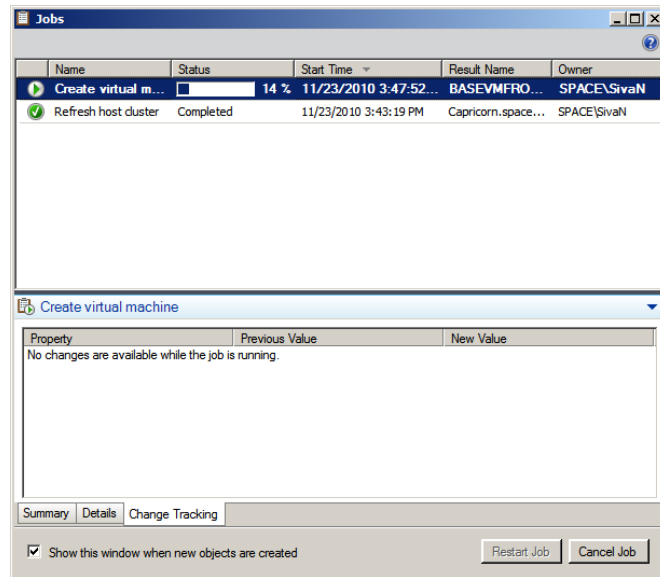
---

- c From the **Specify the operating system you will install in the virtual machine** list, select the operating system based on the ISO selected, and then click **Next**. The **Summary** screen appears.



- 9 Create the new VM.

Select the **Start the Virtual machine after deploying it on the host** check box if required, and then click **Create**. The virtual machine is created and the **Jobs** window appears.



### 10 Verify the VM.

Verify if there are any errors logged. The completed status confirms that the VM has been created successfully.

## Tips and Recommendations

Note the following points while creating a VM from an extracted ISO available on a CD or a DVD:

- 1 Insert the bootable OS CD/DVD in the CD/DVD drive of the host server machine.
- 2 Stop the virtual machine created.
- 3 Select **No Media** in the virtual machine properties in the Virtual Drive Area.

If you do not do these, you will get the following warning message:

Warning (12711)

“VMM cannot complete the WMI operation on server <server name> because of error: [MSCluster\_Resource.Name="SCVMM Historian DVD"] the group or resource is not in the correct state to perform the requested operation.

(The group or resource is not in the correct state to perform the requested operation (0x139F)”



# Preparing a Virtual Image from a Physical Machine

You can prepare a virtual image from a physical machine using the following:

- Disk2vhd
- System Center Virtual Machine Manager (SCVMM)

Disk2vhd helps you create Virtual Hard Disk (VHD) versions of physical disks that you can use in Microsoft Virtual PCs or Microsoft Hyper-V VMs. Disk2vhd also helps you create VHDs on local volumes, even ones being converted, although this is not recommended.

One of the advantages of using Disk2vhd is that you can run it on an online system. Disk2vhd uses Volume Snapshot capability, introduced in Windows XP, to create consistent point-in-time snapshots of the volumes you want to include in a conversion.

For more information on Disk2vhd, refer to <http://technet.microsoft.com/en-us/sysinternals/ee656415.aspx>.

System Center Virtual Machine Manager (SCVMM) allows you to convert an existing physical computer into a VM. During a physical-to-virtual machine conversion (P2V conversion), images of the hard disks on the physical computer are created and formatted as virtual hard disks. These images are used in the new virtual machine. The new virtual machine has the same computer identity as the source machine. SCVMM provides a conversion wizard that automates most of the conversion process.

The following sections describe how to create a virtual image from a physical machine using SCVMM.

You can create a VM from either an online or an offline source machine.

During the creation of a VM from a source machine, SCVMM temporarily installs an agent on the source computer that you want to convert.

For an online P2V conversion, SCVMM uses Volume Shadow Copy Service (VSS) to copy data while the server continues to work with user requests. The source computer is not restarted during the conversion.

For an offline P2V conversion, the source computer restarts into the Windows Pre-installation Environment (Windows PE) before SCVMM converts the physical disks to VHDs.

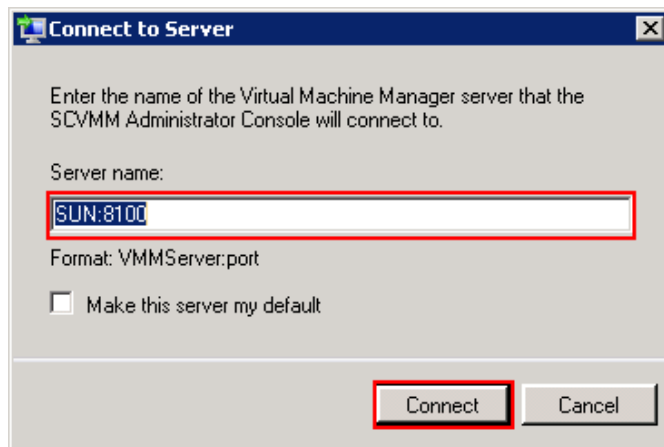
## Creating a Virtual Image from a Physical Machine - Online Conversion

You can create a virtual machine from a physical machine in the online mode. This means the source machine continues to function normally during the conversion. The Virtual Machine Manager creates a copy of local New Technology File System (NTFS) volumes and data of VSS-aware applications. The VSS ensures that data is backed up consistently while the source machine continues to work with user requests. The VMM uses the read-only checkpoint to create a VHD.

**Note:** Since SCVMM uses HTTP and WMI services, ensure that WMI service is running and a firewall is not blocking HTTP and WMI traffic at the source machine.

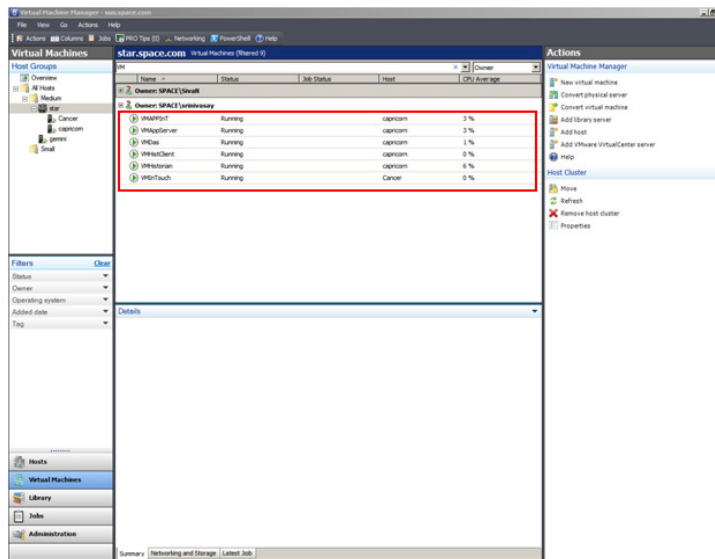
### To create a virtual image from an online physical machine

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



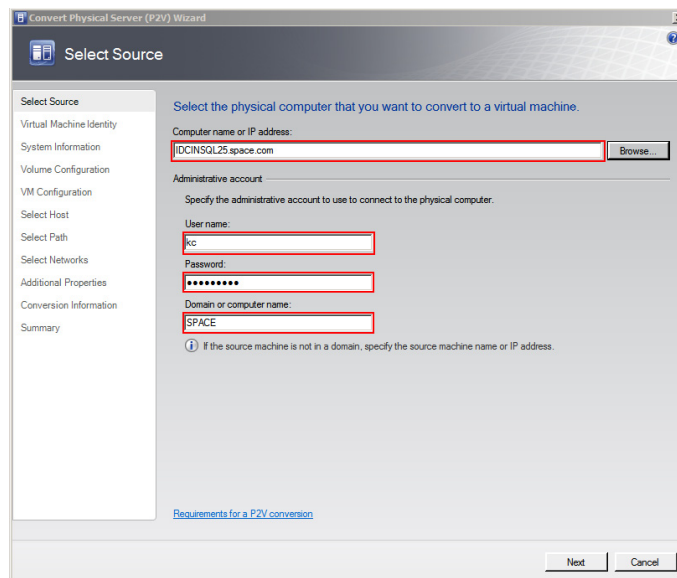
- b In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it in the SCVMM server configuration, if required.



2 Open the **Convert Physical Server (P2V) Wizard** window.

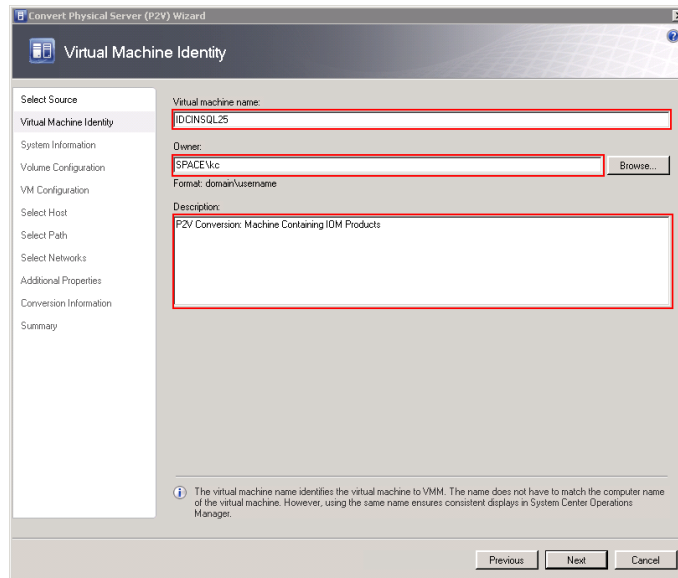
On the **Actions** menu of the **Virtual Machine Manager** window, point to **Virtual Machine Manager**, and then click **Convert Physical Server**. The **Select Source** screen in the **Convert Physical Server (P2V) Wizard** window appears.



### 3 Enter the source machine details.

On the **Select Source** screen, enter the computer name or IP address, user name, password, and the domain name, and then click **Next**. The **Virtual Machine Identity** screen appears.

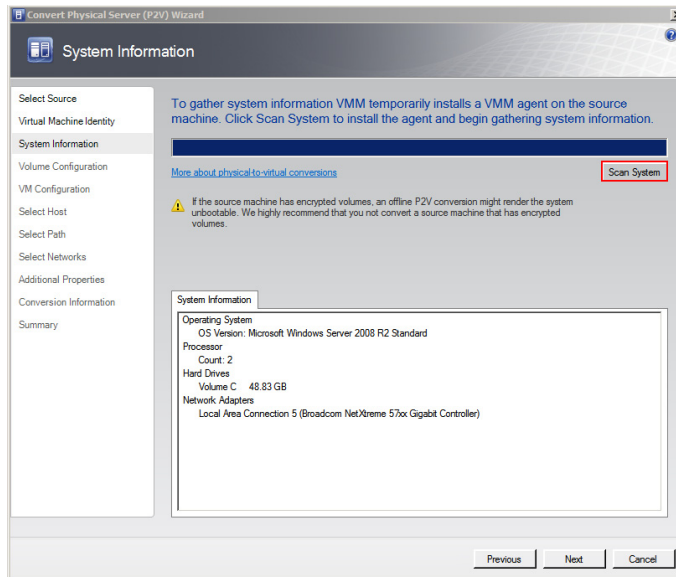
**Note:** You can either type the computer name or click **Browse** to select the required computer name.



### 4 Enter the virtual machine details.

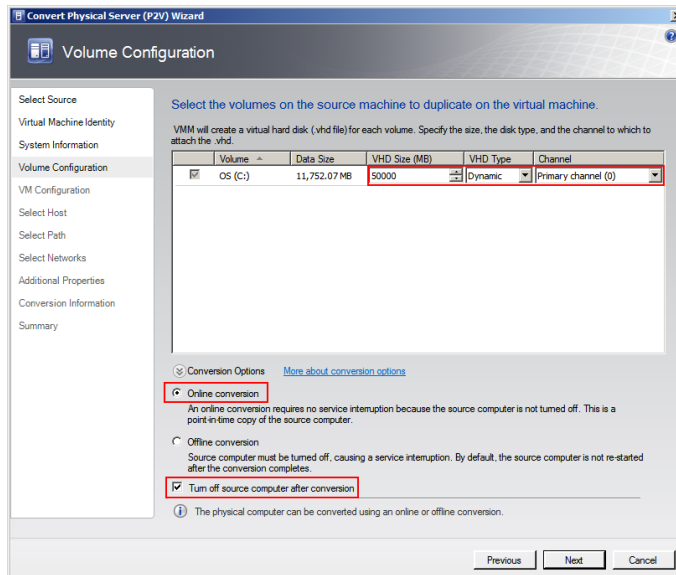
Enter the virtual machine name, owner name, and description name, and then click **Next**. The **System Information** screen appears.

**Note:** You can either type or click **Browse** to select the relevant owner name.

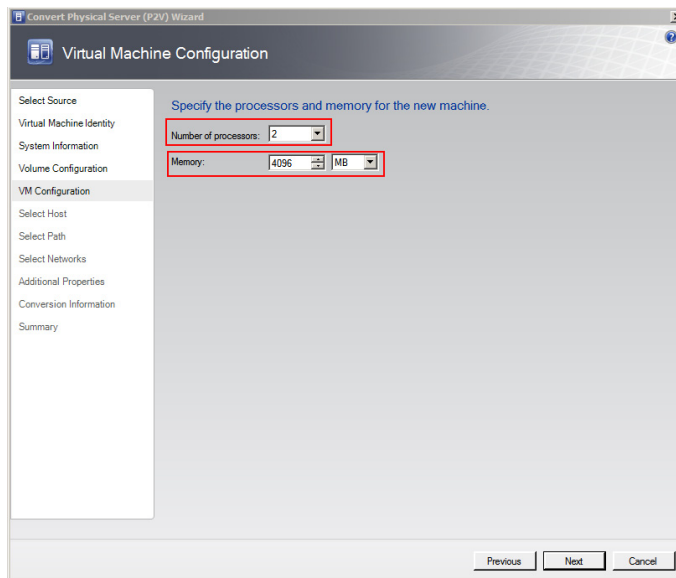


**5** Install an agent in the source machine.

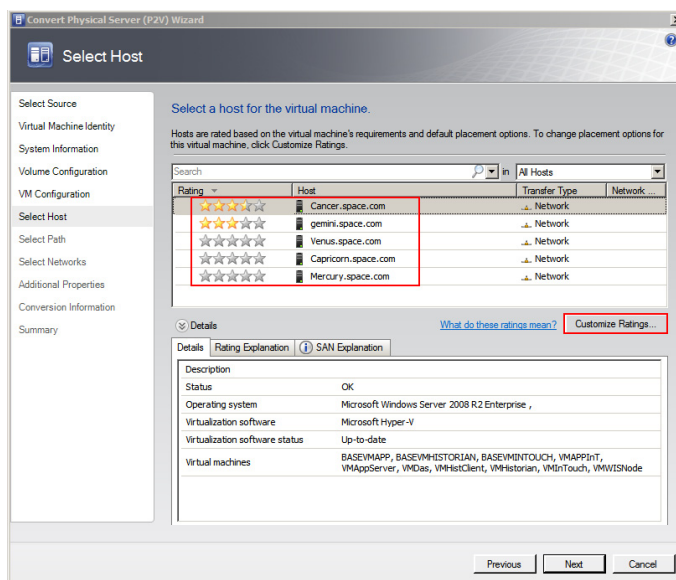
Click **Scan System** to install the agent in the source machine, and then click **Next**. The **Volume Configuration** screen appears.



- 6 Configure the volume for the new VM.
  - a Select the relevant VHD size, VHD type, and channel.
  - b Click the **Online conversion** option.
  - c Select the **Turn Off source computer after conversion** check box, and then click **Next**. The **Virtual Machine Configuration** screen appears.



- 7 Specify the number of processors and memory for the new VM. Select the required figures from the **Number of processors** and **Memory** boxes, and then click **Next**. The **Select Host** screen appears.



- 8 Select a host for the new VM.
  - a View the rating of each host.
  - b Select a suitable host to deploy the VM.

---

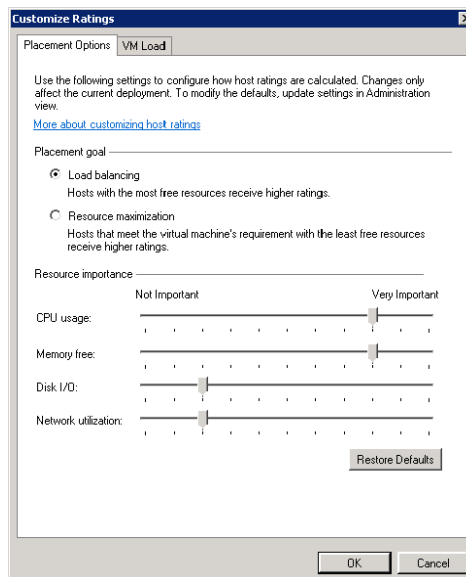
**Note:** All hosts that are available for placement are given a rating of 0 to 5 stars based on their suitability to host the virtual machine. The ratings are based on the hardware, resource requirements, and expected resource usage of the virtual machine. The ratings are also based on placement settings that you can customize for the VMM or for individual virtual machine deployments. However, the ratings are recommendations. You can select any host that has the required disk space and memory available.

---

**Important:** In SCVMM 2008 R2, the host ratings that appear first are based on a preliminary evaluation by SCVMM. The ratings are for the hosts that run Windows Server 2008 R2 or ESX Server. Click a host to view the host rating based on a more thorough evaluation.


---

- c To view the placement settings used by the VMM to rate the hosts, click **Customize Ratings**. The **Customize Ratings** window appears.





You can modify the settings if required.

- d** To view additional information about a host rating, select the host and click the following tabs:
- Details

Details		Rating Explanation	 SAN Explanation
Description			
Status	OK		
Operating system	Microsoft Windows Server 2008 R2 Enterprise , Service Pack 1, v.721		
Virtualization software	Microsoft Hyper-V		
Virtualization software status	Up-to-date		
Virtual machines	AppServerVMNode1, AppServerVMNode2, Harsh_CommonUI, HCVMMODE, HistorianVMNode, InTouchVMNode, NLBNODE1, NLBNODE2, NLBNODE3		





This tab displays the status of the host and lists the virtual machines that are currently deployed on it.

- Ratings Explanation

Details		Rating Explanation	 SAN Explanation
 This host meets all of the requirements of this virtual machine.			

This tab lists the conditions that cause a host to receive a zero rating.

- SAN Explanation

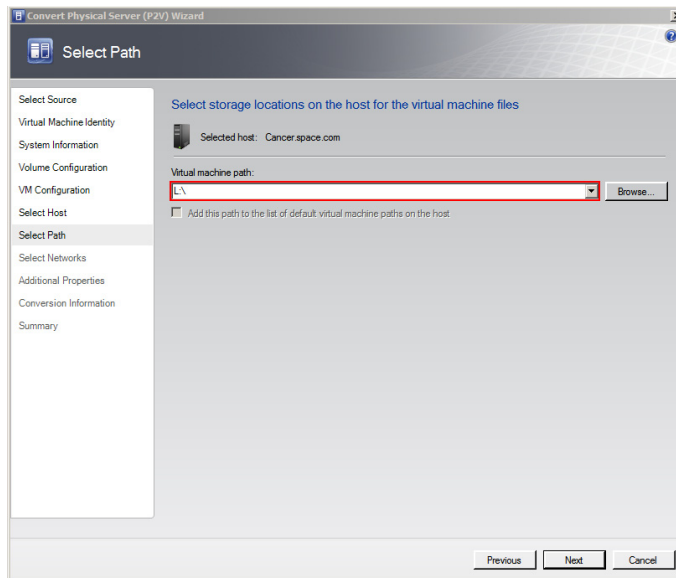
Details		Rating Explanation	 SAN Explanation
 The server gemini.space.com does not contain any host bus adapter (HBA) ports. Fibre Channel SAN transfer cannot be used.			
 The server gemini.space.com does not have the Microsoft iSCSI Initiator installed. iSCSI SAN transfer cannot be used.			
 The server gemini.space.com does not have an HBA which supports NPIV.			

This tab lists the conditions that prevent a Storage Area Network (SAN) transfer used to move the virtual machine's files to the host.



- e Click **Next**. The **Select Path** screen appears.

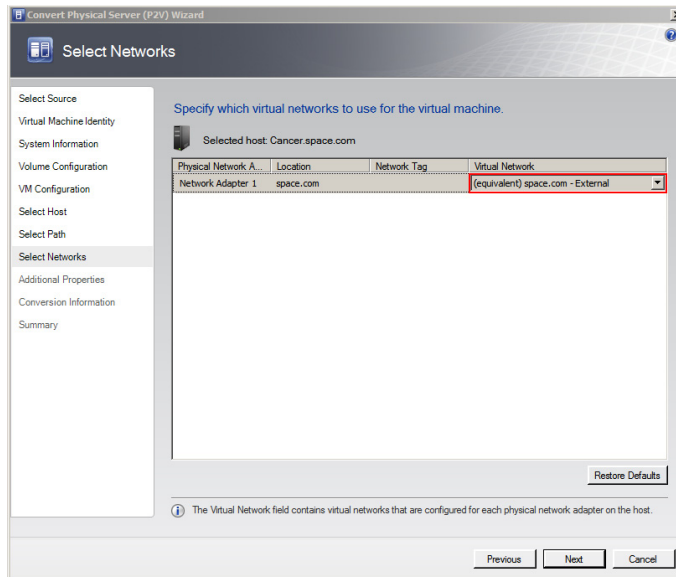
**Note:** If no host in the list has sufficient disk space to host the new virtual machine, click **Previous** to return to the **Volume Configuration** screen and reduce the size of one or more volumes. You can also override the default placement options that VMM uses to calculate the host ratings. Any changes that you make apply only for the virtual machine that you are deploying.



- 9 Select the storage location for the VM files.

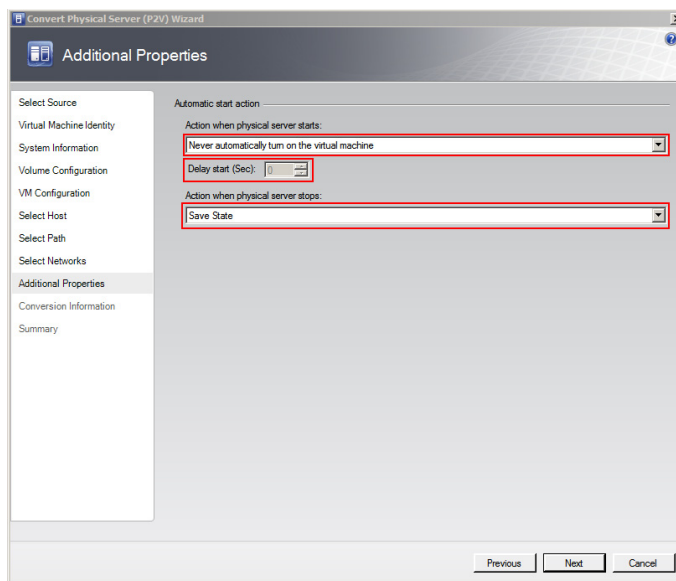
On the **Select Path** screen, enter the virtual machine path, and then click **Next**. The **Select Networks** screen appears.

**Note:** This path refers to the drives that are free to allocate the host machine. One drive is allocated to one virtual path machine. You can either type or click **Browse** to select the relevant path.



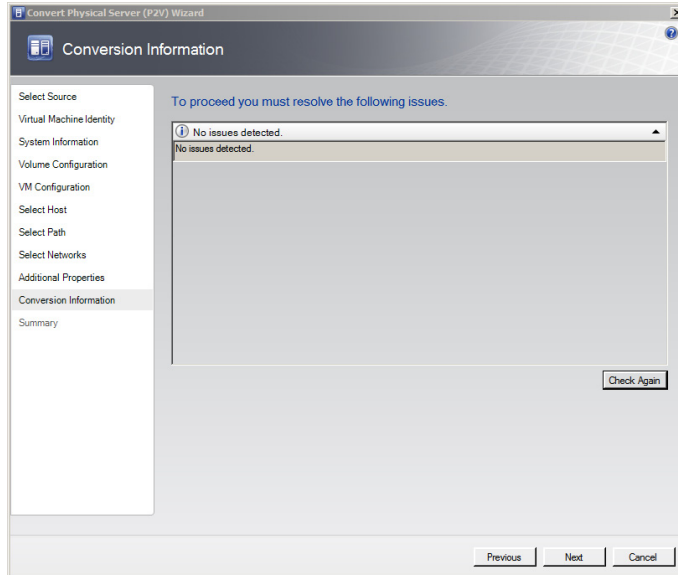
**10** Select the network to be used for the new VM.

In the **Virtual Network** list, click the virtual network you want to use for the virtual machine, and then click **Next**. The **Additional Properties** window appears.

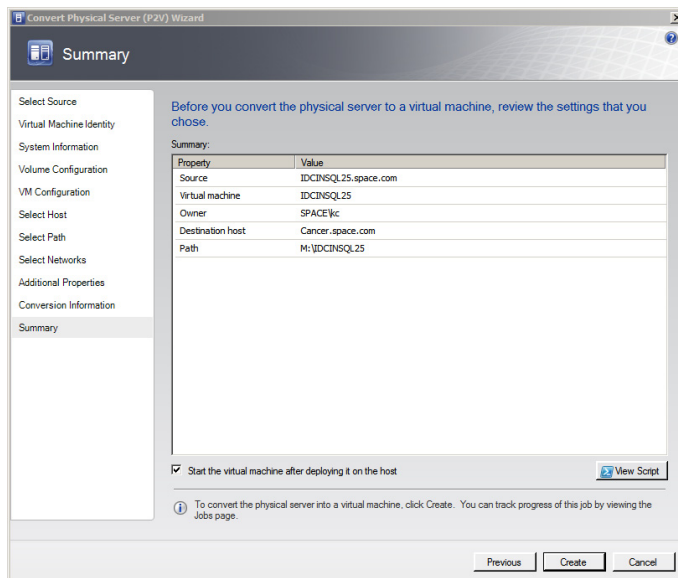


- Specify the actions you want the VM to perform when the physical server starts or stops.

Select the actions as required, and then click **Next**. The **Conversion Information** screen appears.



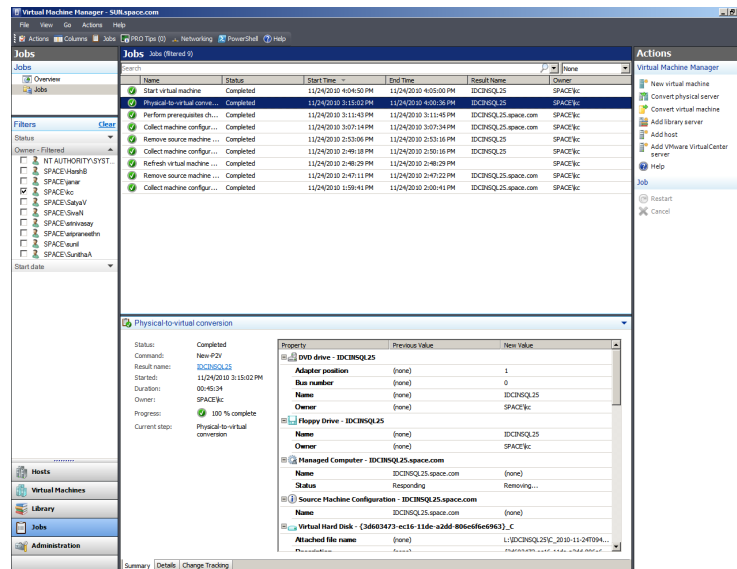
- Verify if there are any issues with the conversion, and then click **Next**. The **Summary** screen appears.



- Create the VM.

View the settings that you have selected for the virtual machine, and then click **Create**. The virtual machine is created and the conversion details are displayed in the **Virtual Machine Manager** window.

**Note:** It takes about 45 minutes to convert to a virtual machine.



The **Virtual Machine Manager** window displays the VM conversion details.

## Observation

When you create a VM from a physical machine in the online mode, all of the data on the physical machine is not saved in the VM. This happens if an IOM product is installed in the physical machine, for example Historian, which acquires data from a remote SF-enabled Application Server.

Since the physical machine operates during the conversion, any data change that happens during the conversion is stored in the physical machine, but not saved in the VM. The state of the created VM is same as the source machine at the time the conversion is initiated. Hence, any data change that takes place during the conversion is not saved in the VM.

## Creating a Virtual Image from a Physical Machine - Offline Conversion

When you create a VM from a physical machine in the offline mode, the source machine restarts in the Windows Pre-installation Environment (Windows PE). SCVMM then clones the disk volume of the source machine to a VHD, and restarts the source machine.

Creating a VM in the offline mode ensures data consistency and is the only method that can be used for Windows 2000 conversion. It is the recommended method to migrate File Allocation Table (FAT) volumes and convert domain controllers.

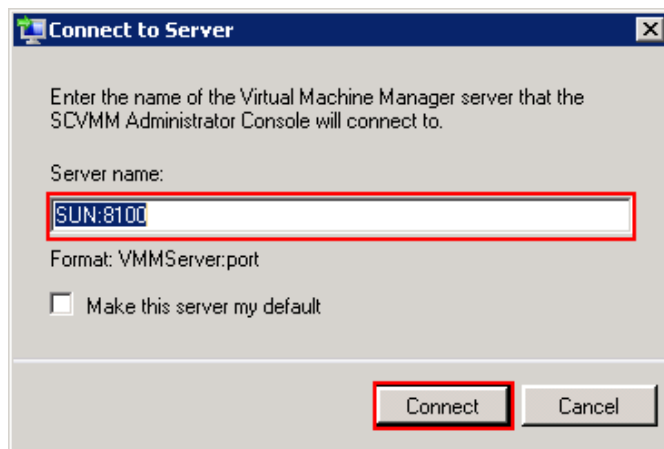
For more information on Windows PE, refer to [http://technet.microsoft.com/en-us/library/cc766093\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc766093(WS.10).aspx).

### Prerequisites for a source machine during an offline P2V conversion

- The source computer must have at least 512 MB of RAM.
- The source computer cannot be in a perimeter network. A perimeter network or a screened subnet is a collection of devices. Subnets are placed between an intranet and the Internet to help protect the intranet from unauthorized Internet users. The source computer for a P2V conversion can be in any other network topology in which the VMM server can connect to the source machine to temporarily install an agent. The VMM server can also make Windows Management Instrumentation (WMI) calls to the source computer.

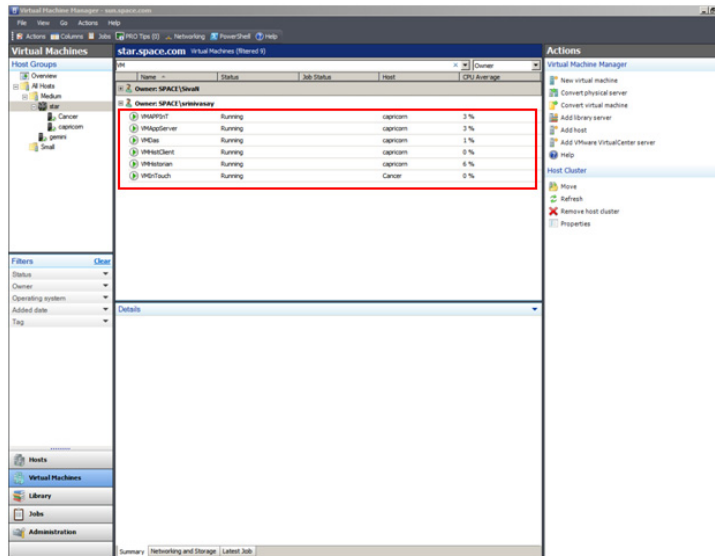
### To create a virtual image from an offline physical machine

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



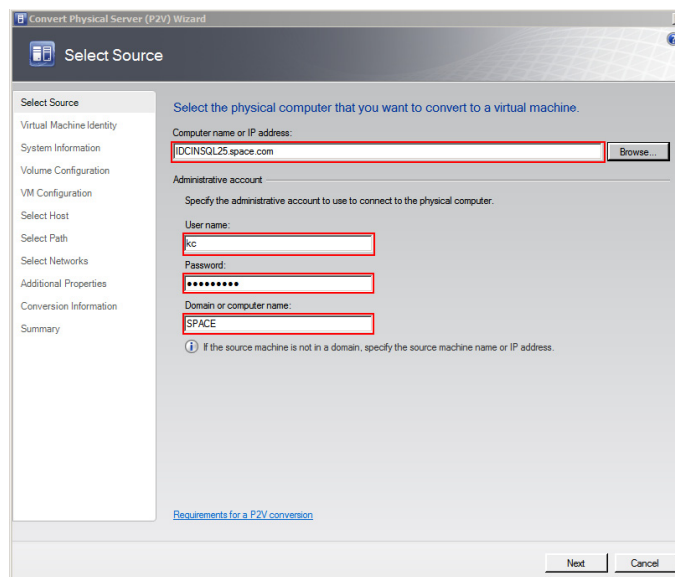
- b** In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it in the SCVMM server configuration, if required.



- 2** Open the **Convert Physical Server (P2V) Wizard** window.

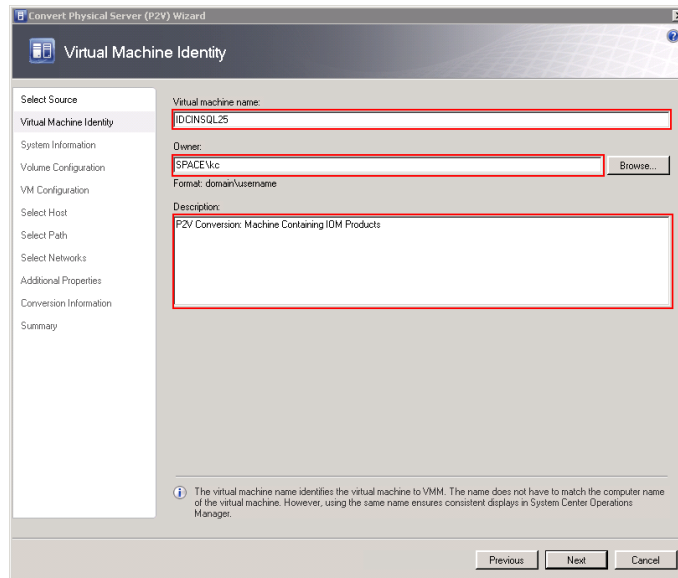
On the **ACTIONS** menu of the **Virtual Machine Manager** window, point to **Virtual Machine Manager**, and then click **Convert Physical Server**. The **Select Source** screen in the **Convert Physical Server (P2V) Wizard** window appears.



### 3 Enter the source machine details.

On the **Select Source** screen, enter the computer name or IP address, user name, password, and the domain name, and then click **Next**. The **Virtual Machine Identity** screen appears.

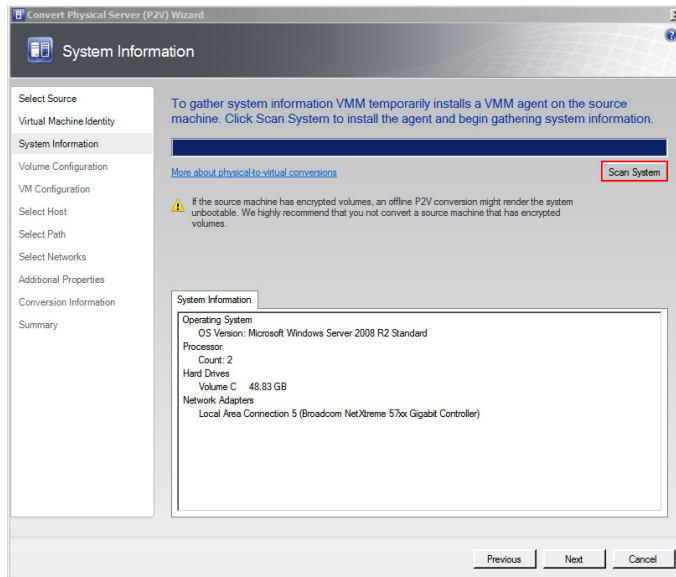
**Note:** You can either type the computer name or click **Browse** to select the required computer name.



### 4 Enter the virtual machine details.

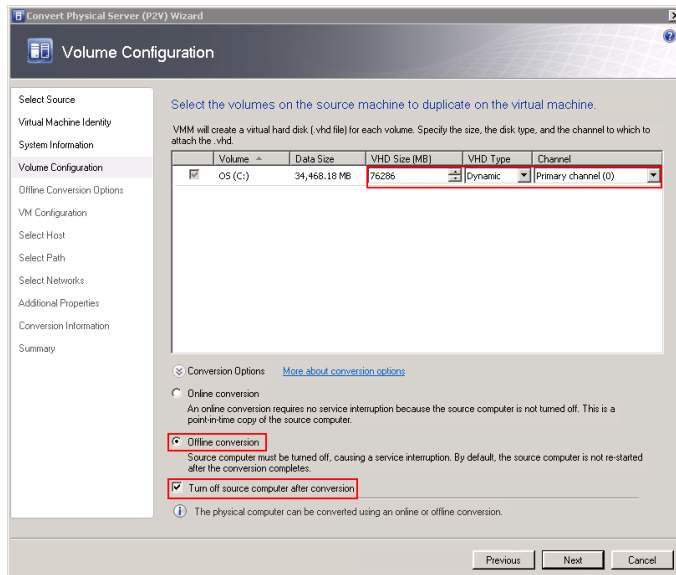
Enter the virtual machine name, owner name, and description name, and then click **Next**. The **System Information** screen appears.

**Note:** You can either type or click **Browse** to select the relevant owner name.



**5** Install an agent in the source machine.

Click **Scan System** to install the agent in the source machine, and then click **Next**. The **Volume Configuration** screen appears.

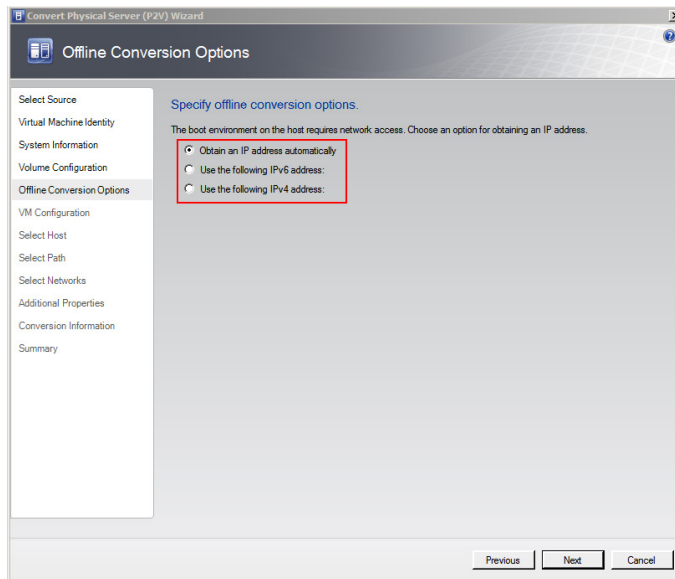


**6** Configure the volume for the new VM.

- a** Select the relevant VHD size, VHD type, and channel.
- b** Click the **Offline conversion** option.

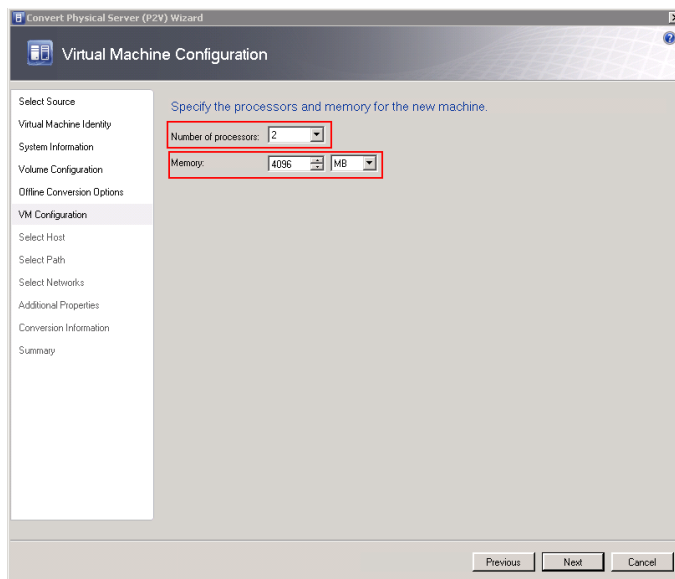


- c Select the **Turn Off source computer after conversion** check box, and then click **Next**. The **Offline Conversion Options** screen appears.

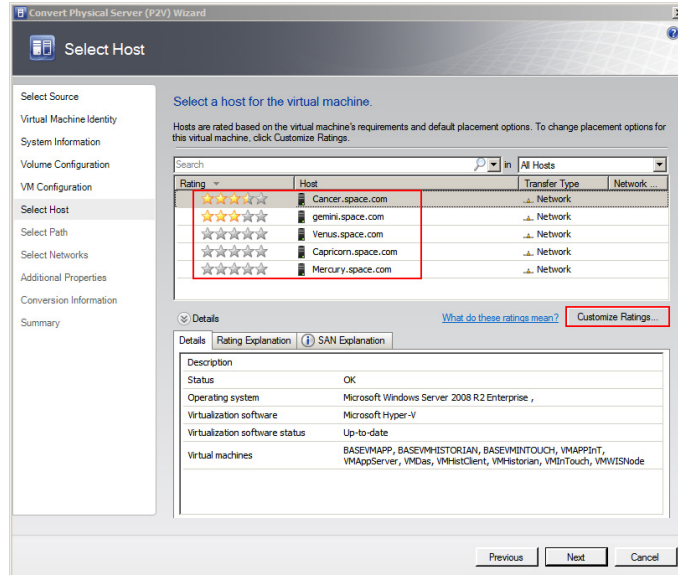


- 7 Select an IP address for offline conversion.

Click the required option to obtain an IP address for the offline conversion, and then click **Next**. The **Virtual Machine Configuration** window appears.



- 8 Specify the number of processors and memory for the new VM. Select the required figures from the **Number of processors** and **Memory** boxes, and then click **Next**. The **Select Host** screen appears.

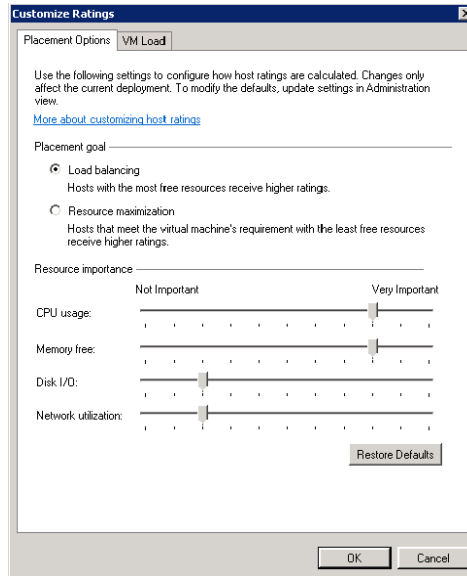


- 9 Select a host for the new VM.
- View the rating of each host.
  - Select a suitable host to deploy the VM.

**Note:** All hosts that are available for placement are given a rating of 0 to 5 stars based on their suitability to host the virtual machine. The ratings are based on the hardware, resource requirements, and expected resource usage of the virtual machine. The ratings are also based on placement settings that you can customize for the VMM or for individual virtual machine deployments. However, the ratings are recommendations. You can select any host that has the required disk space and memory available.

**Important:** In SCVMM 2008 R2, the host ratings that appear first are based on a preliminary evaluation by SCVMM. The ratings are for the hosts that run Windows Server 2008 R2 or ESX Server. Click a host to view the host rating based on a more thorough evaluation.

- c To view the placement settings used by the VMM to rate the hosts, click **Customize Ratings**. The **Customize Ratings** window appears.



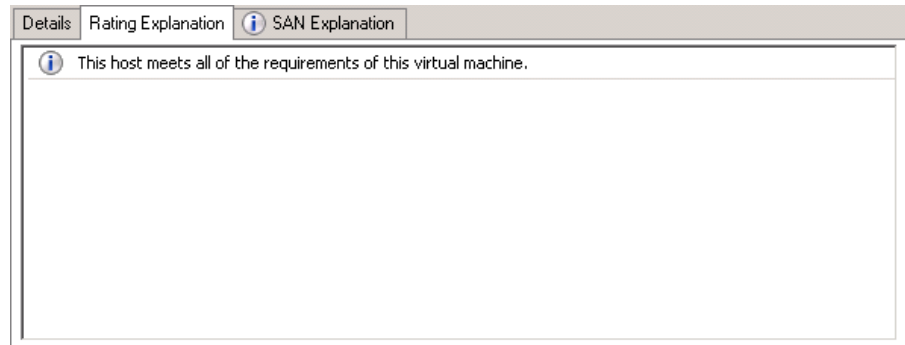
You can modify the settings if required.

- d To view additional information about a host rating, select the host and click the following tabs:
  - Details

Details	
Rating Explanation	SAN Explanation
Description	
Status	OK
Operating system	Microsoft Windows Server 2008 R2 Enterprise , Service Pack 1, v.721
Virtualization software	Microsoft Hyper-V
Virtualization software status	Up-to-date
Virtual machines	AppServerVMNode1, AppServerVMNode2, Harsh_CommonUI, HCVMNODE, HistorianVMNode, InTouchVMNode, NLBNODE1, NLBNODE2, NLBNODE3

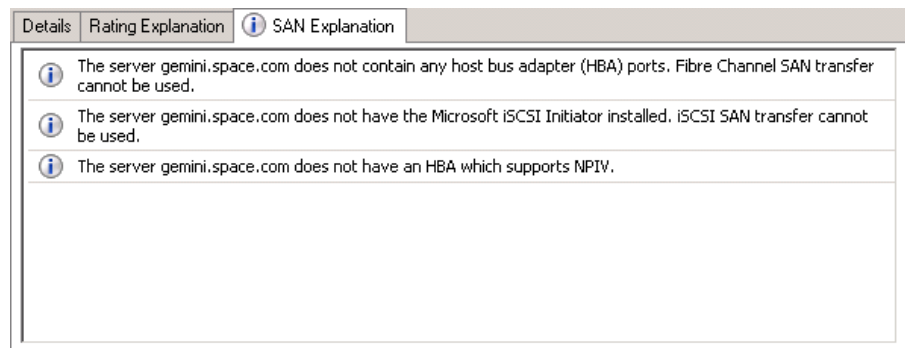
This tab displays the status of the host and lists the virtual machines that are currently deployed on it.

- Ratings Explanation



This tab lists the conditions that cause a host to receive a zero rating.

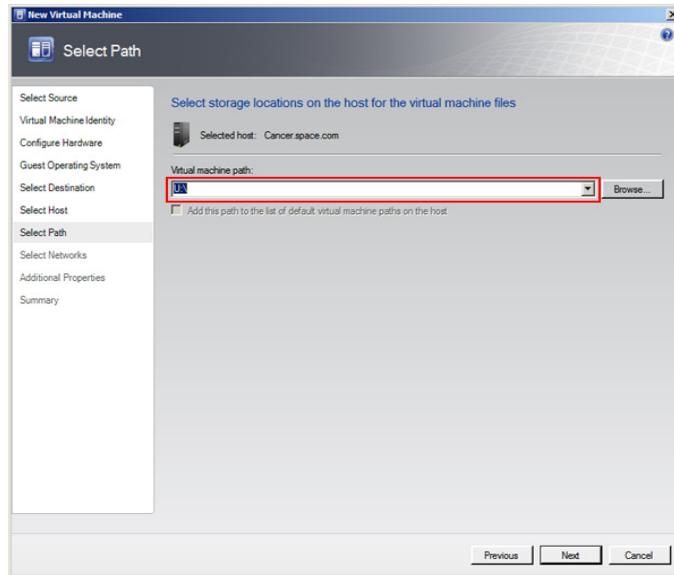
- SAN Explanation



This tab lists the conditions that prevent a Storage Area Network (SAN) transfer used to move the virtual machine's files to the host.

- e Click **Next**. The **Select Path** screen appears.

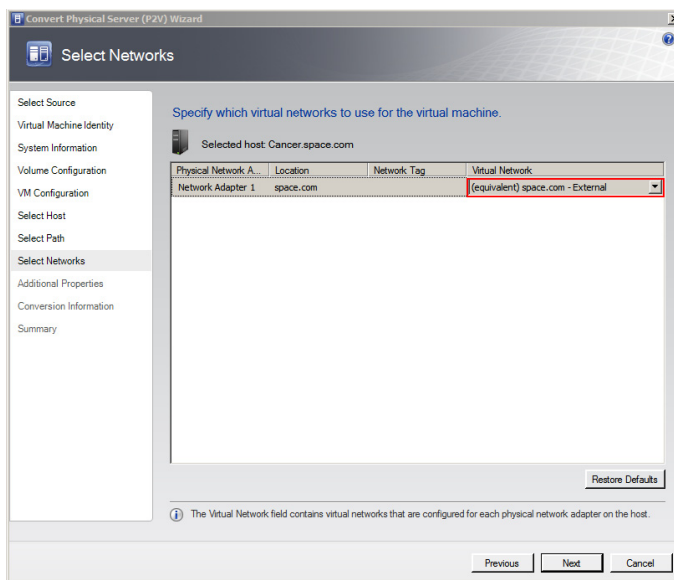
**Note:** If no host in the list has sufficient disk space to host the new virtual machine, click **Previous** to return to the **Volume Configuration** screen and reduce the size of one or more volumes. You can also override the default placement options that VMM uses to calculate the host ratings. Any changes that you make apply only for the virtual machine that you are deploying.



**10** Select the storage location for the VM files.

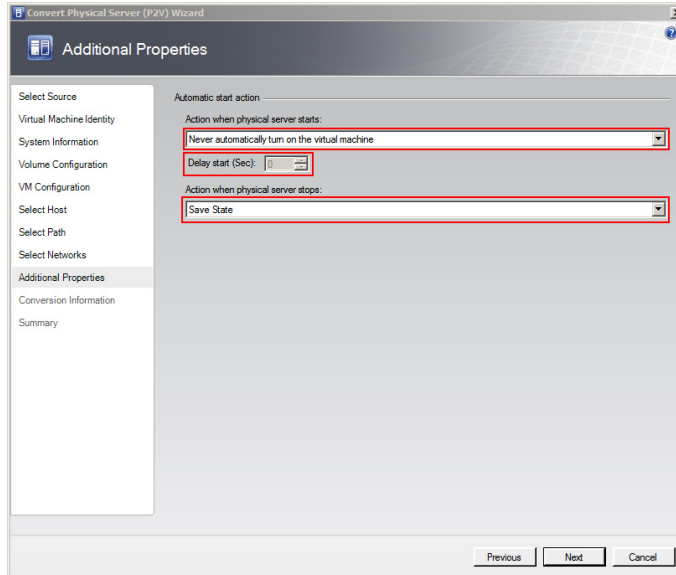
On the **Select Path** screen, enter the virtual machine path, and then click **Next**. The **Select Networks** screen appears.

**Note:** This path refers to the drives that are free to allocate the host machine. One drive is allocated to one virtual machine. You can either type or click **Browse** to select the relevant path.

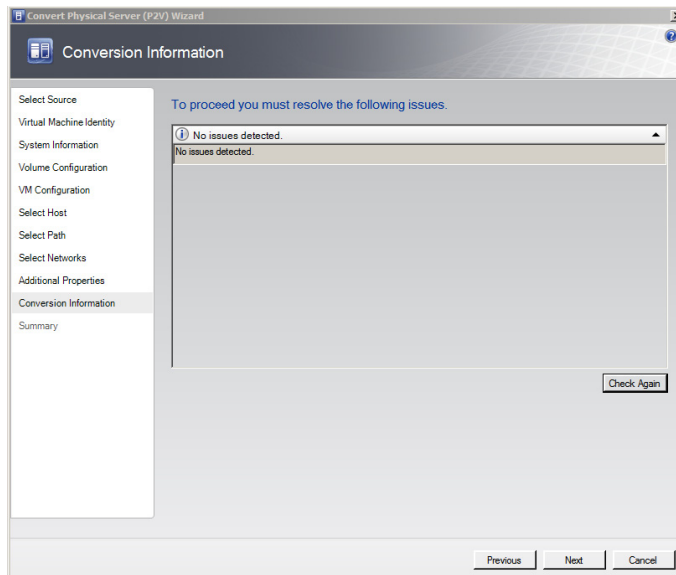


**11** Select the network to be used for the new VM.

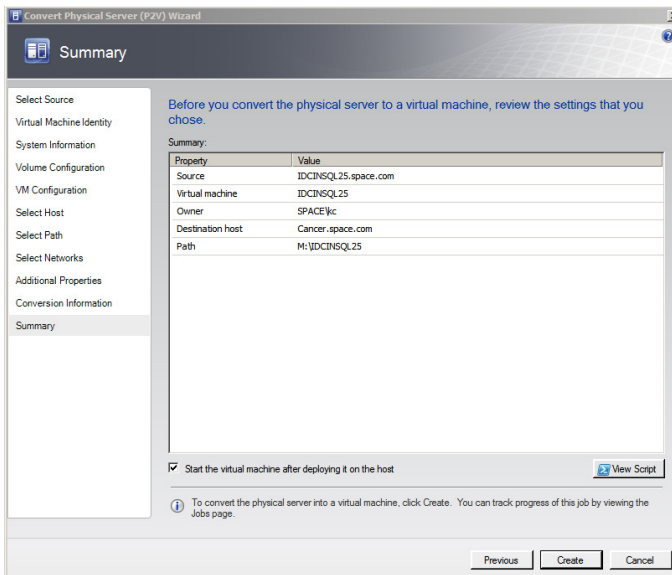
In the **Virtual Network** list, click the virtual network you want to use for the virtual machine, and then click **Next**. The **Additional Properties** window appears.

**12** Specify the actions you want the VM to perform when the physical server starts or stops.

Select the actions as required, and then click **Next**. The **Conversion Information** screen appears.



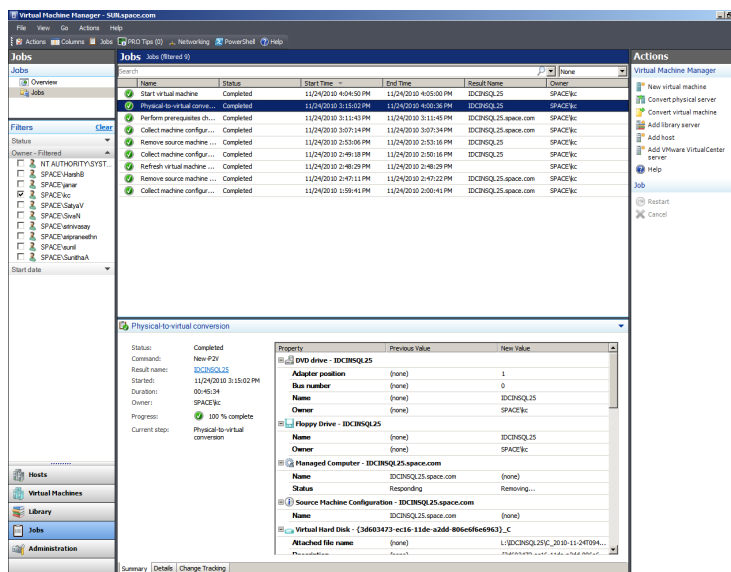
**13** Verify if there are any issues with the conversion, and then click **Next**. The **Summary** screen appears.



**14** Create the VM.

View the settings that you have selected for the virtual machine, and then click **Create**. The virtual machine is created and the conversion details are displayed in the **Virtual Machine Manager** window.

**Note:** It takes about 45 minutes to convert to a virtual machine.



The **Virtual Machine Manager** window displays the VM conversion details.

## Observation

When you create a VM from a physical machine in the offline mode, and if an IOM product is installed in the physical machine, for example Historian, which acquires data from a remote Application Server that is SF-enabled, select the **Turn off source computer after conversion** check box. This helps save all data in the created VM.

**Note:** If you do not select the **Turn off source computer after conversion** check box, all data changes that take place during the conversion is saved in the source machine.

When the physical machine is in the offline mode during the conversion and the Application Server is in the SF mode, the SF data is forwarded to the VM after it is created.

## Tips and Recommendations

Category	Recommendation
Hardware	<ul style="list-style-type: none"> <li>● Ensure that the hardware is compatible for conversion before converting it to a virtual machine.</li> <li>● You cannot transfer a bad sector on a disk during a conversion.</li> </ul>
Virtual Machine Manager	<ul style="list-style-type: none"> <li>● During conversion, SCVMM installs Virtual Machine Manager Agent in the source machine, and this agent takes care of all automation processes. After conversion of the source machine to a VM, the SCVMM server sometimes cannot remove this agent automatically from the physical machine. In such situations, you need to uninstall the agent (SCVMM agent) manually from the physical machine (Go to <b>Control Panel</b> and click <b>Add Remove Programs</b>).</li> <li>● Since Virtual Machine Manager uses HTTP and WMI service, ensure that WMI service is running and a firewall is not blocking HTTP and WMI traffic at the source machine.</li> </ul>



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<b>Category</b>	<b>Recommendation</b>
Network	If the source machine communicates with other machines remotely, you can create a VM from an offline machine as SF data stored at remote machines will be forwarded to the newly-created VM.
VMware	Before you convert a VMware virtual machine to a Hyper-V or Virtual Server virtual machine, you must uninstall VMware tools on the guest operating system of the virtual machine.
Operating Systems	<ul style="list-style-type: none"><li>● VMM does not support P2V conversion for computers with Itanium architecture-based operating systems. .</li><li>● VMM does not support P2V on source computers running Windows NT Server 4.0. However, you can use the Microsoft Virtual Server 2005 Migration Toolkit (VSMT) or third-party solutions for converting computers running Windows NT Server 4.0.</li><li>● VMM 2008 R2 does not support converting a physical computer running Windows Server 2003 SP1 to a virtual machine managed by Hyper-V. Hyper-V does not support Integration Components on computers running Windows Server 2003 SP1. As a result, there is no mouse control when you use Remote Desktop Protocol (RDP) to connect to the virtual machine. To avoid this, update the operating system to Windows Server 2003 SP2 before you convert the physical computer. As an alternative, you can convert the computer by using VMM 2008, and then deploy the virtual machine in VMM 2008 R2.</li></ul>

---

# Preparing a Virtual Image from Another Virtual Image

VMM allows you to copy existing VMware virtual machines and create Hyper-V or Virtual Server VMs. Virtual-to-Virtual (V2V) conversion is a read-only operation that does not delete or affect the original source virtual machine. You can copy VMware virtual machines that are on an ESX host, in the VMM Library, or on a Windows share. The resulting virtual machine matches VMware virtual machine properties, including name, description, memory, disk-to-bus assignment, CD and DVD settings, network adapter settings, and parameters.

To prepare a virtual image from another virtual image, you need to follow a two-step method:

- Create a template from an existing VM
- Create a new VM from the template

A virtual machine template is a library resource and consists of the following parts:

**Hardware profile** - To define a standard set of hardware settings, you can create a hardware profile and associate it with a template. When you create a new template or create a virtual machine from a template, you can specify the virtual hardware settings or reuse an existing hardware profile from the library. Like operating system profiles, hardware profiles are logical entities that are stored in the database.

**Virtual hard disk** - You can use a generalized virtual hard disk from the library or create a virtual hard disk from an existing virtual machine. If the source virtual machine for your template has multiple virtual hard disks, select the disk that contains the operating system. To simplify the generalization process, include Virtualization Guest Services (such as Virtual Machine Additions or Integration Components) in your template.

**Guest operating system profile** (optional) - To use the same product key, administrator password, time zone, and other items in a set of templates, you can create a guest operating system profile and store it in the library. When you create a new template or a virtual machine from a template, you can specify the settings manually or use an operating system profile associated with your answer files.

Templates provide a standardized group of hardware and software settings that you can use to create multiple new virtual machines configured with those settings. VMM supports both customized and non-customized templates.

**Important:** Customized templates are the most common VMM templates that require an operating system profile to automate deployment. Non-customized templates do not have an operating system profile attached to it. You can use them for operating systems that cannot be customized like Windows 7 or Linux.

## Creating a Template from an Existing VM

When you create a template from an existing virtual machine, consider the following:

- The virtual machine that you use as a source to create a template must be the one deployed on a host (not stored in the library).
- The source virtual machine becomes the new template and is, therefore, no longer available as a virtual machine.

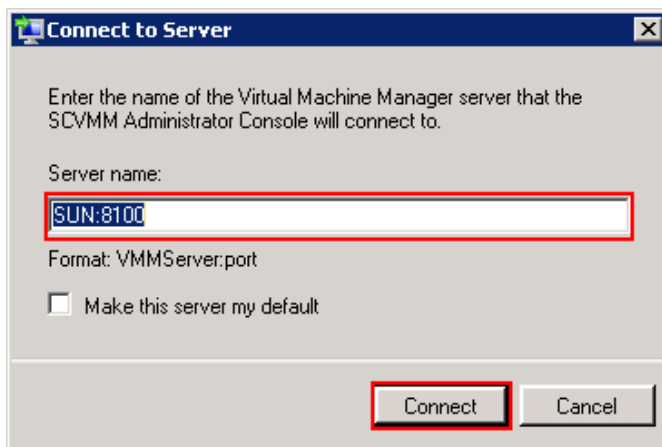
### Prerequisites to create a template

Delete all checkpoints from the source VM. Then open the Hyper-V Manager on the host and check the status of the merge operation for the virtual machine. In the Status column, Merge in progress indicates that the checkpoint has not been deleted. Wait until this operation has been completed before you start creating a template.

Stop or save the state of the source VM.

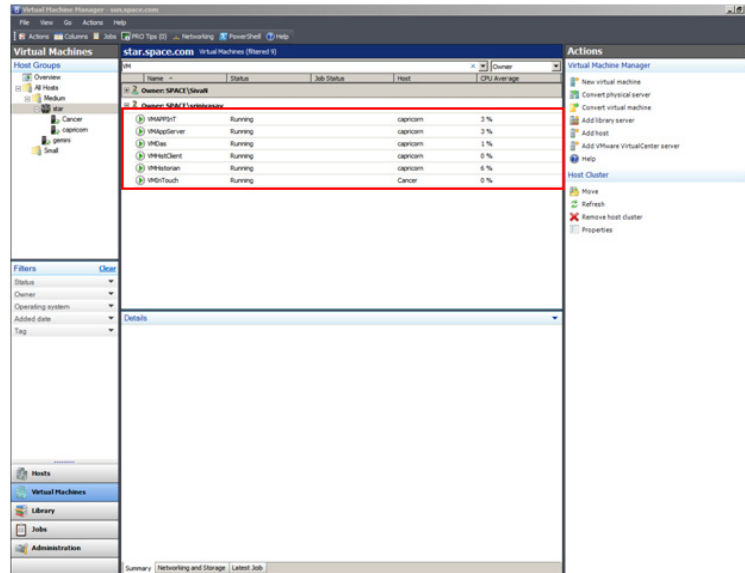
### To create a template from an existing VM

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



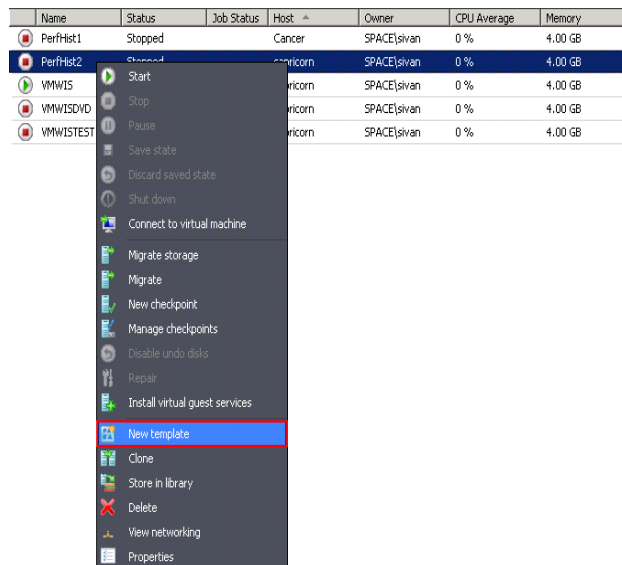
- b** In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it in the SCVMM server configuration, if required.

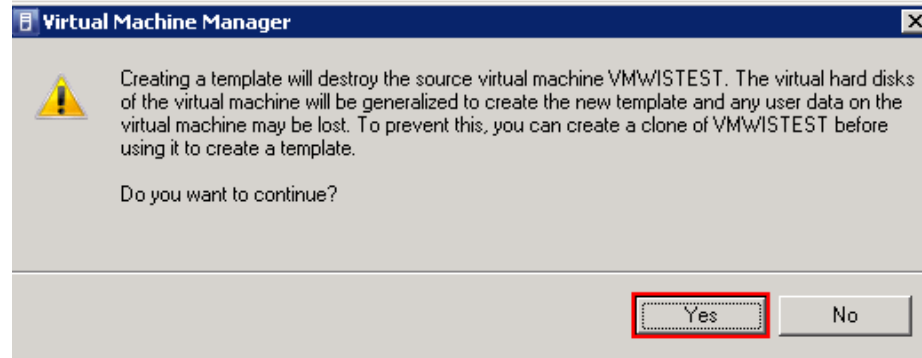


- 2** Select the source VM to create a template.

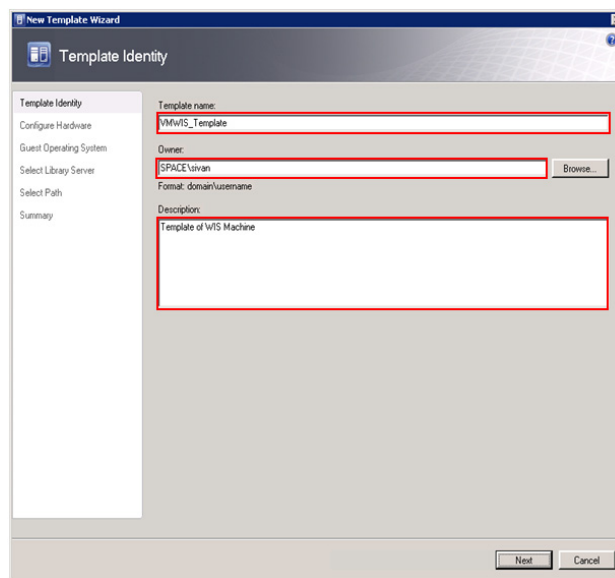
On the **Virtual Machine Manager** window, right-click the VM you want to use as the source. The VM menu appears.



- 3 Open the **New Template Wizard** window.
  - a On the VM menu, click **New template**. A warning message appears.



- b Click **Yes**. The **Template Identity** screen in the **New Template Wizard** window appears.



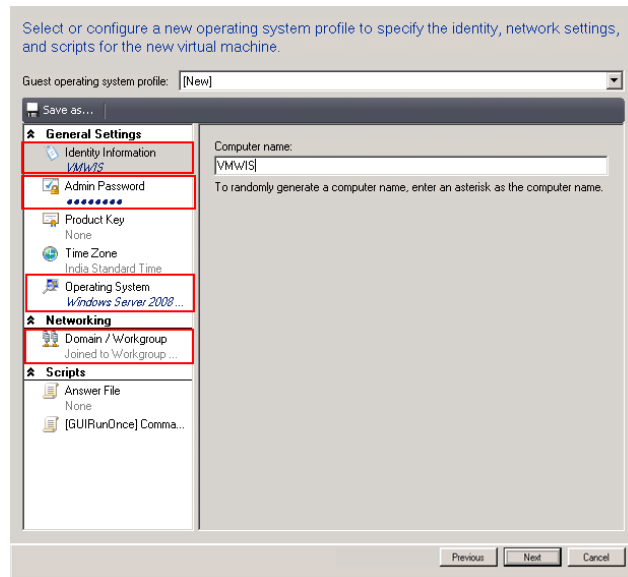
- 4 Enter the template details.
 

Enter the template name, owner name, and description, and then click **Next**. The **Configure Hardware** screen appears.

**Note:** You can either type or click **Browse** to select the relevant owner name. The owner must have an Active Directory domain account.

- 5 Go to the **Guest Operating System** screen.
 

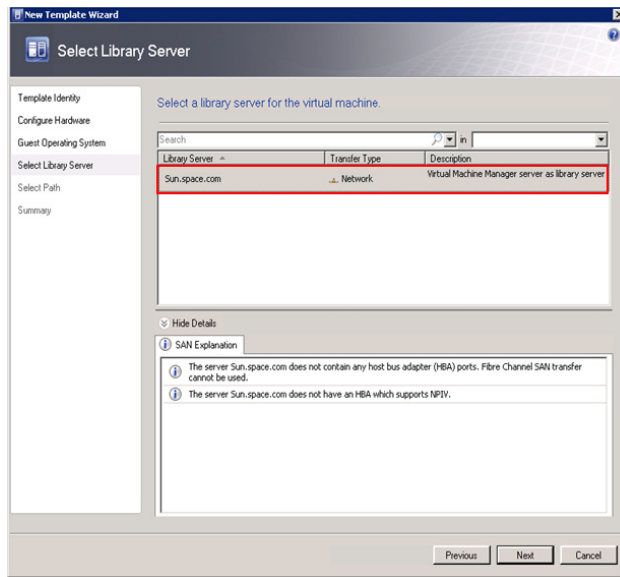
On the **Configure Hardware** screen, click **Next**. The **Guest Operating System** screen appears.



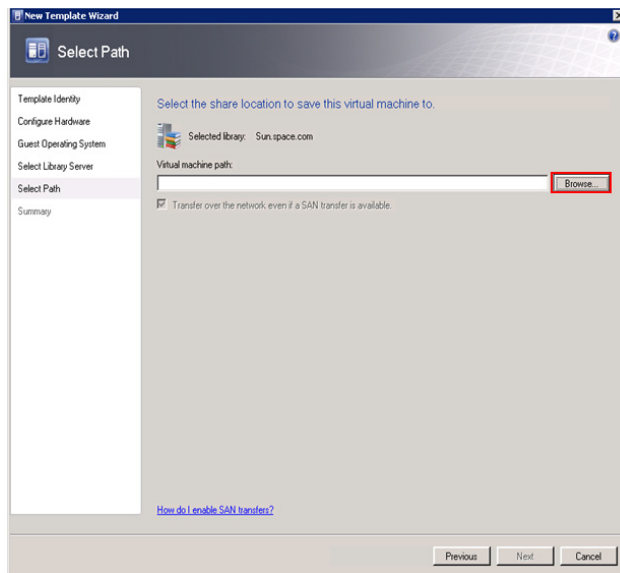
**6** Enter the details of the new VM.

On the **Guest Operating System** screen, do the following:

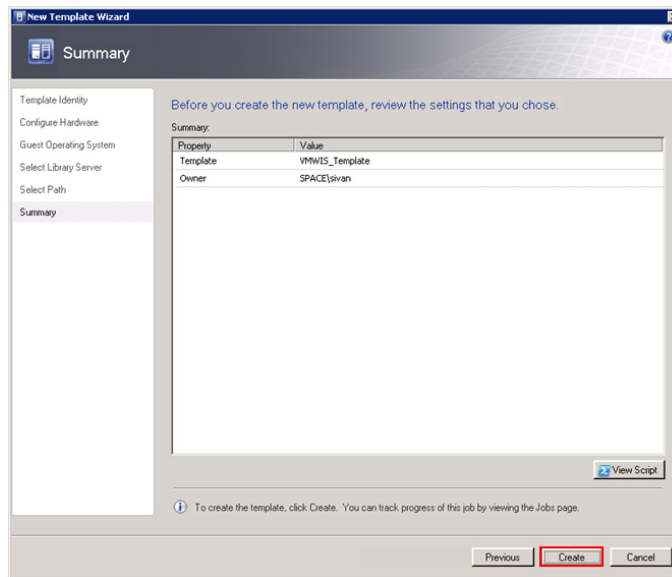
- a** In the **Computer name** box, enter a name for the new VM, and then click **Admin Password** under **General Settings**.
- b** In the **Password** and **Confirm** boxes, enter the password for the administrator account of the new VM, and then click **Operating System**.
- c** From the **Operating system** list, select the operating system based on the ISO selected, and then click **Domain/workgroup** under **Networking**.
- d** Click the relevant option to specify a workgroup or domain for the new VM. If you have clicked the **domain** option, enter user name and password, and then click **Next**. The **Select Library Server** screen appears.



- 7 Select a library server for the new VM.  
Select a library server for the template to be used, and then click **Next**. The **Select Path** screen appears.

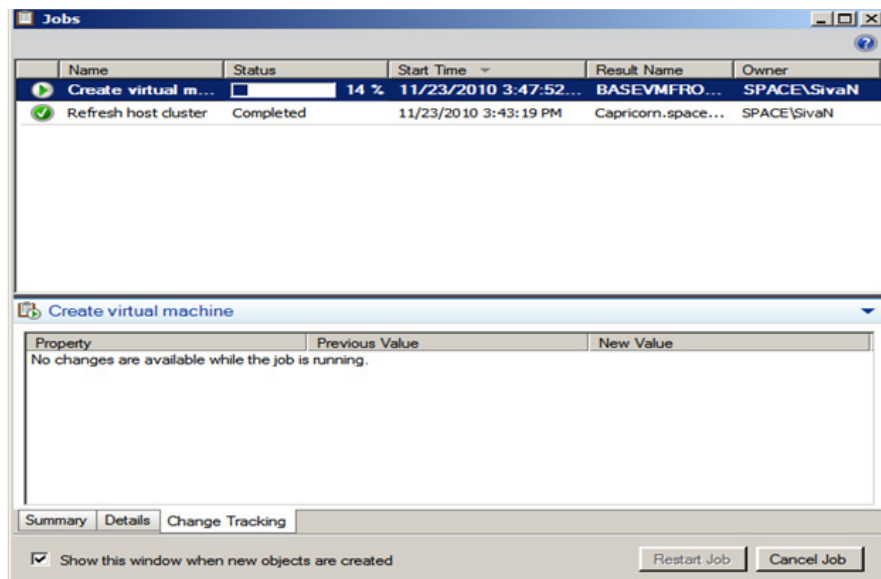


- 8 Select a location to save the new VM.
  - a Click **Browse** to select the location of the template. The selected path appears in the **Virtual machine path** box.
  - b Click **Next**. The **Summary** screen appears.



## 9 Create a template.

Click **Create**. The **Jobs** window appears.



View the status of the template you created. The completed status confirms that the template has been created successfully.

**Note:** If the template is not created successfully, you can refer to <http://technet.microsoft.com/en-us/library/cc764306.aspx> to verify the cause.



## Creating a Virtual Machine from a Template

You can create a VM from a template of an existing VM.

### Considerations

- You cannot change the system disk or startup disk configuration.
- Templates are database objects that are displayed in the library. The templates are displayed in the **VMs and Templates** folder in the Library Server.

### Requirements

- The virtual hard disk must have a supporting OS installed.
- The administrator password on the virtual hard disk should be blank as part of the Sysprep process. However, the administrator password for the guest OS profile may not be blank.
- For customized templates, the OS on the virtual hard disk must be prepared by removing the computer identity information. For Windows operating systems, you can prepare the virtual hard disk by using the Sysprep tool.

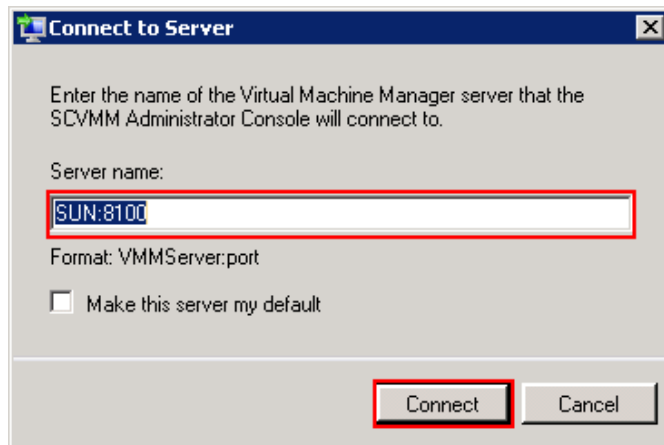
### Prerequisite

The template of the source VM should be created before creating the new VM.

For more information on creating a template, refer to "Creating a Template from an Existing VM" on page 659.

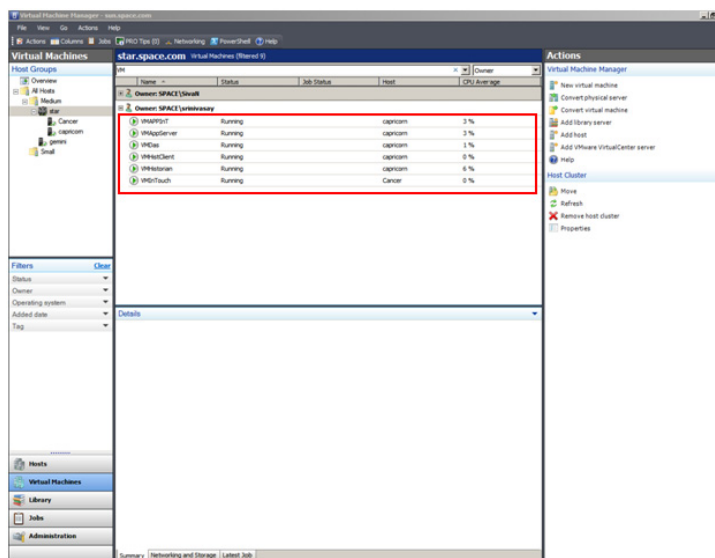
### To create a virtual machine from a template

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



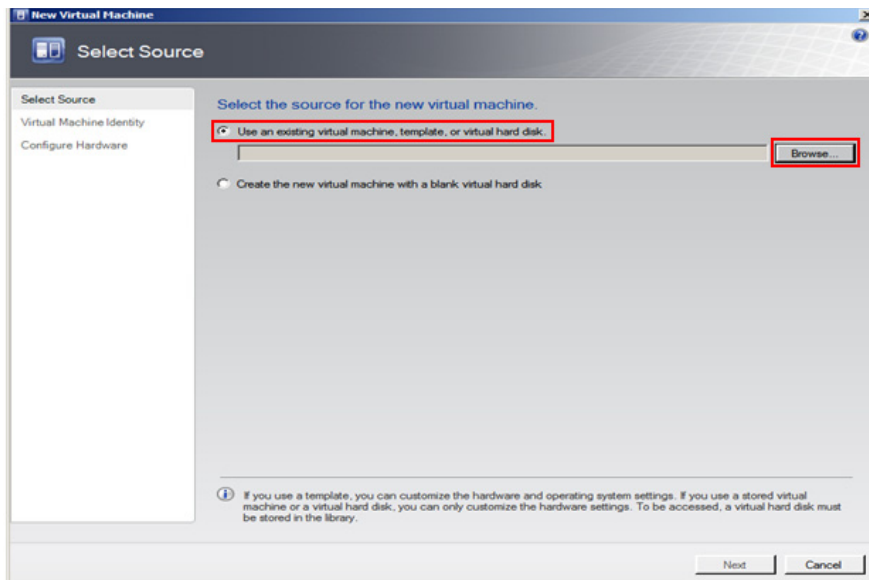
- b In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it in the SCVMM server configuration, if required.



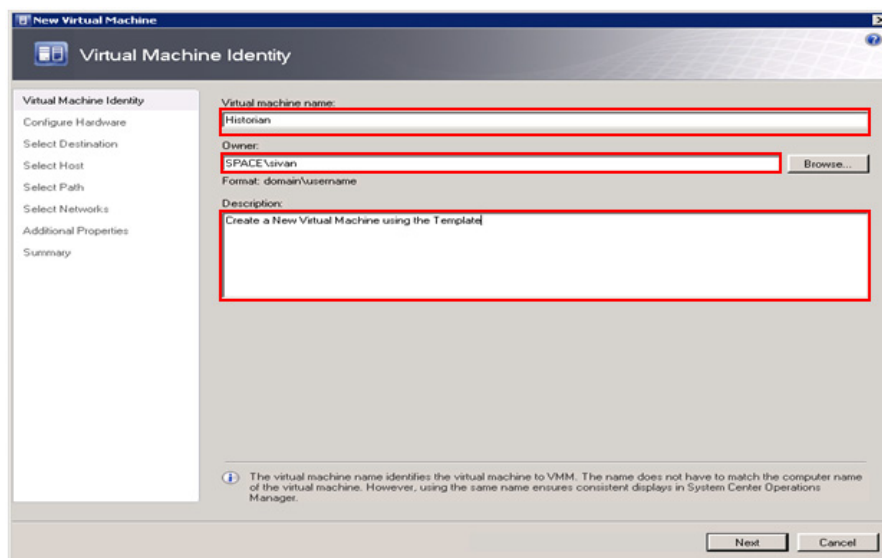
2 Open the **New Virtual Machine** window.

On the **ACTIONS** menu of the **Virtual Machine Manager** window, point to **Virtual Machine Manager**, and then click **New Virtual Machine**. The **Select Source** screen in the **New Virtual Machine** window appears.



3 Select the source for the new VM.

- a Click the **Use an existing virtual machine, template, or virtual hard disk** option.
- b Click **Browse** to select the source machine template, and then click **OK**. The **Virtual Machine Identity** screen appears.



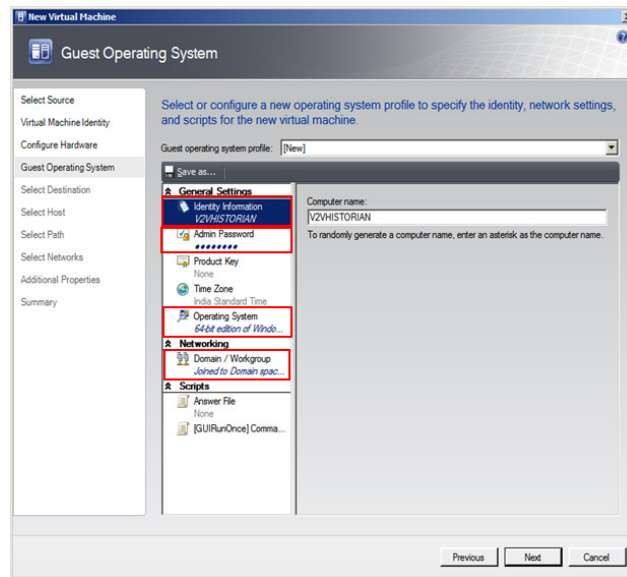
**4** Enter the details of the new VM.

Enter the virtual machine name, owner name, and description, and then click **Next**. The **Configure Hardware** screen appears.

**Note:** You can either type or click **Browse** to select the relevant owner name. The owner must have an Active Directory domain account.

**5** Go to the **Guest Operating System** screen.

On the **Configure Hardware** screen, click **Next**. The **Guest Operating System** screen.

**6** Enter the details of the new VM.

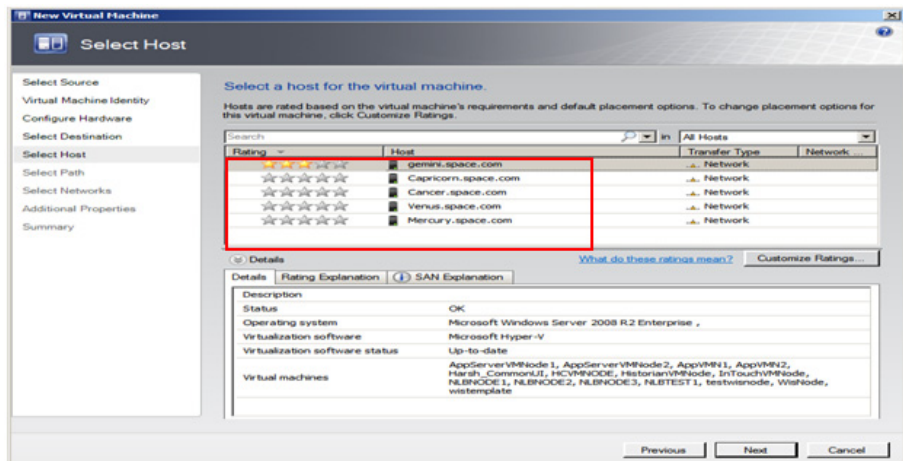
On the **Guest Operating System** screen, do the following:

- a** In the **Computer name** box, enter a name for the new VM, and then click **Admin Password** under **General Settings**.
- b** In the **Password** and **Confirm** boxes, enter the password for the administrator account of the new VM, and then click **Operating System**.

**Note:** To prompt for a password while creating a virtual machine with the template, enter an asterisk (\*) in the **Password** box. If you leave the field blank, you will not be able to create the virtual machine.

- c** From the **Operating system** list, select the operating system based on the ISO selected, and then click **Domain/workgroup** under **Networking**.

- d Click the relevant option to specify a workgroup or domain for the new VM. If you have clicked the **domain** option, enter user name and password, and then click **Next**. The **Select Host** screen appears.

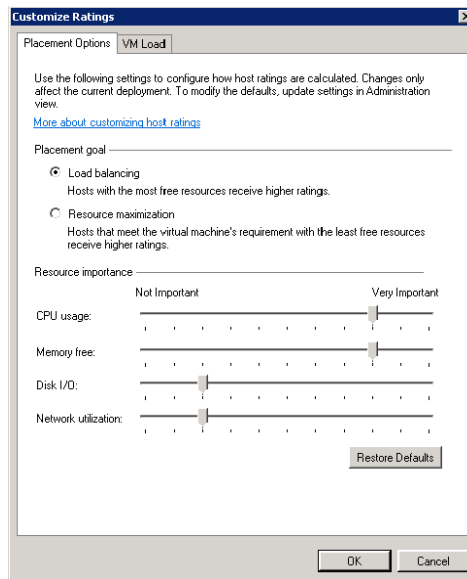


- 7 Select a host for the new VM.
- View the rating of each host.
  - Select a suitable host to deploy the VM.

**Note:** All hosts that are available for placement are given a rating of 0 to 5 stars based on their suitability to host the virtual machine. The ratings are based on the hardware, resource requirements, and expected resource usage of the virtual machine. The ratings are also based on placement settings that you can customize for the VMM or for individual virtual machine deployments. However, the ratings are recommendations. You can select any host that has the required disk space and memory available.

**Important:** In SCVMM 2008 R2, the host ratings that appear first are based on a preliminary evaluation by SCVMM. The ratings are for the hosts that run Windows Server 2008 R2 or ESX Server. Click a host to view the host rating based on a more thorough evaluation.

- c To view the placement settings used by the VMM to rate the hosts, click **Customize Ratings**. The **Customize Ratings** window appears.



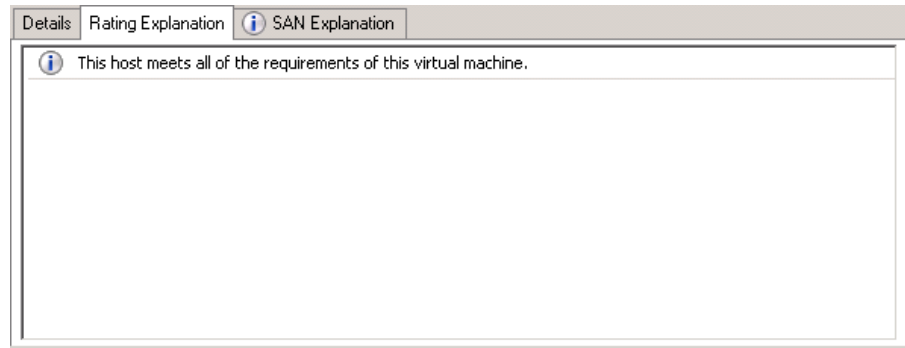
You can modify the settings if required.

- d To view additional information about a host rating, select the host and click the following tabs:
  - Details

Details	
Rating Explanation	SAN Explanation
Description	
Status	OK
Operating system	Microsoft Windows Server 2008 R2 Enterprise , Service Pack 1, v.721
Virtualization software	Microsoft Hyper-V
Virtualization software status	Up-to-date
Virtual machines	AppServerVMNode1, AppServerVMNode2, Harsh_CommonUI, HCVMNODE, HistorianVMNode, InTouchVMNode, NLBNODE1, NLBNODE2, NLBNODE3

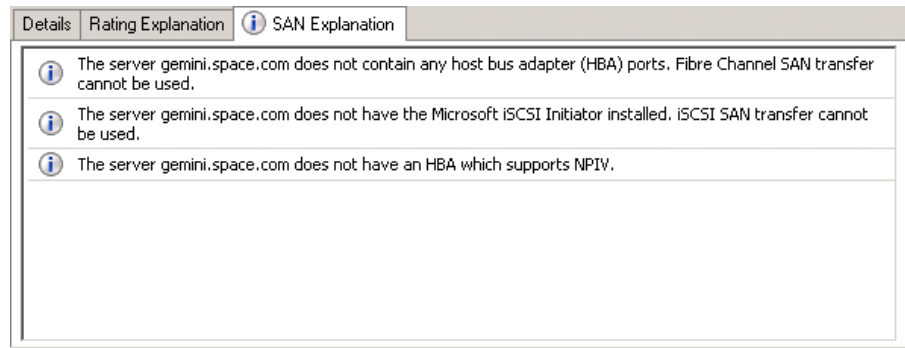
This tab displays the status of the host and lists the virtual machines that are currently deployed on it.

● Ratings Explanation



This tab lists the conditions that cause a host to receive a zero rating.

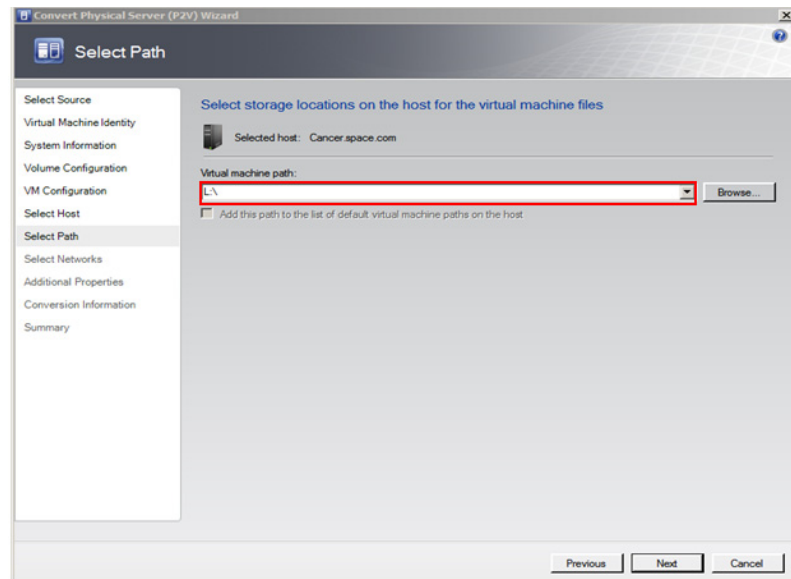
● SAN Explanation



This tab lists the conditions that prevent a Storage Area Network (SAN) transfer used to move the virtual machine's files to the host.

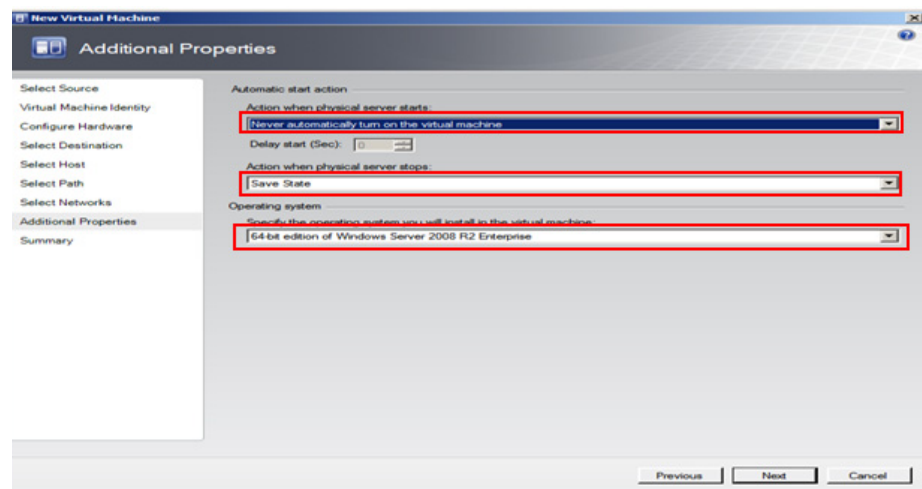
- e Click **Next**. The **Select Path** screen appears.

**Note:** If a host has network optimization enabled, a green arrow appears in the **Network Optimization** column. VMM 2008 R2 enables you to use the network optimization capabilities that are available on Hyper-V hosts that are running Windows Server 2008 R2. For information about network optimization and the hardware that supports it, see the "Windows Server 2008 R2" documentation. After a virtual machine is deployed, this feature is displayed only for virtual machines that are deployed on a host that runs Windows Server 2008 R2.



- 8 Select the storage location for the VM files.

On the **Select Path** screen, enter the path to store the VM files, and then click **Next**. The **Additional Properties** screen appears.





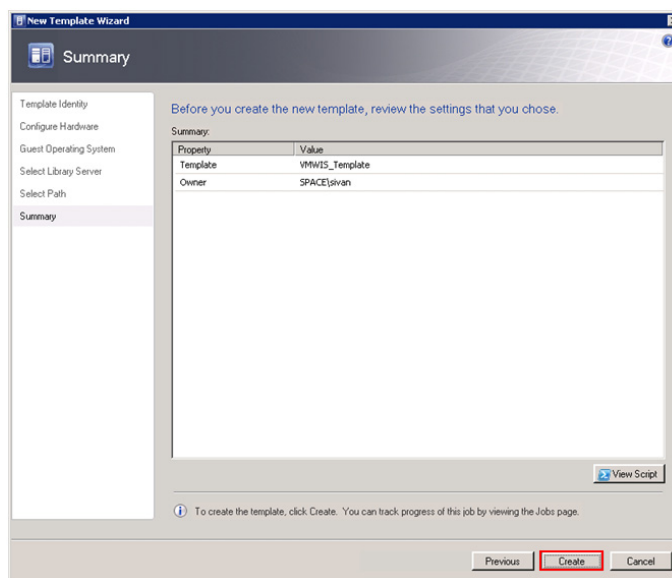
- 9 Specify any additional properties of the VM.
  - a In the **Action when physical server starts** list, click **Never automatically turn on the virtual machine**.
  - b In the **Action when physical server stops** list, click **Save State**.

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**Note:** You can configure the details as required.

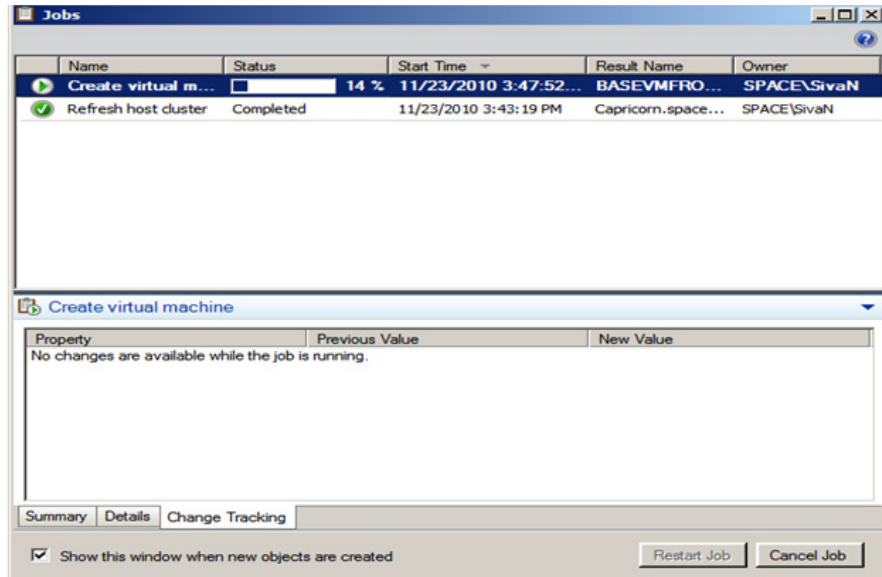
---

- c From the **Specify the operating system you will install in the virtual machine** list, select the operating system based on the ISO selected, and then click **Next**. The **Summary** screen appears.



- 10 Create a template.

Click **Create**. The **Jobs** window appears.



View the status of the template you created. The completed status confirms that the template has been created successfully.

## Tips and Recommendations

- When creating a template, use a base OS without an SQL Server.
- To create a VM that hosts System Platform Products, select the template with the relevant OS. Install the SQL Server as required, and then install the System Platform Product.
- If you create a template with an SQL Server and/or System Platform Products, and you create a VM with that template, ensure the machine name is the same as the node name in the template. If you use a different name, do the following:

Product	Recommendation
Historian	<ul style="list-style-type: none"> <li>● Modify the SQL Server instance name with the new host name. To modify the name, execute the following queries in the SQL Server Management Studio:  <pre>sp_dropserver@@servername sp_addserver &lt;hostname&gt;, local</pre> Then, restart the SQL server service.</li> <li>● Register the Historian Server with the new host name in the SMC. <ul style="list-style-type: none"> <li><b>a</b> Right-click the Historian group, and then select <b>New Historian Registration</b>.</li> <li><b>b</b> Enter the host name in the Historian along with the other required details.</li> </ul> </li> <li>● Modify the local IDAS with the host name.</li> </ul>
Application Server (GR)	<ul style="list-style-type: none"> <li>● Modify the SQL Server instance name with the new host name.</li> <li>● Restart the SQL Server service.</li> <li>● While connecting to Galaxy, in the Application Server IDE, select the new host name for GR node.</li> <li>● Before creating a template from a VM, ensure that all Galaxy objects are undeployed.</li> </ul>

## Preparing a Virtual Image from a Ghost Backup

VMM allows you to create a virtual machine using .VHD images created using a ghost backup. You cannot create a virtual machine directly from a ghost .GHO backup file. Ghost backup images are created using the Symantec Ghost Utility software.

To create a virtual machine from a ghost backup, do the following:

- a** Create a ghost backup (.GHO).
- b** Convert a ghost backup (.GHO) to a virtual hard disk (.VHD).
- c** Create a virtual machine from .VHD.

The procedure to create a .GHO image is explained in the Symantec™ Ghost Imaging Foundation 7 documentation.

Refer to the following links for information on Creation of Ghost Backup (.GHO) and Conversion of Ghost backup (.GHO) to Virtual Hard Disk (.VHD).

- [ftp://ftp.symantec.com/public/english\\_us\\_canada/products/symantec\\_ghost\\_solution\\_suite/2.0/manuals/Ghost\\_imp\\_guide.pdf](ftp://ftp.symantec.com/public/english_us_canada/products/symantec_ghost_solution_suite/2.0/manuals/Ghost_imp_guide.pdf)
- <http://www.symantec.com/business/support/index?page=content&id=DOC2207&key=52023&actp=LIST>
- [http://www.symantec.com/business/support/resources/sites/BUSINESS/content/staging/DOCUMENTATION/2000/DOC2565/en\\_US/1.0/EM\\_GIF\\_user\\_gde.pdf](http://www.symantec.com/business/support/resources/sites/BUSINESS/content/staging/DOCUMENTATION/2000/DOC2565/en_US/1.0/EM_GIF_user_gde.pdf).

## Create a Virtual Machine from a .VHD

You can use the New Virtual Machine feature of the VMM to create a virtual machine from an existing VHD. VMM creates a copy of the source VHD so that the original VHD is not moved or modified. The administrator password on the VHD should be blank as part of the Sysprep process.

You can also create a template from the VHD, and then create the new virtual machine from the template.

**Limitations:** When creating a new virtual machine directly from an existing VHD, you cannot specify the OS configuration information (sysprep settings). To specify sysprep settings, you need to do the following:

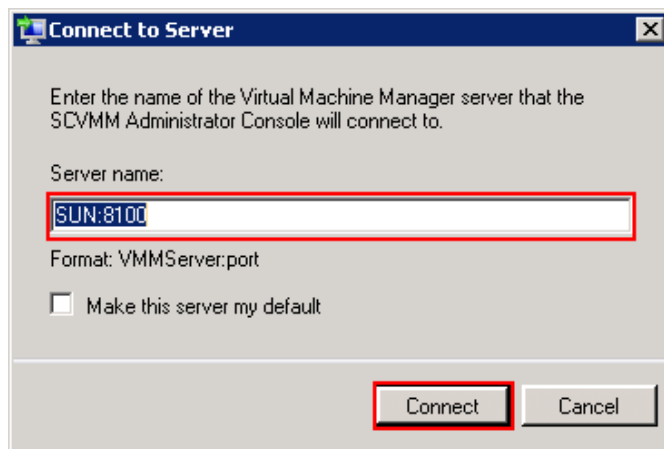
- Create a template
- Create the new virtual machine based on that template

**To create a virtual machine from a .VHD**

- 1 Copy the created .VHD file.

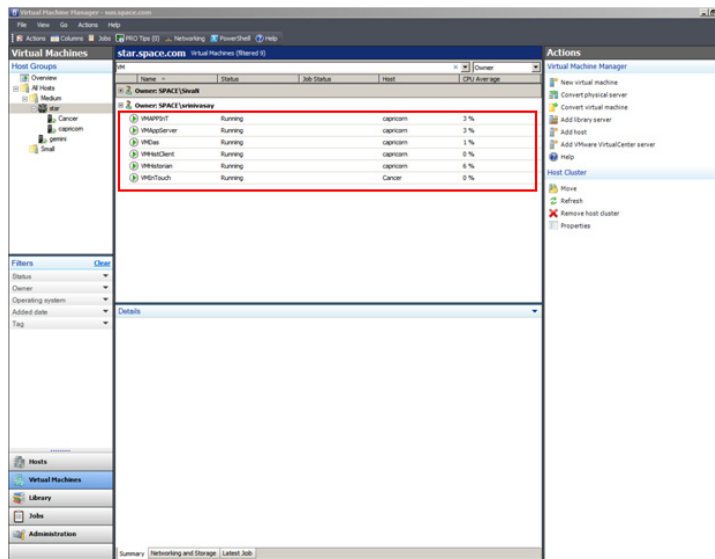
Copy the .VHD file that is created using the ghost image to the Virtual Server Library.

- 2 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



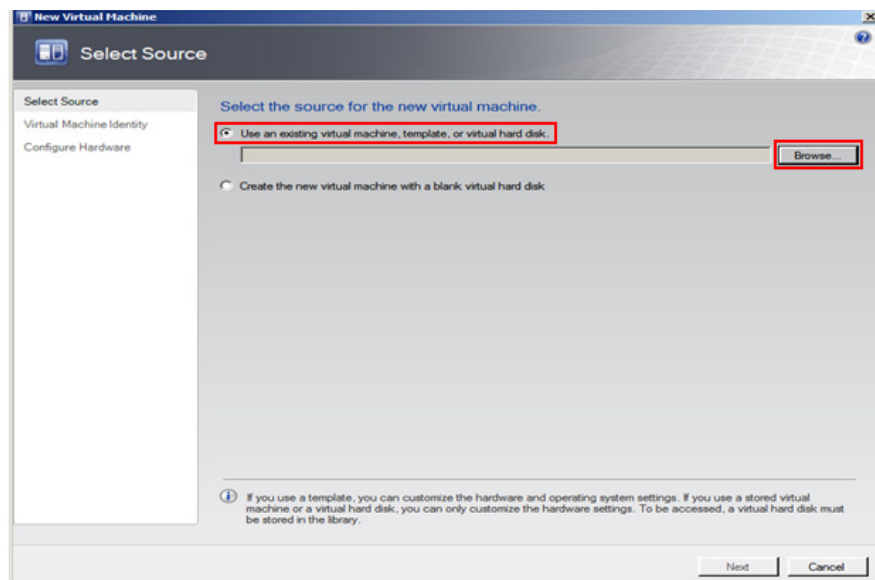
- b In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it in the SCVMM server configuration, if required.

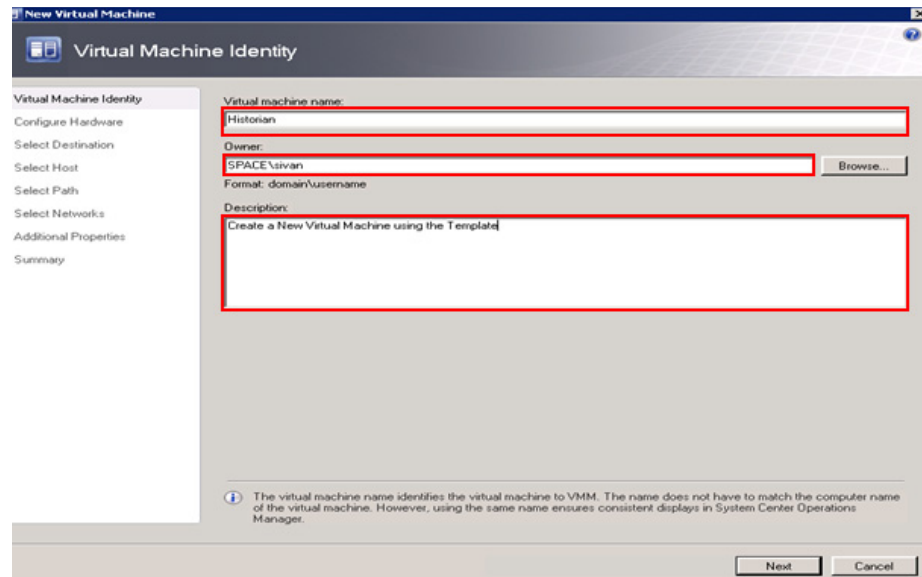


### 3 Open the **New Virtual Machine** window.

On the **Actions** menu of the **Virtual Machine Manager** window, point to **Virtual Machine Manager**, and then click **New Virtual Machine**. The **Select Source** screen in the **New Virtual Machine** window appears.



- 4 Select the source for the new VM.
  - a Click the **Use an existing virtual machine, template, or virtual hard disk** option.
  - b Click **Browse** to select the .VHD image, and then click **OK**. The **Virtual Machine Identity** screen appears.



The screenshot shows the 'New Virtual Machine' wizard, specifically the 'Virtual Machine Identity' step. The window title is 'New Virtual Machine' and the subtitle is 'Virtual Machine Identity'. On the left, there is a navigation pane with the following options: Virtual Machine Identity (selected), Configure Hardware, Select Destination, Select Host, Select Path, Select Networks, Additional Properties, and Summary. The main area contains the following fields and controls:

- Virtual machine name:** A text box containing 'Historian'.
- Owner:** A text box containing 'SPACE\svivan' and a 'Browse...' button.
- Format:** 'domain/username'.
- Description:** A text box containing 'Create a New Virtual Machine using the Template'.

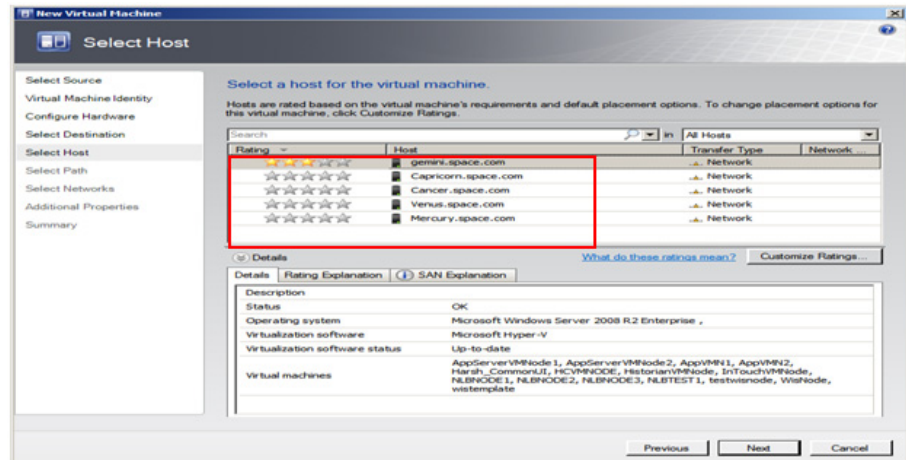
At the bottom, there is a help icon and a note: 'The virtual machine name identifies the virtual machine to VMM. The name does not have to match the computer name of the virtual machine. However, using the same name ensures consistent displays in System Center Operations Manager.' Below the note are 'Next' and 'Cancel' buttons.

- 5 Enter the details of the new VM.

Enter the virtual machine name, owner name, and description, and then click **Next**. The **Configure Hardware** screen appears.

**Note:** You can either type or click **Browse** to select the relevant owner name. The owner must have an Active Directory domain account.

- 6 Go to the **Select Host** screen.
  - a On the **Configure Hardware** screen, click **Next**. The **Guest Operating System** screen.
  - b On the **Guest Operating System** screen, click **Next**. The **Select Host** screen appears.



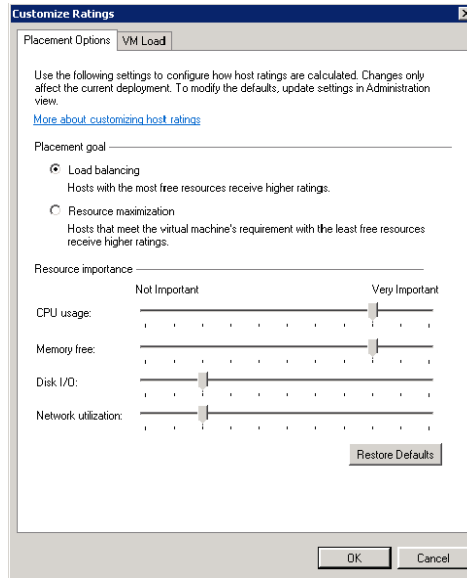
- 7 Select a host for the new VM.
  - a View the rating of each host.
  - b Select a suitable host to deploy the VM.

**Note:** All hosts that are available for placement are given a rating of 0 to 5 stars based on their suitability to host the virtual machine. The ratings are based on the hardware, resource requirements, and expected resource usage of the virtual machine. The ratings are also based on placement settings that you can customize for the VMM or for individual virtual machine deployments. However, the ratings are recommendations. You can select any host that has the required disk space and memory available.

**Important:** In SCVMM 2008 R2, the host ratings that appear first are based on a preliminary evaluation by SCVMM. The ratings are for the hosts that run Windows Server 2008 R2 or ESX Server. Click a host to view the host rating based on a more thorough evaluation.



- c To view the placement settings used by the VMM to rate the hosts, click **Customize Ratings**. The **Customize Ratings** window appears.



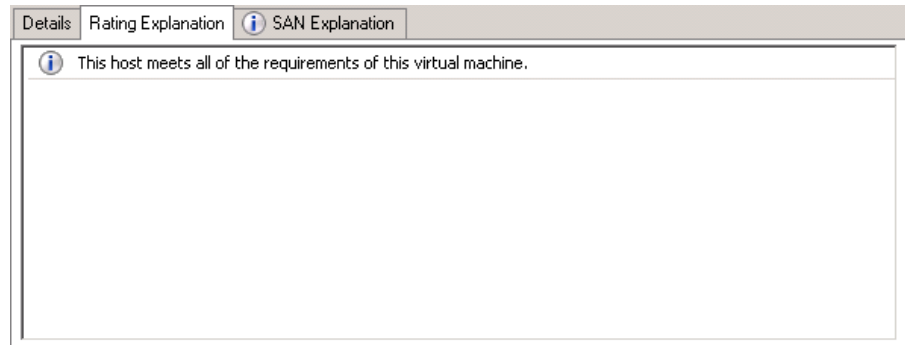
You can modify the settings if required.

- d To view additional information about a host rating, select the host and click the following tabs:
  - Details

Details	
Rating Explanation	SAN Explanation
Description	
Status	OK
Operating system	Microsoft Windows Server 2008 R2 Enterprise , Service Pack 1, v.721
Virtualization software	Microsoft Hyper-V
Virtualization software status	Up-to-date
Virtual machines	AppServerVMNode1, AppServerVMNode2, Harsh_CommonUI, HCVMNODE, HistorianVMNode, InTouchVMNode, NLBNODE1, NLBNODE2, NLBNODE3

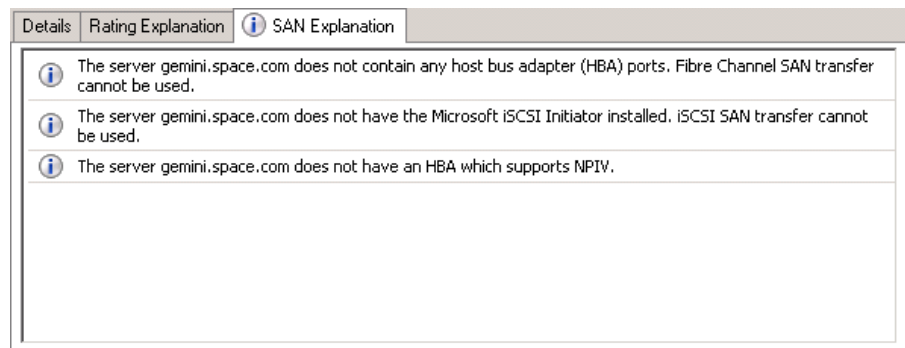
This tab displays the status of the host and lists the virtual machines that are currently deployed on it.

- Ratings Explanation



This tab lists the conditions that cause a host to receive a zero rating.

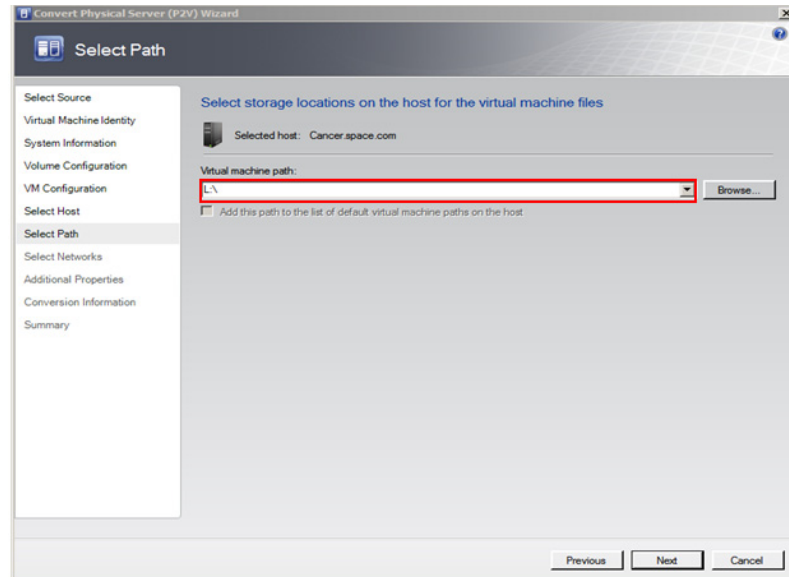
- SAN Explanation



This tab lists the conditions that prevent a Storage Area Network (SAN) transfer used to move the virtual machine's files to the host.

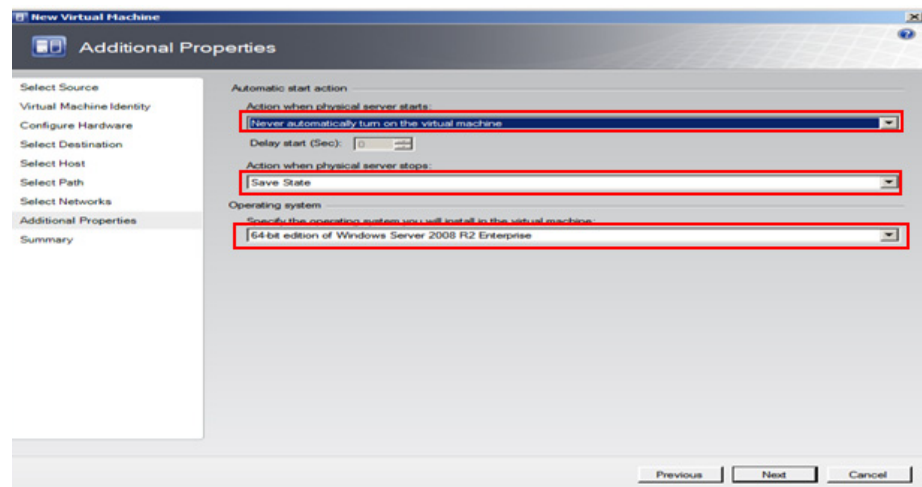
- e Click **Next**. The **Select Path** screen appears.

**Note:** If a host has network optimization enabled, a green arrow appears in the **Network Optimization** column. VMM 2008 R2 enables you to use the network optimization capabilities that are available on Hyper-V hosts that are running Windows Server 2008 R2. For information about network optimization and the hardware that supports it, see the "Windows Server 2008 R2" documentation. After a virtual machine is deployed, this feature is displayed only for virtual machines that are deployed on a host that runs Windows Server 2008 R2.



**8** Select the storage location for the VM files.

On the **Select Path** screen, enter the path to store the VM files, and then click **Next**. The **Additional Properties** screen appears.

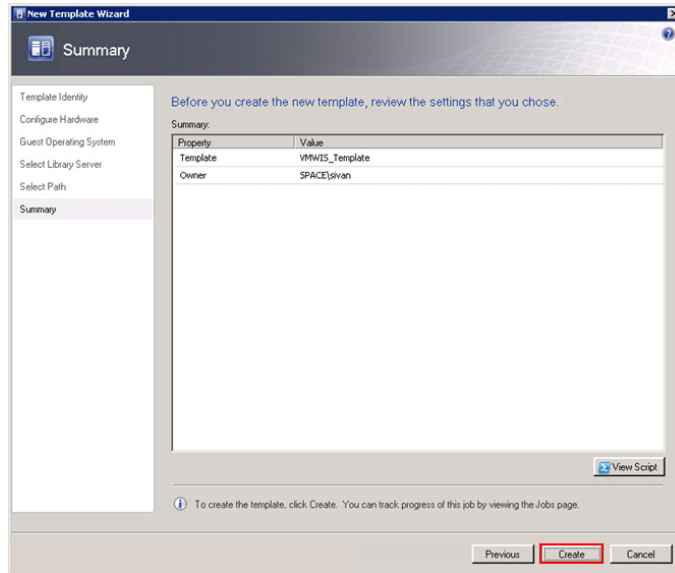


**9** Specify any additional properties of the VM.

- a** In the **Action when physical server starts** list, click **Never automatically turn on the virtual machine**.
- b** In the **Action when physical server stops** list, click **Save State**.

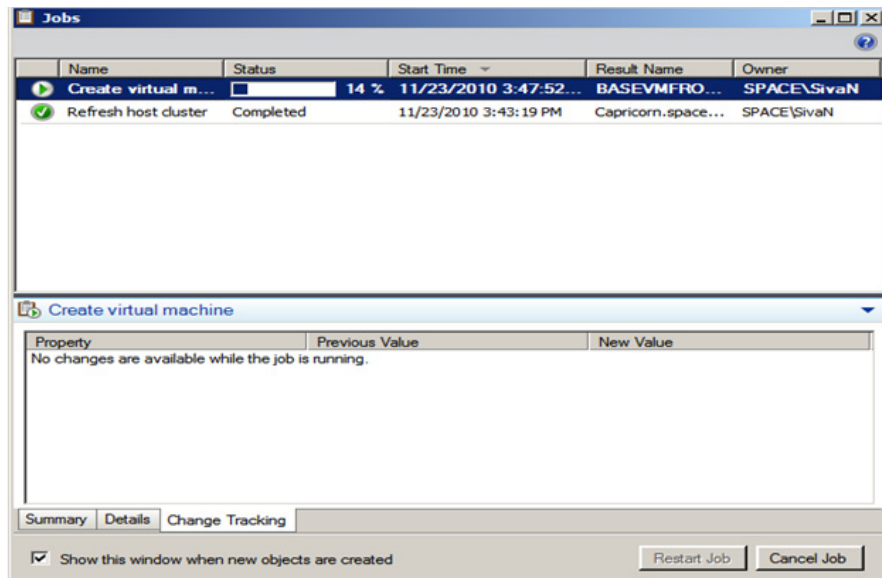
**Note:** You can configure the details as required.

- c From the **Specify the operating system you will install in the virtual machine** list, select the operating system based on the template selected, and then click **Next**. The **Summary** screen appears.



## 10 Create a template.

Click **Create**. The **Jobs** window appears.



View the status of the template you created. The completed status confirms that the template has been created successfully.

## Recommendation

When taking ghost backup, ensure that all drives where programs are installed are part of the backup.



---

## Chapter 7

# Implementing Backup Strategies in a Virtualized Environment

A virtual server backup is a copy of data stored on a virtual server to prevent data loss. There are two fundamental types of backups:

- Guest-level backup
- Host-level backup

### **Backup and Restore Strategies**

There are a number of backup and restore strategies in both virtualized and non-virtualized environments. In the guest level, the virtual machines (VMs) are backed up as if they were physical servers. Although this strategy is among the simplest, it also has several drawbacks. You need to install backup software in each virtual machine (VM) to be copied in Guest Operating Systems, and maintain separate backup jobs (or even multiple backup jobs) per VM. This approach requires additional resources to execute the backups, and can affect the performance of the virtual machines. This backup type is not suitable for restore in the event of a disaster or granular restores within applications, such as databases or email.

Another backup strategy is to use a host-level backup. In this approach, back up the entire VM at one time. However, it can be as granular as your backup and restore application allows it to be.

We recommend the host-level backup. It creates a complete disaster recovery image of the virtual server, which can be restored directly into the source virtual infrastructure.

### Checkpointing Method

In this method you can take point-in-time checkpoints (snapshots) of the entire VM. We recommend this method as it ensures data consistency and allows for a fast and complete restore of the entire VM. One of the few disadvantages in this method is that you need to restore the entire checkpoint even if a file is lost or corrupt.

In a Microsoft virtualized environment, you can take and restore checkpoints using either System Center Virtual Machine Manager 2008 R2 (VMM) or Microsoft® Hyper-V Manager. The following sections describe how to implement backup strategies using SCVMM.

## Taking Checkpoints Using SCVMM

By creating a checkpoint, you can save all contents of a virtual machine hard disk. You can reset your machine to a previous configuration if required, without having to uninstall programs or reinstall operating systems. This also helps you test applications across various configurations.

You can checkpoint one or multiple VMs both in the online and offline modes. However, you can checkpoint a VM only when it is deployed on a host.

---

**Important:** Typically, there are dependencies among nodes. Taking a checkpoint of a VM and restoring it later could negatively impact those dependencies. For more information, refer to "Checkpoints of System Platform Products - Observations and Recommendations" on page 707.

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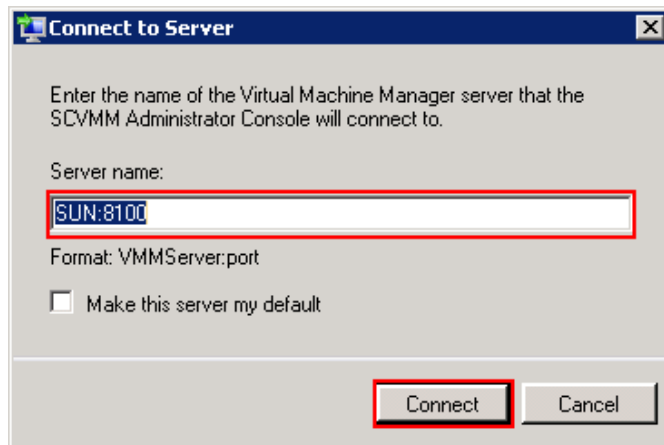
## Taking a Checkpoint of an Offline VM

It is recommended that you shut down the virtual machine before creating a checkpoint. You can also create a checkpoint of the virtual machine offline. This stops the machine temporarily while the checkpoint is created. Turning off the virtual machine prevents loss of data while the conversion takes place.



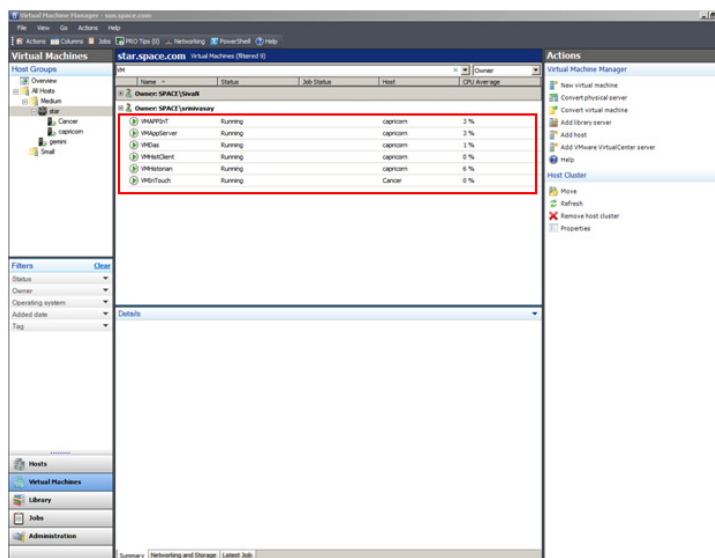
## To take a checkpoint of an offline VM

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



- b In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

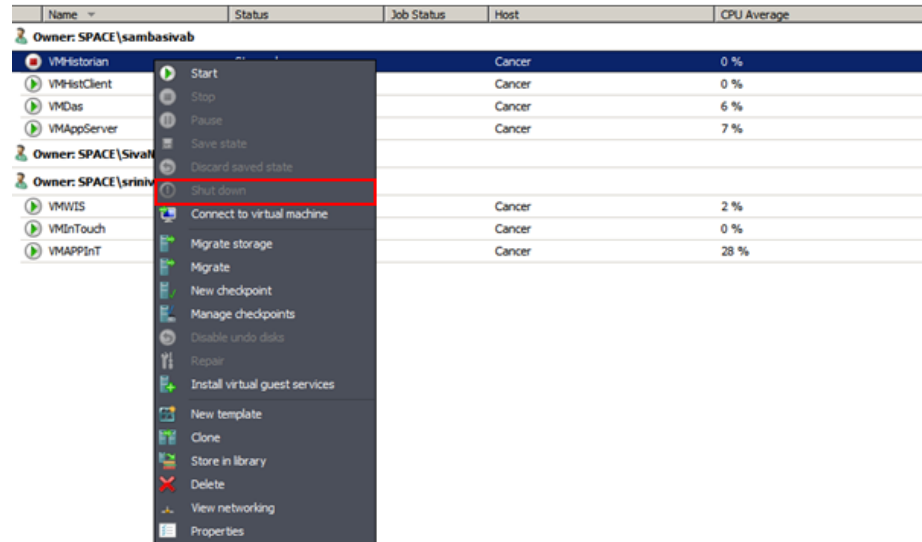
**Note:** By default, the port number is 8100. However, you can modify it, if required.



- 2 Select the VM that you want to checkpoint.

On the **Virtual Machine Manager** window, right-click the VM for which you want to take a checkpoint. The VM menu appears.

**Note:** To create checkpoints of all VMs, select all VMs together and then right-click the selection.



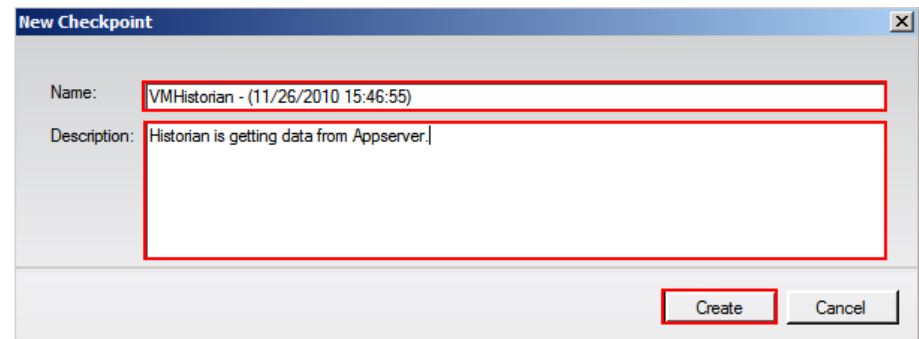
- 3 Shut down the VM you selected.

- a On the VM menu, click **Shut down**.

- 4 Make a new checkpoint.

- a Right-click the VM that is now Shut down (offline) and click **New checkpoint**. The **New Checkpoint** window appears.

**Note:** The **New Checkpoint** window does not appear if you are creating checkpoints for all VMs.



- b Modify the name of the checkpoint and enter a description for it, and then click **Create**. The checkpoint is created and the **Virtual Machine Manager** window appears.

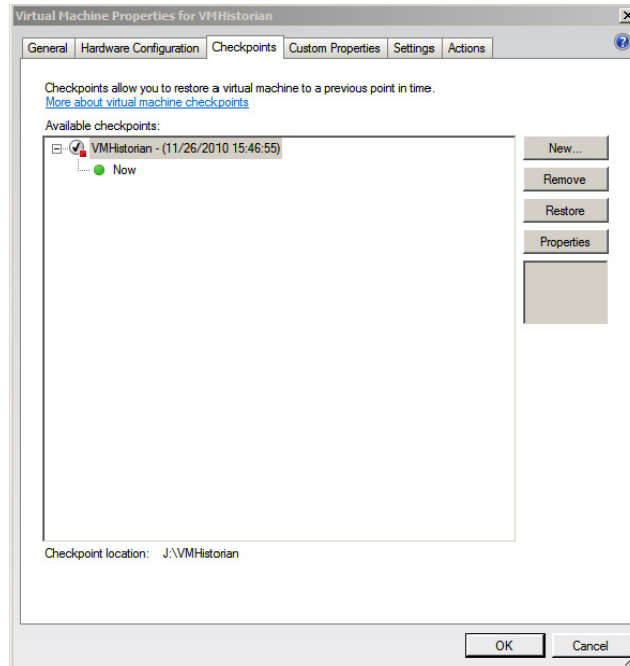
---

**Note:** By default, the **Name** box displays the name of the VM and the time when the checkpoint is created.

---

**5** Verify the checkpoint.

Right-click the VM and click **Manage checkpoints**. The **Virtual Machine Properties** window appears.



This window displays all the checkpoints created for the VM. The corresponding details indicate the date and time when each checkpoint was created. A green dot appears below the checkpoint you created indicating that it is now active. Click **OK** to exit the window.

## Taking a Checkpoint of an Online VM

It is possible to create checkpoints of a virtual machine while it is running. However, creating a checkpoint in online mode requires special application support.

---

**Important:** To avoid losing any data, do not make any configuration changes to the machine while creating a checkpoint. For more information, refer to "Checkpoints of System Platform Products - Observations and Recommendations" on page 707.

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If you create a checkpoint after making configuration changes when the VM is online there may be issues when you restore the VM to that checkpoint.

For example, if you create a checkpoint for an online IOM Historian Product VM state and then try to restore it, the history block that is created shows a discrepancy in the start and end time and the following errors are displayed.

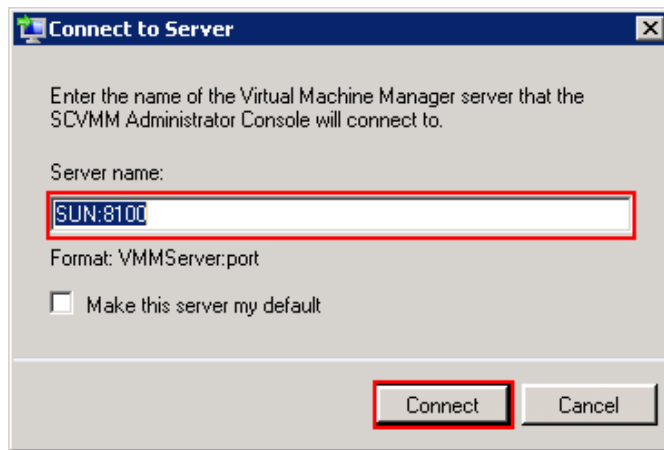
Warning: aahIndexSvc Attempted to create history block ending in the future

Error: aahIndexSvc ERROR: Invalid file format

To avoid such errors, stop the Historian VM before creating a checkpoint in the online mode.

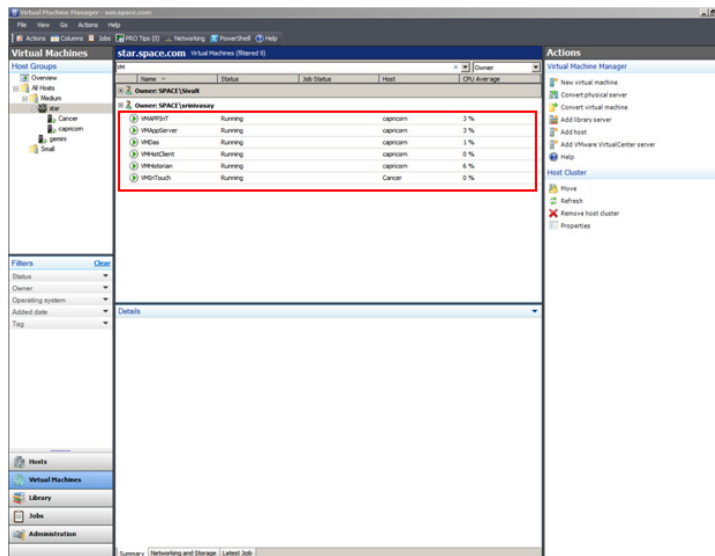
### To take a checkpoint of an online VM

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



- b** In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

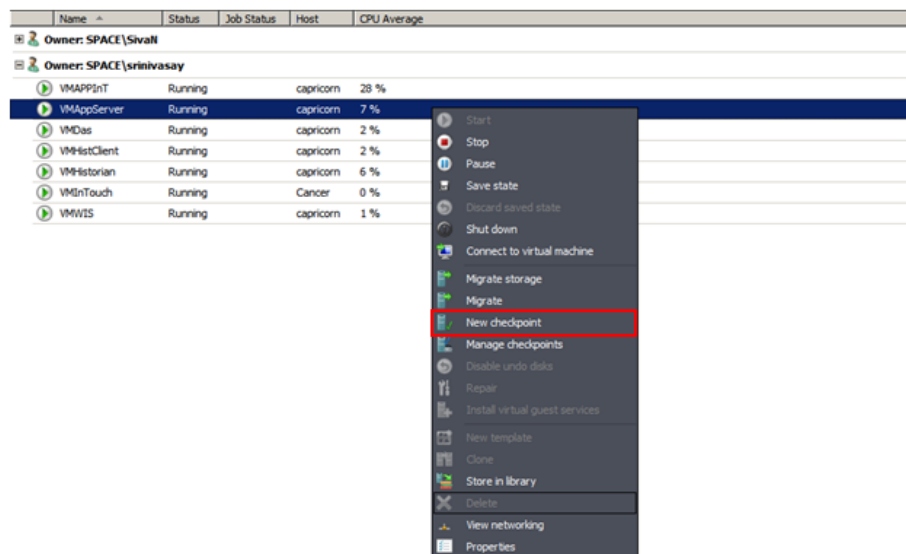
**Note:** By default, the port number is 8100. However, you can modify it, if required.



- 2** Select the VM that you want to checkpoint.

On the **Virtual Machine Manager** window, right-click the VM for which you want to take a checkpoint. The VM menu appears.

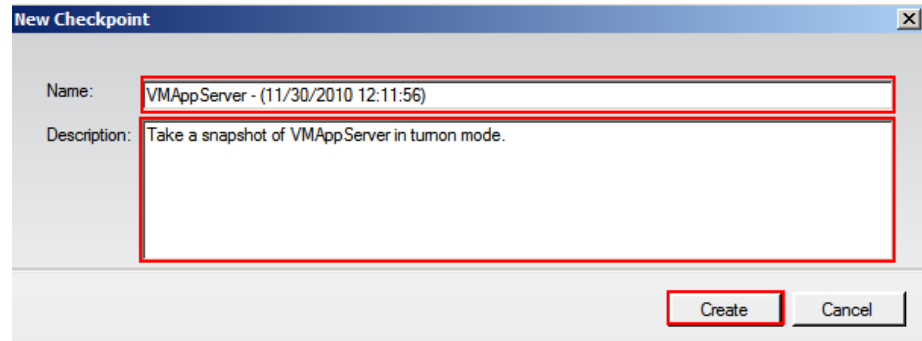
**Note:** To create checkpoints of all VMs, select all VMs together and then right-click the selection.



**3** Make a new checkpoint.

- a** Click **New checkpoint**. The **New Checkpoint** window appears.

**Note:** The **New Checkpoint** window does not appear, if you are creating checkpoints for all VMs.

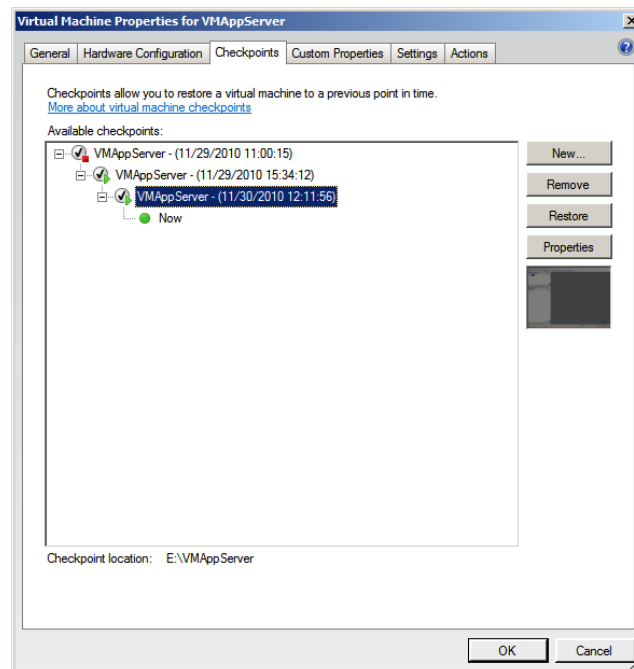


- b** Modify the name of the checkpoint and enter a description for it, and then click **Create**. The checkpoint is created and the **Virtual Machine Manager** window appears.

**Note:** By default, the **Name** box displays the name of the VM and the time when the checkpoint is created.

**4** Verify the checkpoint.

Right-click the VM for which you have created a checkpoint and click **Manage checkpoints**. The **Virtual Machine Properties** window for the selected VM appears.



This window displays all the checkpoints created for the VM. The corresponding details indicate the date and time when each checkpoint was created. A green dot appears below the checkpoint you created indicating that it is now active. Click **OK** to exit the window.

## Restoring Checkpoints

You can revert a virtual machine to a previous state by restoring it to the required checkpoint. When you restore a virtual machine to a checkpoint, VMM stops the virtual machine and the files on the virtual machine are restored to their previous state.

---

**Important:** If the virtual machine has been in use since the checkpoint was created, take a backup of the data files before you restore the virtual machine to avoid loss of any data.

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## Restoring Checkpoints from a Virtual System Platform Backup

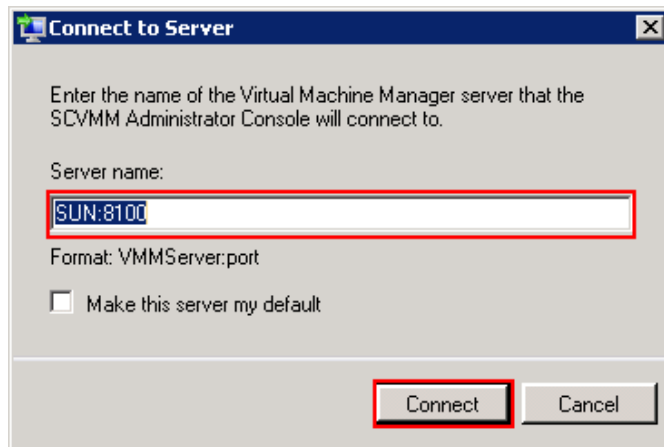
You can restore a VM to its previous state by using checkpoints. You can restore checkpoints of VMs both in the online and offline modes.

### Restoring a Checkpoint of an Offline VM

When you restore a VM to a checkpoint taken of an offline VM, there should not be any loss of data. When checkpoints are taken from a VM that is offline, the machine temporarily stops, minimizing data loss during the conversion process.

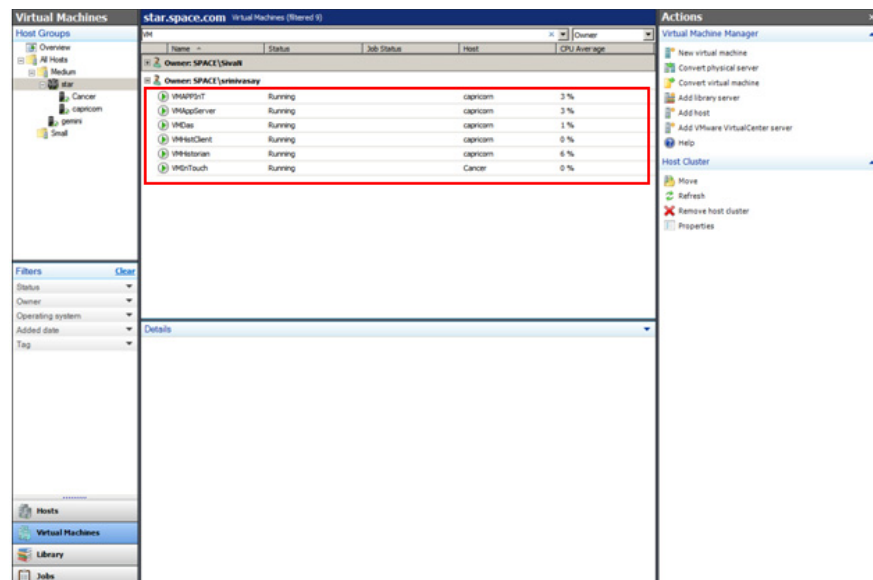
### To restore a checkpoint of an offline VM

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



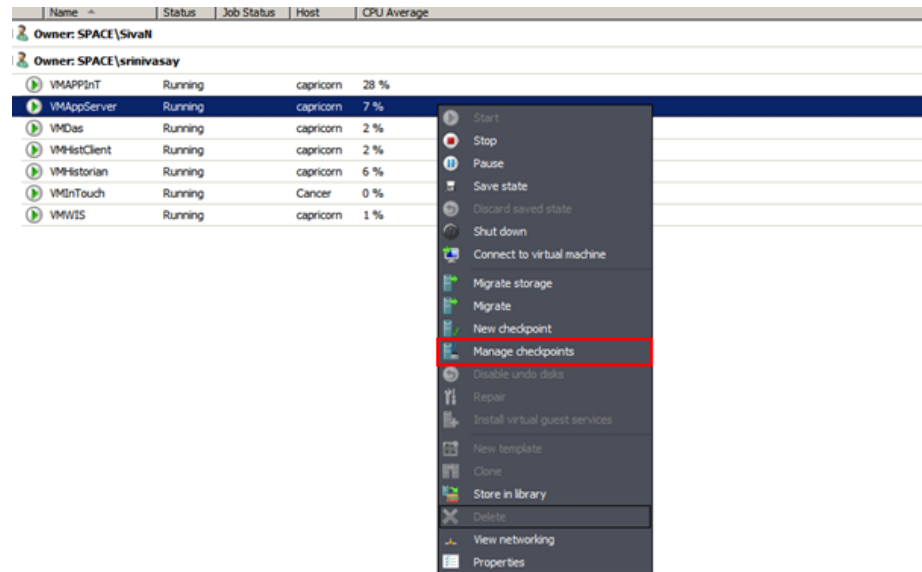
- b In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it, if required.

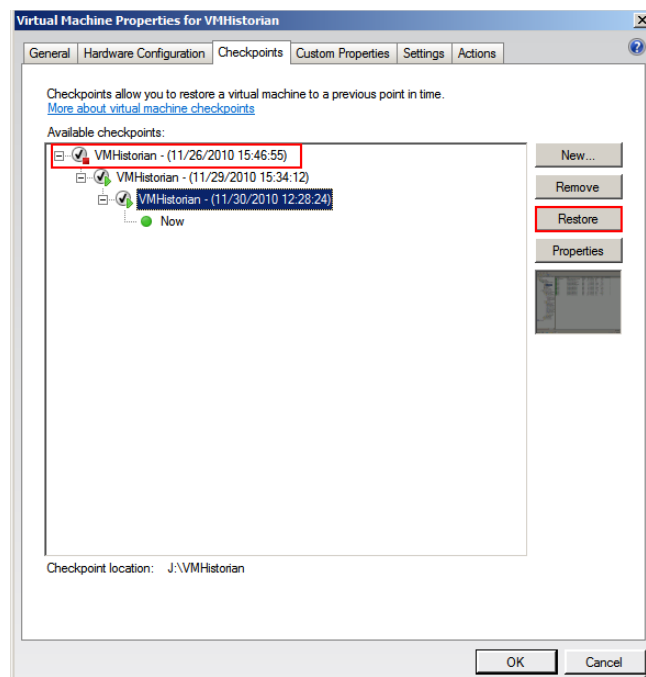




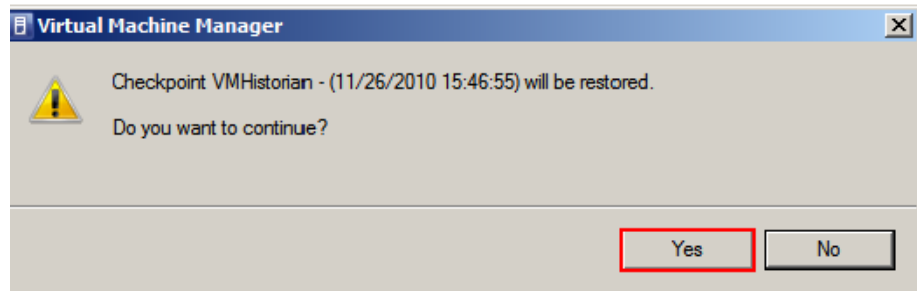
- 2 Select the offline VM for which you want to restore a checkpoint. In the **Virtual Machine Manager** window, right-click the VM that you want to restore. The VM menu appears.



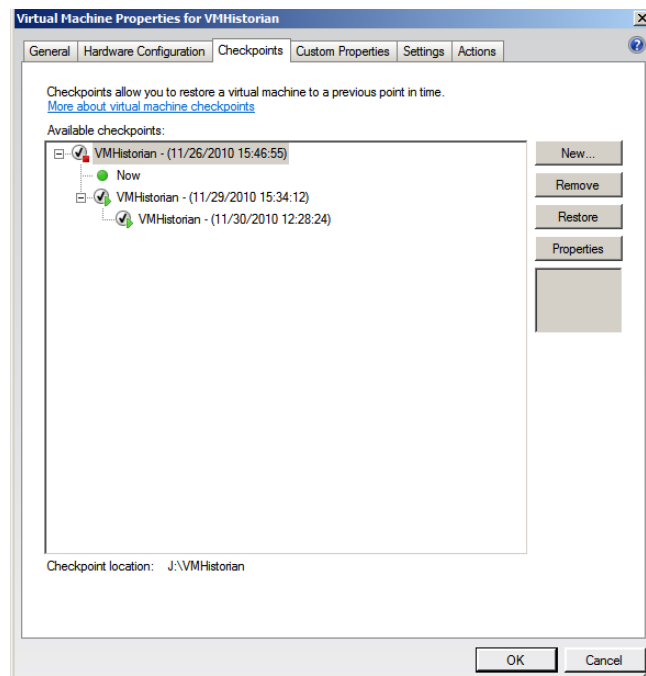
- 3 Restore the checkpoint.
  - a Click **Manage checkpoints**. The **Virtual Machine Properties** window appears.



- b** Select the VM that is offline and click **Restore**. A confirmation message appears.



- c** Click **Yes**. The checkpoint is restored and the **Virtual Machine Properties** window appears.



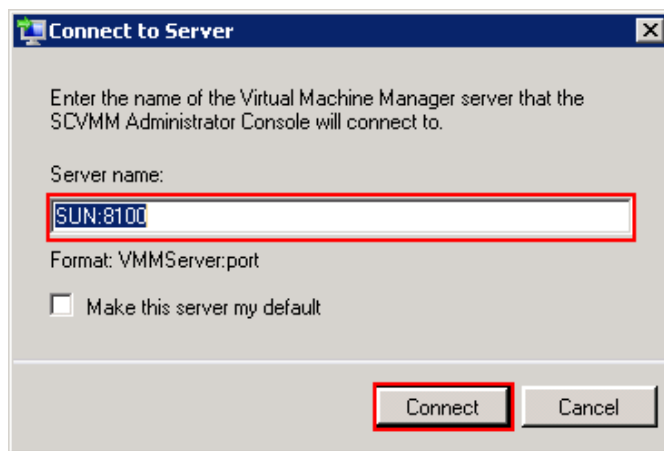
A green dot appears below the checkpoint that you restored indicating that it is now active. Click **OK** to exit the window.

## Restoring a Checkpoint of an Online VM

You can restore a VM to a checkpoint that was taken when the machine was online. Restoring a VM to a checkpoint taken while online may lead to loss of data. However, if no changes to the configuration were made while creating the checkpoint, there should not be any data loss.

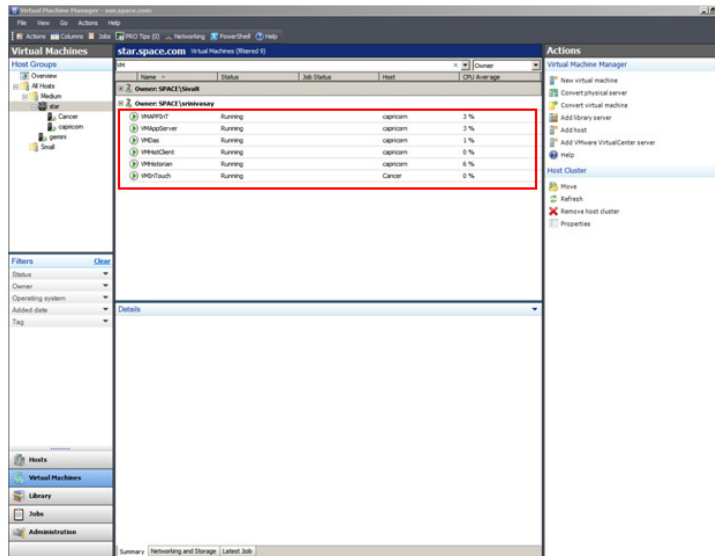
### To restore a checkpoint of an online VM

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



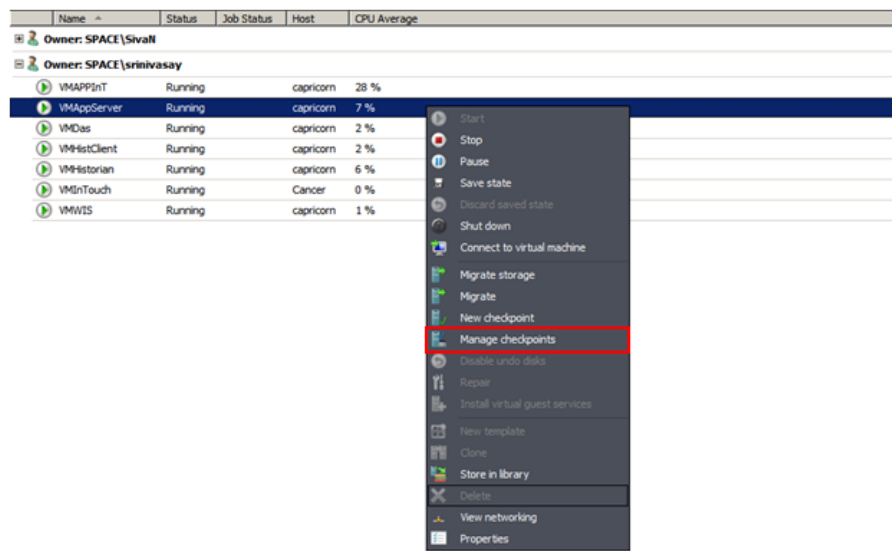
- b** In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it, if required.

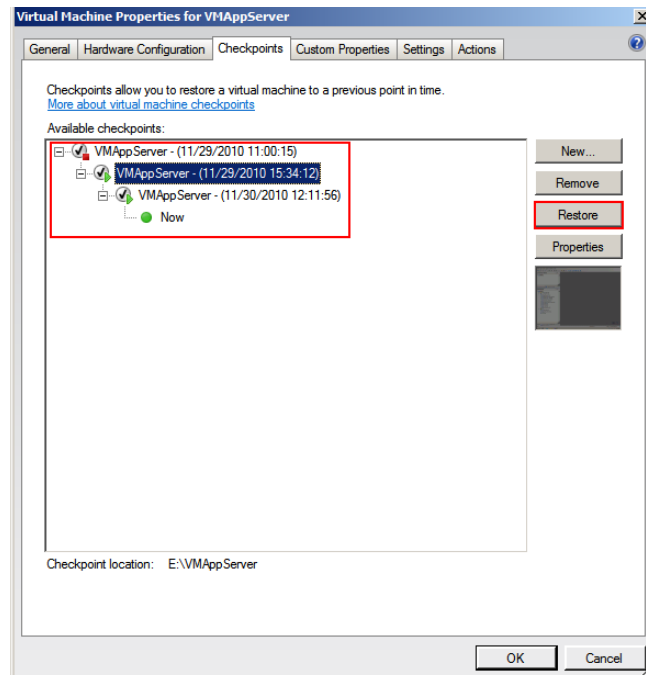


- 2** Select the VM for which you want to restore a checkpoint.

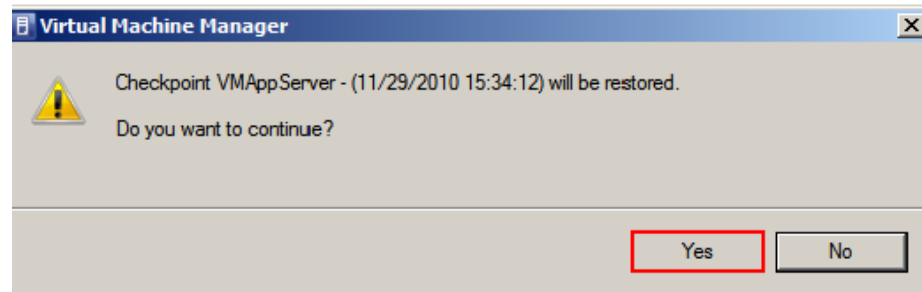
On the **Virtual Machine Manager** window, right-click the VM that you want to restore. The VM menu appears.



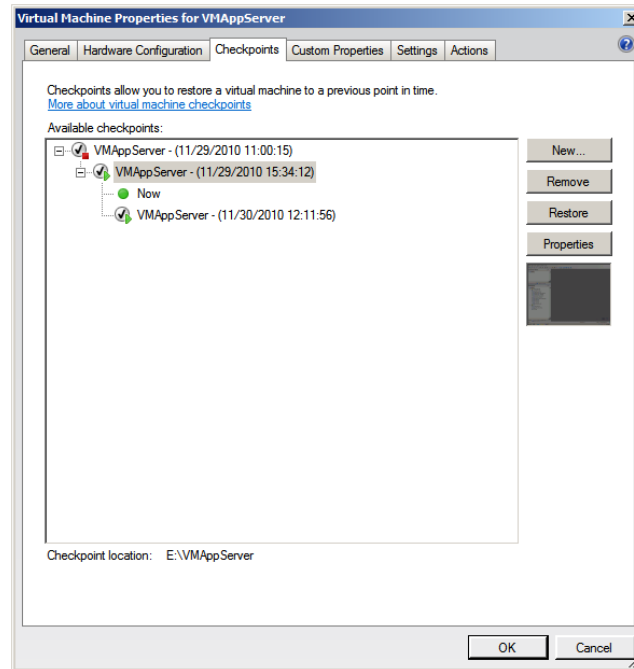
- 3 Restore the checkpoint.
  - a Click **Manage checkpoints**. The **Virtual Machine Properties** window appears.



- b Select the checkpoint that you want to restore and click **Restore**. A confirmation message appears.



- c Click **Yes**. The checkpoint is restored and the **Virtual Machine Properties** window appears.



A green dot appears below the checkpoint you restored indicating that it is now active. Click **OK** to exit the window.

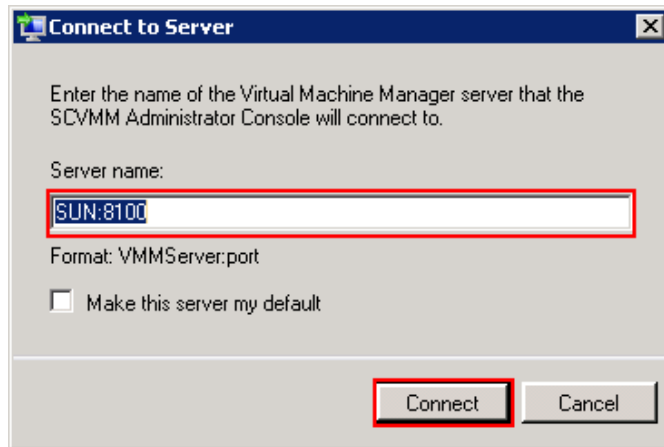
## Take and Restore Checkpoints of Products with No Dependencies

You can create and restore checkpoints of IOM products that do not have dependencies. When you restore the VM to a checkpoint, data is restored up to the point at which you took the checkpoint. Data related to all changes made after the checkpoint was taken is not captured and will not be restored.

For example, on an Application Server node, two User Defined Objects (UDOs) are created at different points in time and checkpoints taken at each point. If you restore your VM to the first checkpoint, it will be restored to the state where only the first UDO was created. The second UDO created will not be backed up or restored in your system.

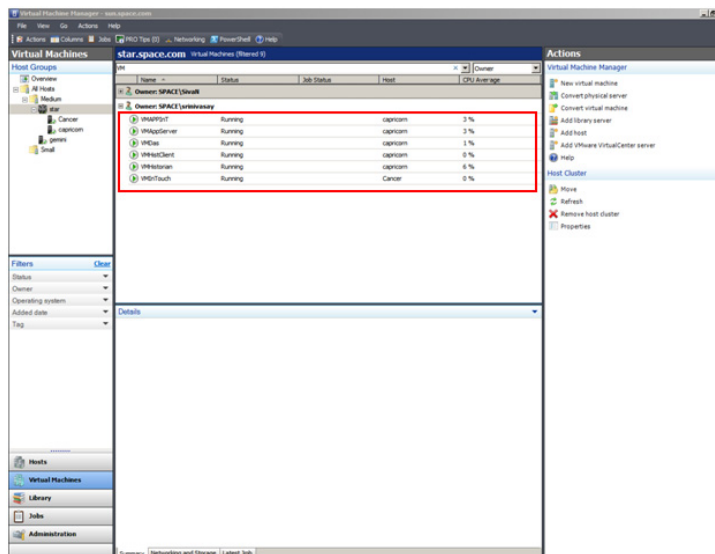
## To take and restore checkpoints of products with no dependencies

- 1 Open the System Center Virtual Machine Manager (SCVMM).
  - a On the **Start** menu, click **All Programs**. On the menu, click **Virtual Machine Manager 2008 R2**, and then **Virtual Machine Manager Administrator Console**. The **Connect to Server** window appears.



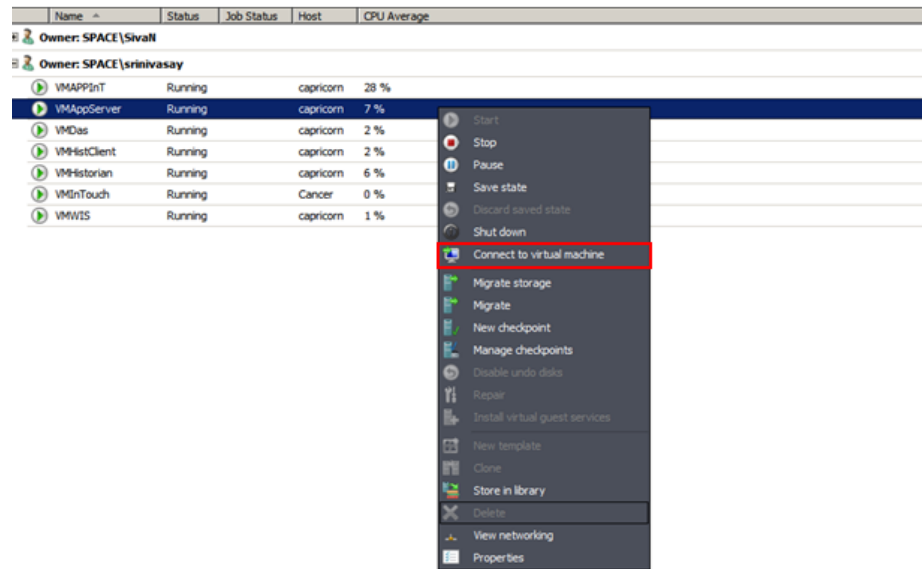
- b In the **Server name** box, enter "localhost:<port number>" or "<SCVMM server name>:<port number>", and then click **Connect**. The **Virtual Machine Manager** window appears.

**Note:** By default, the port number is 8100. However, you can modify it, if required.



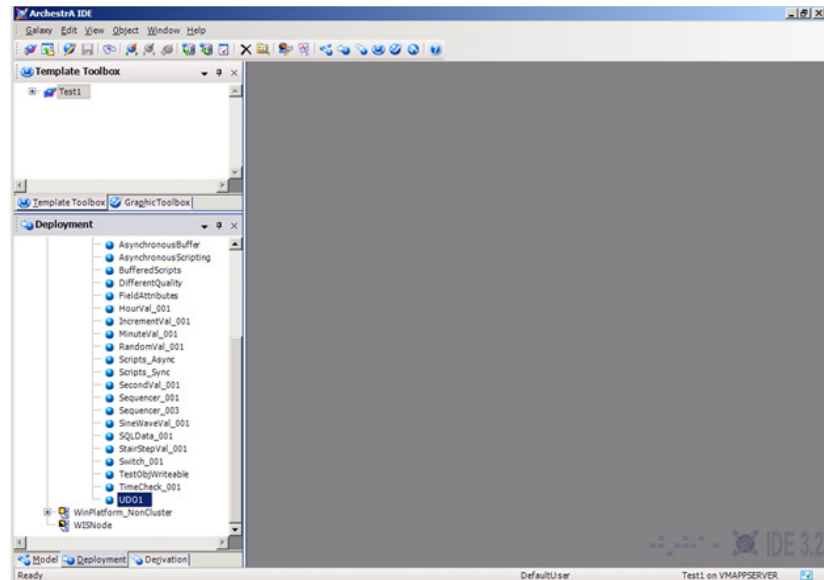
- 2 Select the VM for which you want to create and restore a checkpoints.

On the **Virtual Machine Manager** window, right-click the VM for which you want to create and restore checkpoints. The VM menu appears.



- 3 Connect to the virtual machine.

Click **Connect to virtual machine**. The **Virtual Machine Viewer** screen appears.





**4** Create UDO1.

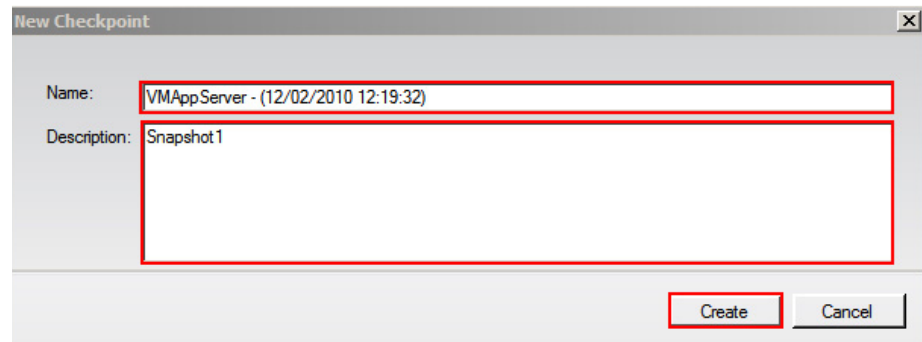
In **Application Server** under **Platform, Engine, and Area**, create UDO1.

**5** Select the VM.

In the **Virtual Machine Manager** window, right-click the VM again. The VM menu appears.

**6** Make a new checkpoint.

**a** Click **New checkpoint**. The **New checkpoint** window appears.



**b** Modify the name of the checkpoint and type a description for it, and then click **Create**. The checkpoint is created and the **Virtual Machine Manager** window appears.

---

**Note:** By default, the **Name** box displays the name of the VM and the time when the checkpoint is created.

---

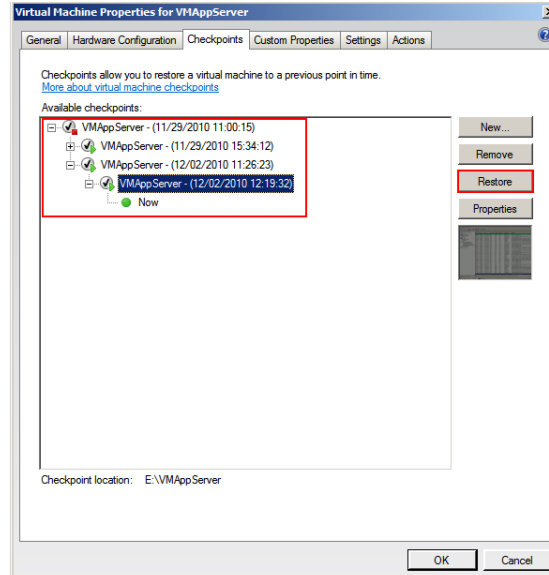
**7** Connect to the virtual machine, if not already connected.

In the **Virtual Machine Manager** window, right-click the VM. In the VM menu, click **Connect to virtual machine**. The **Virtual Machine Viewer** screen appears.

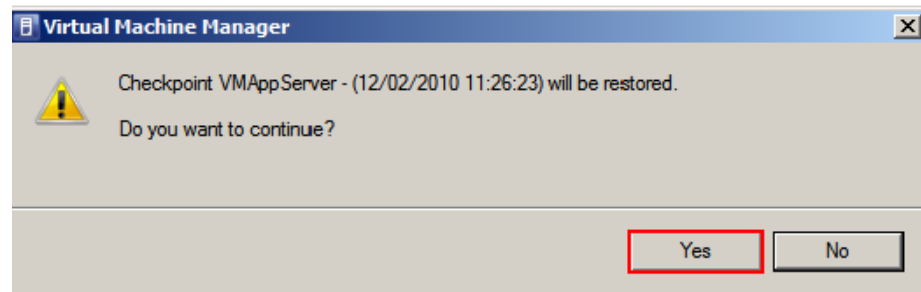
**8** Create UDO2.

In **Application Server** under **Platform, Engine, and Area**, create UDO2.

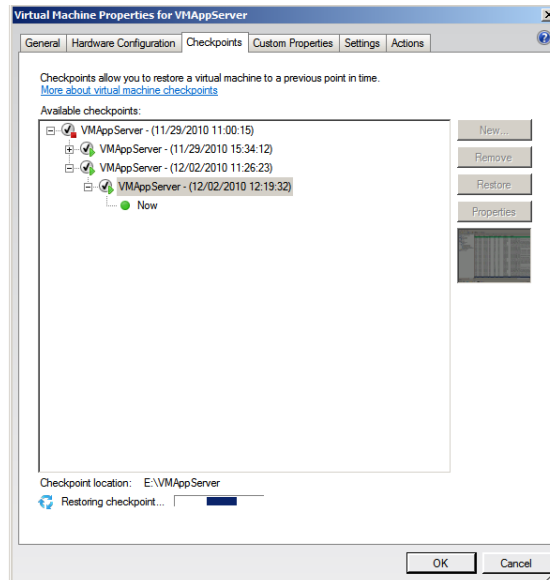
- 9 Restore the VM.
  - a In the **Virtual Machine Manager** window, right-click the VM and then click **Manage Checkpoints**. The **Virtual Machine Properties** window appears.



- b Select the required checkpoint and click **Restore**. A confirmation message appears.



- c Click **Yes**. The checkpoint is restored.



A green dot appears below the checkpoint that you restored indicating that it is now active. Click **OK** to exit the window.

## Checkpoints of System Platform Products - Observations and Recommendations

The following are some of the observations and recommendations to take and restore checkpoints of System Platform Products.

- Take checkpoints of System Platform Products only when there are no configuration changes. For example, some of the scenarios where the checkpoints should not be taken are as follows:

<b>System Platform Product</b>	<b>Configuration Changes</b>
Application Server	deploy, migrate, import, export, check-in, check-out
Historian	import, export, create history block

- You must be aware of the consequences and make decisions when taking and restoring checkpoints of System Platform Products that have dependencies. If the configuration of a System Platform node has a dependency on the configuration of another System Platform node, it is recommended to take and restore checkpoints on such dependent nodes together. For more information, refer to "Recommendations" on page 709.

## Taking and Restoring Checkpoints (Snapshots) in the Offline Mode

It is recommended that you take checkpoints of System Platform Products when the VMs hosting them are in the offline mode. Turn off the System Platform Product VM before taking a checkpoint.

Restoring checkpoints of VMs in the offline mode result in smooth functioning of the System Platform Products after the restoration. After restoring a checkpoint, start the VM, and then start the System Platform Product hosted in the VM.

## Taking and Restoring Checkpoints (Snapshots) in the Online Mode

While the VM is in the online mode, the System Platform Product hosted on the VM functions in either the following way:

- **Scenario 1:** If the System Platform Product is not running on an online VM, it functions smoothly after the restoration of checkpoints.
- **Scenario 2:** If a checkpoint is taken while the System Platform Product is running on an online VM and there are no configuration changes in progress, the System Platform Product performs normally. However, when checkpoints are restored, there would be issues with the System Platform Product running on that VM. Some of the issues are explained in the following table.

## Recommendations

Observation	Recommendations
<p><b>Historian</b></p>	<ul style="list-style-type: none"> <li>● Do not take checkpoints while a history block change is in progress. Restoring such a checkpoint leads to unpredictable behavior of the product.</li> <li>● In case of communication issues between the Historian and dependent System Platform Products, restart the VMs.</li> <li>● If a checkpoint is taken before configuring Application Server to historize attributes, re-deploy the platform after the Historian is restored.</li> </ul>
<p><b>Issue 1:</b> When you restore a checkpoint of the Historian node taken while the Historian was running and the block change was in progress, there is a conflict in the start and end time in the history block. The following errors and warnings are logged:</p> <p>Warning: aahIndexSvc Attempted to create history block ending in the future.</p> <p>Error: aahIndexSvc ERROR: Invalid file format.</p>	<p>As a recovery step of Issue 1, shut down and disable the Historian, and then start and enable it.</p>
<p><b>Issue 2:</b> While creating a checkpoint there may be an action in progress resulting from an event. The incomplete action is not saved when you restore such a checkpoint.</p>	
<p><b>Application Server</b></p>	

<b>Observation</b>	<b>Recommendations</b>
If checkpoints are restored on either GR node or remote IDE node, the configurations might go out of synchronization.	Perform galaxy object component synchronization (GOCS) after opening the IDE on the remote node.
<b>Data Acquisition Server (DAS)</b>	
If checkpoints are restored on DAS, there may be connectivity and configuration mismatch issues for the dependent System Platform Products.	Deactivate, and then activate the DAS with appropriate configuration file. If it does not resolve the connectivity issues, restart the dependent System Platform Product VMs.
<b>InTouch</b>	
If the AlarmDBLogger is configured on the local SQL Server, restoring checkpoints results in expected data loss.	If the alarm data is critical, configure the AlarmDBLogger on a remote SQL Server.
<b>Wonderware Information Server (WIS)</b>	
If checkpoints are restored on WIS, there may be connectivity issues for the dependent System Platform Products.	Log off and re-launch the WIS browser.
<b>Historian Client</b>	
If checkpoints are restored on Historian Client, there may be connectivity issues to access the Historian.	Log off the server connection and log on to the Historian Client Applications.

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# Glossary

<b>Application Engine (AppEngine)</b>	A scan-based engine that hosts and executes the run-time logic contained within Automation Objects.
<b>application object</b>	<p>An Automation Object that represents some element of your production environment. This can include things like:</p> <ul style="list-style-type: none"><li>● An automation process component. For example, a thermocouple, pump, motor, valve, reactor, or tank</li><li>● An associated application component. For example, function block, PID loop, sequential function chart, ladder logic program, batch phase, or SPC data sheet</li></ul>
<b>Application Server</b>	<p>It is the supervisory control platform. Application Server uses existing Wonderware products, such as InTouch for visualization, Wonderware Historian for data storage, and the device integration product line like a Data Access Server (DAServer) for device communications.</p> <p>An Application Server can be distributed across multiple computers as part of a single Galaxy namespace.</p>
<b>ArchestrA</b>	The distributed architecture for supervisory control and manufacturing information systems. It is an open and extensible technology based on a distributed, object-based design.
<b>child partition</b>	Child partitions are made by the hypervisor in response to a request from the parent partition. There are a couple of key differences between a child partition and a parent/root partition. Child partitions are unable to create new partitions. Child partitions do not have direct access to devices (any attempt to interact with hardware directly is routed to the parent partition). Child partitions do not have direct access to memory. When a child partition tries to access memory the hypervisor / virtualization stack re-maps the request to different memory locations.

- clone** A VM clone is an exact copy of a VM at a specific moment in time. The most common use of a VM clone is for mass deployment of standardized VMs, called VM templates. VM clones also come in handy for test and development; because they allow use of a real workload without affecting the production environment. A VM clone is not appropriate for backup, disaster recovery, or other data protection methods.
- clustered file system** A clustered file system organizes files, stored data, and access for multiple servers in a cluster. Clustered file systems are most useful when clusters work together and require shared access, which individual file systems do not provide. A Windows or Linux clustered file system can also identify and isolate defective nodes in a cluster. A Windows clustered file system will isolate the node logically, while a Linux clustered file system will use a utility to power down the node.
- compact** To reduce the size of a dynamically expanding virtual hard disk by removing unused space from the .vhd file. See also dynamically expanding virtual hard disk
- differencing disk** A virtual hard disk that is associated with another virtual hard disk in a parent-child relationship. The differencing disk is the child and the associated virtual hard disk is the parent.
- differencing virtual hard disk (diffdisk)** A virtual hard disk that stores the changes or "differences" to an associated parent virtual hard disk for the purpose of keeping the parent intact. The differencing disk is a separate .vhd file (that may be stored in a separate location) that is associated with the .vhd file of the parent disk. These disks are often referred to as "children" or "child" disks to distinguish them from the "parent" disk. There can be only one parent disk in a chain of differencing disks. There can be one or more child disks in a differencing disk chain of disks that are "related" to each other. Changes continue to accumulate in the differencing disk until it is merged to the parent disk. See also virtual hard disk. A common use for differencing disks is to manage storage space on a virtualization server. For example, you can create a base parent disk—such as a Windows 2008 R2 Standard base image - and use it as the foundation for all other guest virtual machines and disks that will be based on Windows Server 2008 R2.
- dynamically expanding virtual hard disk (dynamic VHD, DVHD)** A virtual hard disk that grows in size each time it is modified. This type of virtual hard disk starts as a 3 KB .vhd file and can grow as large as the maximum size specified when the file was created. The only way to reduce the file size is to zero out the deleted data and then compact the virtual hard disk. See also virtual hard disk, VHD.
- external virtual network** A virtual network that is configured to use a physical network adapter. These networks are used to connect virtual machines to external networks. See also internal virtual network, private virtual network.
- failover** In server clusters, failover is the process of taking resource groups offline on one node and bringing them online on another node.



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<b>fragmentation</b>	The scattering of parts of the same disk file over different areas of the disk.
<b>guest operating system</b>	This is the operating system/runtime environment that is present inside a partition. Historically with Virtual Server / Virtual PC, in a host operating system and a guest operating system where the host ran on the physical hardware and the guest ran on the host. In Hyper-V, all operating systems on the physical computer are running on top of the hypervisor so the correct equivalent terms are parent guest operating system and child guest operating system. Many find these terms confusing and instead use physical operating system and guest operating system to refer to parent and child guest operating systems, respectively.
<b>guests and hosts</b>	A guest virtual machine and host server are the two main building blocks of virtualization. The guest virtual machine is a file that contains a virtualized operating system and application, and the host server is the hardware on which it runs. The other important component is the hypervisor—the software that creates the guest virtual machine and lets it interact with the host server. The hypervisor also makes the host server run multiple guest virtual machines.
<b>historical storage system (Historian)</b>	The time series data storage system that compresses and stores high volumes of time series data for later retrieval. The standard Historian is the Wonderware Historian.
<b>hypervisor</b>	The hypervisor is to Hyper-V what the kernel is to Windows. The hypervisor is the lowest level component that is responsible for interaction with core hardware. It is responsible for creating, managing, and destroying partitions. It directly controls access to processor resource and enforces an externally-delivered policy on memory and device access. The hypervisor is just over 100k in size and the entire Hyper-V role is around 100mb in size. A full installation of Windows Server 2008 with Hyper-V will be multiple gigabytes in size. After you have installed the Hyper-V role, the hypervisor is loaded as a boot critical device.
<b>live migration</b>	Virtual machine live migration is the process of moving a VM from one host server to another without shutting down the application. The benefits of virtual machine live migration are some of the biggest selling points for virtualization, affecting business continuity, disaster recovery, and server consolidation. Virtual machine live migration is a feature in all of the major virtualization platforms, including VMware vSphere, Microsoft Hyper-V R2, and Citrix Systems XenServer.
<b>logical processor</b>	This is a single execution pipeline on the physical processor. Earlier, if someone told you that they had a two-processor system, you would know exactly what they had. Today, if someone told you they had a two-processor system, you do not know how many cores each processor has, or if hyperthreading is present. A two-processor computer with

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hyperthreading would actually have four execution pipelines, or four logical processors. A two-processor computer with quad-core processors would, in turn, have eight logical processors.

**management operating system**

The operating system that was originally installed on the physical machine when the Hyper-V role was enabled. After installing the Hyper-V role, this operating system is moved into the parent partition. The management operating system automatically launches when you reboot the physical machine. The management operating system actually runs in a special kind of virtual machine that can create and manage the virtual machines that are used to run workloads and/or different operating systems. These virtual machines are sometimes also called child partitions. The management operating system provides management access to the virtual machines and an execution environment for the Hyper-V services. The management operating system also provides the virtual machines with access to the hardware resources it owns.

**memory overcommit**

A hypervisor can let a guest VM use more memory space than that available in the host server. This feature is called memory overcommit. Memory overcommit is possible because most VMs use only a little bit of their allocated physical memory. That frees up memory for the few VMs that need more. Hypervisors with memory overcommit features can identify unused memory and reallocate it to more memory-intensive VMs as needed.

**Network Load Balancing (NLB)**

A Windows network component that uses a distributed algorithm to load-balance IP traffic across a number of hosts, helping to enhance the scalability and availability of mission-critical, IP-based services.

**network virtualization**

Network virtualization lets you combine multiple networks into one, divide one network into many and even create software-only networks between VMs. The basis of network virtualization is virtual network software, to which there are two approaches: internal and external. Internal network virtualization uses virtual network software to emulate network connectivity among VMs inside a host server. External network virtualization virtual network software to consolidate multiple physical networks or create several virtual networks out of one physical network.

**NTFS**

An advanced file system that provides performance, security, reliability, and advanced features that are not found in any version of the file allocation table (FAT).

**parent partition**

The parent partition can call hypervisor and request for new partitions to be created. There can only be one parent partition. In the first release of Hyper-V, the parent and root partitions are one and the same.

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<b>partition</b>	A partition is the basic entity that is managed by the hypervisor. It is an abstract container that consists of isolated processor and memory resources with policies on device access. A partition is a lighter weight concept than a virtual machine and could be used outside the context of virtual machines to provide a highly isolated execution environment.
<b>physical computer</b>	The computer, or more specifically, the hardware that is running the Hyper-V role.
<b>physical processor</b>	It is the squarish chip that you put in your computer to make it run. This is sometimes also referred to as a "package" or a "socket".
<b>private virtual network</b>	A virtual network without a virtual network adapter in the management operating system. It allows communication only between virtual machines on the same physical server.
<b>processor topology</b>	This is the concept by which your logical processors correlate to your physical processors. For example, a two processor, quad-core system and a four-processor dual-core system both have eight logical processors but they have different processor topologies.
<b>P2V</b>	A physical-to-virtual server migration, also known as a P2V server migration, is the process of converting a physical workload into a VM. To perform a physical-to-virtual server migration, copy bits from the physical disk to the VM, inject drivers, then modify other bits to support the drivers. Some operating systems and virtual server migration tools let you perform a P2V server migration while the host is running, but others require a shutdown.
<b>release key combination</b>	The key combination (CTRL+ALT+LEFT ARROW by default) that must be pressed to move keyboard and mouse focus from a guest operating system back to the physical computer.
<b>root partition</b>	This is the first partition on the computer. This is the partition that is responsible for starting the hypervisor. It is also the only partition that has direct access to memory and devices.
<b>saved state</b>	A manner of storing a virtual machine so that it can be quickly resumed (similar to a hibernated laptop). When you place a running virtual machine in a saved state, Virtual Server and Hyper-V stop the virtual machine, write the data that exists in memory to temporary files, and stop the consumption of system resources. Restoring a virtual machine from a saved state returns it to the same condition it was in when its state was saved.
<b>small computer system interface (SCSI)</b>	A standard high-speed parallel interface used for connecting microcomputers to peripheral devices, such as hard disks and printers, and to other computers and local area networks (LANs).

<b>snapshot</b>	A VM snapshot backup is the most common way to protect a virtual machine. A VM snapshot is a copy of the state of a VM (and any virtual disks assigned to it) as it exists in server memory at a specific moment. The snapshot is usually saved to the SAN, where it can be recovered in case of a failure. Regular VM snapshot backups can significantly reduce recovery point objectives.
<b>storage area network (SAN)</b>	A set of interconnected devices, such as disks and tapes, and servers that are connected to a common communication and data transfer infrastructure, such as fibre channel.
<b>storage virtualization</b>	Storage virtualization separates the operating system from physical disks used for storage, making the storage location independent. The benefits of storage virtualization include more efficient storage use and better management. Dynamic provisioning is similar to storage virtualization, but it still requires more traditional storage management.
<b>system center virtual machine manager (SCVMM)</b>	A centralized management console that helps you manage and administer a virtual environment.
<b>.vfd or virtual floppy disk</b>	The file format for a virtual floppy disk. See also virtual floppy disk.
<b>.vhd or virtual hard disk</b>	The file format for a virtual hard disk, the storage medium for a virtual machine. It can reside on any storage topology that the management operating system can access, including external devices, storage area networks, and network-attached storage.
<b>virtual hardware</b>	The computing resources that the host server assigns to a guest VM make up the virtual hardware platform. The hypervisor controls the virtual hardware platform and allows the VM to run on any host server, regardless of the physical hardware. The virtual hardware platform includes memory, processor cores, optical drives, network adapters, I/O ports, a disk controller and virtual hard disks. Virtualization lets a user adjust the levels of these resources on each VM as needed.
<b>virtual machine</b>	A virtual machine (VM) is a file that includes an application and an underlying operating system combines with a physical host server and a hypervisor to make server virtualization possible. A virtual machine is a super-set of a child partition. A virtual machine is a child partition combined with virtualization stack components that provide functionality, such as access to emulated devices, and features like being able to save state a virtual machine. As a virtual machine is essentially a specialized partition, the terms "partition" and "virtual machine" is often used interchangeably. But, while a virtual machine will always have a partition associated with it, a partition may not always be a virtual machine.

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<b>virtual machine bus</b>	A communications line used in Hyper-V by virtual machines and certain types of virtual devices. The virtual devices that use virtual machine bus have been optimized for use in virtual machines.
<b>virtual machine configuration</b>	The configuration of the resources assigned to a virtual machine. Examples include devices such as disks and network adapters, as well as memory and processors.
<b>Virtual machine connection</b>	A Hyper-V management tool that allows a running virtual machine to be managed through an interactive session.
<b>virtual machine management service</b>	The SCVMM service that provides management access to virtual machines.
<b>virtual machine monitoring</b>	Virtual machine monitoring actually means virtual machine performance monitoring. Virtual machine performance monitoring tools keep tabs on the state of VMs in an environment. Though it is possible to monitor the VM performance from within, but it's recommended to monitor it from outside the VM.
<b>virtual machine snapshot</b>	A virtual machine snapshot is a point in time image of a virtual machine that includes its disk, memory and device state at the time that the snapshot was taken. At any time can be used to return a virtual machine to a specific moment in time, at any time. Virtual machine snapshots can be taken irrespective of the state or type of child guest operating system being used.
<b>virtual network</b>	A virtual version of a physical network switch. A virtual network can be configured to provide access to local or external network resources for one or more virtual machines.
<b>virtual network manager</b>	The Hyper-V component used to create and manage virtual networks.
<b>virtualization server</b>	A physical computer with the Hyper-V role installed. This server contains the management operating system and it provides the environment for creating and running virtual machines. Sometimes referred to as a server running Hyper-V.
<b>virtualization stack</b>	The virtualization stack is everything else that makes up Hyper-V. This is the user interface, management services, virtual machine processes, emulated devices.
<b>virtual processor</b>	A virtual processor is a single logical processor that is exposed to a partition by the hypervisor. Virtual processors can be mapped to any of the available logical processors in the physical computer and are scheduled by the hypervisor to allow you to have more virtual processors than you have logical processors.
<b>virtual switch</b>	A virtual switch is the key to network virtualization. It connects physical switches to VMs through physical network interface cards and ports. A virtual switch is similar to a virtual bridge, which many virtualization platforms use, but it is more advanced. Virtual LANs,

EtherChannel and additional virtual networking tools are only available in a virtual switch. Some virtual switches even offer their own security features.

**virtualization WMI provider**

The WMI provider for virtualization that can be used with the hypervisor API to enable developers and scripters to build custom tools, utilities, and enhancements for the virtualization platform.

**VMDK**

The Virtual Machine Disk (VMDK) file format is used to identify VMware virtual machines. (In virtualization, the hypervisor creates a VM file that consists of an operating system instance, an application and other associated components.) Other platforms that support the VMDK file format include Sun Microsystems xVM, Oracle VirtualBox, and QEMU. It competes with Microsoft's Virtual Hard Disk format, which is used in Virtual Server and Hyper-V.

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