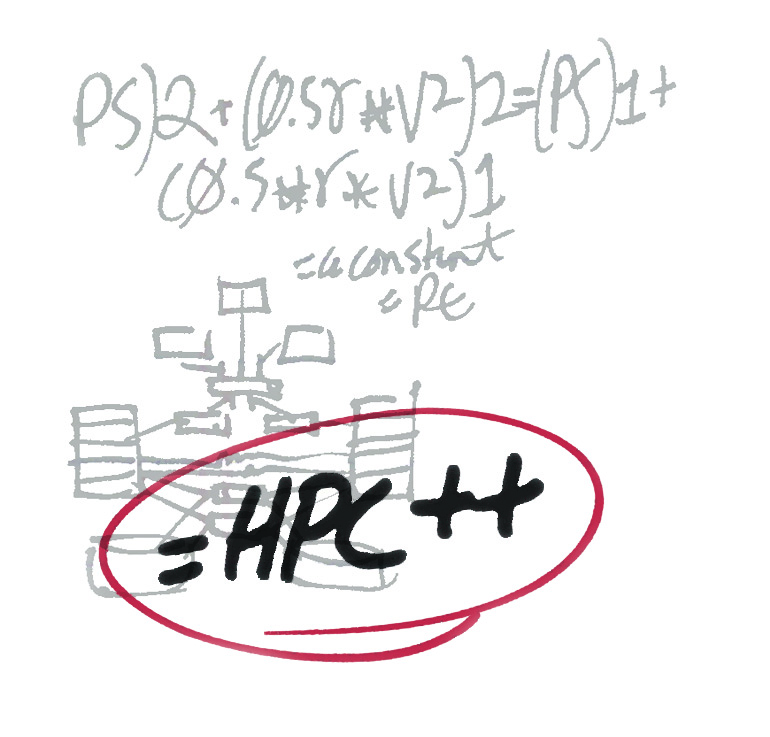
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**Windows HPC Server 2008 Reviewers Guide**

Published: September 2008

For the latest information, please see http://www.microsoft.com/hpc

**Abstract**

Windows® HPC Server 2008 brings the power, performance, and scale of high-performance computing (HPC) to mainstream computing. The centralized management and deployment interface in Windows HPC Server helps to simplify deployment for both large and small compute clusters, providing a simple and effective management experience to increase the productivity of cluster administrators, while offering seamless security, storage, and desktop access to cluster resources and management.

Windows HPC Server 2008 comprises Windows Server® 2008 and Microsoft® HPC Pack 2008. The Microsoft HPC Pack 2008 includes a highly scalable Job Scheduler that provides support for interactive service-oriented architecture (SOA) applications using HPC for Windows® Communication Foundation (WCF) and for parallel jobs using Microsoft Message Passing Interface (MS-MPI). Administrators can set up essential applications from key independent software vendors (ISVs) on the cluster to help meet business needs in a timely, cost-effective, and highly productive manner; users can submit and monitor jobs from within familiar ISV applications without having to become familiar with new user interfaces.

Windows HPC Server 2008 can take advantage of the comprehensive parallel programming environment and debugging capabilities of Microsoft® Visual Studio® 2005; additionally, MS-MPI is now integrated with the Event Tracing for Windows infrastructure. This consolidates application, networking, and operating system events from many compute nodes into a single, time-correlated record to speed debugging. Users can easily develop a parallel application using a SOA programming model and existing mainstream applications like Microsoft® Office Excel®.

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# Overview of Windows HPC Server 2008

Windows® HPC Server 2008, the next generation of high performance computing (HPC) solutions, provides enterprise-class tools, performance, and scalability for a highly productive HPC environment. Built on Windows Server® 2008 64-bit technology, Windows HPC Server 2008 can efficiently scale to thousands of processing cores and includes a management console that helps proactively monitor and maintain system health and stability. Job scheduling interoperability and flexibility enables integration between Windows®- and Linux-based HPC platforms, and supports batch and service-oriented architecture (SOA) workloads.

Windows HPC Server 2008 simplifies deployment and management. By using the existing Windows-based information technology (IT) infrastructure, Windows HPC Server 2008 simplifies management, security, and storage for the cluster, and provides seamless access from the desktop.

Windows HPC Server 2008 includes improved provisioning based on the Windows Server 2008 Windows Deployment Services (WDS) technology, a faster Microsoft Message Passing Interface (MS-MPI) that includes new NetworkDirect support, an advanced Job Scheduler, and a new management interface built on the Microsoft® System Center user interface (UI), which supports Windows PowerShell™ as a preferred scripting interface.

Windows HPC Server 2008 integrates with other Microsoft® products to help increase HPC productivity and improve the overall user experience. This includes collaboration through Microsoft® Office SharePoint® Server 2007 and the Windows® Workflow Foundation (WF), in addition to improved management and efficiency with Microsoft System Center solutions. Because it is integrated with the Windows® Communication Foundation (WCF), Windows HPC Server 2008 lets developers working with SOA applications take advantage of the parallel computing offered by HPC solutions.

Users whose work demands HPC solutions employ applications that execute complex computations and elaborate data output. Microsoft has worked with independent software vendors (ISVs) to port applications to Windows HPC Server 2008 that serve several markets, including manufacturing, life sciences, geological sciences, government, higher education, and financial services.

When a user submits a job to the cluster, the job, along with its properties, is recorded in the head node database, entered into the execution queue, and then run when the resources it requires become available. Because the cluster is in the user’s Active Directory® Domain Services (AD DS) domain, jobs execute using that user’s permissions, eliminating the complexity of using and synchronizing different credentials; the user does not have to resort to additional data-sharing methods or compensate for permission differences among different operating systems.

# Primer on Windows HPC Server 2008

HPC has evolved considerably during the last two decades. The “supercomputer” solutions of the early 1990s provided enormous parallel computing power, but they were very expensive and required a great deal of expertise to deploy, manage, and maintain. Consequently, customers for these solutions were generally limited to governments and large research institutions.

While the most advanced supercomputing solutions available today are still out of reach for many organizations, almost any organization can cluster inexpensive and readily available commodity hardware, taking advantage of the increased computing power brought by 64-bit processor architecture and the associated increase in memory address space. The cost to create a small cluster for HPC is approximately $5,000–10,000: about 10,000 times less than it cost in 1991 to produce the same computing power. This gives organizations more options; for example, they can submit large-scale or high-precision jobs to supercomputer systems while executing smaller, routine tasks using a local cluster.

While the setup cost has decreased considerably, most HPC solutions are still difficult and expensive to use, manage, and integrate into an overall computing infrastructure, particularly for smaller organizations. In addition, many HPC solutions do not support standard applications. With the release of Windows HPC Server 2008, Microsoft aims to address these issues.

Administrators can deploy, manage, and extend Windows HPC Server 2008 using familiar tools and technologies right from their desktop or laptop computer. Windows HPC Server 2008 provides:

**Reliable performance** **x64-bit technology**—Windows HPC Server 2008 can scale to thousands of processing cores and it includes management tools that help system administrators proactively monitor system health and maintain system stability. Windows HPC Server 2008 is also reliable: it employs the failover capabilities in Windows Server 2008 and Microsoft® SQL Server® 2008 to provide high availability in the event of system failure.

**Enhanced productivity**—With Windows HPC Server 2008, you can accomplish more, in less time, and with reduced effort by taking advantage of users’ existing skills because Windows HPC Server is integrated with the tools already in use in your enterprise:

* Administrators can use existing Microsoft management tools to centrally manage their entire Windows Server infrastructure.
* Users don’t need to master command-line interfaces to harness the power of HPC.
* Application developers can work with familiar development tools like Visual Studio to develop parallel programs.
* Teams can manage their projects and collaborate via workflows through the use of Microsoft Office SharePoint Server 2007.

**A familiar development environment**—Windows HPC Server 2008 uses an intuitive design, so developers can apply their existing Windows-based skills and experience. In addition, Visual Studio is the most widely used integrated development environment (IDE) in the industry, and Visual Studio 2008 includes support for developing HPC applications, including parallel compiling and debugging capabilities. Microsoft Partners provide additional compiler and math library options. Windows HPC Server 2008 supports the MPI standard through the Microsoft MPI stack (called MS-MPI) or through third-party stacks.

Windows HPC Server 2008 puts an HPC solution within reach for individuals and organizations that might not be able to afford the total cost of ownership (TCO) otherwise. They can now capitalize on their investment in a Windows-based infrastructure and skilled resources for HPC workloads.

## What’s New in Windows HPC Server 2008?

When developing Windows HPC Server 2008, Microsoft focused on four key areas: systems management, job scheduling, networking and MPI, and storage. The new features include:

**Systems Management**

* New Administration Console based on System Center UI framework that integrates every aspect of cluster management.
* Node grouping to let administrators categorize and batch operations on compute nodes.
* Monitoring heat map for an at-a-glance view of cluster status.
* Scriptable control of the cluster with Windows PowerShell and other command-line tools.
* High availability for multiple head nodes.
* Improved compute node provisioning using Windows Deployment Services.
* Built-in support for cluster-wide updating.
* Built-in system diagnostics.
* Built-in cluster reporting.
* Extensible reporting that lets job scheduling analysis use external database tools like Microsoft® SQL Server® 2005 Analysis Services (SSAS).
* Microsoft® System Center Operations Manager 2007 Management Pack.

**Job Scheduling**

* Integration with WCF, enabling SOA application developers to apply the power of parallel computing offered by HPC solutions.
* Job scheduling granularity at processor core, processor socket, and compute node levels.
* Performance improvements for large clusters.
* Support for external databases for job scheduling.
* New job scheduling policies.
* Support for Open Grid Forum’s HPC Basic Profile interface for Job Scheduler interoperability.

**Networking** **and MPI**

* NetworkDirect, a new Remote Direct Memory Access (RDMA) network interface that provides dramatic performance improvements for MPI applications running over high-speed fabrics.
* Improved Network Configuration Wizard.
* New shared memory MS-MPI implementation for multicore servers.
* MS-MPI integrated with Event Tracing for Windows.

**Storage**

* Improved iSCSI storage area network (SAN) support in Windows Server 2008.
* Improved Server Message Block v2 (SMB v2) in Windows Server 2008.
* New parallel file system support and vendor partnerships for clusters with high-performance storage needs.

Table 1 provides a quick comparison of differences between versions 1 and 2 of Windows HPC technology: Windows® Compute Cluster Server 2003 (version 1) and Windows HPC Server 2008 (version 2).

**Table 1 Version Comparisons**

|  |  |  |
| --- | --- | --- |
| Feature | Windows Compute Cluster Server 2003 | Windows HPC Server 2008 |
| Operating System | Windows Server® 2003  Service Pack 1 (SP1) | Windows Server 2008 |
| Processor Type | X64 (AMD64 or Intel EM64T) | X64 (AMD64 or Intel EM64T) |
| Node Deployment | Remote Installation Services (RIS) (Windows Deployment Services legacy mode) | Windows Deployment Services |
| Head Node Redundancy | N/A | Windows failover clustering and SQL Server failover clustering |
| Management | Basic node and job management | Integrated node and job management, grouping, monitoring at-a-glance, diagnostics |
| Network Topology | Network Configuration Wizard | Improved Network Configuration Wizard |
| MS-MPI | Winsock Direct-based | NetworkDirect-based: new shared memory implementation for multicore processors results in improved performance for bandwidth and latency. |
| Scheduler | Command-line or GUI | Integrated in management console, with support for Windows PowerShell scripting and previous command-line UI scripts from v1. Greatly improved speed and scalability. Support for SOA applications. |
| Reporting | N/A | Integrated into management console. Extensibility features make it possible to use SQL Server Analysis Services for additional analysis. |
| Monitoring | Rely on Windows. No cluster-specific support. | Heat map on cluster or node group. Per-node charts. Cluster-wide performance overview. |
| Diagnostics | N/A | In-the-box verification tests and performance tests. Store, filter, and view test results and history. |

## About MPI, MPICH, and MS-MPI

MPI is a standard API and specification for message passing. It was designed specifically for HPC scenarios executed on large computer systems or on clustered commodity computers.

The MS-MPI is a version of the Argonne National Labs Open Source MPICH2 implementation that is widely used by existing HPC clusters. MS-MPI is compatible with the MPICH2 Reference Implementation and includes a full-featured API with more than 160 function calls.

The MS-MPI software in Windows HPC Server 2008 is built on the Windows Sockets networking API (Winsock) so MS-MPI networking traffic can use TCP/IP as normal, or, for best performance and CPU efficiency, can use Winsock Direct drivers to bypass the TCP stack and go directly to the networking hardware’s native interface.

MS-MPI can utilize any Ethernet interconnect that is supported on Windows Server 2008, in addition to low-latency and high-bandwidth interconnections, such as InfiniBand or Myrinet, through NetworkDirect or Winsock Direct drivers provided by hardware manufacturers. As a result, a single MPI stack supports many fabrics without sacrificing performance. This flexibility should ease the burden of management for network administrators. More importantly, such flexibility means that applications do not have to be rebuilt for specific network hardware.

As a result, ISVs have a much smaller test matrix for their products (speeding their time to market and lowering cost) and customers do not have to buy and maintain multiple versions (one for each type of network hardware they have) of a single application. Gigabit Ethernet provides a high-speed, cost-effective interconnection fabric, while InfiniBand is ideal for latency-sensitive and high-bandwidth applications.

MS-MPI includes support (bindings) for the C, Fortran77, and Fortran90 programming languages. Microsoft® Visual Studio® 2008 includes a parallel debugger that works with MS-MPI. Developers can launch their MPI applications on multiple compute nodes from within the Visual Studio environment, and Visual Studio automatically connects the processes on each node, enabling developers to individually pause and examine program variables on each node.

### System Requirements

Windows HPC Server 2008 is a two-DVD package. The first DVD contains the setup for a 64-bit version of Windows Server 2008 that is restricted to an HPC workload, and the second DVD contains the Microsoft® HPC Pack 2008, which provides the additional interfaces, tools, and management infrastructure.

In Windows HPC Server 2008, any computer designated as either a head node or a compute node must meet minimum hardware and software requirements. If an organization’s plans include installing the administrative and user components on a remote computer, the remote computer must have an operating system that is compatible with the Microsoft HPC Pack 2008. Head nodes may also have additional software requirements, such as Windows Deployment Services or Internet Connection Sharing (ICS) Network Address Translation (NAT), depending on the networking environment in which the cluster is installed.

### Hardware Requirements

The minimum hardware requirements for Windows HPC Server 2008 are similar to the hardware requirements for the x64-based version of the Windows Server® 2008 Standard operating system. Windows HPC Server 2008 supports up to 128 GB of RAM.

Supported processors include:

* AMD Opteron
* AMD Athlon 64
* AMD Phenom
* Intel Xeon with Intel EM64T
* Intel Pentium with Intel EM64T
* Intel Core 2 Duo with Intel EM64T

**Table 2 Minimum Hardware Requirements**

|  |  |
| --- | --- |
| Hardware | Requirements |
| CPU | x64 architecture computer with Intel Pentium or Xeon family processors with Intel Extended Memory 64 Technology (EM64T) processor architecture; AMD Opteron family processors; AMD Phenom family processors; AMD Athlon 64 family processors; compatible processor(s) |
| RAM | 512 MB |
| Multiprocessor support | Windows Server® 2008, HPC Edition, and Windows Server 2008 Standard support up to four processors per server. Windows Server® 2008 Enterprise supports up to eight processors per server. |
| Minimum disk space for setup | 50 GB |
| Disk volumes | A single system volume is required for the head and compute nodes.  Redundant array of independent disks (RAID) is supported, but not required.  The system volume must be Master Boot Record (MBR). Additional volumes can be MBR or GUID Partition Table (GPT). |
| Network interface card | At least one network interface card (NIC) is required. If a private network is used, the head node requires at least two NICs, and compute nodes at least one. Each node may also require a high-speed NIC for an application network. |

### Software Requirements

The head and compute nodes for Windows HPC Server 2008 can be any of the following:

* The 64-bit version of Windows Server 2008 Standard
* The 64-bit version of Windows Server 2008 Enterprise

The Job Scheduler uses SQL Server as its repository. An existing SQL Server 2005 or SQL Server 2008 installation can be used, or the HPC Pack 2008 installer will install Microsoft® SQL Server® Express. Microsoft® SQL Server® Standard Edition or SQL Server® Enterprise Edition is required for head node failover clustering.

The Administration Console and job scheduling user console components are automatically installed on the head node of the compute cluster. These components can also be installed on other computers, enabling either remote management of the cluster or job submission from client computers. The supported operating systems for installation of the remote components are:

* Windows Server 2003 Service Pack 2 (SP2) or Release 2 (R2) (32-bit or x64 versions)
* Windows Server 2008 (32-bit or x64 versions)
* Windows® XP Professional SP3
* Windows® XP Professional, x64 Edition SP2
* Windows Vista® Business, Windows Vista® Enterprise, and Windows Vista® Ultimate Service Pack 1 (SP1)
* **Note:** Windows HPC Server 2008 is designed solely for use with high performance computing applications and does not support use as a general-purpose infrastructure server.

# Getting Started

This section provides basic conceptual information and general procedures for installing a high-performance computing cluster using Windows® HPC Server 2008.

For detailed deployment information and step-by-step procedures, see the Windows HPC Server 2008 Deployment Guide (<http://go.microsoft.com/fwlink/?LinkID=117921>). Also, to properly plan for your cluster deployment, it is strongly recommended that you first review the Windows HPC Server 2008 Design Guide (<http://go.microsoft.com/fwlink/?LinkId=124376>).

* **Note:** You can configure your HPC cluster for high availability by installing the head node in the context of a failover cluster. If the server that is acting as the head node fails, the other server in the failover cluster automatically begins acting as the head node (through a process known as failover). For more information about running an HPC cluster with failover clustering, see <http://go.microsoft.com/fwlink/?LinkId=123894>.

## Checklist: Deploy an HPC Cluster

The following checklist describes the overall process of deploying a Windows HPC Server 2008 cluster.

Before you start deploying your HPC cluster, review the list of prerequisites and initial considerations.

* Prepare for Your Deployment by making important decisions on active directory domain, user account, and network topology to use for the cluster.
* Deploy the head node by installing Windows Server 2008 and HPC Pack 2008.
* Configure the head node by following the steps in the configuration to-do list.
* Add nodes to the cluster by deploying them from bare metal, by importing an XML file, or by manually configuring them.
* Run diagnostic tests to verify that the deployment of the cluster was successful.

## Step 1: Prepare for Your Deployment

**Configuring the Firewall**

The head node and the compute nodes in your HPC cluster must be members of an Active Directory® domain. Before deploying your cluster, you must choose the Active Directory domain that you will use for your HPC cluster.

If you do not have an Active Directory domain to which you can join your cluster, or if you prefer not to join an existing domain, you can install the Active Directory Domain Services (AD DS) role on the head node and then configure a domain controller on that node. For more information about installing the AD DS role on a computer that is running Windows Server 2008, see <http://go.microsoft.com/fwlink/?LinkID=119580>.

**Caution:** If you choose to install and configure an Active Directory domain controller on the head node, consult with your network administrator about the correct way to isolate the new Active Directory domain from the enterprise network, or how to join the new domain to an existing Active Directory forest.

**Choose a user account for installation and diagnostics**

During the configuration process of your HPC cluster, you must provide credentials for a domain user account that will be used for installation and diagnostics. You must choose an existing account or create a new account, before starting your cluster deployment.

The following is a list of details to take into consideration when choosing the user account:

* The user account that you choose must be a domain account with enough privileges to create Active Directory computer accounts for the compute nodes. Alternatively, you can create the computer accounts manually or ask your domain administrator to create them for you.
* If part of your deployment requires access to resources on the enterprise network, the user account must have the necessary permissions to access those resources—for example, installation files that are available on a network server.
* If you want to restart nodes remotely from the cluster administration console (HPC Cluster Manager), the account must be a member of the local Administrators group on the head node. This requirement is only necessary if you do not have scripted power control tools that you can use to remotely restart the compute nodes.

**Choose a network topology for your cluster**

Windows HPC Server 2008 supports five cluster topologies. These topologies are distinguished by how the compute nodes in the cluster are connected to each other and to the enterprise network. The five supported cluster topologies are:

* Topology 1: Compute Nodes Isolated on a Private Network
* Topology 2: All Nodes on Enterprise and Private Networks
* Topology 3: Compute Nodes Isolated on Private and Application Networks
* Topology 4: All Nodes on Enterprise, Private, and Application Networks
* Topology 5: All Nodes on an Enterprise Network

For more information about each network topology, see <http://go.microsoft.com/fwlink/?LinkId=124377>.

When you are choosing a network topology, you must take into consideration your existing network infrastructure:

* Decide which network in the topology that you have chosen will serve as the enterprise network, the private network, and the application network.
* Do not have the network adapter that is connected to the enterprise network on the head node in automatic configuration (that is, the IP address for that adapter does not start with: 169.254). That adapter must have a valid IP address, dynamically or manually assigned (static).
* If you choose a topology that includes a private network, and you are planning to add nodes to your cluster from bare metal:
* Ensure that there are no Pre-Boot Execution Environment (PXE) servers on the private network.
  + If you want to use an existing DHCP server for your private network, ensure that it is configured to recognize the head node as the PXE server in the network.
  + If you want to enable DHCP server on your head node for the private or application networks and there are other DHCP servers connected to those networks, you must disable those DHCP servers.
* If you have an existing Domain Name System (DNS) server connected to the same network as the compute nodes, no action is necessary, but the compute nodes will be automatically deregistered from that DNS server.
  + Contact your system administrator to determine if Internet Protocol security (IPsec) is enforced on your domain through Group Policy. If IPsec is enforced on your domain through Group Policy, you may experience issues during deployment. A workaround is to make your head node an IPsec boundary server so that compute nodes can communicate with the head node during PXE boot.

## Step 2: Deploy the head node

**Install Windows Server 2008 on the head node computer**

To deploy the head node of your HPC cluster, you must start by installing Windows Server 2008 HPC Edition, or another 64-bit edition of Windows Server 2008 on the computer that will act as the head node. For more information about installing Windows Server 2008, including system requirements, see <http://go.microsoft.com/fwlink/?LinkID=119578>.

**Important:** We strongly recommend that you perform a clean installation of Windows Server 2008 before installing Microsoft HPC Pack 2008. If you want to install Microsoft HPC Pack 2008 on an existing installation of Windows Server 2008, remove all server roles first and then follow the procedures in this guide.

**Note:** It is recommended that you obtain the latest device drivers for your head node computer from the Web site of your hardware vendors.

**Join the head node computer to a domain**

As described in the [previous](#DSDOC_d0780f1a_bc13_4d2c_859f_f35023b87b) section, the head node must be a member of an Active Directory domain. After you have installed Windows Server 2008 on the head node, manually join the head node to an existing Active Directory domain.

**Install Microsoft HPC Pack 2008 on the head node computer**

After Windows Server 2008 is installed on the head node computer, and the head node is joined to an Active Directory domain, you can install Microsoft HPC Pack 2008 on the head node.

** To install Microsoft HPC Pack 2008 on the head node computer**

1. To start the Microsoft HPC Pack 2008 installation wizard on the computer that will act as the head node, run setup.exe from the HPC Pack 2008 installation media or from a network location.
2. On the **Getting Started** page, click **Next**.
3. On the **Microsoft Software License Terms** page, read or print the software license terms in the license agreement, and accept or reject the terms of that agreement. If you accept the terms, click **Next**.
4. On the **Select Installation Type** page, click **Create a new HPC cluster by creating a head node**, and then click **Next**.
5. Continue to follow the steps in the installation wizard.

## Step 3: Configure the head node

**Configure the HPC cluster network**

The HPC cluster network configuration is the first step in the configuration process of your head node. The HPC cluster network is configured by following the **Network Configuration Wizard** in HPC Cluster Manager. When configuring the HPC cluster network, you must choose the network topology that you have selected for your cluster, as described in Step 1.

**Important:** Before you start configuring the HPC cluster network in HPC Cluster Manager, ensure that the head node and the computers that you will add as compute nodes to the cluster are physically connected according to the network topology that you have chosen for your cluster. Also, ensure that you are able to identify to which network each one of the network adapters in the head node is connected.

** To configure the HPC cluster network**

1. If HPC Cluster Manager is not already open on the head node, open it. Click **Start**, point to **All Programs**, click **Microsoft HPC Pack**, and then click **HPC Cluster Manager**.
2. In the **To-do List**, click **Configure your network**.
3. Follow the steps in the **Network Configuration Wizard**.

**Provide installation credentials**

Installation credentials must be provided in order to configure new compute nodes. These credentials will be used when installing the operating system, applications, and when adding nodes to the Active Directory domain. Also, these same credentials will be used when running diagnostic tests on the cluster nodes.

 **To provide installation credentials**

1. In the **To-do List**, click **Provide installation credentials**. The **Installation Credentials** dialog box appears.
2. Type the user name, including the domain (DOMAIN\User), and then the password for the domain user account you will use to deploy compute nodes and to run diagnostic tests.

**Important:** The account must be a domain account with enough privileges to create Active Directory computer accounts for the compute nodes. Alternatively, you can create the computer accounts manually or ask your domain administrator to create them for you.

**Important:** If part of your deployment requires access to resources on the enterprise network, the account should have the necessary permissions to access those resources.

**Important:** If you want to restart nodes remotely from the cluster administration console (HPC Cluster Manager), the account must be added as an HPC cluster administrator on the head node. This requirement is only necessary if you do not have scripted power control tools that you can use to remotely restart the compute nodes.

1. To save the specified credentials, click **OK**.

**Configure the naming of new nodes**

If you deploy compute nodes from bare metal, and you are not using a node XML file to import nodes to the cluster, Windows HPC Server 2008 will automatically generate computer names for the new nodes that are being deployed. You need to specify how those names will be generated, by defining a naming series.

The naming series is defined by selecting a root name and the starting number that will accompany that name. The starting number is enclosed in percentage signs (%). For example: ClusterNode%1000%.

When you deploy compute nodes from bare metal, nodes will be named in sequence, as they become available. For example, if you deploy three nodes after specifying the following naming series: ClusterNode-%100%, those nodes will be assigned these names:

* ClusterNode-100
* ClusterNode-101
* ClusterNode-102

**Important:** Compute node names are limited to 15 characters. When specifying the compute node naming series, take into account the number of compute nodes in your deployment and ensure that the series that you specify will not generate names that exceed 15 characters. For example, if your deployment will consist of 1,000 compute nodes, and your starting number is 1, your root name cannot have more than 12 characters; otherwise, your node number 1,000 will need a name that consists of 16 characters.

** To specify the compute node naming series**

1. In the **To-do List**, click **Configure the naming of new nodes**. The **Specify Compute Node Naming Series** dialog box appears.
2. Type the naming series that you want to use. The preview helps you to see an example of how the naming series will be applied to the names of the compute nodes.

**Note:** You cannot specify a compute node naming series that consists only of numbers.

1. To save the compute node naming series that you have specified, click **OK**.

**Create a node template**

Node templates are new in Windows HPC Server 2008. They define the necessary tasks for configuring and adding compute nodes to your cluster. With a node template, you can deploy an operating system image, add specific drivers and software to compute nodes, or simply add a preconfigured node to your cluster. Because you might have more than one type of compute node, or you may be adding compute nodes to your cluster in different ways, you can create different templates that apply to different nodes or situations.

You can create two types of node templates:

* **With an operating system image**. This type of template includes a step to deploy an operating system on the compute nodes. Use this type of template when adding compute nodes from bare metal.
* **Without an operating system image**. This type of template is used to add preconfigured compute nodes to the cluster, or to update existing nodes.

The type of template that you create for the initial deployment of your HPC cluster depends on how you decided to add compute nodes to your cluster.

**Important:** If you will create a node template with an operating system image, you will need the installation media for Windows Server 2008 HPC Edition or another 64-bit edition of Windows Server 2008, or you must have the installation files available on a network location that is accessible from the head node computer.

** To specify the compute node naming series**

1. In the **To-do List**, click **Create a node template**.
2. Follow the steps in the **Create Node Template Wizard**.

**Note:** The node templates that you create with the **Create Node Template Wizard** include the most common deployment and configuration tasks. You can add more tasks to the node templates that you create by using the **Node Template Editor**. For more information, on the **Specify Template Name** page of the **Create Node Template Wizard**, click **Understanding Node Templates**.

## Step 4: Add Compute Nodes to the Cluster

Windows HPC Server 2008 simplifies the deploying process of compute nodes by providing automatic node imaging, automatic naming of nodes, and other capabilities to streamline deployment tasks. Also, it provides tools that you can use to monitor the progress of your deployment.

**Important:** Unlike previous versions of Windows HPC Server 2008, the default in Windows HPC Server 2008 is to respond only to Pre-Boot Execution (PXE) requests that come from existing compute nodes. This default setting is automatically changed when you use the **Add Node Wizard** to add nodes from bare metal. Also, you can manually change this setting in the **Options** menu, under **Deployment Settings**.

After creating a node template, you can use the **Add Node Wizard** to add compute nodes to your HPC cluster. There are three ways by which you can add compute nodes to your cluster:

* Deploy compute nodes from bare metal
* Add compute nodes by importing a node XML file
* Add preconfigured compute nodes

For more information about each of these three node deployment options, see the Windows HPC Server 2008 Deployment Guide (<http://go.microsoft.com/fwlink/?LinkID=117921>).

** To add compute nodes to your cluster**

1. In the To-do List, click Add compute nodes.
2. Follow the steps in the Add Node Wizard.

**Note:** Step-by-step procedures for adding compute nodes to your cluster are available in the HPC Cluster Manager Help documentation. To see these procedures, on the **Select Deployment Method** page of the **Add Node Wizard**, click **Adding Nodes to a Cluster**.

## Step 5: Run Diagnostic Tests on the Cluster

After you have configured your head node and added all compute nodes to the cluster, you should run diagnostic tests to validate cluster functionality and troubleshoot any configuration issues.

** To run diagnostic tests on the cluster**

1. In the **To-do List**, click **Validate your cluster** (under **Diagnostics**).
2. On the **Run Diagnostics** dialog box, ensure that the **Run all functional tests** and **All nodes** options are selected, and then click **OK**.
3. To see the progress of the diagnostic tests and the test results, in **Diagnostics**, click **Test Results**.
4. To see detailed information about a test, double-click the test. To expand the information in a section of the test results, click the down arrow for that section.

**Note:** For more information about using diagnostic tests to troubleshoot your cluster, see <http://go.microsoft.com/fwlink/?LinkID=122091>.

## Summary

For those seeking productive solutions for high performance computing, Windows HPC Server 2008 provides a comprehensive platform built on Windows Server 2008, which helps to simplify deployment, management, and integration with existing infrastructure, thus helping to improve the productivity of your system administrators, application developers, and end users. Windows HPC Server 2008 unites the power of commodity x64-based computers, the security of Active Directory, and the Windows Server 2008 operating system to provide an affordable, easy-to-use, and scalable HPC solution. Windows HPC Server 2008 uses Node Templates to help simplify and speed deployment of compute nodes using standard Windows Server 2008 deployment technologies. Additional compute nodes can be added to a cluster by simply connecting computers to the network.

The Microsoft Message Passing Interface implementation is compatible with the reference MPICH2 and uses high-speed Network Direct drivers. Integration with Active Directory helps enable role-based security for administration and users, and the use of the System Center user interface model provides a familiar administrative and scheduling interface. The Windows HPC Server 2008 Job Scheduler supports heterogeneous clusters and enables the use of Service Oriented Architecture applications on the cluster.

## Related Links

* For additional online resources, including step-by-step guides on job submission and configuring failover clusters, technical reference documentation and troubleshooting guides visit the followng Web sites:
  + Windows HPC Server TechCenter (<http://technet.microsoft.com/en-us/hpc/default.aspx>)
  + Windows HPC Server Technical Library (<http://technet.microsoft.com/en-us/library/cc514029.aspx>).
* For more information on Windows Server 2008 and the Windows Server System visit the following Web sites:
  + The [Windows Server System Web site](http://www.microsoft.com/servers/default.mspx) at <http://www.microsoft.com/servers/default.mspx>
  + The [Windows Server 2008 Web site](http://www.microsoft.com/windowsserver2008/) at <http://www.microsoft.com/windowsserver2008/>

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