MATLAB Distributed Computing Server with HPC Cluster in Microsoft Azure

Introduction

This article shows you how to deploy the MATLAB Distributed Computing Server (hereinafter referred to as MDCS) with the Windows HPC cluster (hereinafter referred to as HPC cluster) in Microsoft Azure. With the HPC cluster deployed in Microsoft Azure, you can then use compute resources in Azure to run your Big Compute workloads with MDCS. A cloud-based HPC cluster provides a flexible, scalable platform for running MDCS without requiring investment in an on-premises compute cluster infrastructure.

Scenario overview

This article provides steps to configure an Active Directory domain controller in Microsoft Azure, deploy an HPC Pack head node in an Azure virtual machine, add compute nodes into the HPC cluster, and install MATLAB Distributed Computing Server on each node. To run MATLAB jobs, you can optionally set up a MATLAB client computer in Microsoft Azure too. This configuration is intended mainly for test or proof-of-concept deployments.

In this article:

Prerequisites

The following are prerequisites to deploy MDCS with HPC cluster in Microsoft Azure.

Microsoft Azure subscription: You must obtain or have access to a Microsoft Azure subscription.

- To create a Microsoft Azure subscription, go to the Microsoft Azure site.
- To access an existing subscription, go to the Microsoft Azure Management Portal.

HPC Pack installation media: The free installation package for the latest version of HPC Pack (HPC Pack 2012 R2) is available from the Microsoft Download Center. You can use this installation package to install a head node in Microsoft Azure, and later to install HPC Pack client utilities on the MATLAB client computer.

MATLAB and Parallel Computing Toolbox: You must obtain licenses for MATLAB and Parallel Computing Toolbox. You can purchase licenses and download the installation package for the latest version of MATLAB (R2013b) and Parallel Computing Toolbox (6.3) from the MathWorks website.

MATLAB Distributed Computing Server: You must obtain a license for MDCS. You can buy the license and download the installation package for the latest version of MDCS (R2013b) from the MathWorks website.

Deploy Windows HPC cluster in Microsoft Azure

This section contains step-by-step procedures for installing an HPC Pack head node in a Microsoft Azure virtual machine. The head node will be joined to an Active Directory domain that is also created on the head node.

NOTE

You can deploy HPC Pack in a Microsoft Azure virtual machine starting with HPC Pack 2012.

Step 1: Create an affinity group

Affinity groups group your Microsoft Azure services to optimize performance. All services within an affinity group will be located close to each other in the same data center.

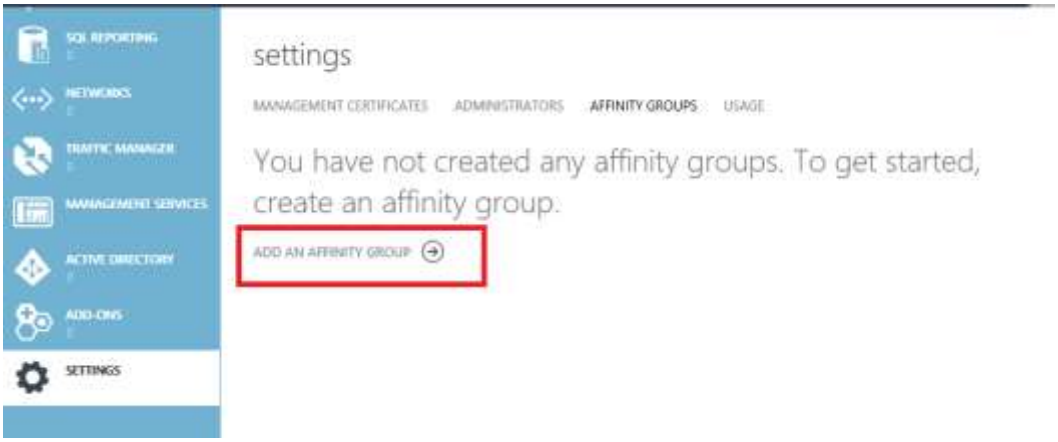
For HPC, it's especially important to use affinity groups because of how Microsoft Azure data centers are designed. Basically, Azure data centers are built using "containers" full of clusters and racks. Each container has specific services—for example, Compute and Storage, SQL Azure, Service Bus, Access Control Service, and so on. Containers are spread across the data center, so when we subscribe or deploy a service, the Fabric Controller (which chooses, based on our solution configuration, where the services should be deployed) can place our services anywhere in the data center. This means that even if we choose the same data center for all our Azure services, we cannot guarantee that the services will be physically close together. Using an affinity group tells the Fabric Controller that services should always be close together, thereby reducing latency and increasing performance.

IMPORTANT

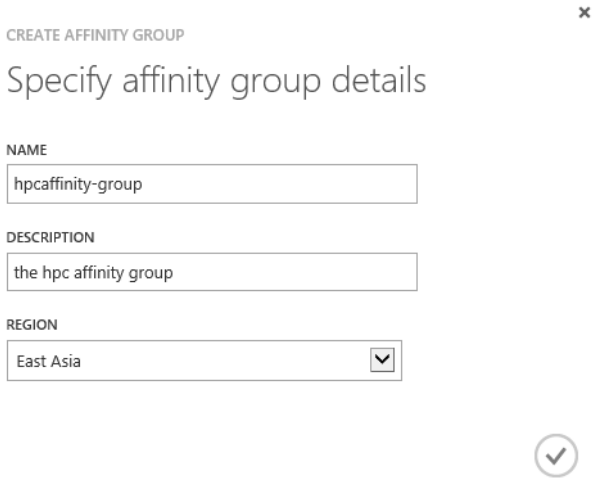
You must create the affinity group before creating any other services. Services are added to the affinity group at creation time, and once a service is created, you cannot add it to an affinity group.

To create an affinity group

1. Sign in to the Microsoft Azure Management Portal.
2. Click the **SETTINGS** tab, click **AFFINITY GROUPS** at the top, and then click **ADD AN AFFINITY GROUP** in the bottom panel.



3. Enter the affinity name and select a region.
4. Click the check mark button to create the new affinity group.



Step 2: Create a Microsoft Azure virtual network

Next, you create a Microsoft Azure virtual network. You will deploy the Active Directory domain and the HPC Pack head node in this network.

IMPORTANT

If you plan to use the network in additional scenarios beyond the scope of this article, plan it carefully. After the virtual network is in use, you can make only limited changes to the network configuration.

For more information about configuring virtual network settings by using the portal, see Configuring a virtual network with the Management Portal.

To create a Microsoft Azure virtual network

1. In the Microsoft Azure Management Portal, click **NEW**, click **NETWORK SERVICES**, click **VIRTUAL NETWORK**, and then click **CUSTOM CREATE**.
2. On the **Virtual Network Details** page, under **AFFINITY GROUP**, select the affinity group that you created in Step 1: Create an affinity group.
3. Skip the **DNS Servers and VPN Connectivity** page, unless you plan an optional site-to-site VPN connection from your on-premises network. For more information about cross-premises connectivity options, see About Secure Cross-Premises Connectivity.
4. On the **Virtual Network Address Spaces** page, accept the default network address space. For this scenario, we suggest that you configure one subnet (*ADSubnet*) as shown below in the address space 10.0.0.0/27. This subnet is used for deploying the head node in an Active Directory domain.

Subnet	Starting IP	CIDR (address count)
ADSubnet	10.0.0.0	/27 (32)

5. Complete the wizard to create the virtual network.

Step 3: Create a Windows Server 2012 Datacenter virtual machine

A virtual machine (VM) in Microsoft Azure is a server in the cloud that you can control and manage. After you create a virtual machine in Azure, you can delete and re-create it whenever you need to, and you can access the virtual machine just like any other server. Virtual hard disks (.vhd files) are used to create a virtual machine. You can use the following types of virtual hard disks to create a virtual machine:

- ***Image*** An image is a template that you use to create a new virtual machine. An image doesn't have specific settings like a running virtual machine, such as the computer name and user account settings. If you use an image to create a virtual machine, an operating system disk is automatically created for the new virtual machine.
- ***Disk*** A disk is a VHD (virtual hard disk) that you can boot and mount as a running version of an operating system. After an image is provisioned, it becomes a disk. A disk is always created when you use an image to create a virtual machine. Any VHD that is attached to virtualized hardware and that is running as part of a service is a disk.

We will create a Windows Server 2012 Datacenter VM from the Windows Server 2012 Datacenter image that will be a domain controller for the Active Directory domain in which we will also deploy the head node.

1. Sign in to the Microsoft Azure Management Portal.
2. Click the **VIRTUAL MACHINES** tab, and then click **NEW** in the bottom panel.

3. Click **COMPUTE**, click **VIRTUAL MACHINE**, and then click **FROM GALLERY**.
4. On **Choose an Image** page, select an edition of **Windows Server 2012 Datacenter** for the virtual machine operating system.
5. On the **Virtual machine configuration** pages, do the following:

   a. Provide a computer name for the virtual machine, and administrator credentials.

   b. In **TIER** select **STANDARD** and in **SIZE** choose a virtual machine size of **A3**, which provides adequate hardware capacity for the head node in many scenarios.

   c. In **CLOUD SERVICE**, select **Create a new cloud service**, and provide a DNS name for the cloud service.

   d. In **REGION/AFFINITY GROUP/VIRTUAL NETWORK**, select the virtual network that you created in Step 2: Create a Microsoft Azure virtual network.

   e. In **VIRTUAL NETWORK SUBNETS**, select *ADSubnet* (the subnet you configured for the Active Directory domain).

f. In **STORAGE ACCOUNT**, select an existing storage account that is in the same affinity group as the virtual network that you created, or select **Use an automatically generated storage account**.

g. In **ENDPOINTS**, accept the default configuration. Then complete the wizard.

Azure will automatically provision and boot the VM once it is created. It will take a few minutes for the new VM to be provisioned. You should see your new VM in the virtual machines listing when it is done.

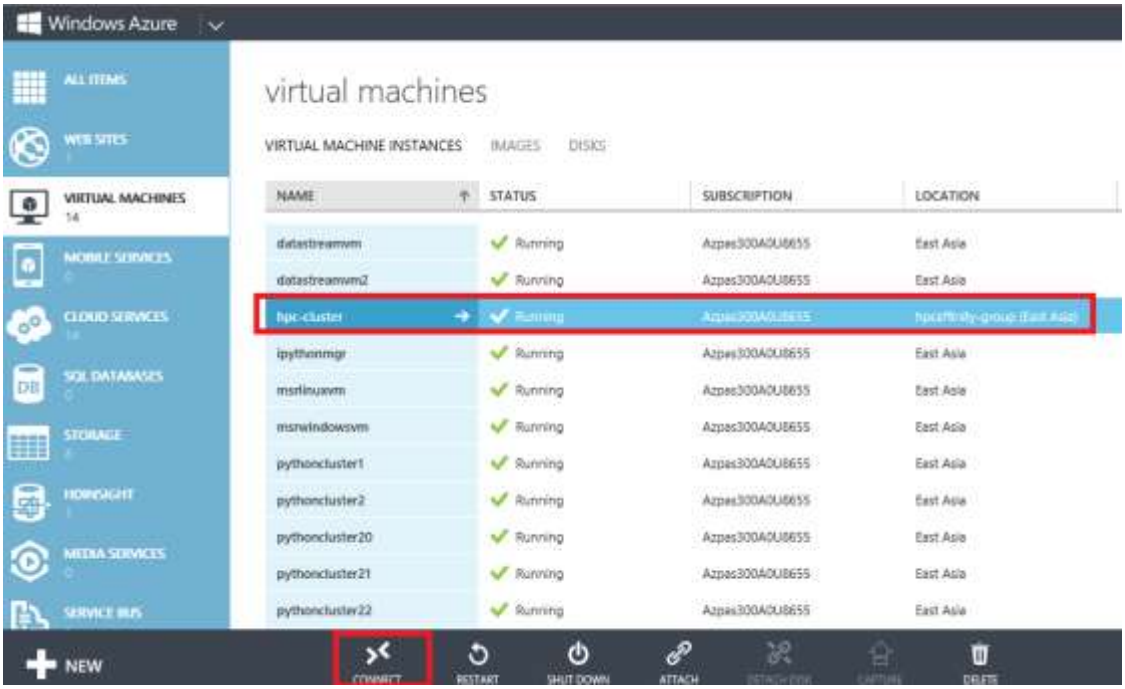
INFORMATION

Creating a VM in this way accomplishes several important tasks for you automatically. First, a virtual hard disk (VHD) file is created for you in blob storage. When you create files in the VM, this is where they are actually stored. Second, a cloud service is created for you so you can reach your VM at http://your-vm-name.cloudapp.net/.

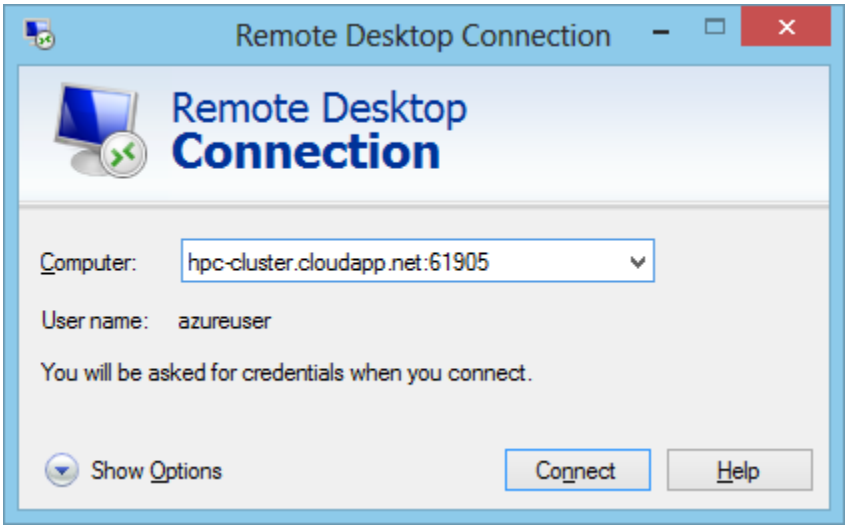
Step 4: Connect to the VM with Remote Desktop Connection

After your VM has been created and started, you can connect to the VM with Remote Desktop Connection.

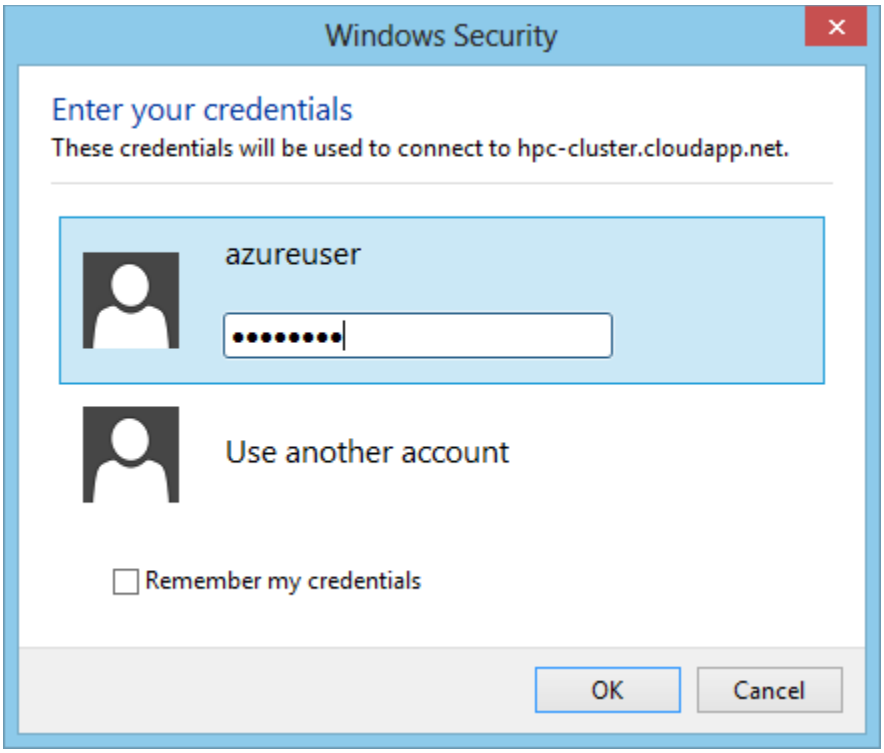
1. Go to the **Virtual Machines** tab and select the VM.
2. With the VM selected, click **Connect** in the bottom panel to download an RDP file to your local machine that tells the Remote Desktop Connection Client how to connect to the new VM.



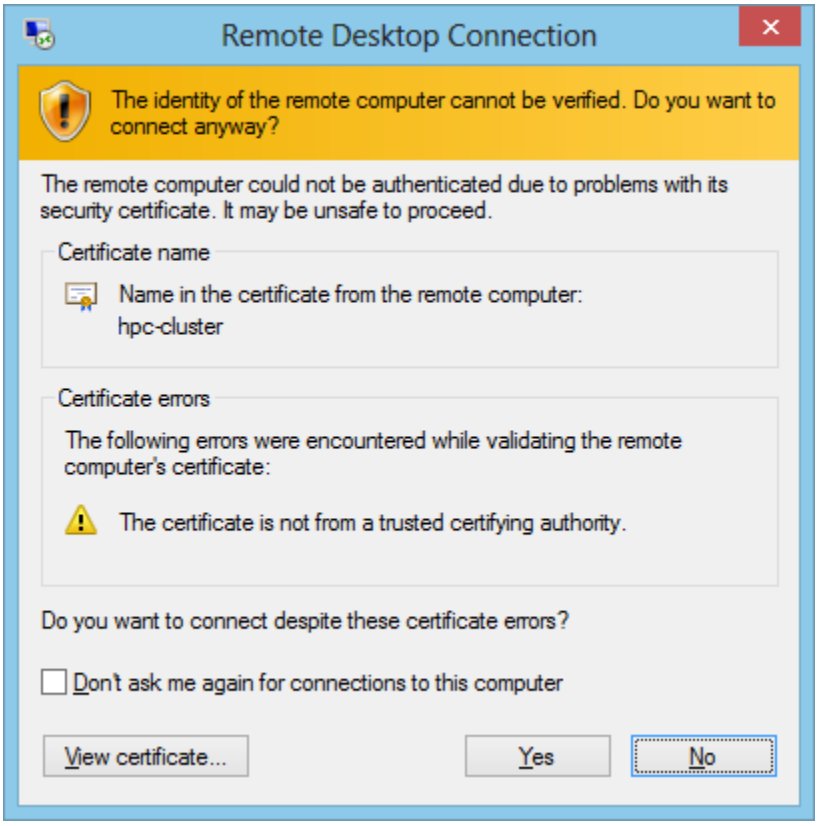
3. Double-click the RDP file to open the connection.



4. When prompted for credentials, enter the user name and password you gave when you created the VM.



5. Don't worry if you see a certificate warning. Just click **Connect**.



6. Server Manager opens automatically once you're logged on. Server Manager is your starting point for almost all management tasks in Windows Server 2012.

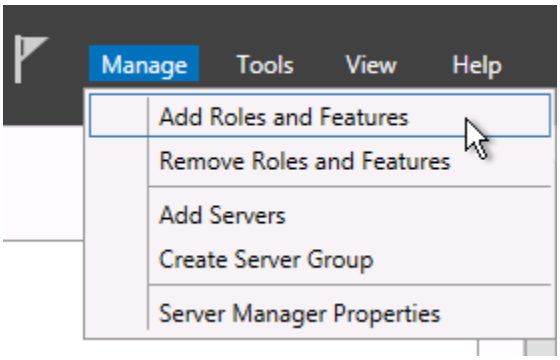
WARNING

Remote Desktop Connection Client won't connect to unknown versions of Windows. If you're being adventurous and created a VM with a preview version of Windows Server, then you may not be able to continue.

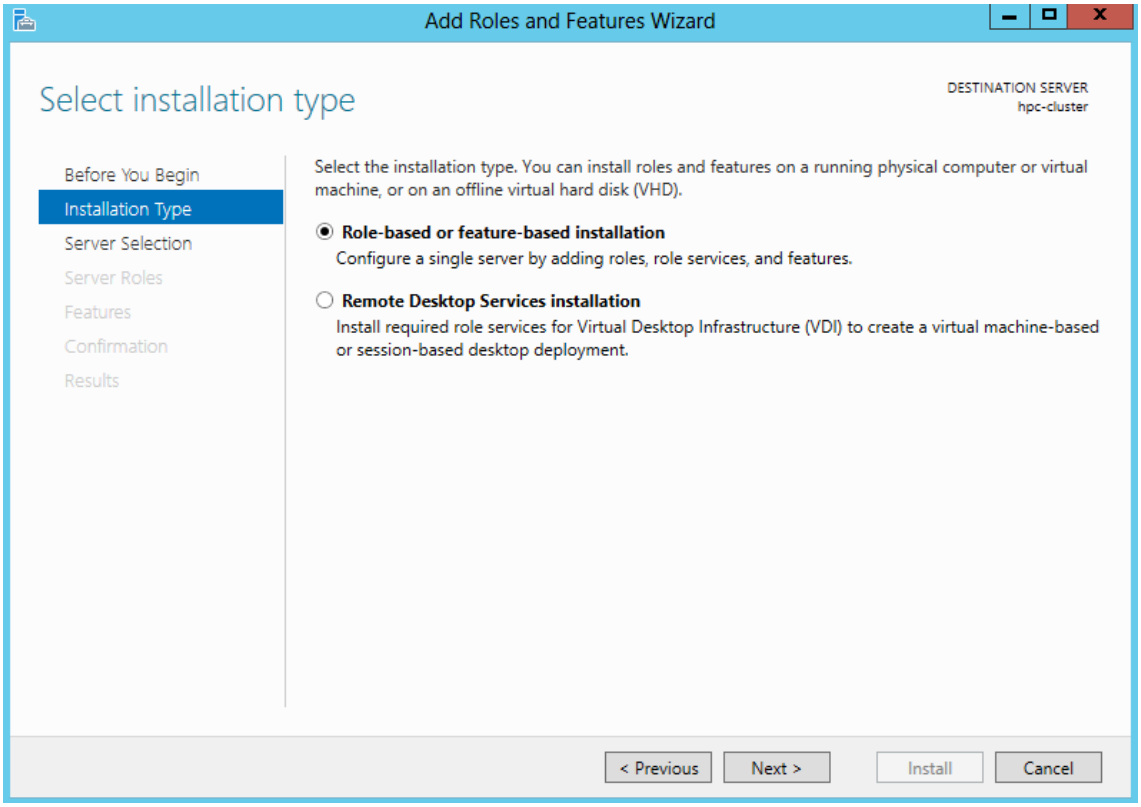
Step 5: Install the Active Directory role

We'll install Active Directory Domain Services in the VM and configure a new Active Directory forest for your compute cluster.

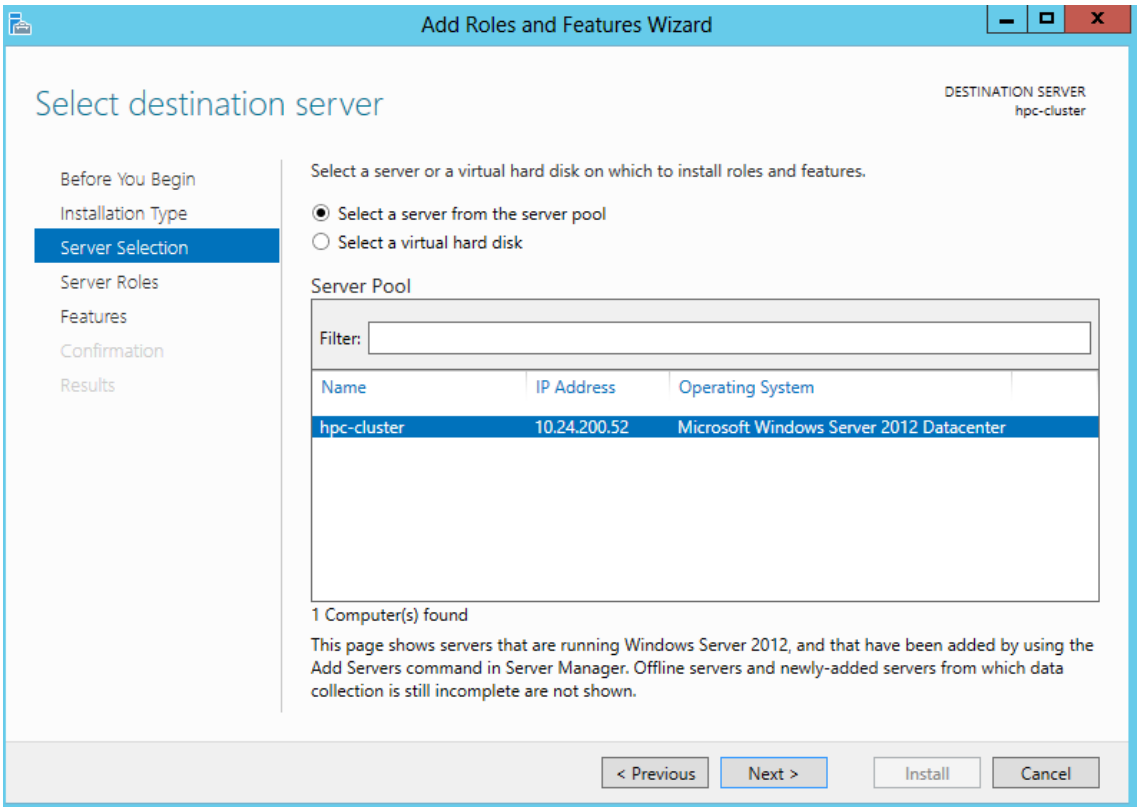
1. In Server Manager, click **Manage** in the upper-right corner, and then select **Add Roles and Features.**



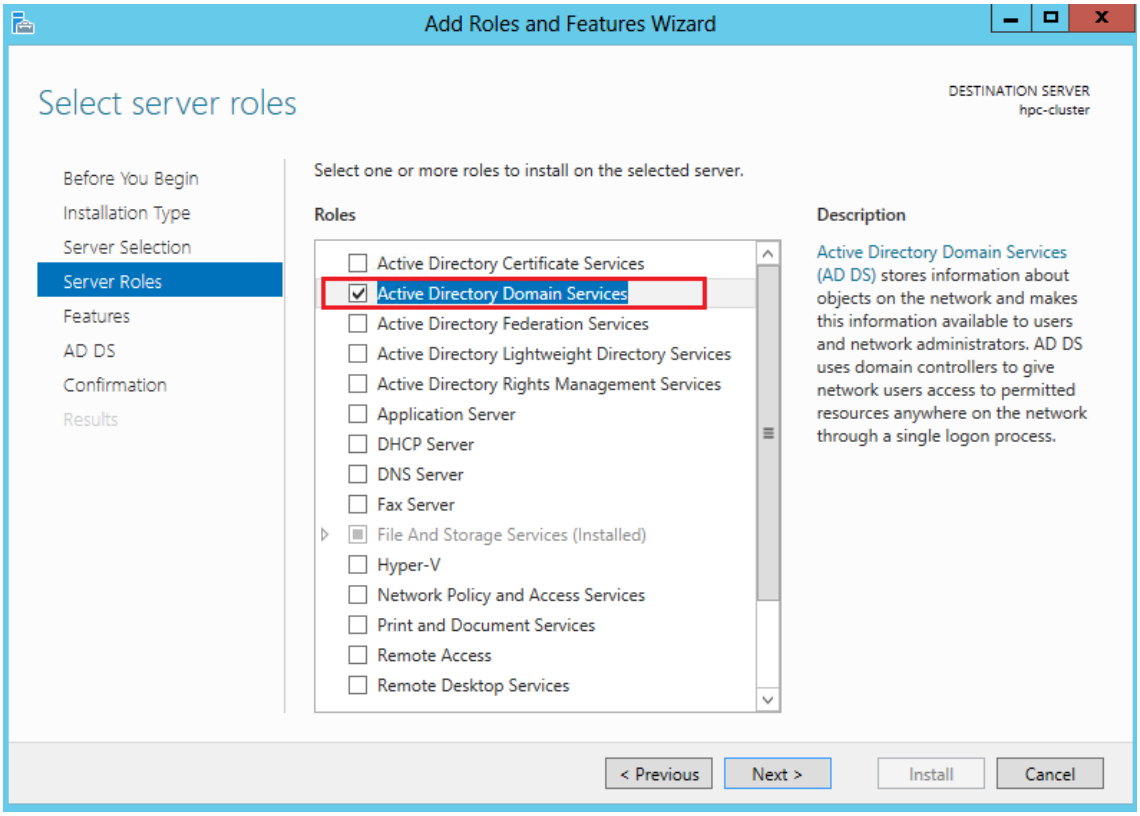
2. Click **Next** to skip the first screen. (If you want, you can select the check box at the bottom to skip this screen automatically next time.)
3. Select **Role-based or feature-based installation**, and click **Next**.



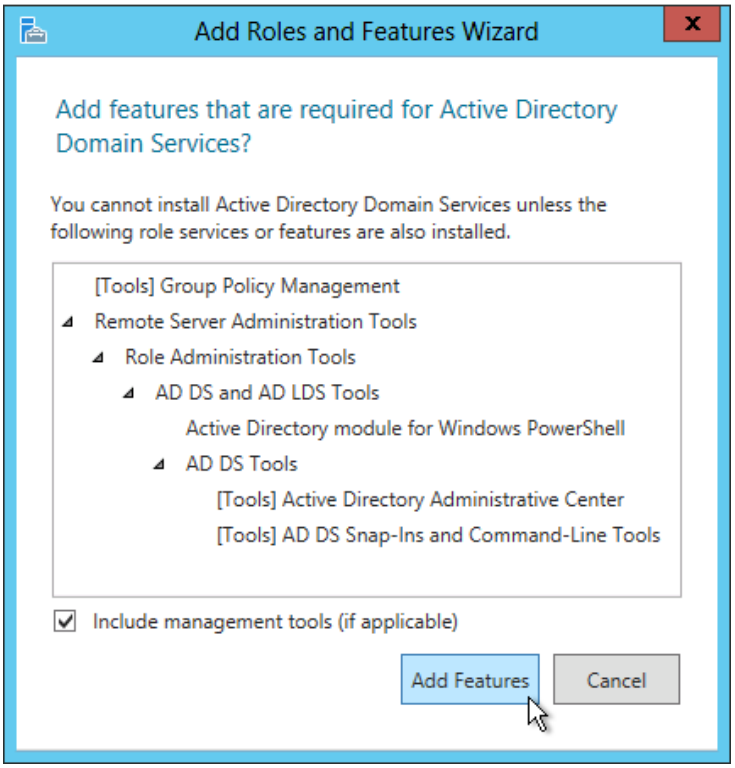
4. The head node will be automatically selected on the **Server Selection** tab. Just click **Next** to continue.



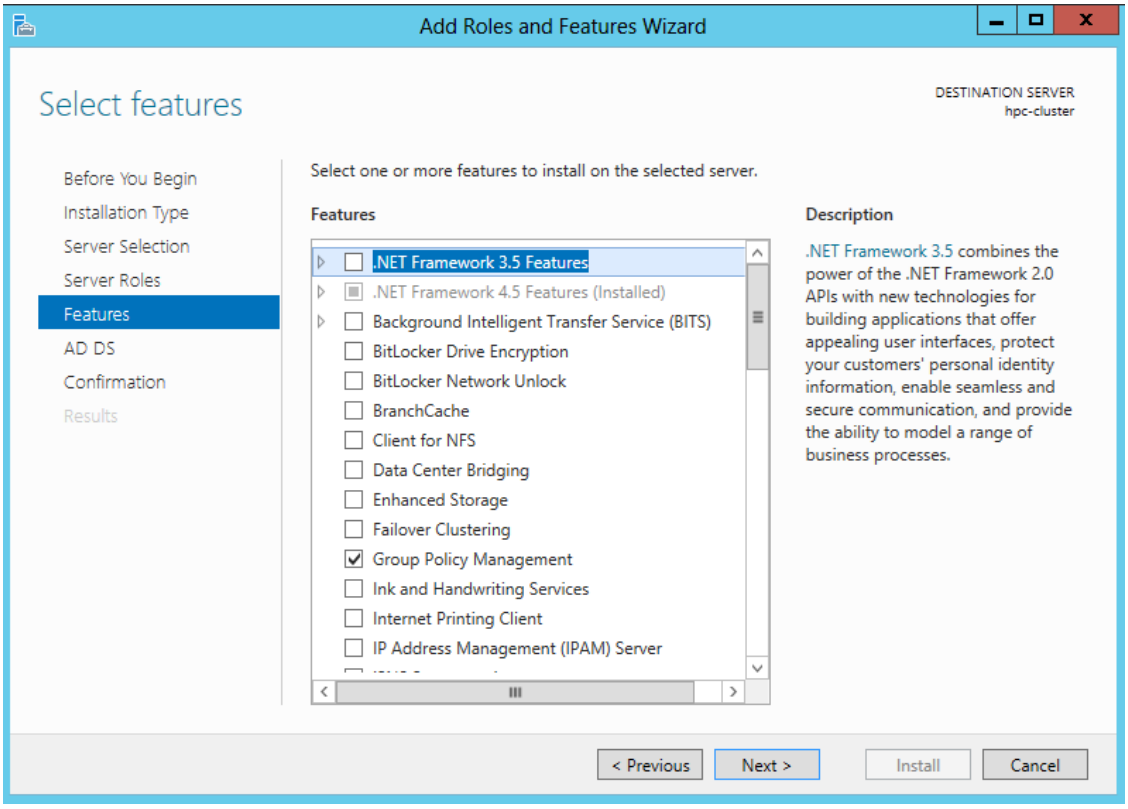
5. Select the check box next to **Active Directory Domain Services** on the **Server Roles** tab.



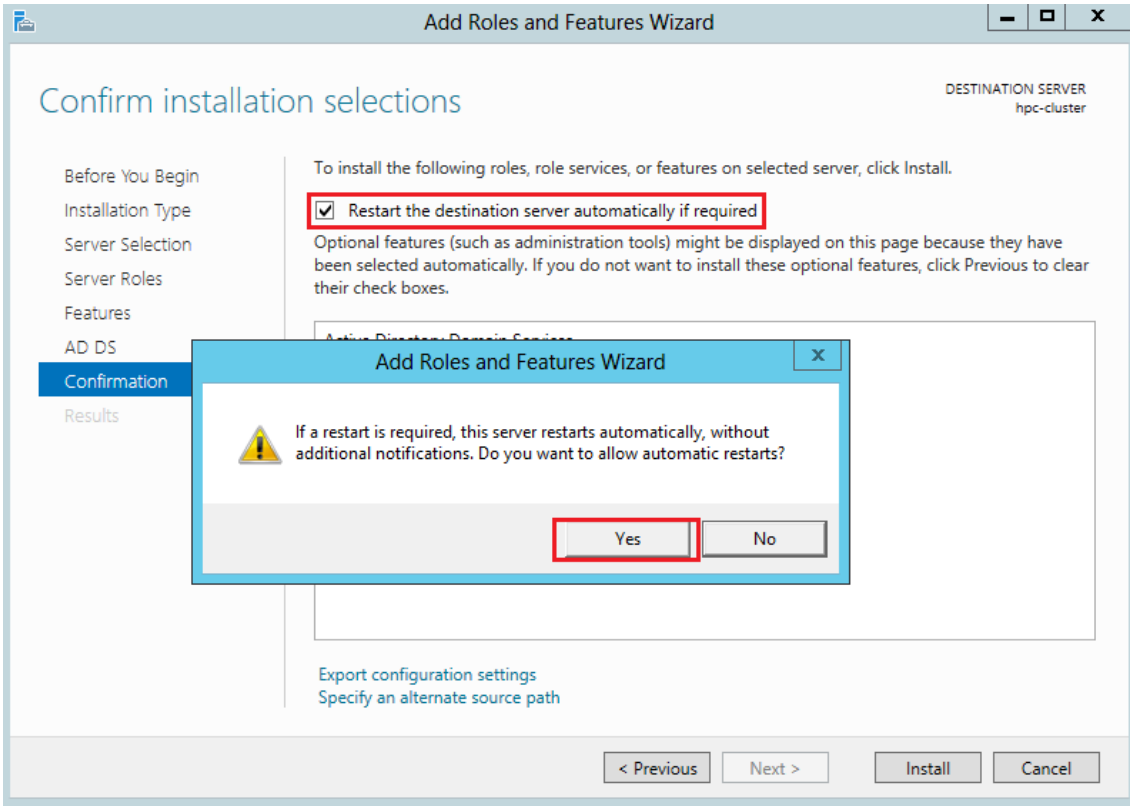
6. Several features must also be installed to add the Active Directory role. Click **Add Features** in the **Add Roles and Features Wizard** to continue.



7. Click **Next** on the **Features** tab. All the features you need have already been selected.

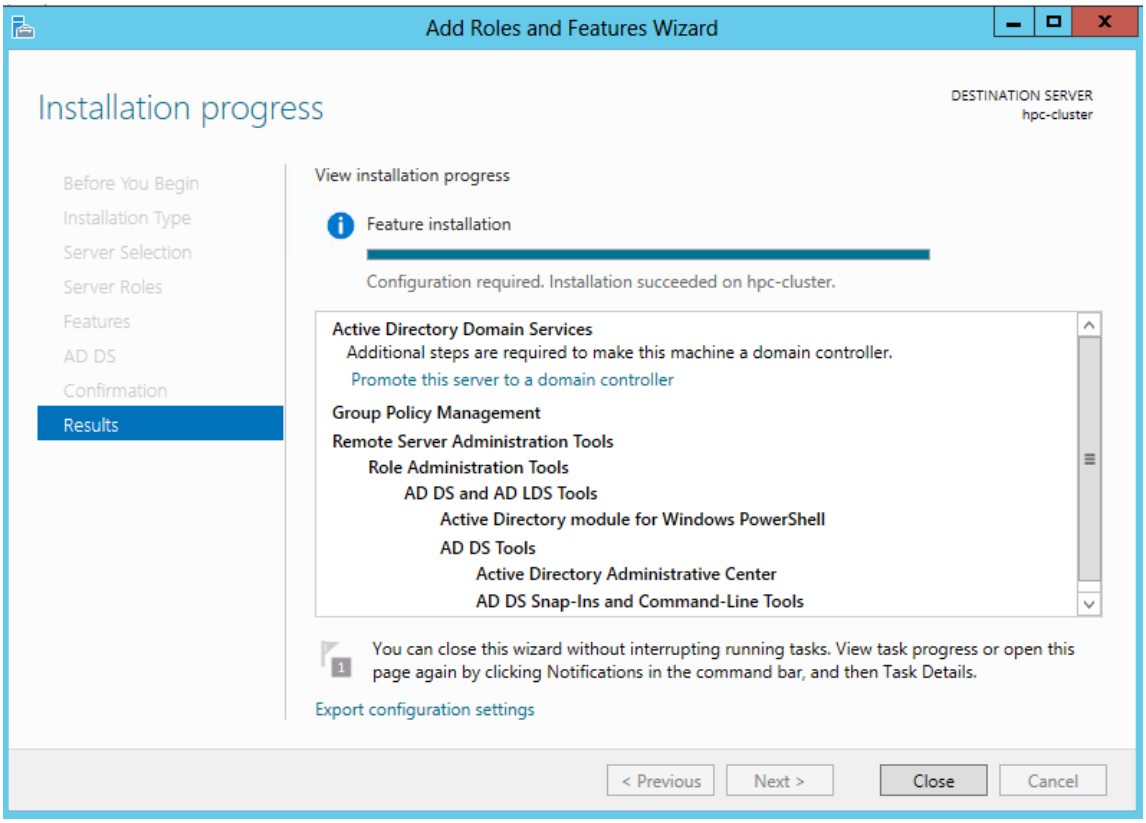


8. Click **Next** until you reach the **Confirmation** tab. On the **Confirmation** tab, select the **Restart the destination server automatically if required** check box, and confirm by clicking **Yes** in the message box.



9. Click **Install** to begin the installation process. This will take several minutes. Note that you may be disconnected from the VM when it restarts. Don't worry—if you get disconnected, just double-click the RDP file you downloaded earlier to reconnect.

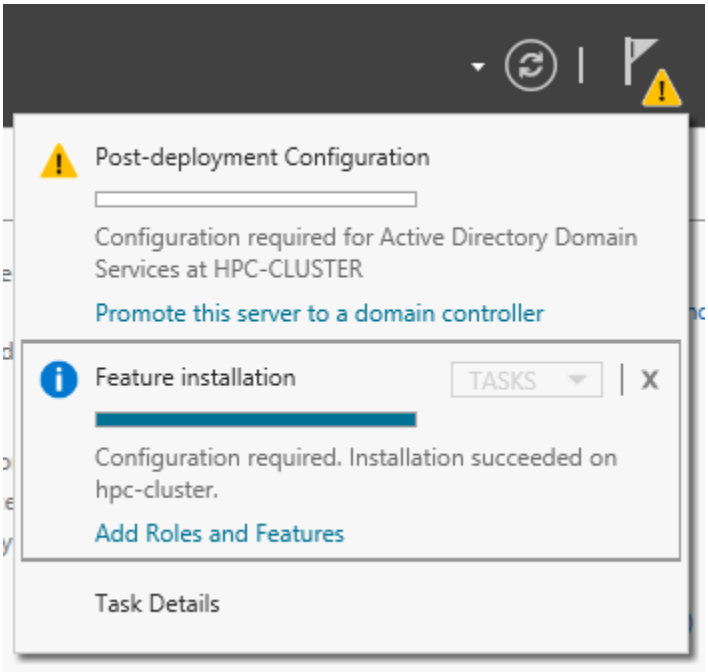
10. Click **Close** to close the installation progress window.



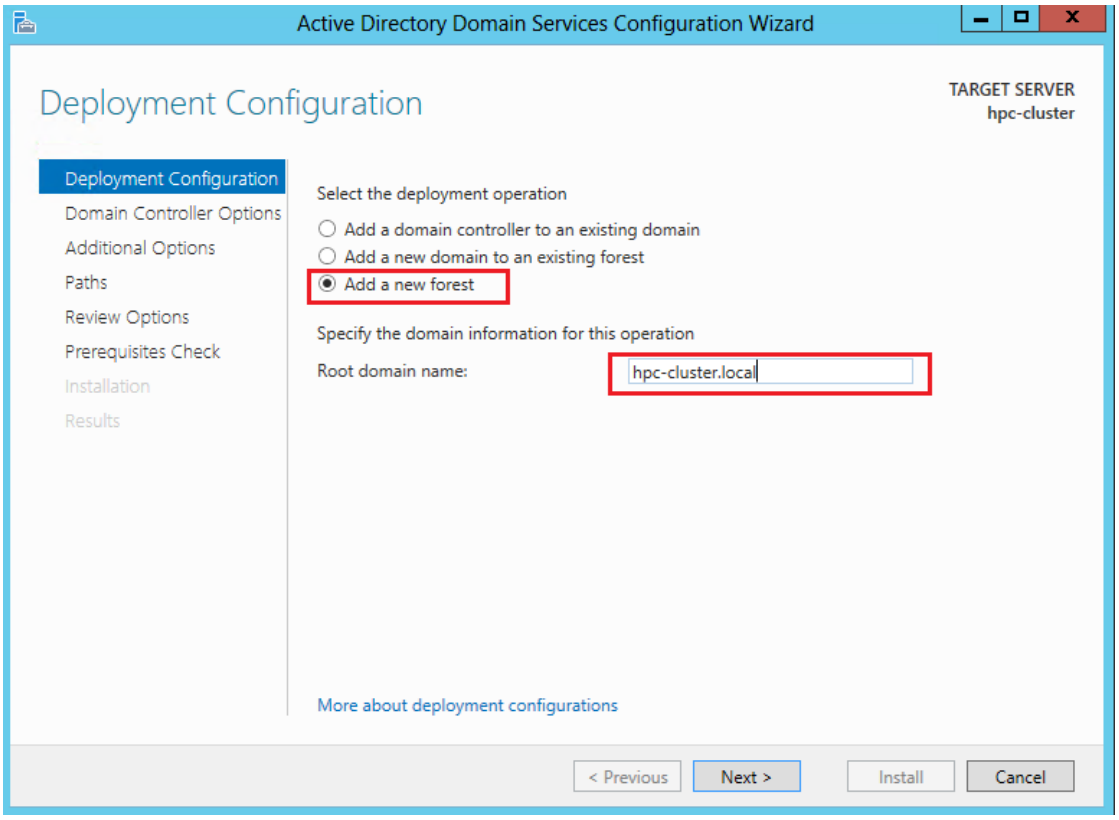
Step 6: Promote the server to a domain controller

We need to establish a new Active Directory domain for the HPC cluster. To do that, we will promote the Windows Server 2012 VM to an Active Directory domain controller.

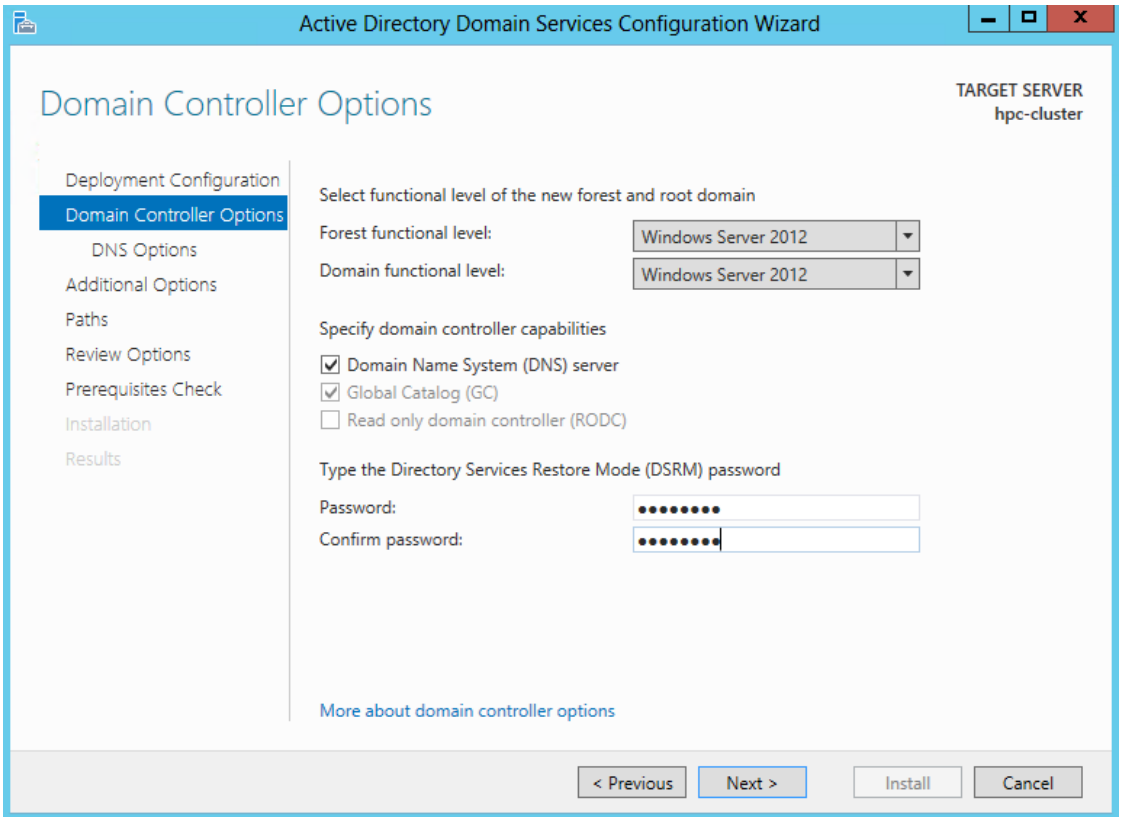
1. After the Active Directory installation is complete, you'll see a yellow sign appear in the notifications area of Server Manager. Click it, and then select **Promote this server to a domain controller**.



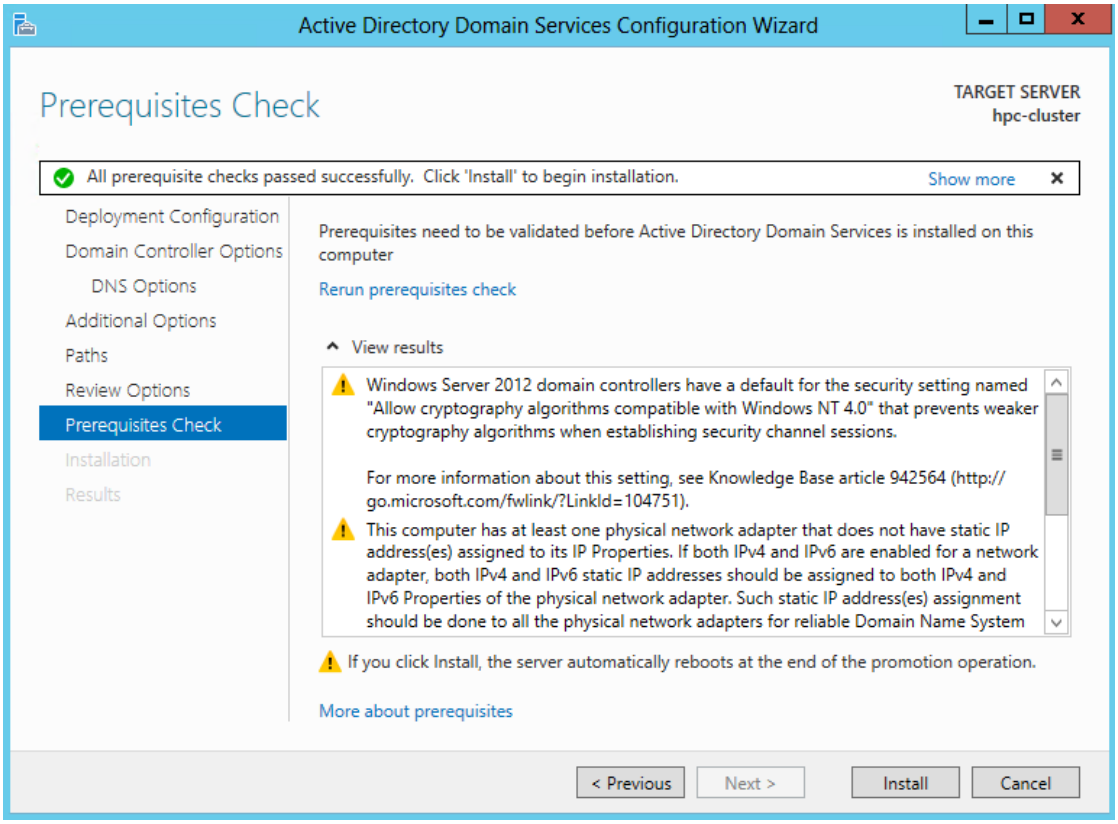
2. Select **Add a new forest**, specify the root domain name with a ".local" top-level domain (TLD), and click **Next**.



3. Wait for the **Domain Controller Options** tab to load, enter the DSRM password, and click **Next**.



4. Click **Next** until you reach the **Prerequisites Check** tab. Don't worry about the warnings—just click **Install** to begin the installation. Installation will take several minutes and may reboot the server a few times.



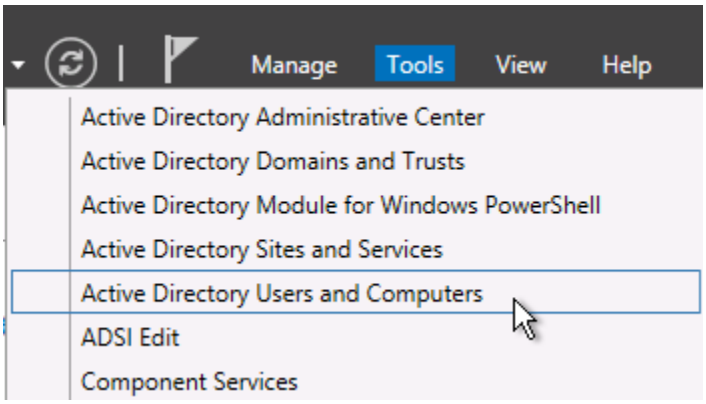
NOTE

If the VM restarts, your Remote Desktop Connection window will close. If that happens, wait a few minutes to give the server a chance to boot up, and then double-click the RDP file again to reopen the connection. If the connection fails, wait a few more minutes. It may take some time for the reboot to complete.

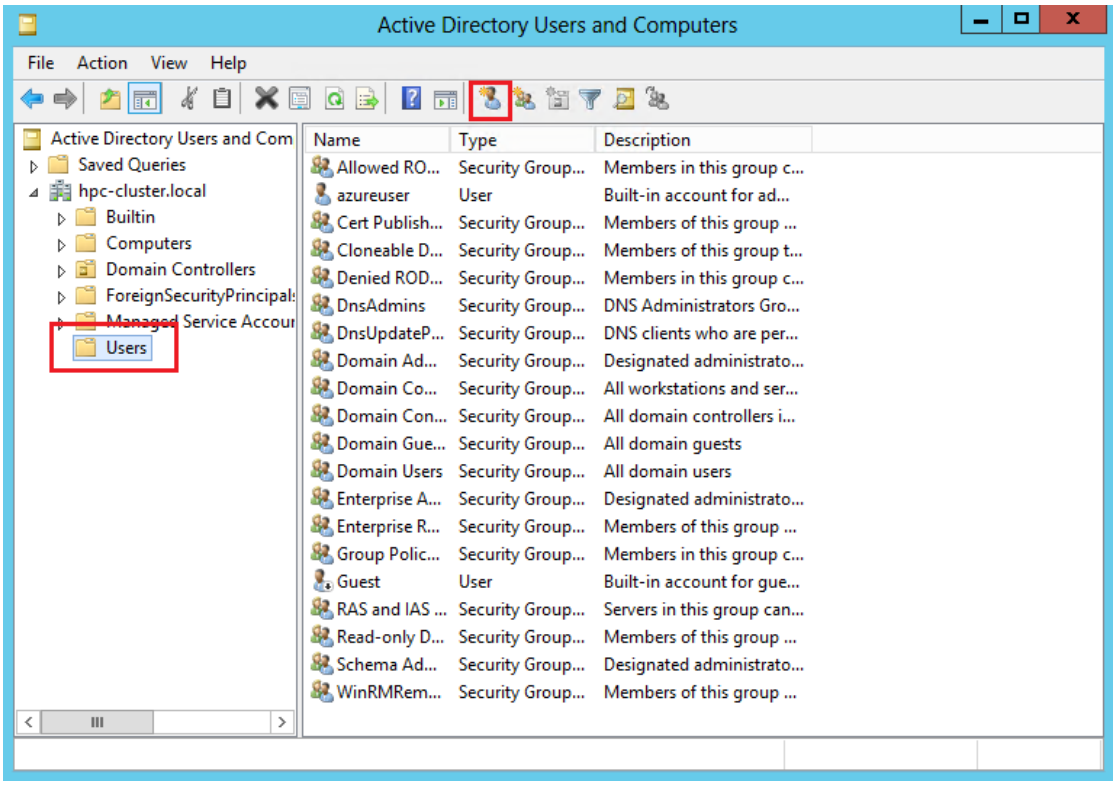
Step 7: Add a domain user account

Microsoft HPC Pack needs to be installed from a domain user account, so we'll add a new administrator account to our new Active Directory domain.

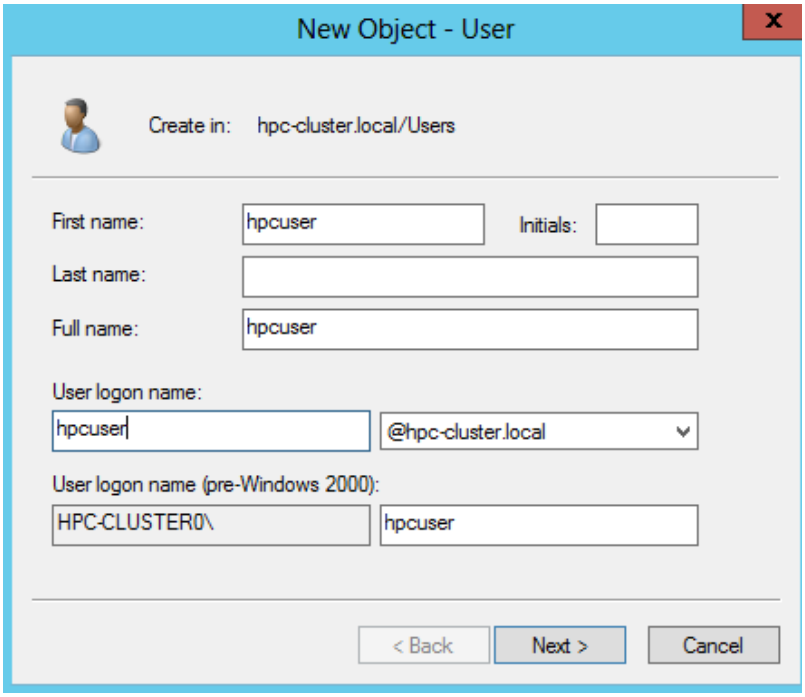
1. Once the server has finished the promotion process, click **Tools** in the upper-right corner of Server Manager, and then select **Active Directory Users and Computers**.



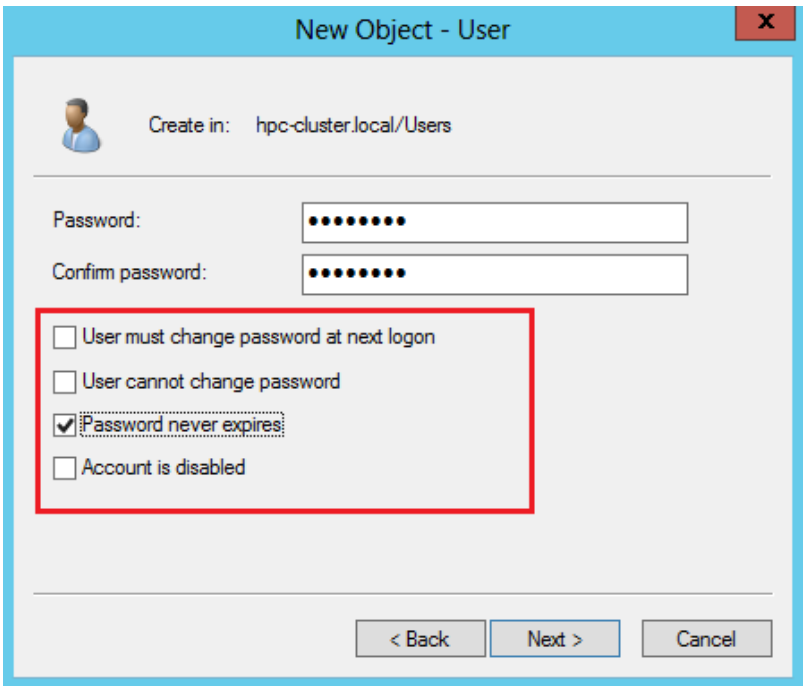
2. In the **Active Directory Users and Computers** window, expand the domain name on the left side and select the **Users** container. Click the icon in the toolbar to add a new domain user.



3. Give the user a first name and a user name, and click **Next**.

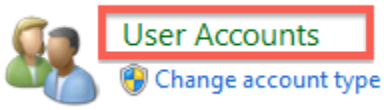


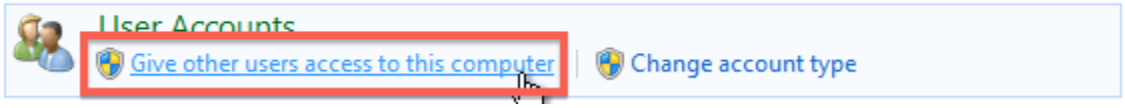
4. Set the user's password, select the **Password never expires** check box as shown, and click **Next**.



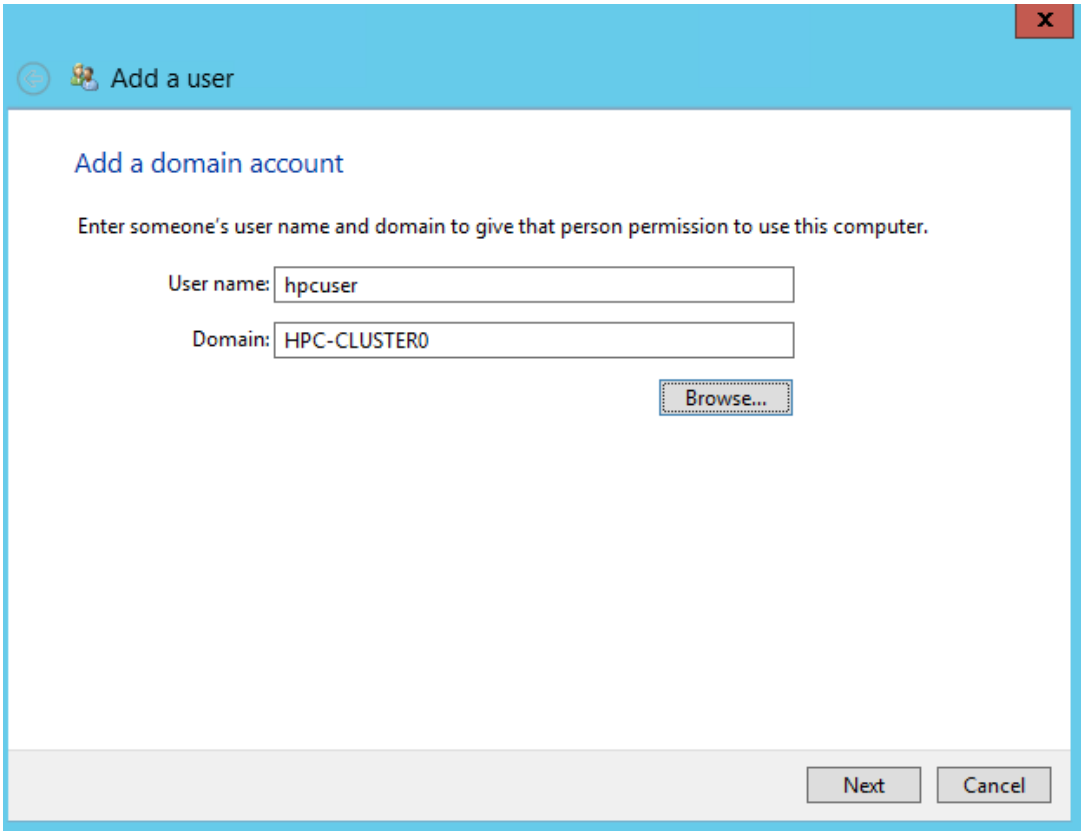
5. Click **Finish** on the final screen to create the user. Close the **Active Directory Users and Computers** window.

6. We will be logging on to the VM as this user, so we need to give the user permission to access the server as an administrator. Open Control Panel, click **User Accounts**, and then click **Give other users access to this computer**.

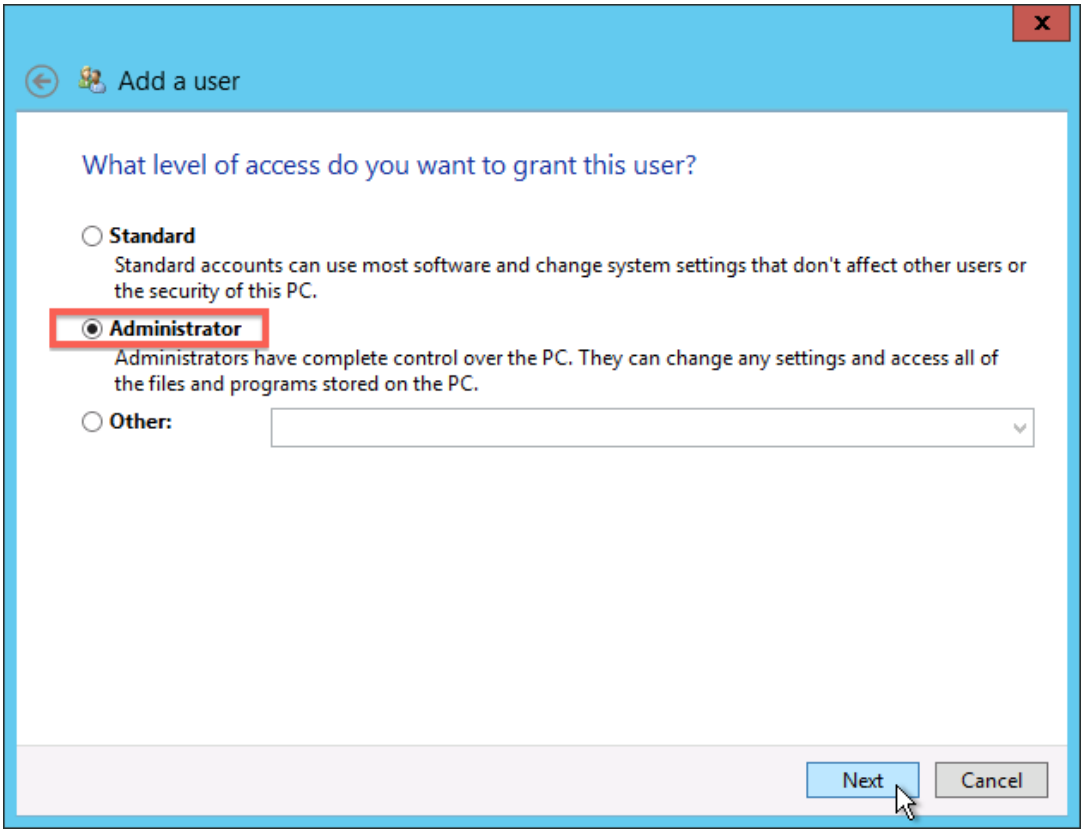




7. Click **Add**. Enter the domain user's user name and the name of the Active Directory domain, and click **Next**.



8. Select **Administrator** to give the domain user administrative privileges, and click **Next**.



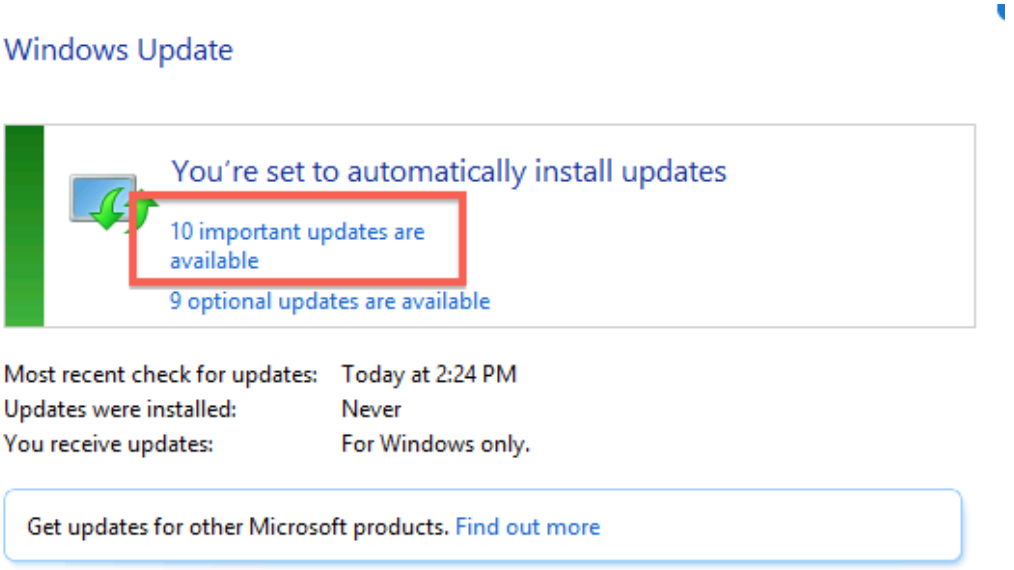
9. Click **Finish** to close the **Add a user** wizard, and then click **OK** to close the **User Accounts** window.

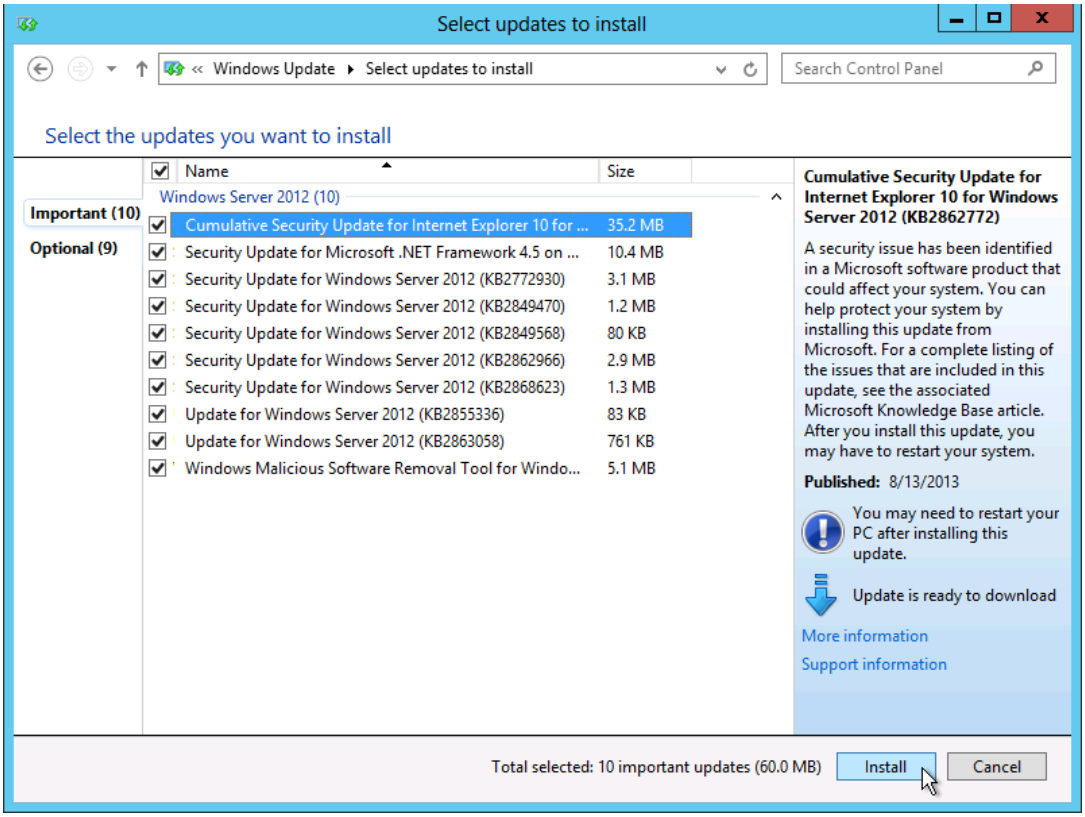
Step 8: Install all critical and important updates

You're almost there, but before we can install Microsoft HPC Pack, we need to make sure that all services are up to date. Part of the HPC Pack installation process is to install various prerequisites, and some of these prerequisites will fail to install if critical updates are not installed.

1. Open Control Panel. Click **System and Security**, and then click **Windows Update**.

2. If important or critical updates are available, click the label listing the updates to open the update window, and then click **Install** to begin the installation process. Wait for the installation to complete.



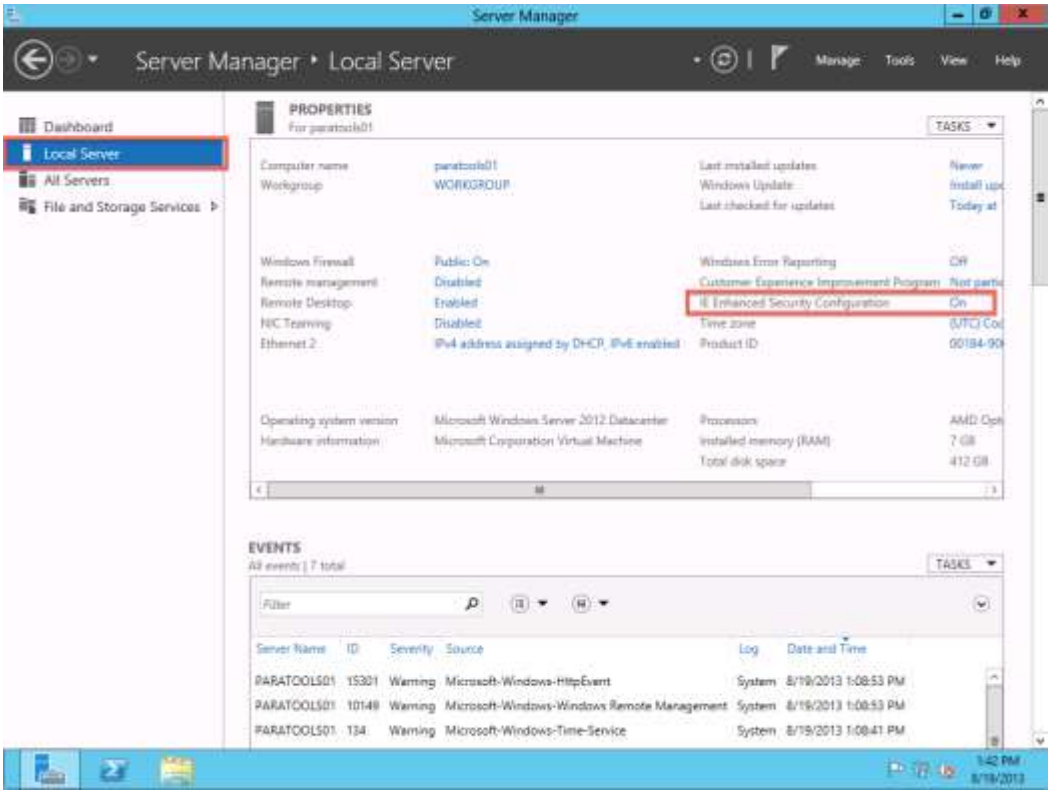


3. Once installation is complete, restart the computer. Remote Desktop Connection will disconnect, so double-click the RDP file to reconnect to the VM.
4. Once you're reconnected, check again for critical and important updates. Continue to install updates and reboot until no more updates are available.

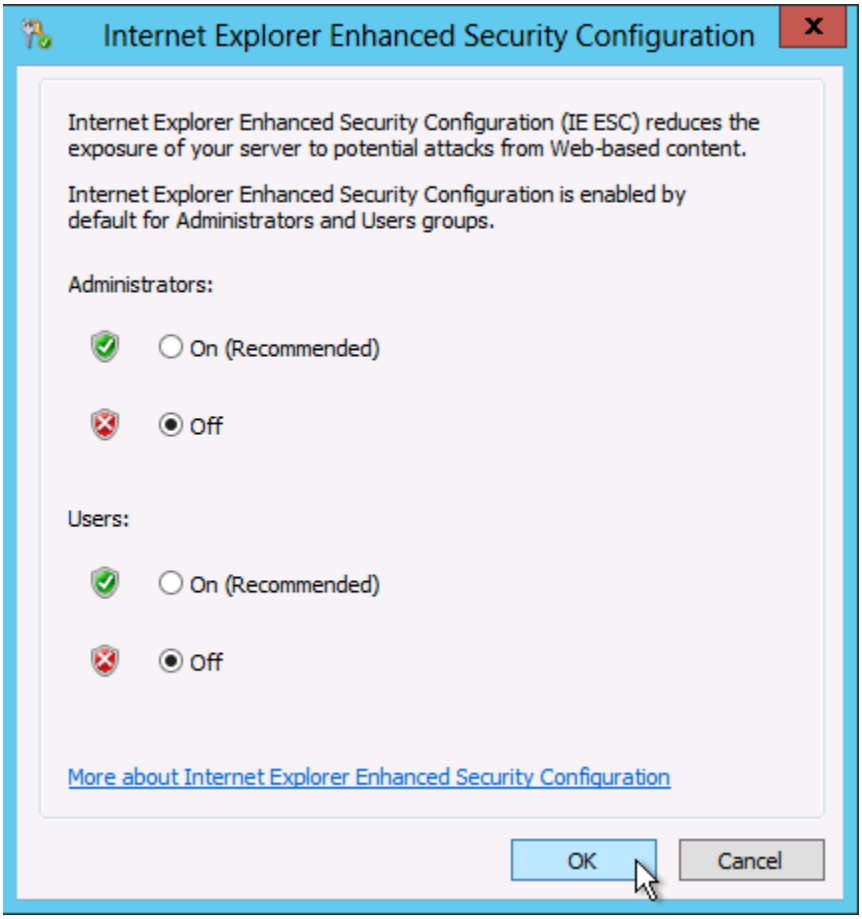
Step 9: Download Microsoft HPC Pack

We'll download Microsoft HPC Pack to the VM.

1. Before you do anything, you need to disable Internet Explorer Enhanced Security Configuration so that you can download files from the Internet. In Server Manager, click **Local Server**. In the Properties pane, click the little blue word **On** next to **IE Enhanced Security Configuration**. (You may need to scroll over if your screen resolution is low.)

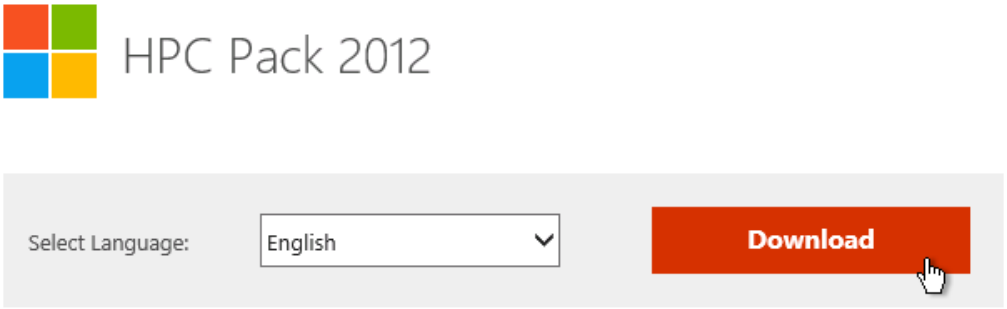


Select **Off** for both **Administrators** and **Users**, and click **OK**.



Internet Explorer Enhanced Security Configuration places your server and Internet Explorer in a configuration that decreases the exposure of your server to potential attacks that can occur through web content and application scripts. This is a good thing for servers, but unfortunately, it makes Internet Explorer effectively unusable on the Internet at large. We have to disable this feature, or we won't be able to download HPC Pack from the Microsoft website. You can learn more about Enhanced Security Configuration in this TechNet article.

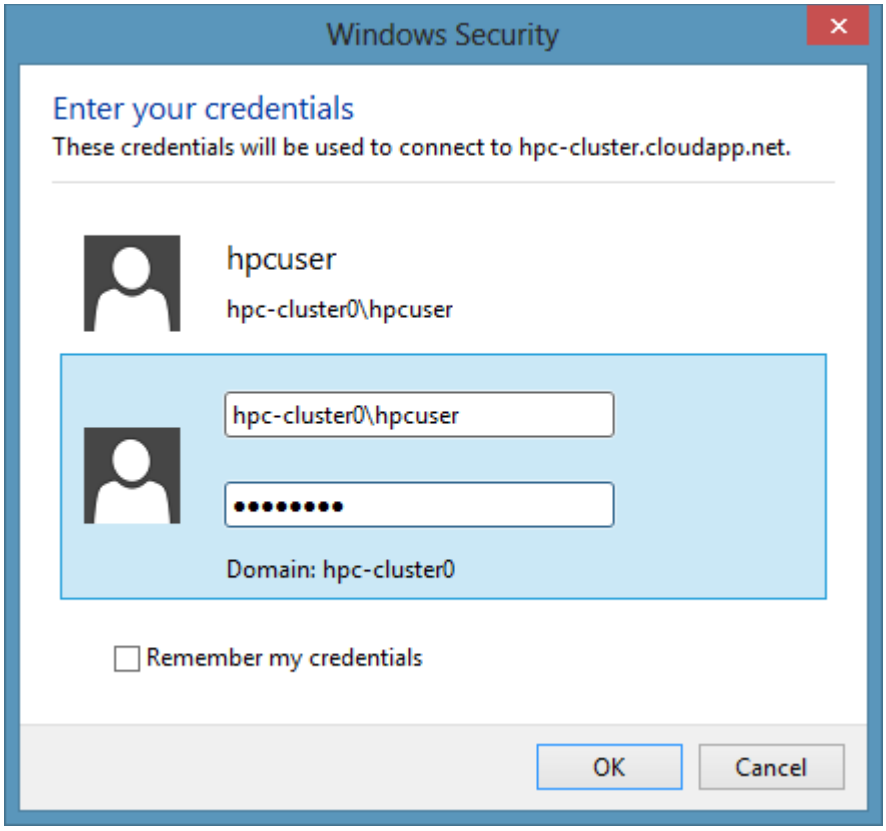
2. After you disable Internet Explorer Enhanced Security Configuration, open Internet Explorer and go to http://www.microsoft.com/en-us/download/details.aspx?id=36054. Click **Download**, and then click **Save** to begin the download. The file is almost 2 GB.



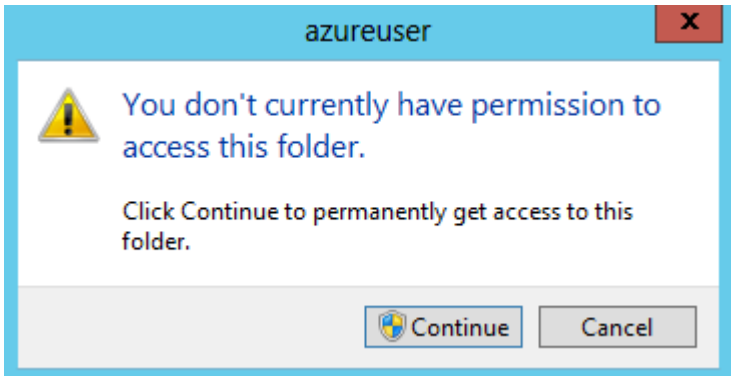
Step 10: Install Microsoft HPC Pack

You are ready to install Microsoft HPC Pack. The installation must be performed as a domain user, so disconnect from the virtual machine now.

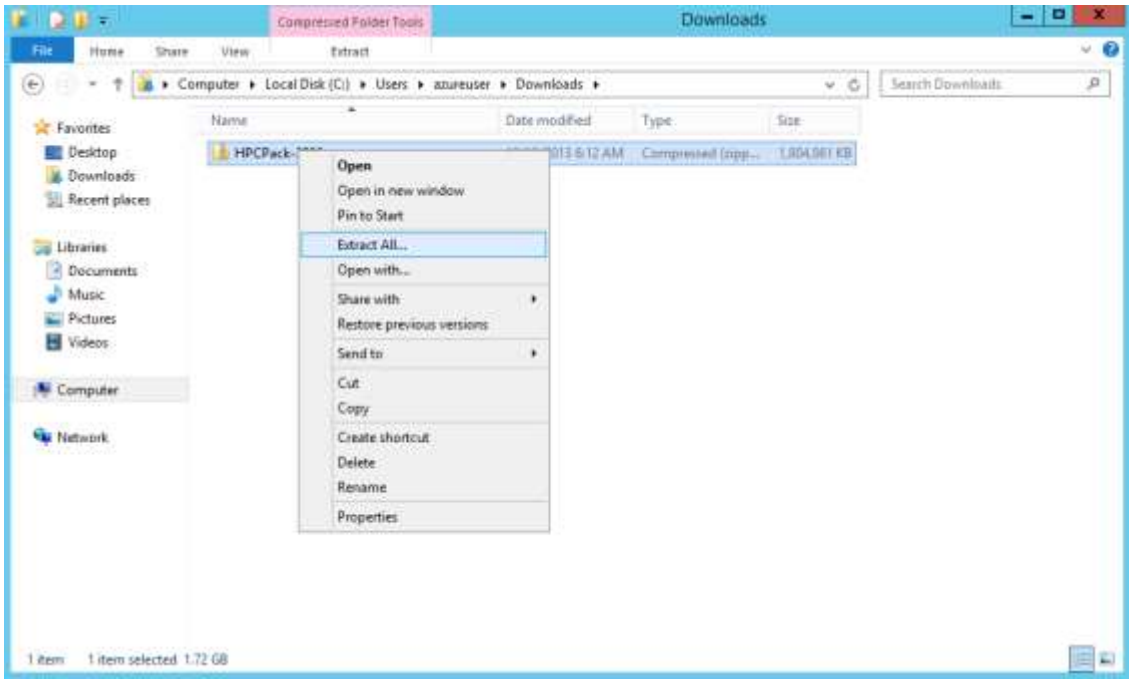
1. Reconnect to the VM and log on with the domain account we created earlier. This is **NOT** the same account we have been using up to this point. If you're connecting from a Mac, be sure to change the domain to the NetBIOS name of your Active Directory domain.



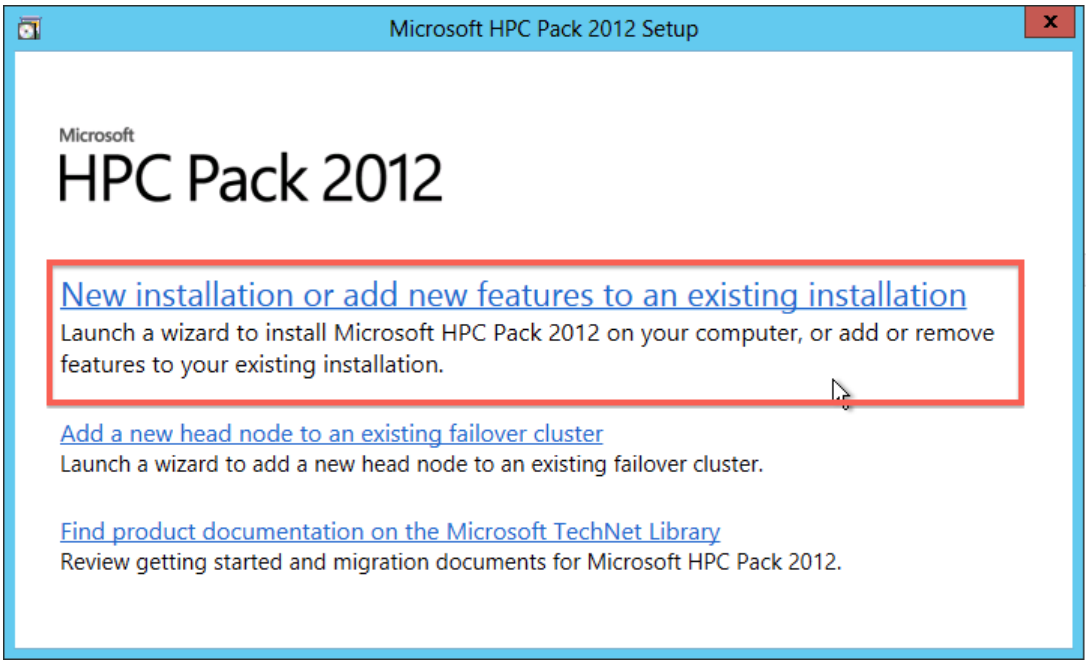
2. Once you're logged on as the domain user, open File Explorer and navigate to **C:\Users\<*local-user-name*>\Downloads**. If you are told you don't have access to the folder, just click **Continue** to get access.



3. Locate the compressed file you downloaded earlier. Right-click the file, and select **Extract All**. Then click **Extract** to unpack the file. It will take a few minutes to unpack everything.

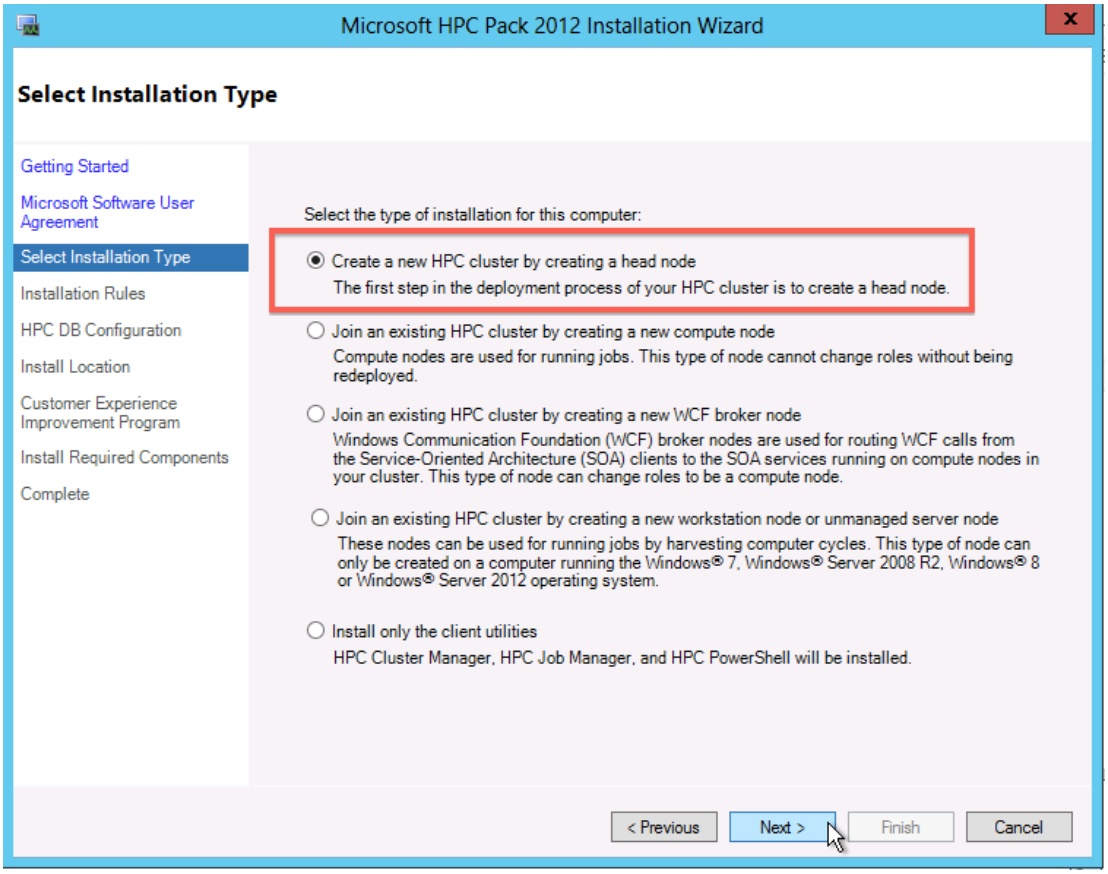


4. After the files are extracted, double click the **HPC Pack** folder, and then double click **setup.exe** to begin installation.
5. Click **New installation or add new features to an existing installation**.

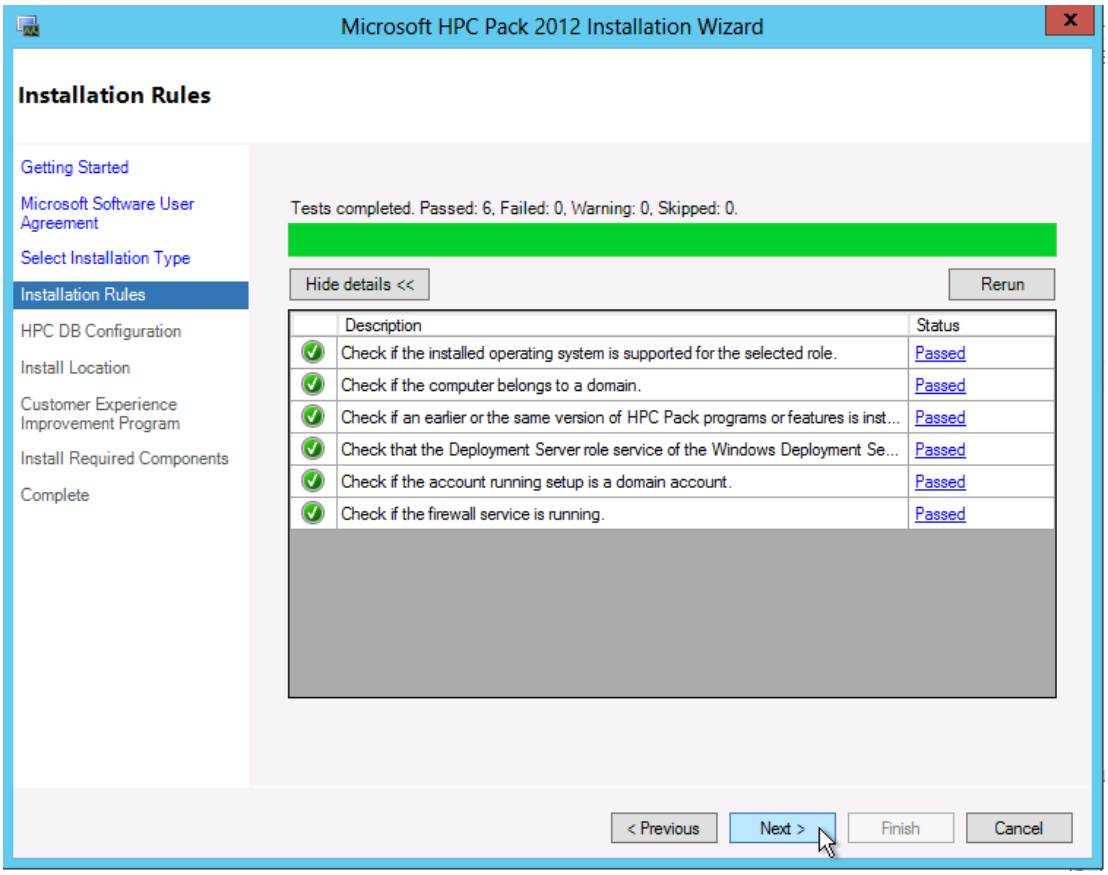


6. In the Installation Wizard window, on **Getting Started** tab, click **Next**, then on **Microsoft Software User Agreement** tab, select the check box to accept the license agreement, and click **Next**.

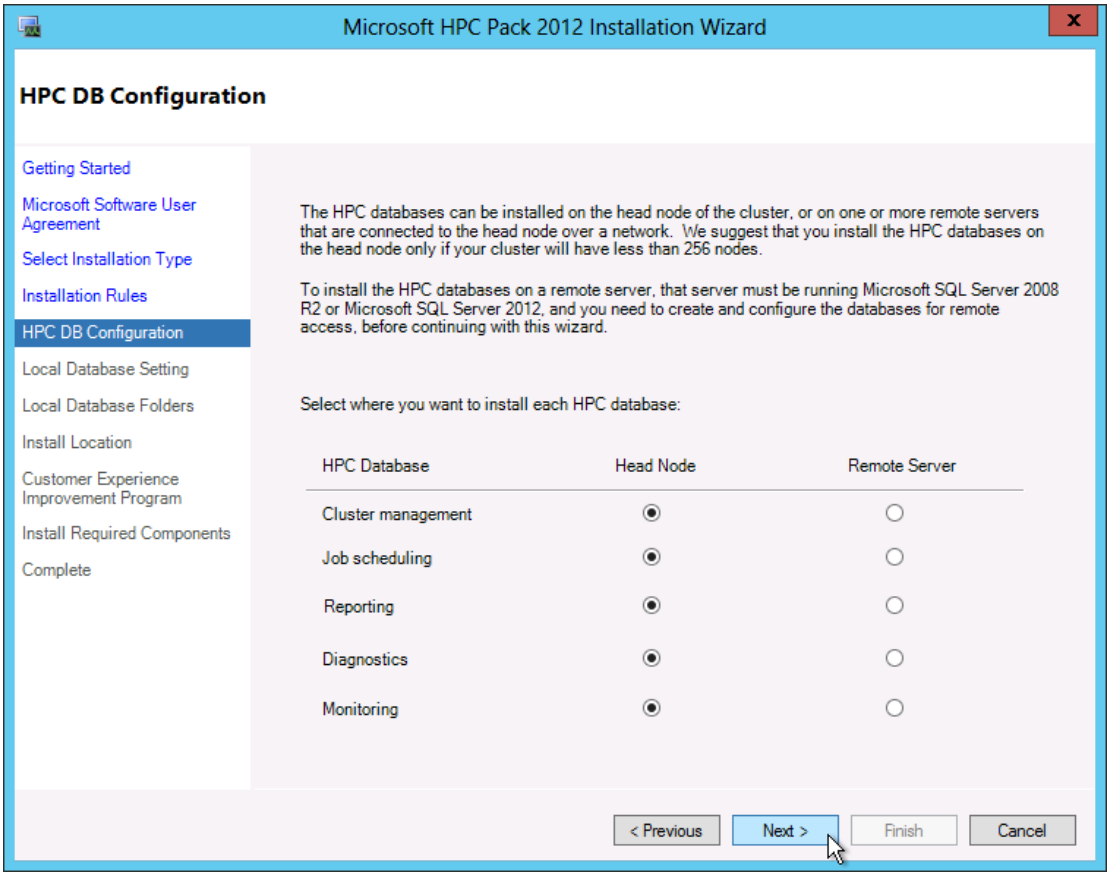
7. Select **Create a new HPC cluster by creating a head node**, and click **Next**.



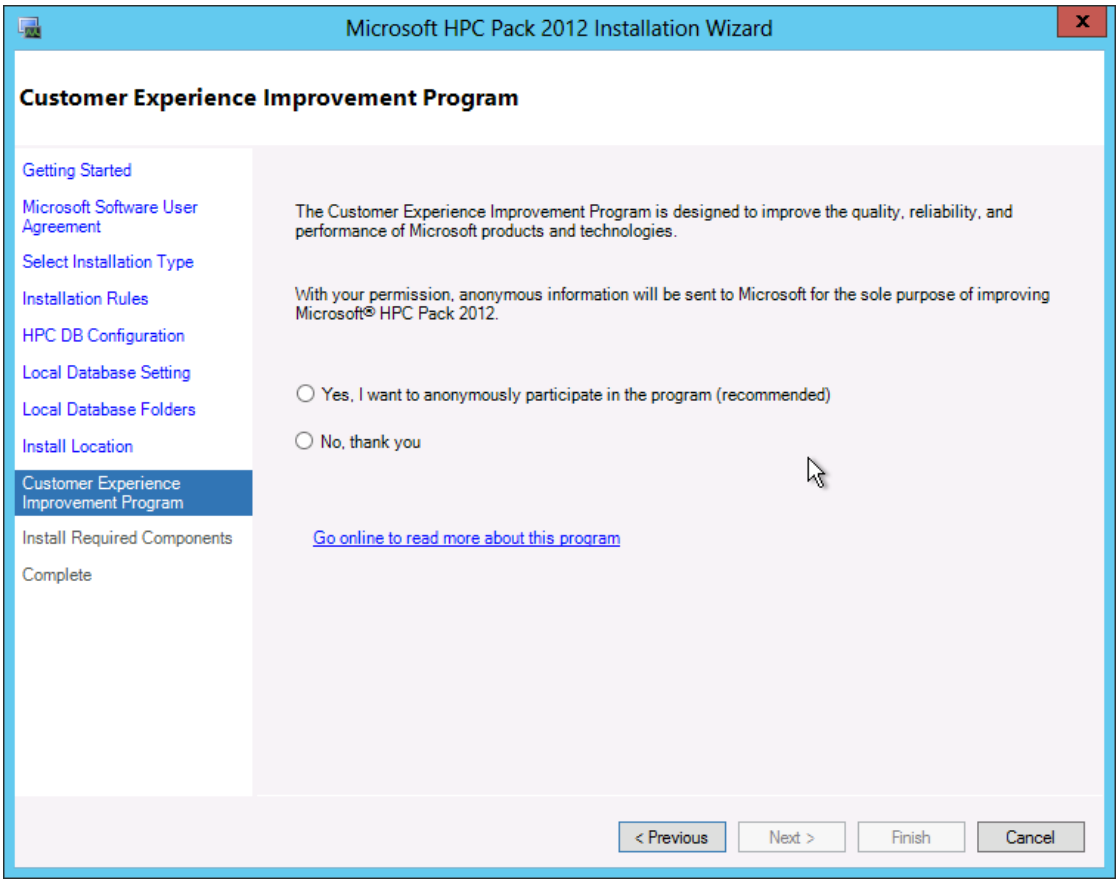
8. The installer will run a few prerequisite checks. Click **Next** if all checks pass. Otherwise, review the steps in this tutorial and make sure you have followed all steps exactly.



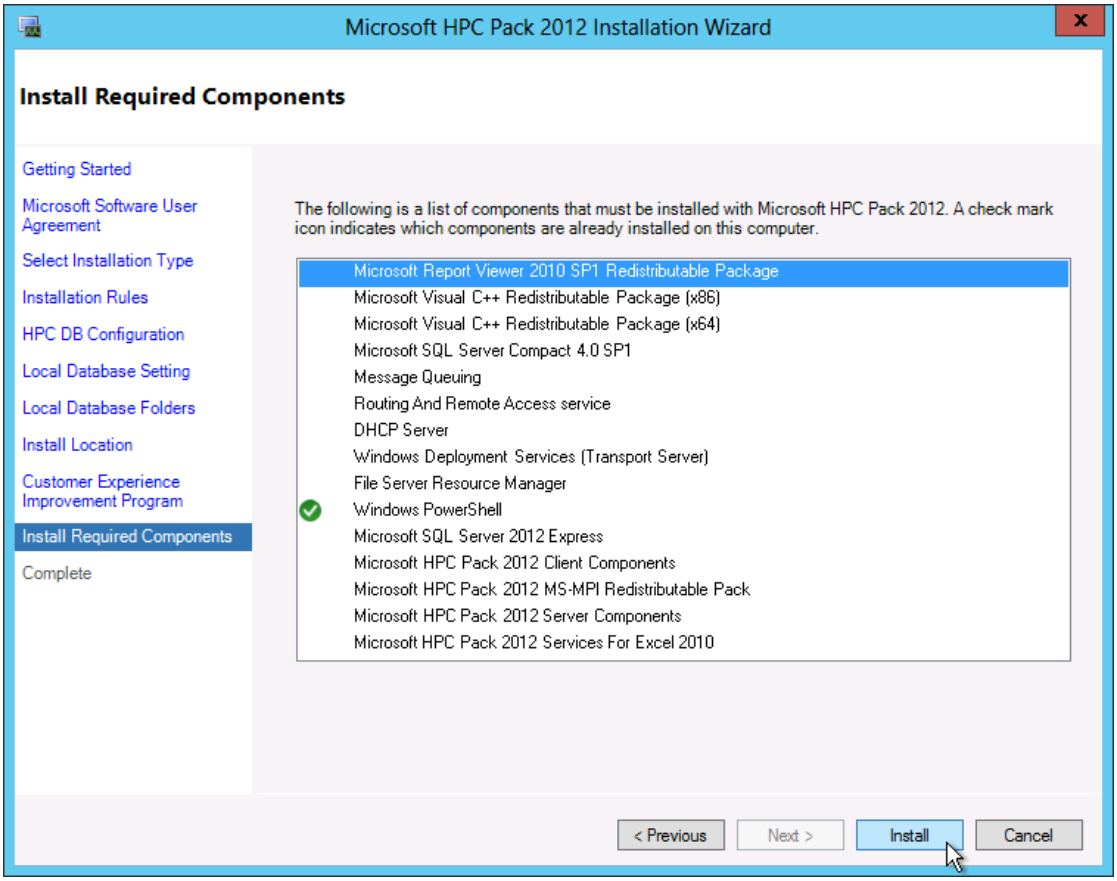
9. Make sure **Head Node** is selected for all HPC databases, and click **Next**.



10. Click **Next** on the tabs until you reach the **Customer Experience Improvement Program** tab. Select one of the options, and then click **Next**.



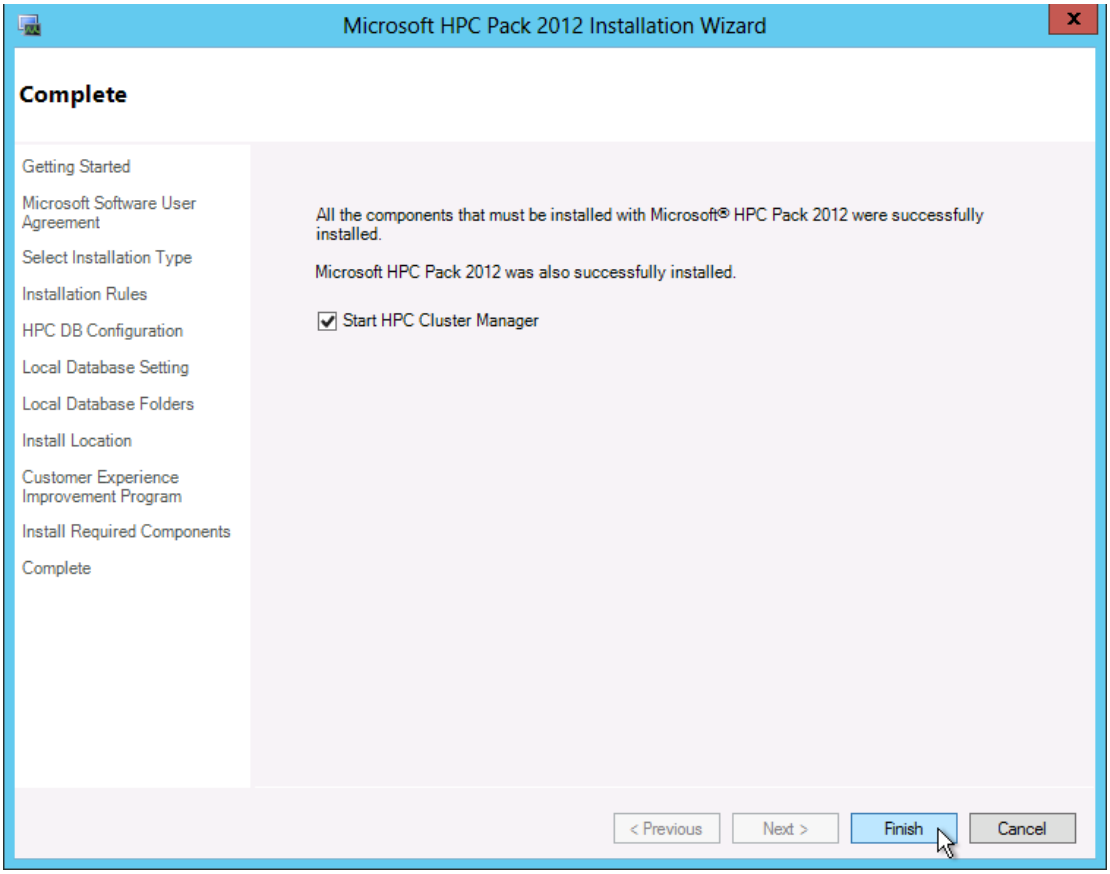
11. On the **Install Required Components** tab, click **Install**. If you have followed this tutorial exactly, you should see that only the Windows PowerShell prerequisite has been installed so far. The installation process will take several minutes.



IMPORTANT

During the installation process, you might see an error like the following. If you do, reboot the VM and restart the HPC Pack installation using exactly the same steps as before. It may take a few attempts, but it will eventually work. Don't forget to log back on as the domain user when you reconnect!

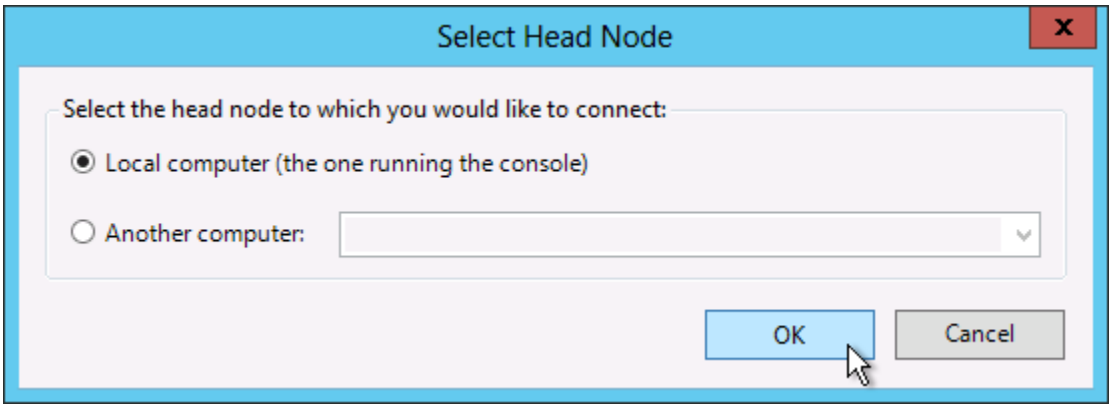
12. You might see a Windows PowerShell warning message similar to **No static IP addresses were found on this computer**. You can safely ignore this warning.
13. Click **Finish** to start the HPC Cluster Manager after the installation finishes.



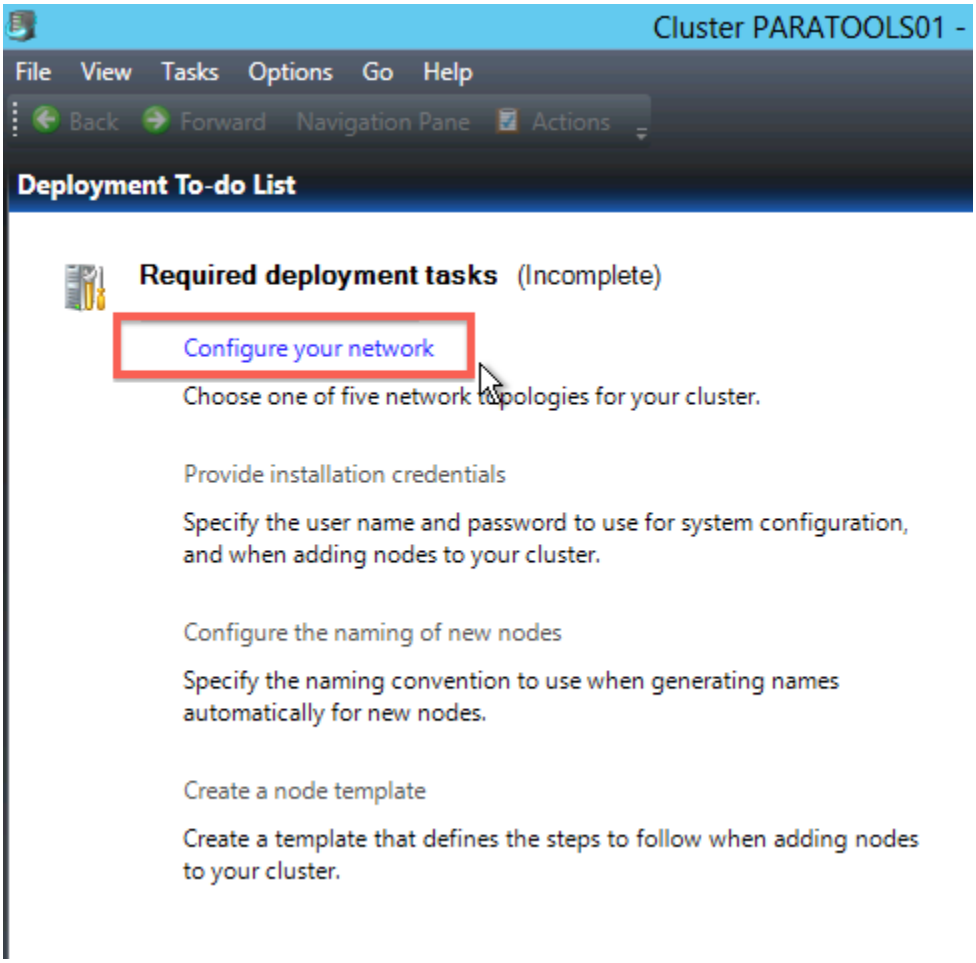
Step 11: Configure Microsoft HPC Pack

You must configure the HPC cluster before you can use it.

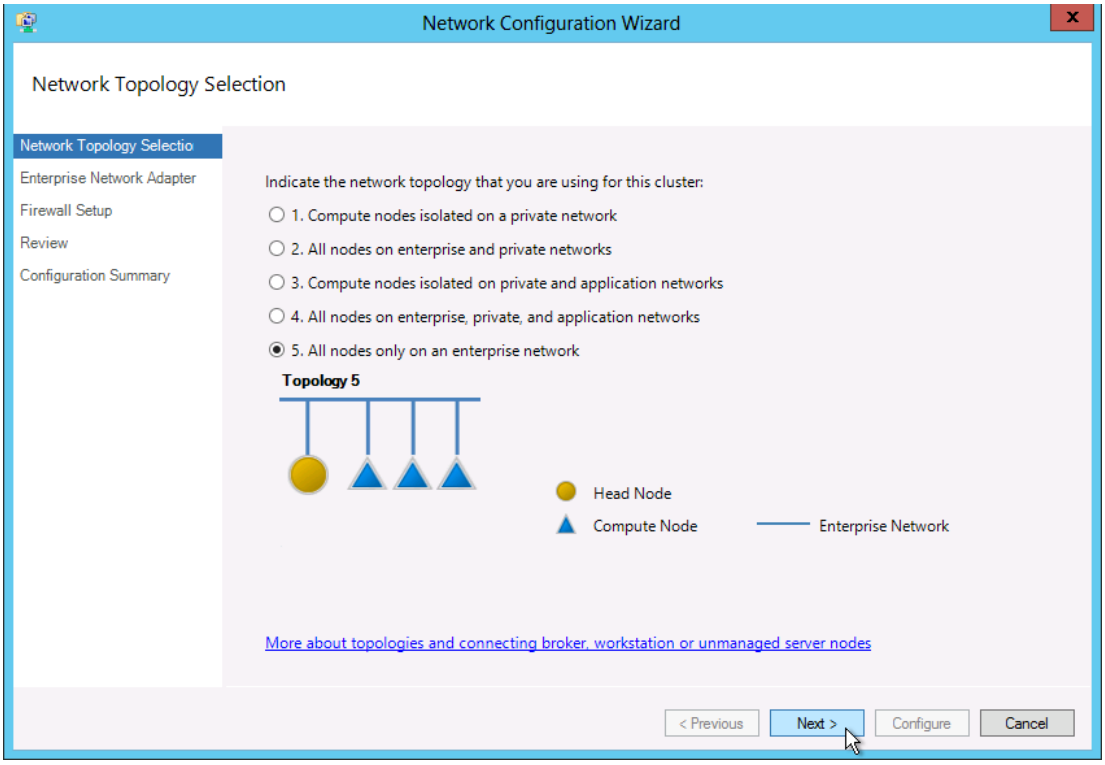
1. On the VM, open the Cluster Manager. In the **Select Head Node** box, select the local computer and click **OK**.



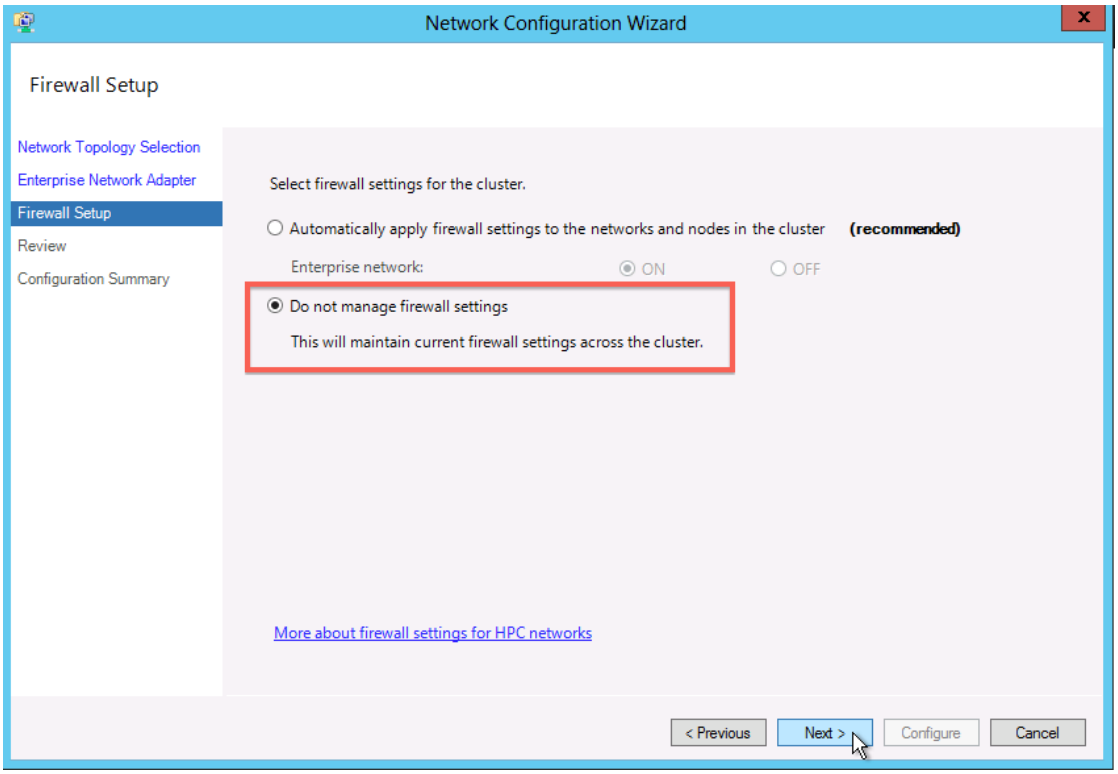
2. In the **Required deployment tasks** section of the Cluster Manager window, click **Configure your network**.



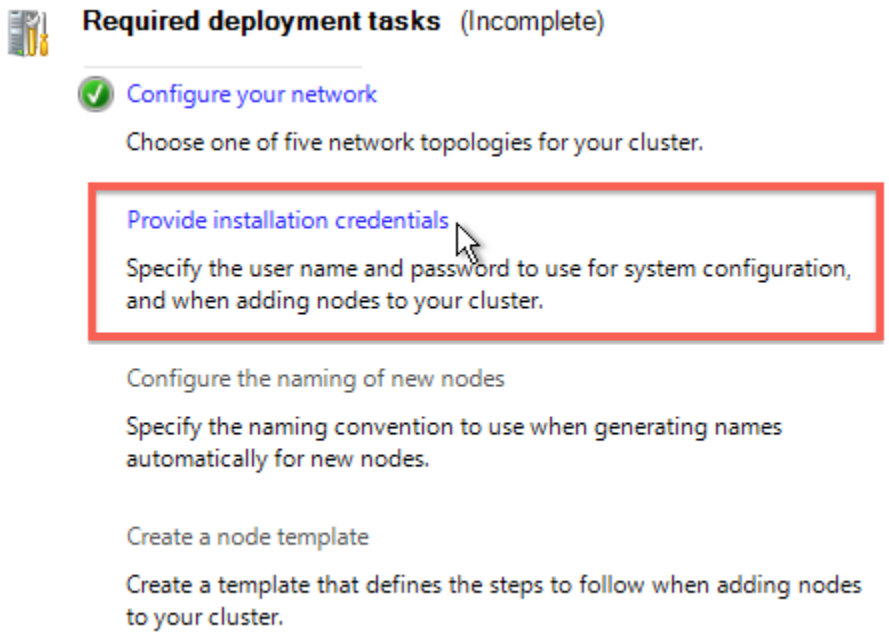
3. Select the fifth cluster topology **All nodes only on an enterprise network**, and click **Next**.



4. Click **Next** on the **Enterprise Network Adapter** tab to accept the default configuration.
5. Select **Do not manage firewall settings** on the **Firewall Setup** tab, and click **Next**.

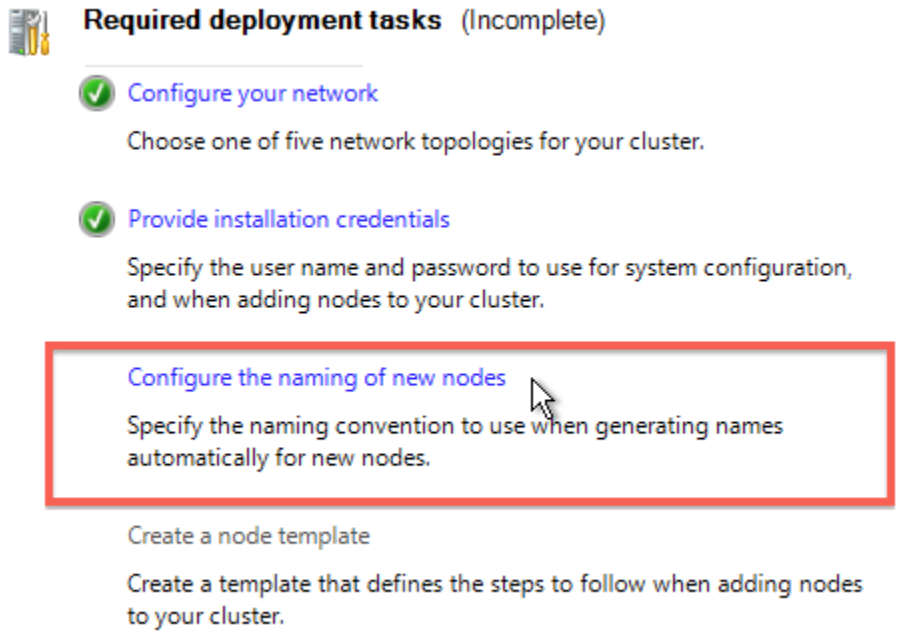


6. Click **Configure** on the **Review** tab to begin the configuration process.
7. Click **Finish** to end the configuration process.
8. In the **Required deployment tasks** section of the Cluster Manager window, click **Provide installation credentials**.

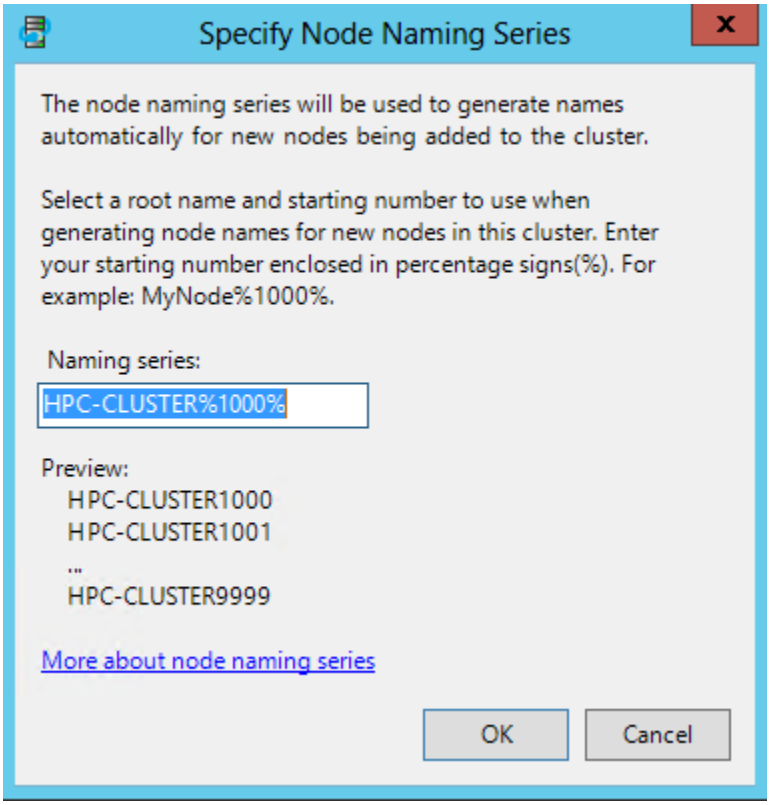


9. Enter the user name and password of the domain user, and click **OK**. You will need to enter the fully qualified user name as shown in the following image.

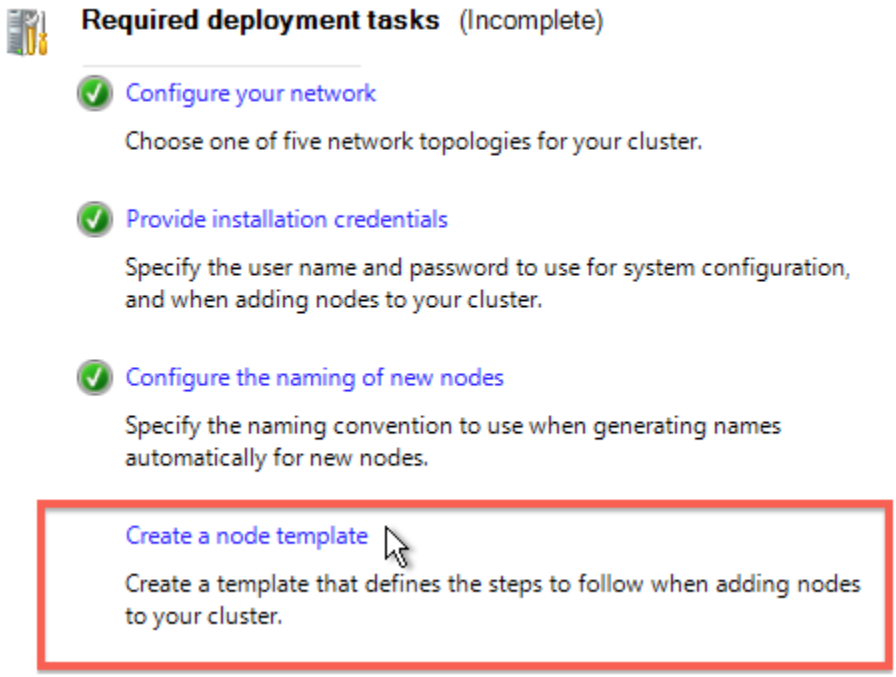
10. In the **Required deployment tasks** section of the Cluster Manager window, click **Configure the naming of new nodes**.



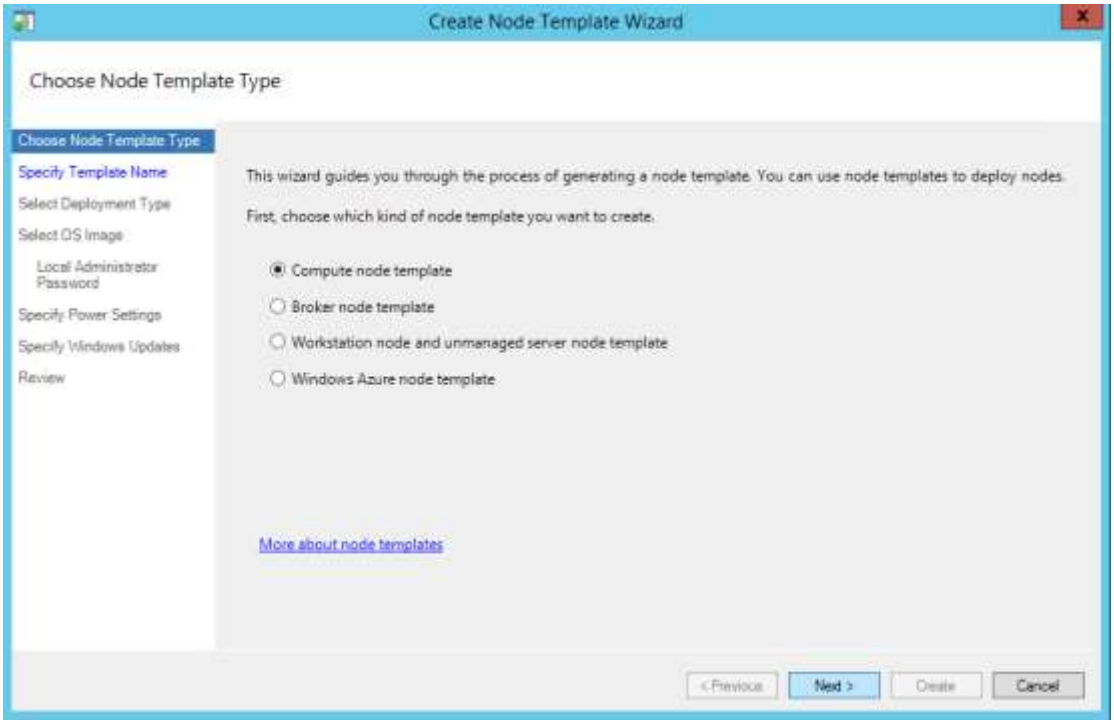
11. Click **OK** to accept the default naming series.



12. In the **Required deployment tasks** section of the Cluster Manager window, click **Create a node template**.



13. Select **Compute node template**, and click **Next**.



14. Click **Next** to accept the default template name.
15. Click **Next** to accept the default settings on every tab until you come to the **Review** tab.

16. Click **Create** to create the node template.

Step 12: Create compute nodes

You can create one or more Microsoft Azure virtual machines by following almost the same steps as you did when creating the head node virtual machines, and then install HPC Pack on them to create compute nodes.

To create a virtual machine for the compute node in the Management Portal

1. Sign in to the Microsoft Azure Management Portal.
2. Click the **VIRTUAL MACHINES** tab, and then click **NEW** in the bottom panel.
3. Click **COMPUTE**, click **VIRTUAL MACHINE**, and then click **FROM GALLERY**.
4. On the **Choose an Image** page, select an edition of **Windows Server 2012 Datacenter** for the virtual machine operating system.
5. On the **Virtual machine configuration** pages, do the following:

   a. Provide a computer name for the virtual machine, and provide administrator credentials.

   b. In **TIER** select **STANDARD** and in **SIZE** choose a virtual machine size of **A4**, which provides adequate hardware capacity for the compute node.

   c. In **CLOUD SERVICE**, select **Create a new cloud service** and provide a DNS name for the cloud service.

   d. In **REGION/AFFINITY GROUP/VIRTUAL NETWORK**, select the virtual network that you created in Step 2: Create a Microsoft Azure virtual network.

   e. In **VIRTUAL NETWORK SUBNETS**, select *ADSubnet* (the subnet you configured for the Active Directory domain).

   f. In **STORAGE ACCOUNT**, select an existing storage account that is in the same affinity group as the virtual network that you created, or select **Use an automatically generated storage account**.

   g. In **ENDPOINTS**, accept the default configuration. Then complete the wizard.

To join the virtual machine for the compute node to the Active Directory domain that you created in Microsoft Azure, configure the preferred DNS server address to point to the IPv4 address of the Active Directory domain controller. If you followed the recommended settings in this article, the IP address of the Active Directory domain controller is 10.0.0.4.

To configure the DNS server address and join the virtual machine to the domain

1. If you have not already done so, connect to the virtual machine from the Management Portal.
2. In Control Panel, in **Network Connections**, right-click the network adapter on the *ADSubnet* (it will have a name similar to **Ethernet 3**), and then click **Properties**.
3. Click **Internet Protocol Version 4 (TCP/IPv4)**, and then click **Properties**.
4. Click **Use the following DNS server address**.

5. In **Preferred DNS server**, type the IP address of the Active Directory domain controller (by default in this scenario, 10.0.0.4). Click **OK** and close the dialog box.
6. Join the virtual machine for the head node to the Active Directory domain that you created in Step 6: Promote the server to a domain controller in Microsoft Azure. You can do this by using standard procedures in Windows Server to change the domain settings in System settings (in Control Panel). You will need to supply the credentials of a domain administrator to join the virtual machine to the domain. You configured the necessary account in a previous step in this article.
7. After the virtual machine joins the domain, follow the prompts to restart the virtual machine.

   NOTE

   When the virtual machine restarts, your remote connection to the virtual machine is interrupted. To continue with the configuration of the compute node, connect again to the virtual machine.

After you create the virtual machine, add a domain user account to the local Administrators group. Use standard procedures in Windows Server to add a domain user account that you created in a previous step to the local Administrators group on the head node virtual machine. This account will be used to install HPC Pack on the virtual machine.

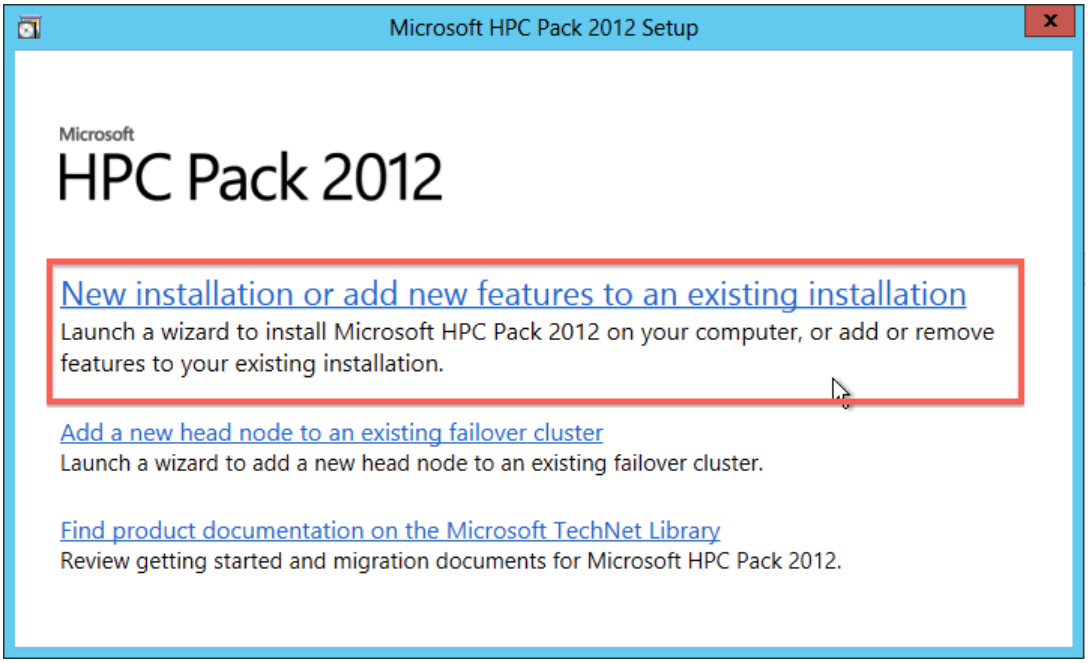
To add a domain user account as a local Administrator

1. In Server Manager, on the **Tools**, select **Computer Management**.
2. Expand **Local Users and Groups**.
3. To select and add the account, right-click **Groups**, right-click **Administrators**, and then click **Add to Group**.

Next, you install HPC Pack on the compute node in Microsoft Azure. The procedure is essentially the same as the one used to install an on-premises compute node. For detailed steps, see Add preconfigured nodes in **Getting Started Guide for HPC Pack**.

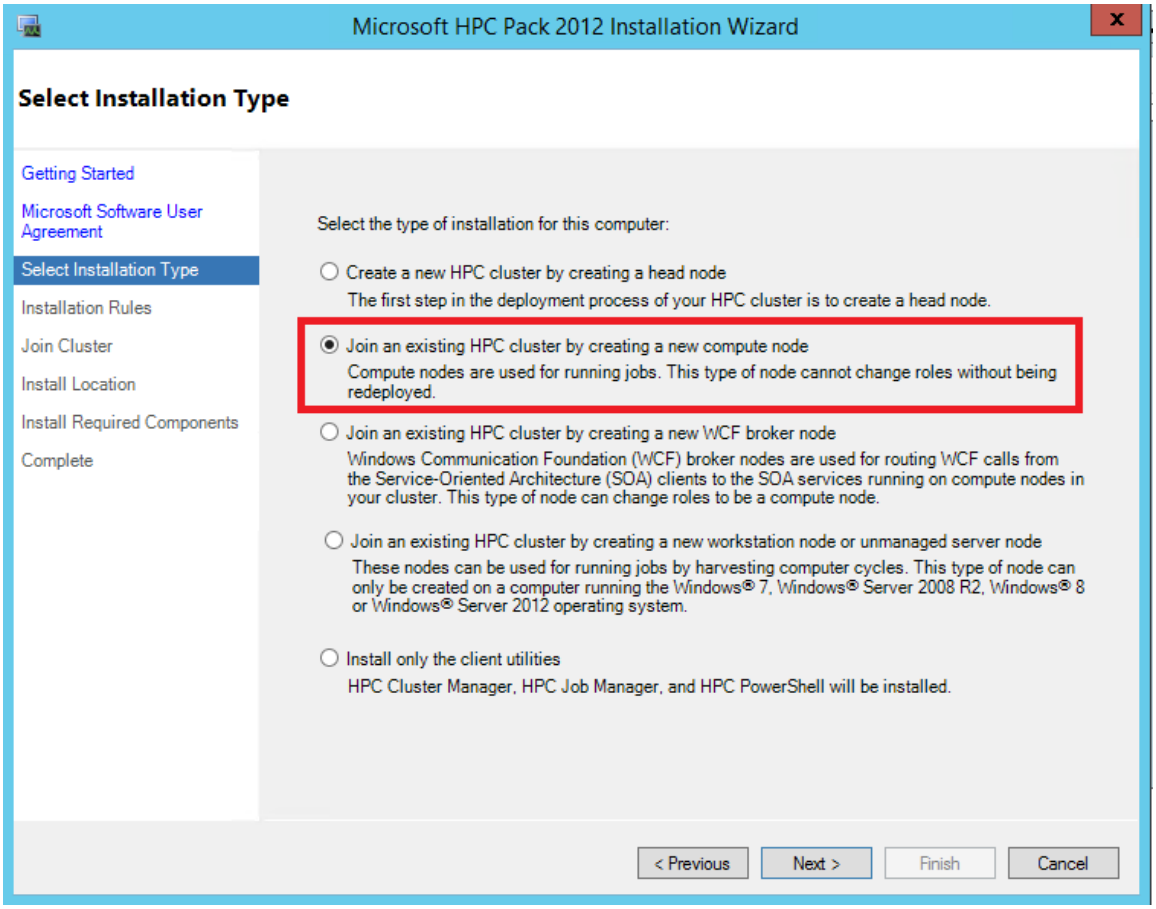
1. Connect to the compute node VM, and log on with the domain account.
2. Open File Explorer, and in the address bar, type **\\<head-node-name>\REMINST**.
3. Double click **setup.exe** to begin installation.

4. Click **New installation or add new features to an existing installation**.

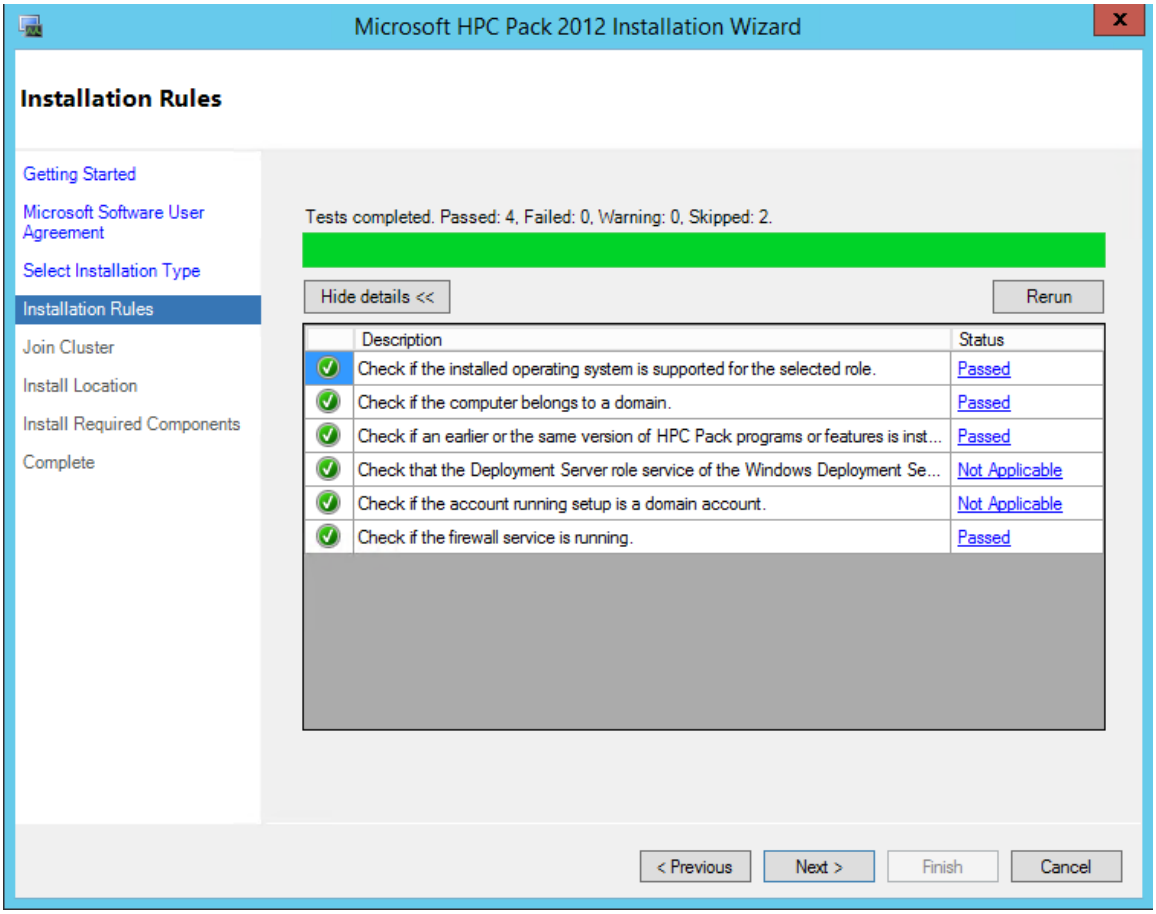


5. In the Installation Wizard window, on **Getting Started** tab, click **Next**, then on **Microsoft Software User Agreement** tab, select the check box to accept the license agreement, and then click **Next**.

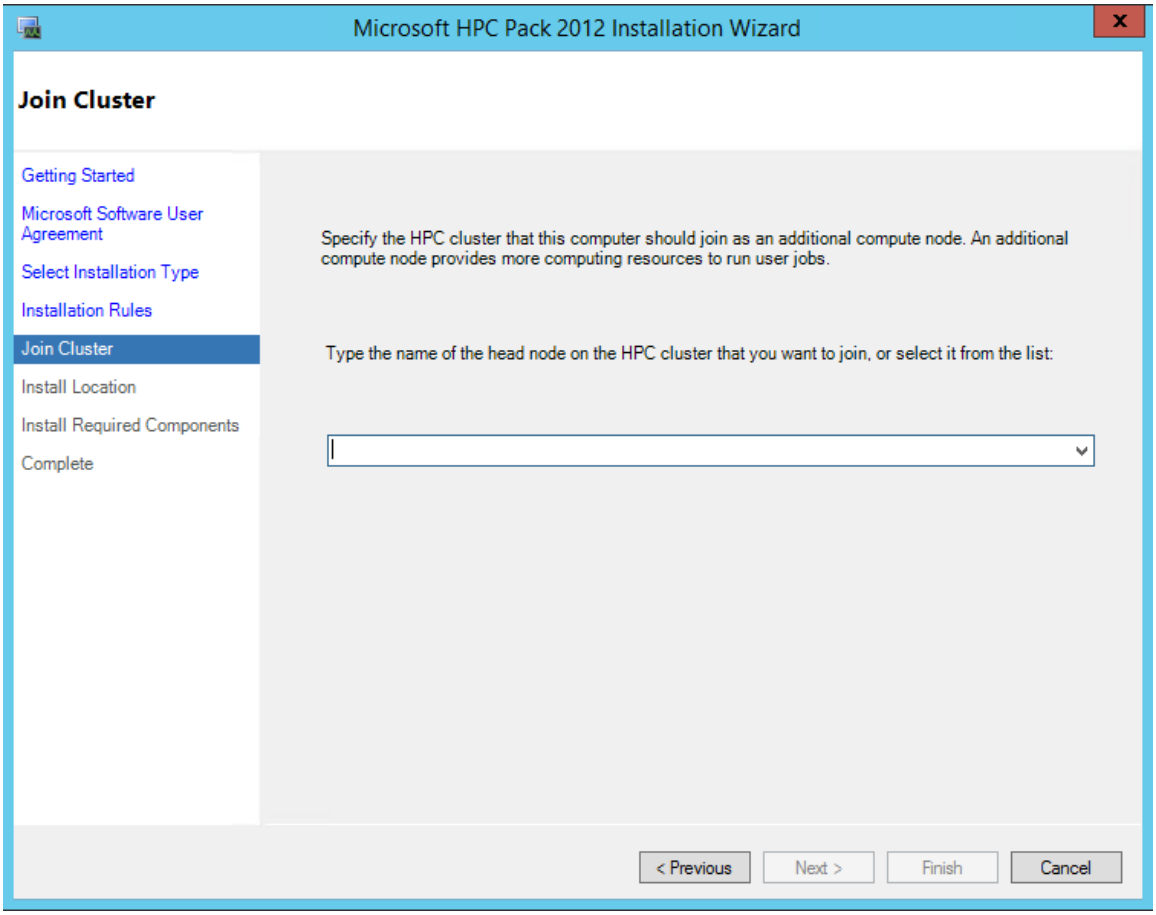
6. Select **Join an existing HPC cluster by creating a new compute node**, and click **Next**.



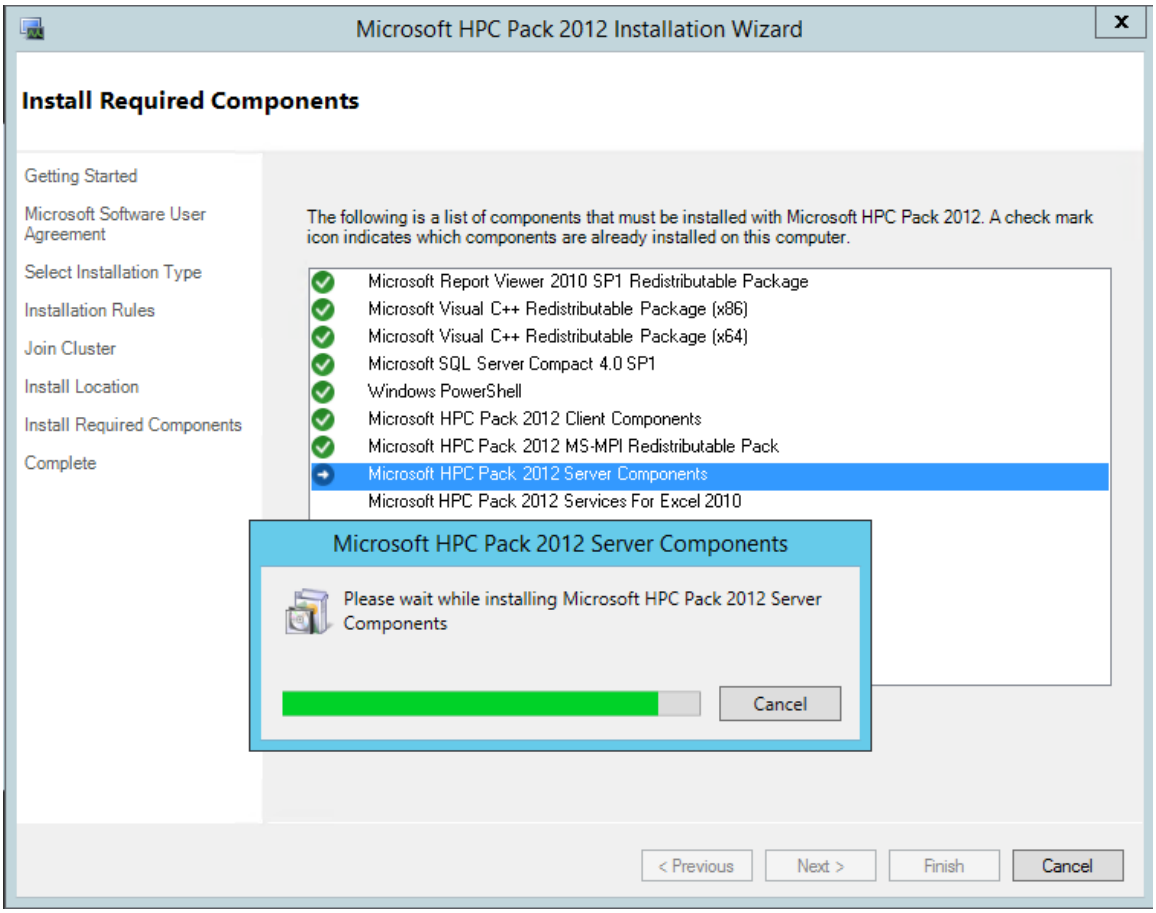
7. The installer will run a few prerequisite checks. Click **Next** if all checks pass. Otherwise, review the steps in this tutorial and make sure you followed all steps exactly.


Microsoft HPC Pack 2012 Installation Wizard
Installation Rules
Getting Started
Microsoft Software User Agreement
Select Installation Type
Installation Rules
Join Cluster
Install Location
Install Required Components
Complete
Tests completed. Passed: 4, Failed: 0, Warning: 0, Skipped: 2.
Hide details <<
Rerun
Description
Status
Check if the installed operating system is supported for the selected role.
Passed
Check if the computer belongs to a domain.
Passed
Check if an earlier or the same version of HPC Pack programs or features is inst...
Passed
Check that the Deployment Server role service of the Windows Deployment Se...
Not Applicable
Check if the account running setup is a domain account.
Not Applicable
Check if the firewall service is running.
Passed
< Previous
Next >
Finish
Cancel

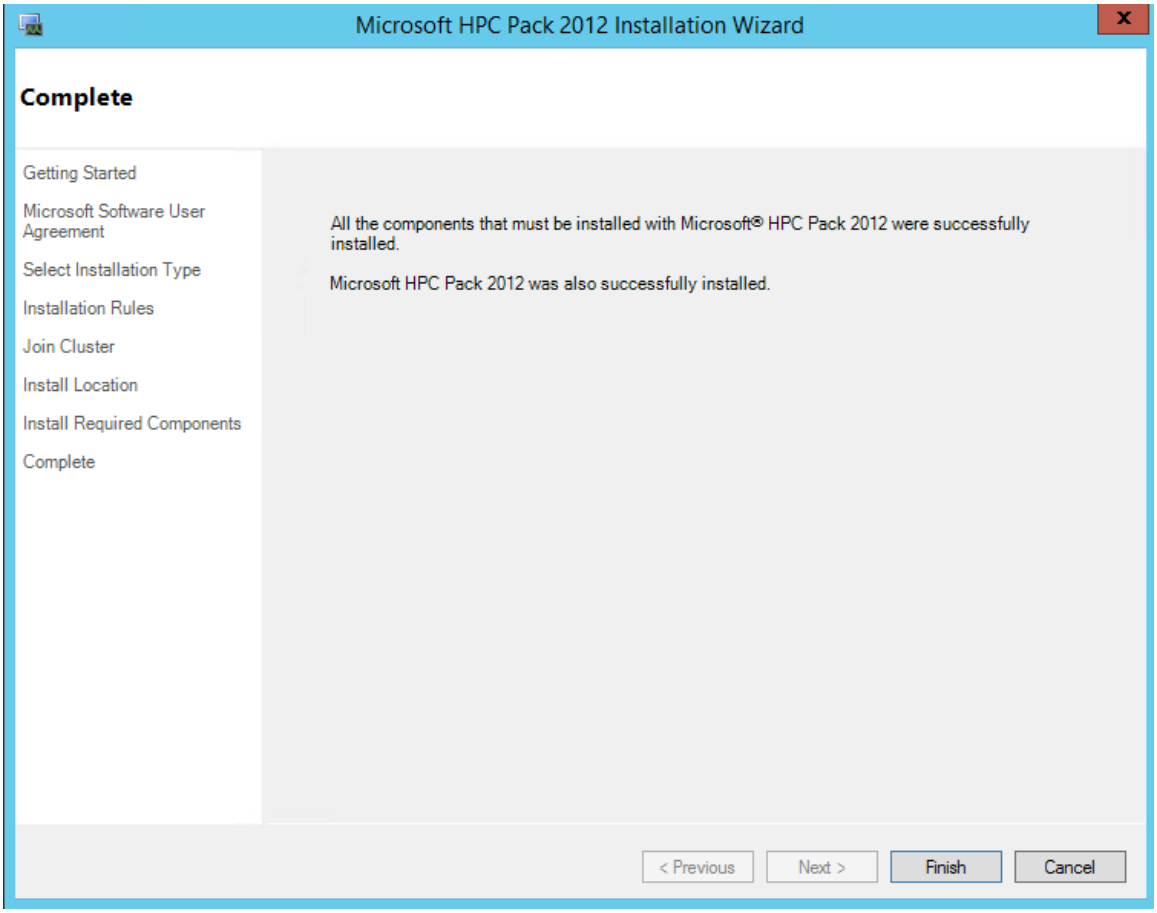
8. Select the head node name in the drop-down list, and click **Next**.



9. Click **Next** on the tabs until you reach the **Install Required Components** tab. Click **Install** on the **Install Required Components** tab. The installation process will take several minutes.



10. Click **Finish** to complete the installation.



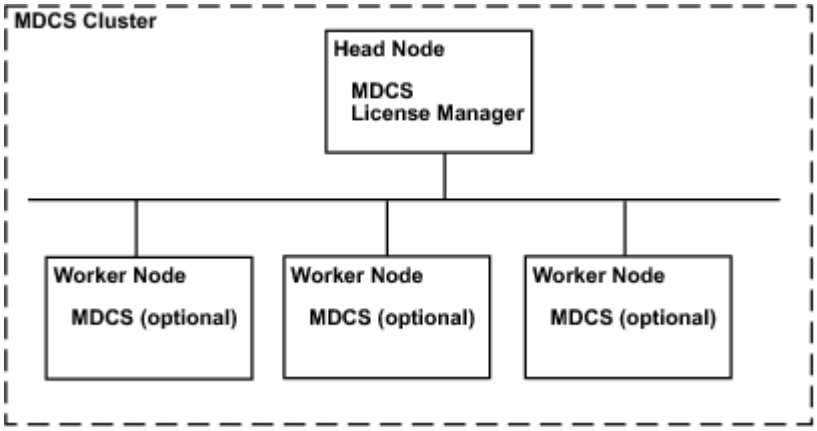
INFORMATION

Go back to your head node, and open HPC Cluster Manager. In the **Node Management** tab, notice that your newly created compute node appears in the node list with **Node State: Unknown** and **Node Health: Unapproved**.

Install MATLAB Distributed Computing Server on HPC nodes

To set up a cluster, you first install MDCS on the HPC head node, called the *head* node. You can also install the license manager on the head node. After performing this installation, you can then optionally install MDCS on the HPC cluster compute nodes, called *worker* nodes. You do not need to install the license manager on worker nodes.

The following figure shows the installations that you perform on your MDCS cluster nodes. This is only one possible configuration. (You can install the cluster license manager and MDCS on separate nodes, but this article does not cover this type of installation.)



NOTE

MathWorks highly recommends installing all MathWorks products on the cluster. MDCS cannot run jobs whose code requires products that are not installed.

This section contains step-by-step procedures to install MDCS R2013b on each node of the HPC cluster. If you need help with the installation, you can find detailed instructions for this release at MATLAB Distributed Computing Server in the MathWorks Documentation Center.

NOTE

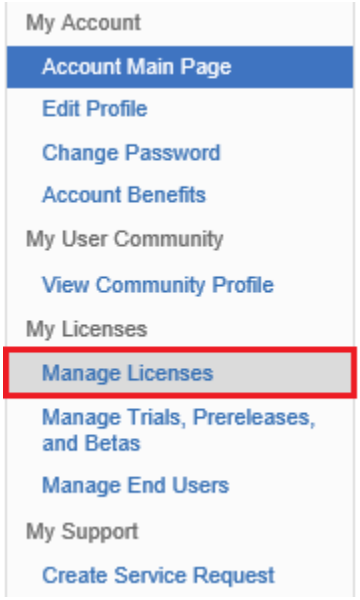
You must have the 64-bit version of MDCS installed on your cluster to use it with HPC Server. 32-bit MDCS does not support HPC Server.

Step 1: Download MDCS installation package

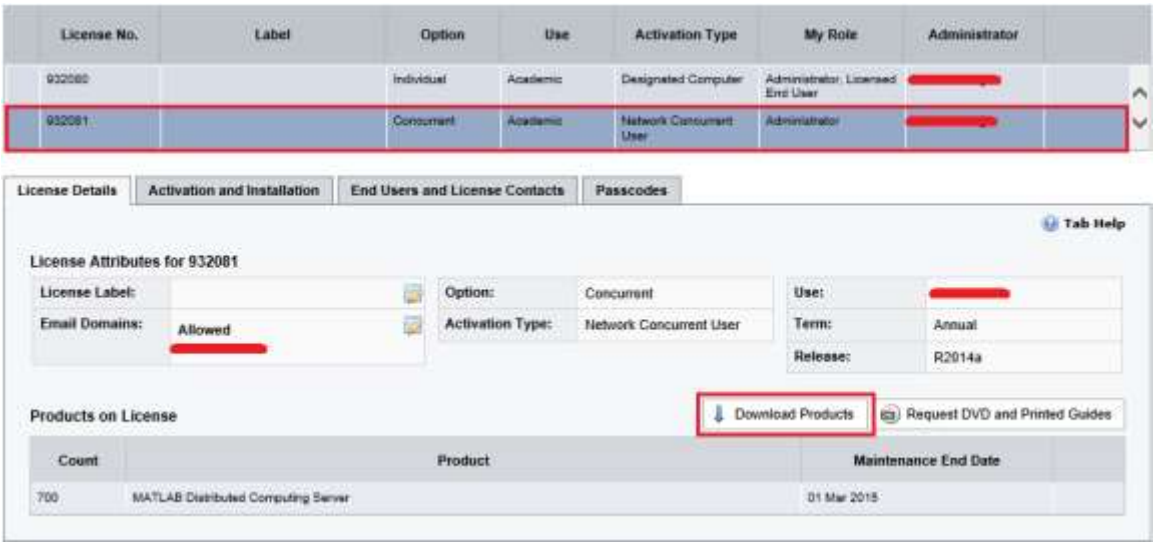
First, you need to download the MDCS installation package from the MathWorks website.

1. Connect to the head node VM and log on with the domain account you created earlier.
2. Open the MathWorks website in Internet Explorer, and sign in with your MathWorks account. Click **My Account** at the top-right corner of the page.

3. On the MathWorks Account page, click **Manage Licenses** in the left navigation panel.

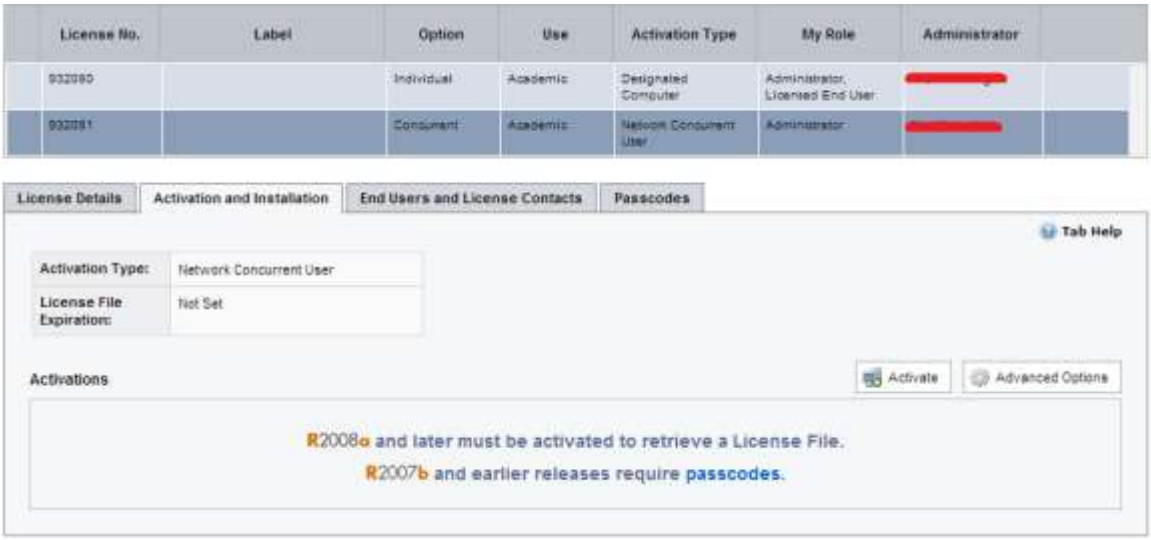


4. On the **Licenses Manage** page, all your purchased licenses will be listed. Make sure that you have purchased the MDCS license. Click your MDCS license, and then click **Download Products** in the panel below.

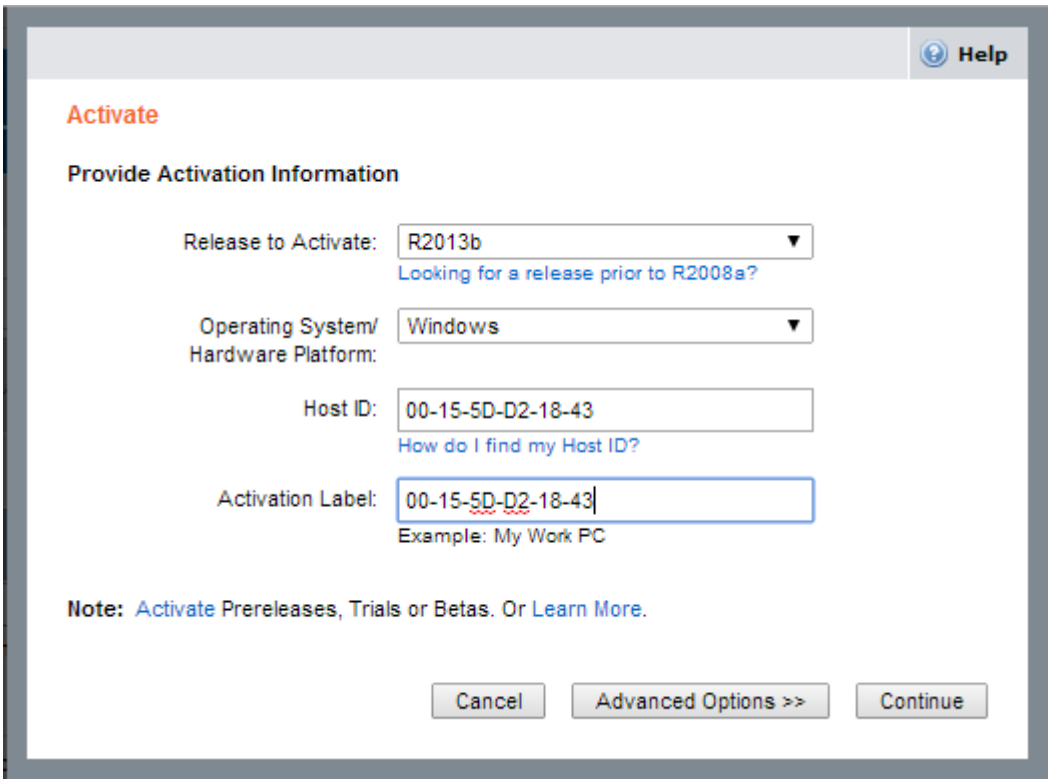


5. On the **Downloads** page, select **R2013b** from the **Download Earlier Release** panel on the right side.
6. On the next page, you can choose to download the products with or without the Java Runtime Environment (JRE). Follow the download wizard to download all MDCS products (64bit) to your hard disk. It is recommended that you download the products to a folder on the C drive, for example, **C:\matlab_R2013b_win64**. Later you will use this installation package again to install MDCS on compute nodes.

7. While downloading the installation package, you also have to download the license file. Go back to the **Licenses Manage** page, choose the **Activation and Installation** tab, and click **Activate**.



8. In the window, enter the required information, and click **Continue**. Write down the **File Installation Key** and download the **license.lic** file to your hard disk. This will be used to activate your MDCS products.



NOTE

The Host ID can be your Volume Serial Number, MAC Address, or IP Address.

Platform	How to find the host ID

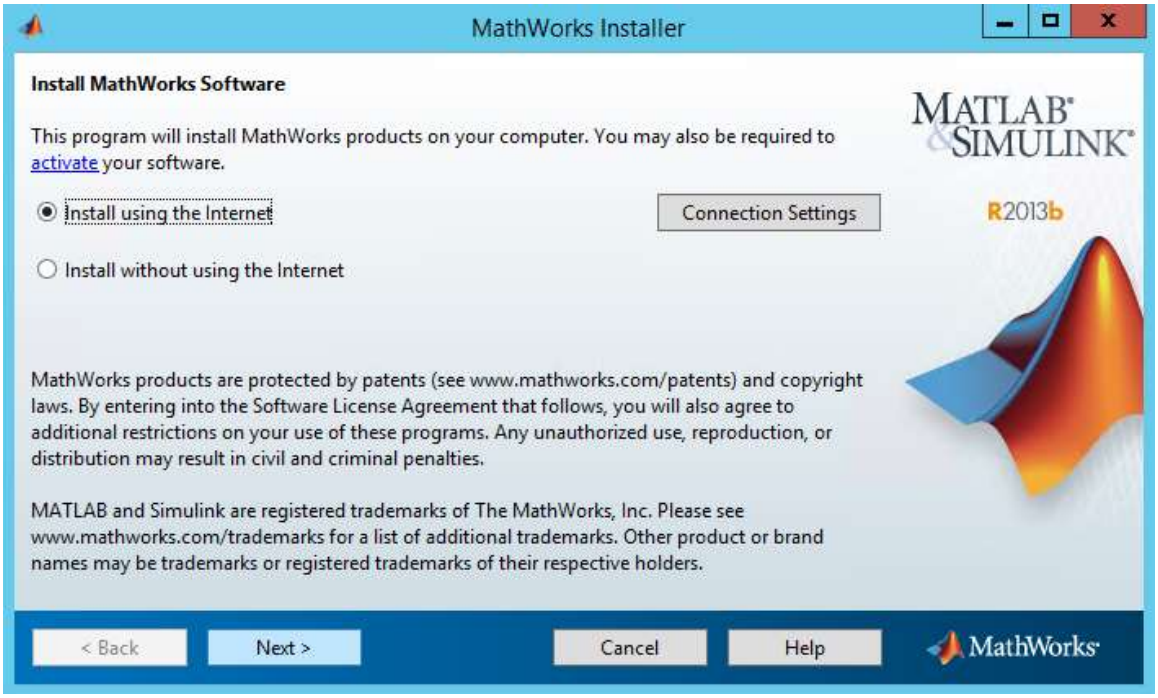
Windows® (all)	For standalone licenses, the host ID can be either the volume serial number of the C:\ drive (Option 1), or the MAC Address (Physical Address) of the first Ethernet adapter (Option 2).
	
	For network licenses, the host ID can be the MAC Address (Physical Address) of the first Ethernet adapter (Option 2) or the IP Address of the first Ethernet adapter (Option 3).
	
	Option 1: Volume Serial Number (Standalone licenses only)
	To obtain the Volume Serial Number, open a Command Prompt window, and run the command:
	
	`vol c:`
	
	Use the serial number listed (ex. 1234-1234).
	
	Option 2: MAC Address (Physical Address, Standalone or Network licenses)
	To obtain the MAC Address, open a Command Prompt window, and run the command:
	
	`getmac`
	
	Use the first Physical Address listed (ex. 00-11-22-aa-bb-cc).
	
	Option 3: IP Address (Network licenses only)
	To obtain the IP address, open a Command Prompt window, and run the command:
	
	`ipconfig`

Step 2: Install MDCS on the head node

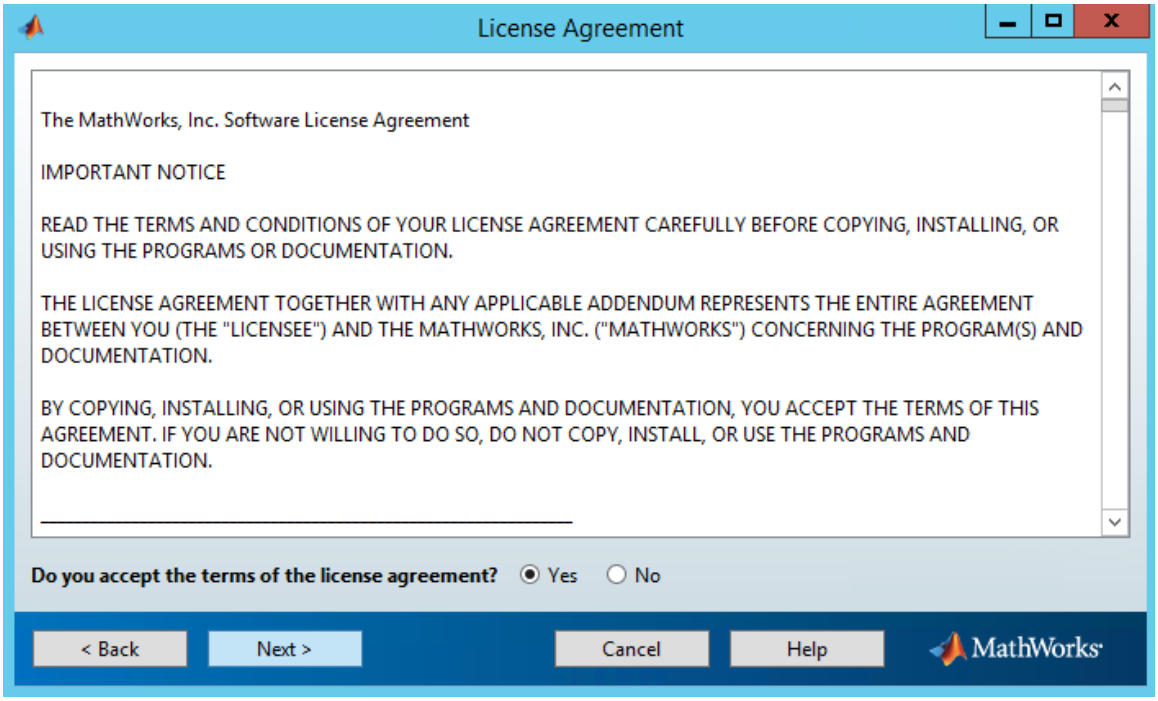
Now you're ready to install the MDCS.

If you download the products through the JRE application, the setup program will start automatically once your download has finished. Otherwise, you can double-click the **matlab_R2013b_win64_installer.exe** in your download folder to extract the installation files. Run **setup.exe** in the subfolder **bin\win64** to start the setup program.

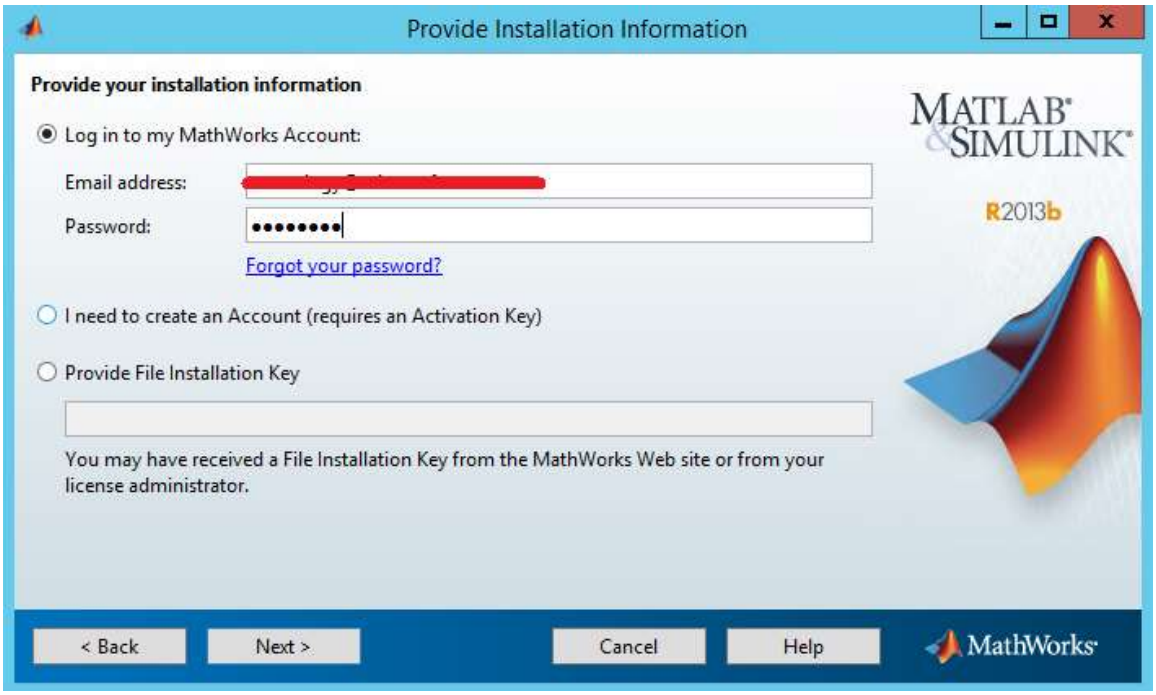
1. Select **Install using the Internet**, and click **Next**.



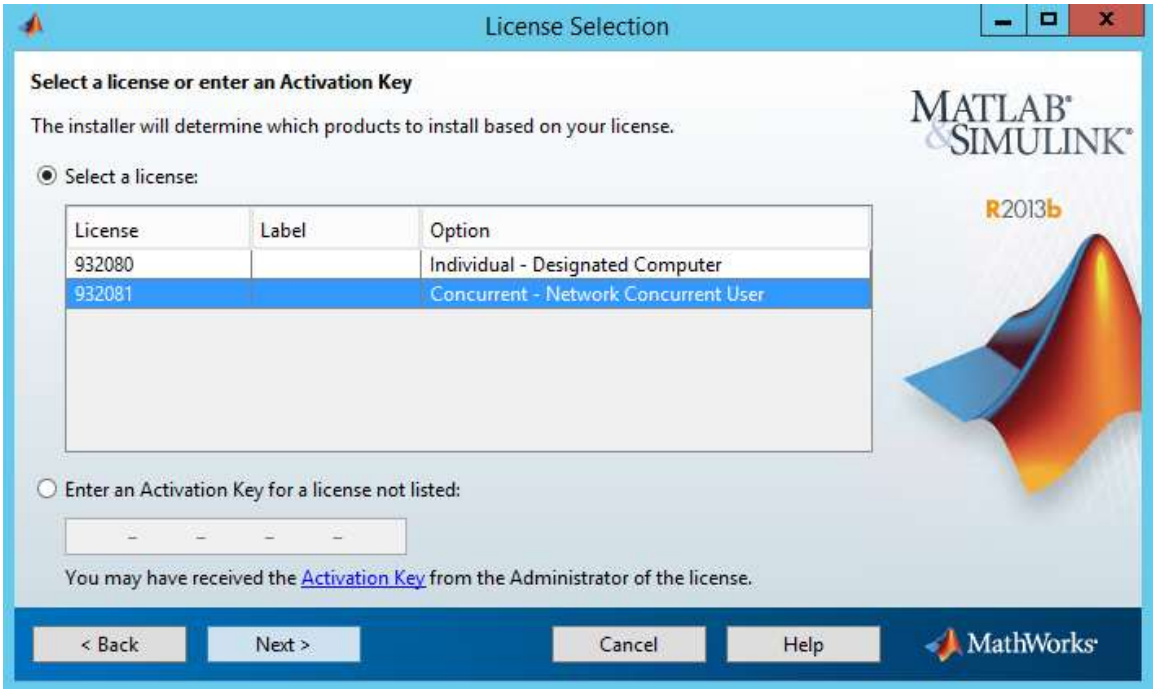
2. Select **Yes** to agree the terms of the license agreement, and then click **Next**.



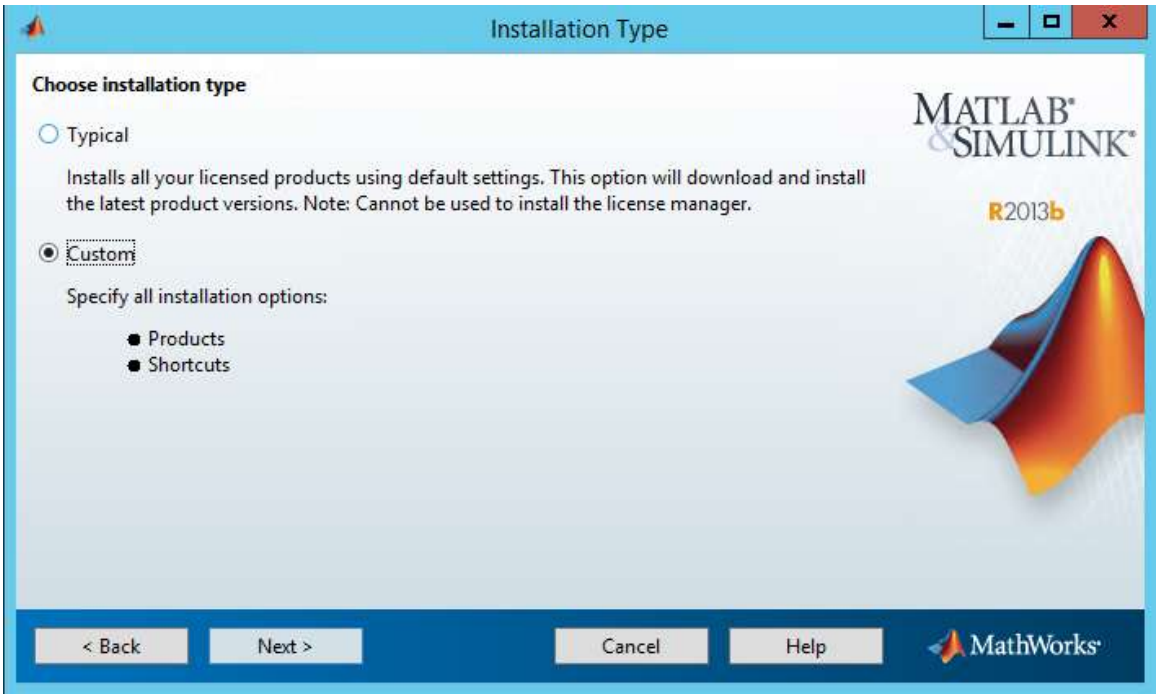
3. Select **Log in to my MathWorks Account**, enter your MathWorks account information, and click **Next**.



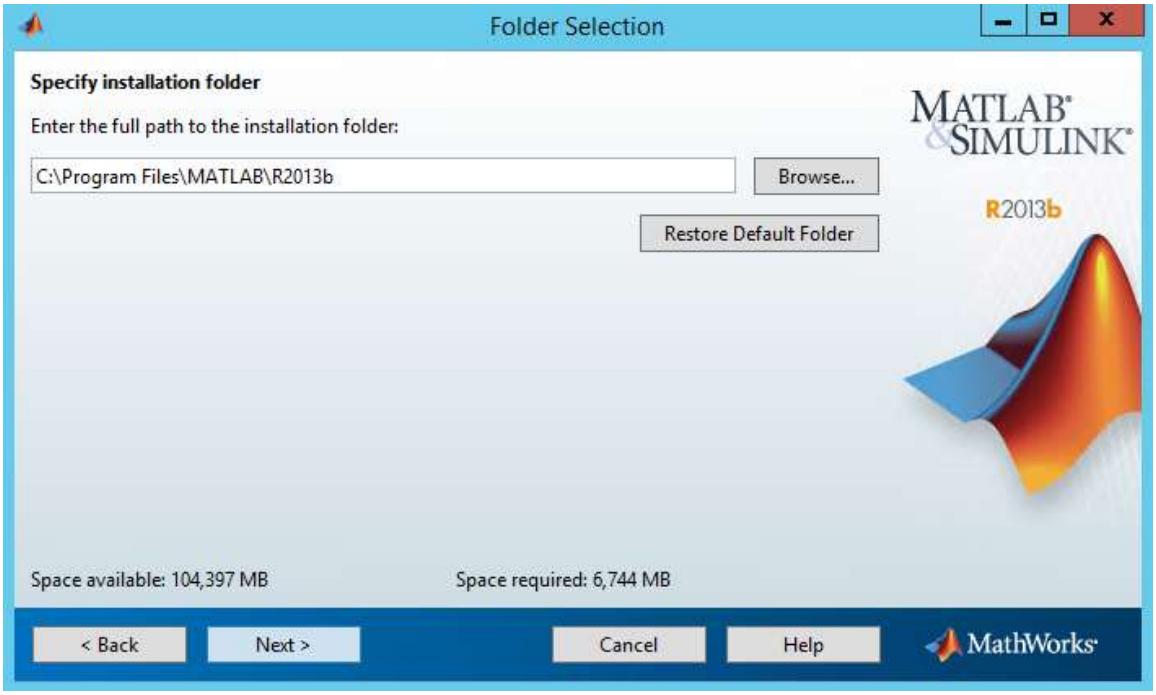
4. Select your MDCS license, and click **Next**.



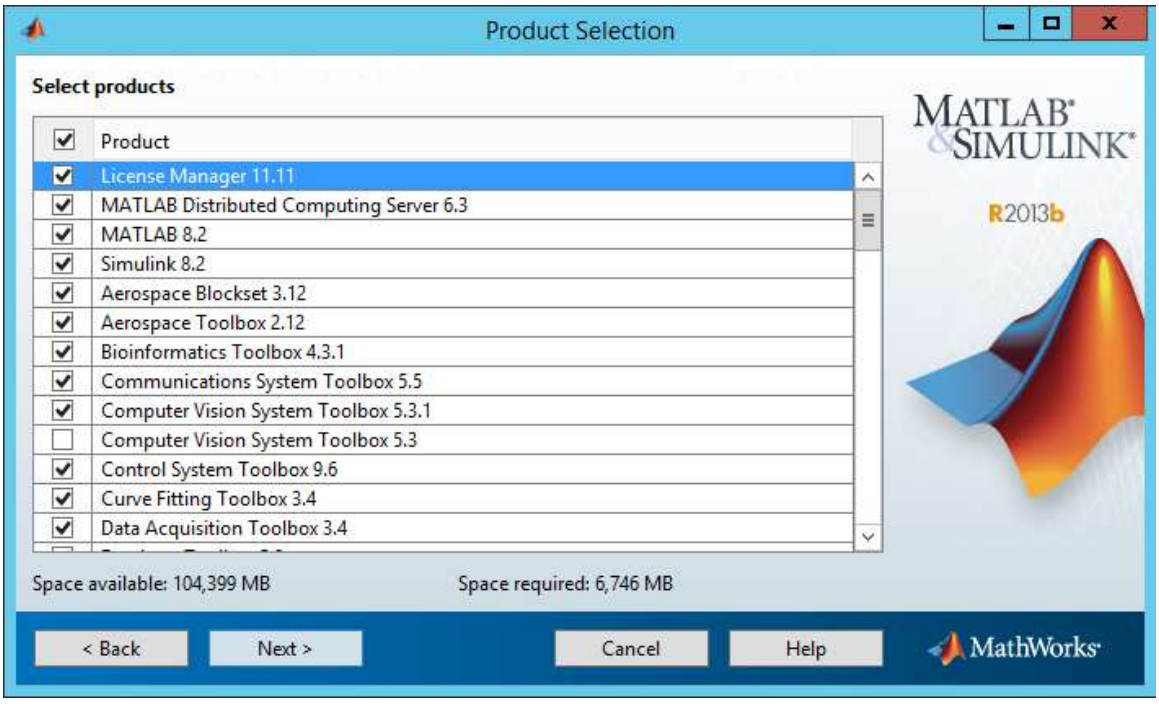
5. Select **Custom** because the typical settings cannot be used to install the license manager. Then click **Next**.



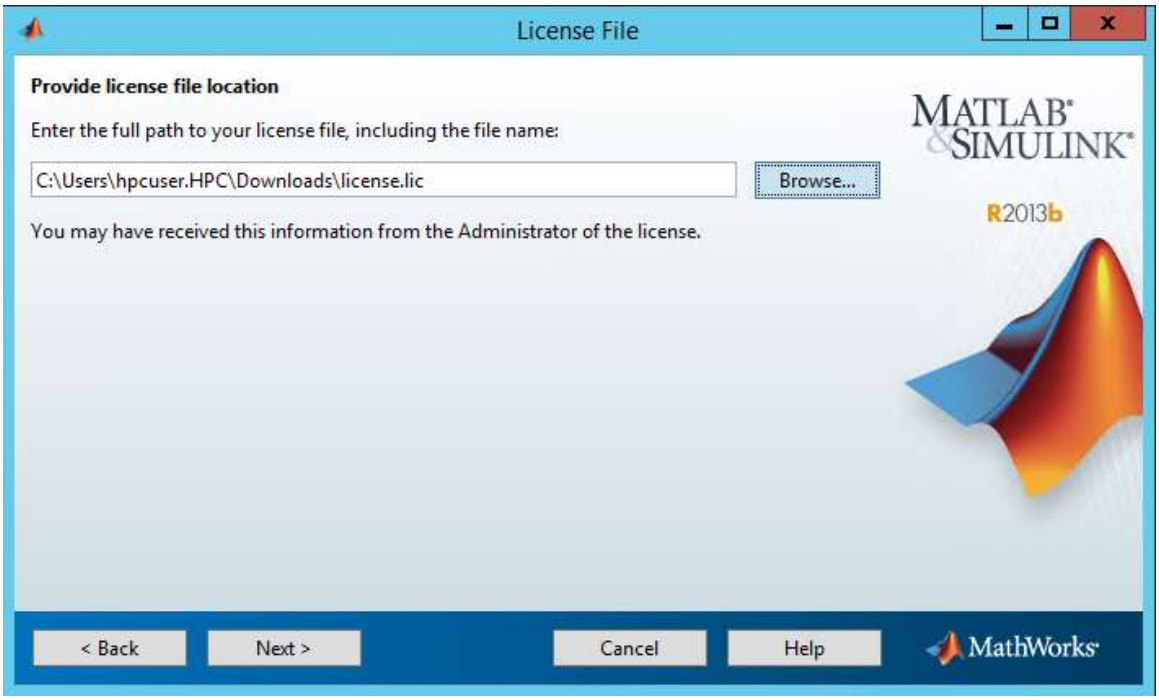
6. Choose the installation folder, and then click **Next**.



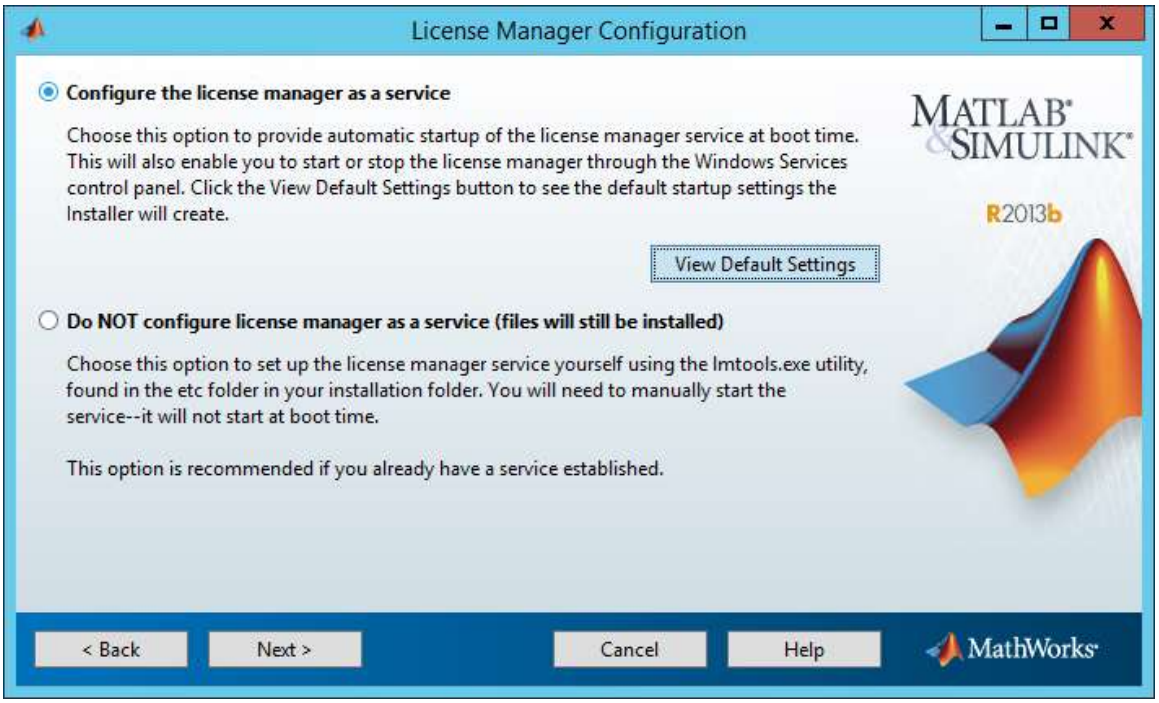
7. Be sure to select the **License Manager** check box in the product list, and then click **Next**.



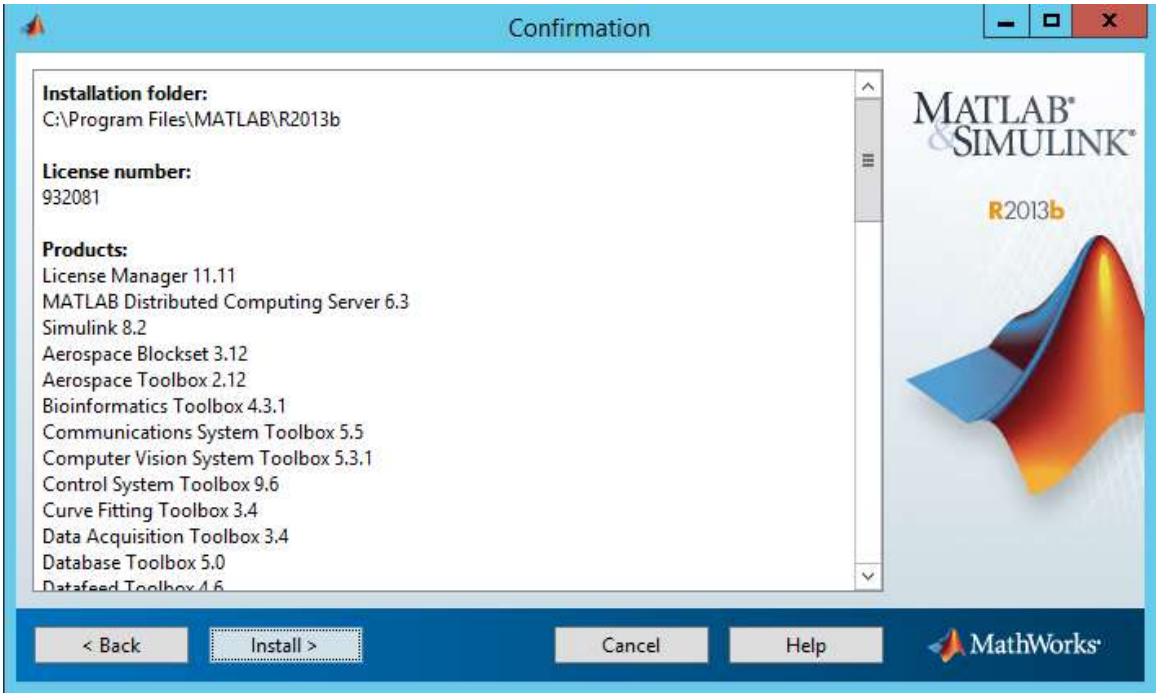
8. Locate the path of the **license.lic** file that you downloaded in Step 1: Download MDCS installation package, and click **Next**.



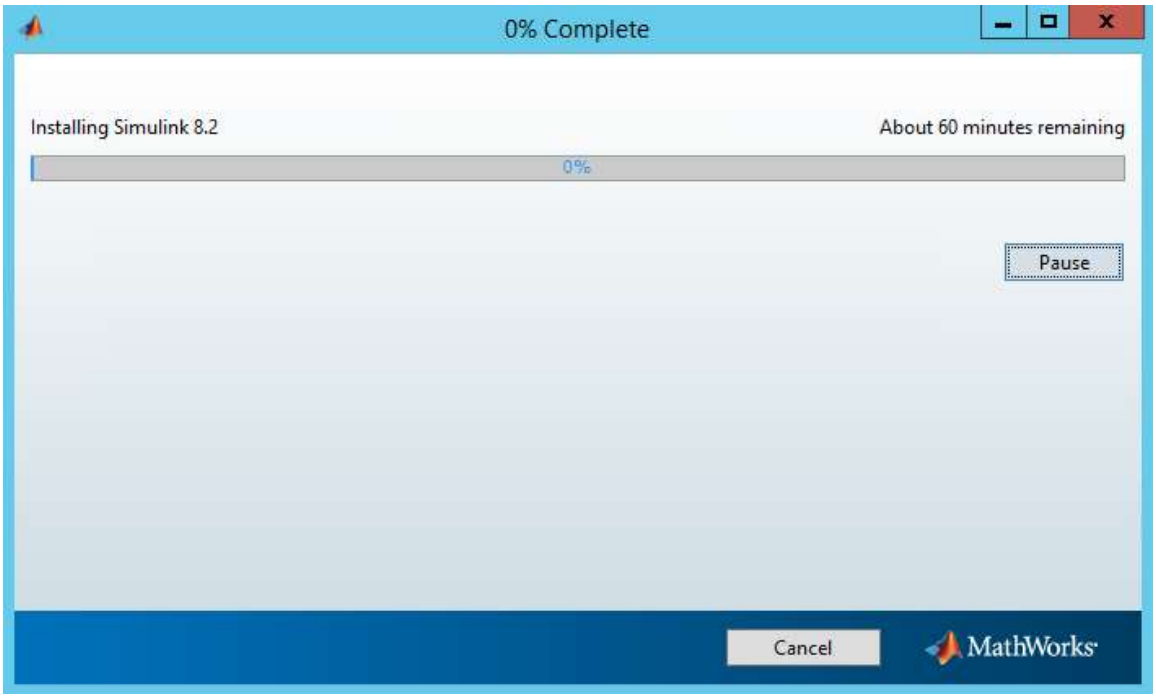
9. Select **Configure the license manager as a service**, and click **Next**.



10. On the **Confirmation** page, click **Install** to start the installation.

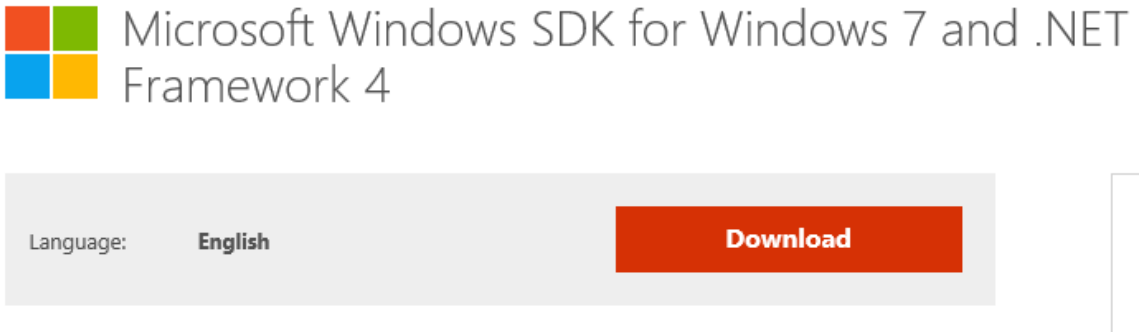


The installation will take about one hour.



After the installation is complete, follow the wizard to finish the installation process.

11. Next, you need to install the Windows SDK 7.1. You can download the installation package from the Microsoft Download Center. Finish the installation with the default settings.



Step 3: Configure the ComputeNode template

In HPC Cluster Manager, we can configure a node template for the compute nodes to install MDCS on compute nodes automatically.

1. Connect to the head node VM and log on with the domain account.
2. Go to the folder that contains the MDCS installation package that you downloaded in Step 1: Download MDCS installation package. Share the folder so that the compute nodes can access it and install MDCS from it.
3. Go to the MDCS installed folder. The default path is *C:\Program Files\MATLAB\R2013b*. Open the subfolder **etc/**. Copy the **license.dat** file to the previous shared folder.

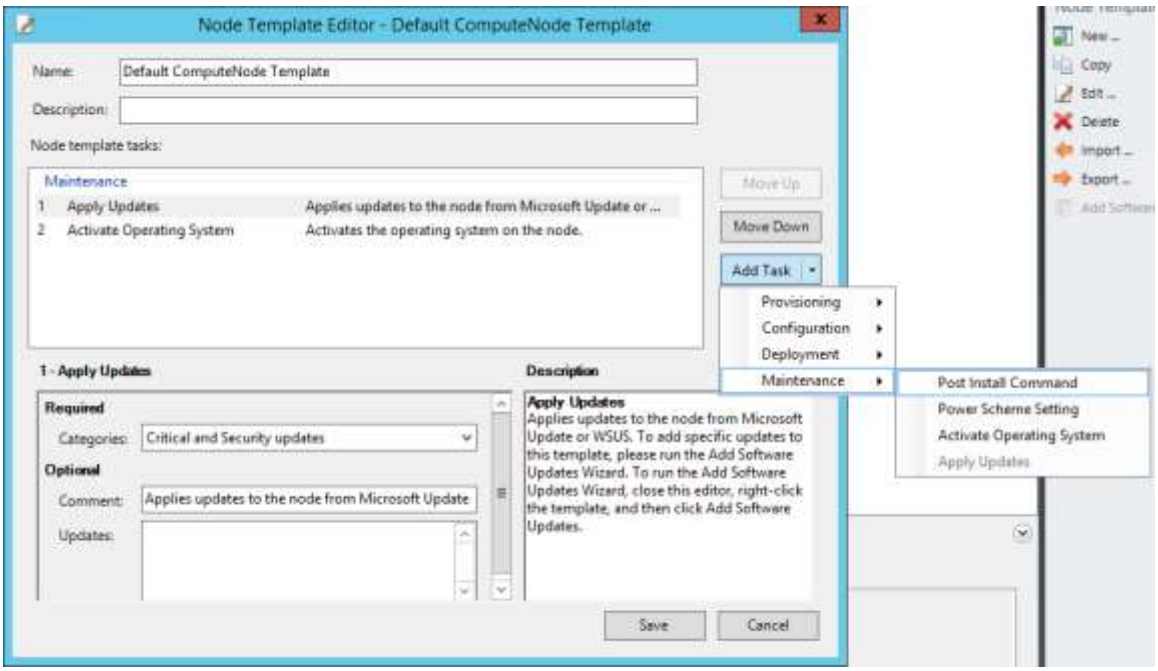
4. Go back to the shared folder. Create a copy of the file **installer_input.txt** and open the <***new_installer_input.txt***>. You will enter some required information in this file.

```
# Specify the installation folder, which should be the same as
the one on the head node.
destinationFolder=C:\Program Files\MATLAB\R2013b

# Specify the File Installation Key you got in Step 1: Download
MDCS installation package.
fileInstallationKey= 02792-37157-22299-45109-14227-……

# Accept the license agreement
agreeToLicense=yes

# Choose silent mode
mode=silent

# Specify the path of the license.dat file, which you just
copied to the shared folder.
licensePath=\\<headnodename>\<shared-folder-name>\license.dat
```

Uncomment the following lines that start with a single '#' and set the desired values.

Save and close the file.

5. Open HPC Cluster Manager, and in the **Configuration** tab, select **Node Templates**. If you follow the steps in this article, you should have a node template named **Default ComputeNode Template** listed in the central panel, which you created in Step 11: Configure Microsoft HPC Pack. Double click to open it.
6. In the **Node Template Editor** window, click **Add Task**, point to **Maintenance**, and then click **Post Install Command**.

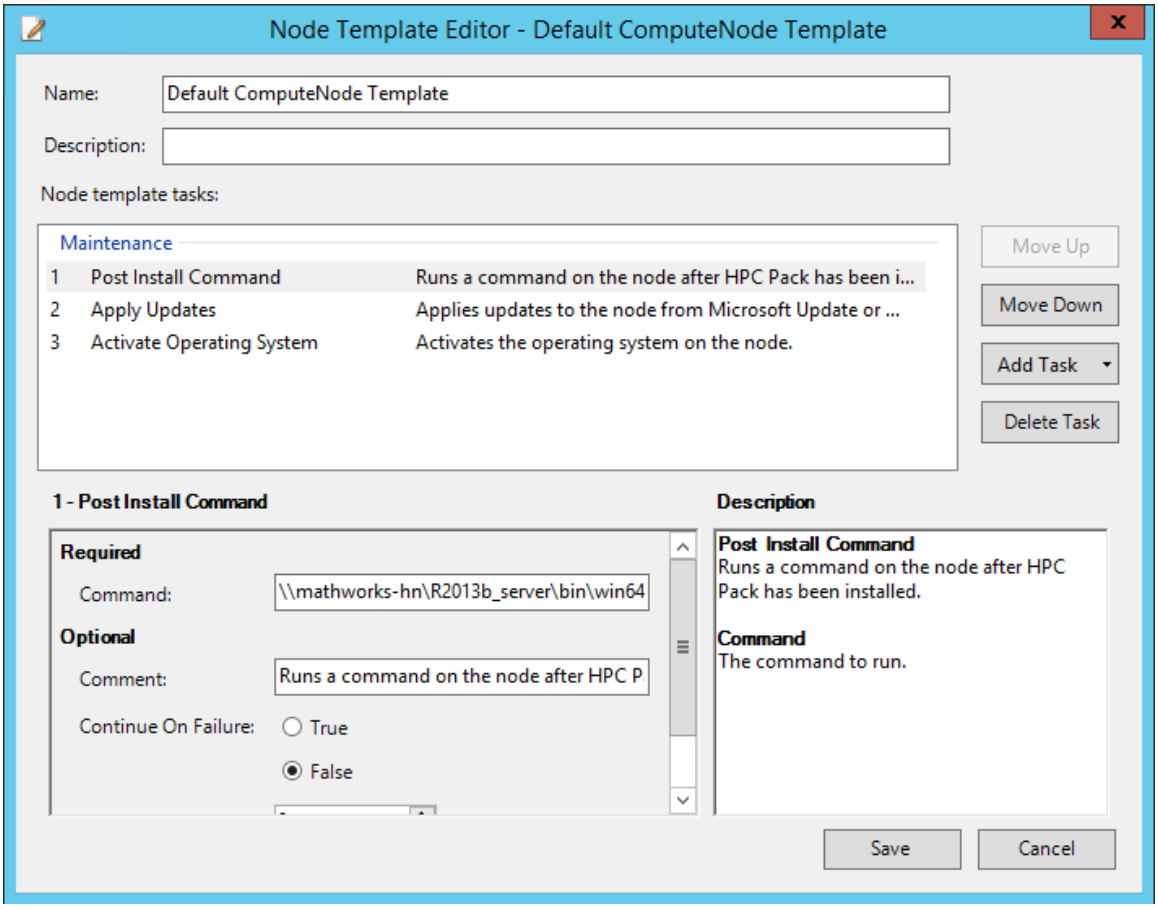


7. In the **1-Post Install Command** panel, enter the following values.

   Command: \\<head-node-name>\<shared-folder-name>\bin\win64\setup.exe -inputFile \\<head-node-name>\<shared-folder-name>\<new_installer_input.txt>

   Timeout: 9999

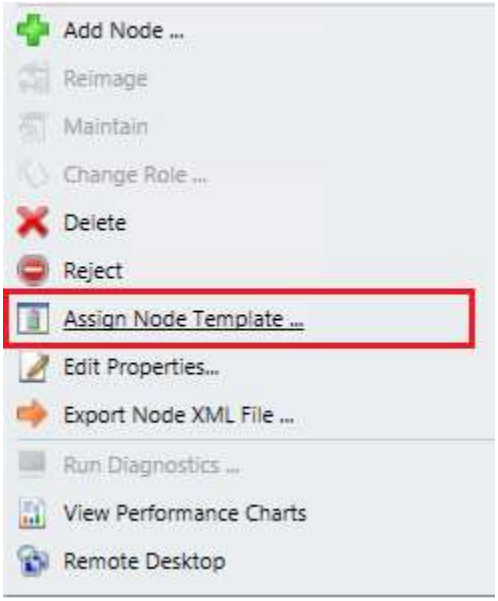
   Working Directory: \\<head-node-name>\<shared-folder-name>\



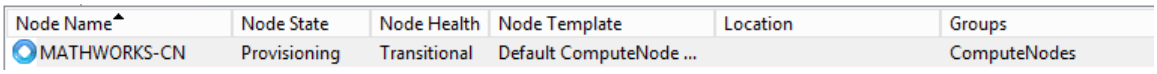
   Click **Save** to close the window.

8. Select the **Node Management** tab, and then select **Nodes**. In the central panel, you can see your compute nodes listed with **Node State**: Unknown and **Node Unapproved**: Unapproved.

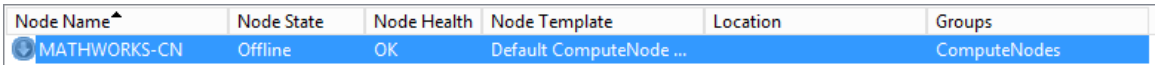
9. Select the compute nodes, and click **Assign Node Template** in the right panel.



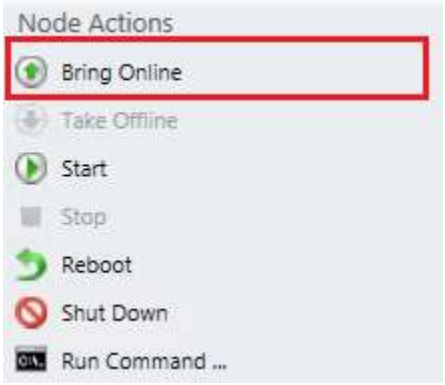
10. In the **Assign Node Template** windows, select **Default ComputeNode Template**, and click **OK**. Then the provision of the compute node starts. The **Node State** of the compute node will be **Provisioning**, and the **Node Health** will be **Transitional**.



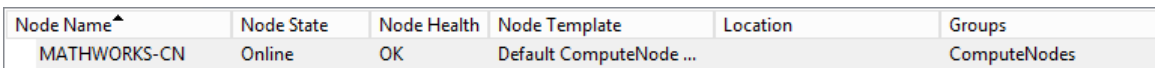
11. Wait till the provision is finished. It may take about two hours. When the provision is completed, the **Node State** of the compute node will be **Offline**, and the **Node Health** will be **OK**.



Select the compute nodes, and click **Bring Online** in the right panel.



12. The **Node State** of the compute node goes to **Online**. Now the compute nodes are ready.



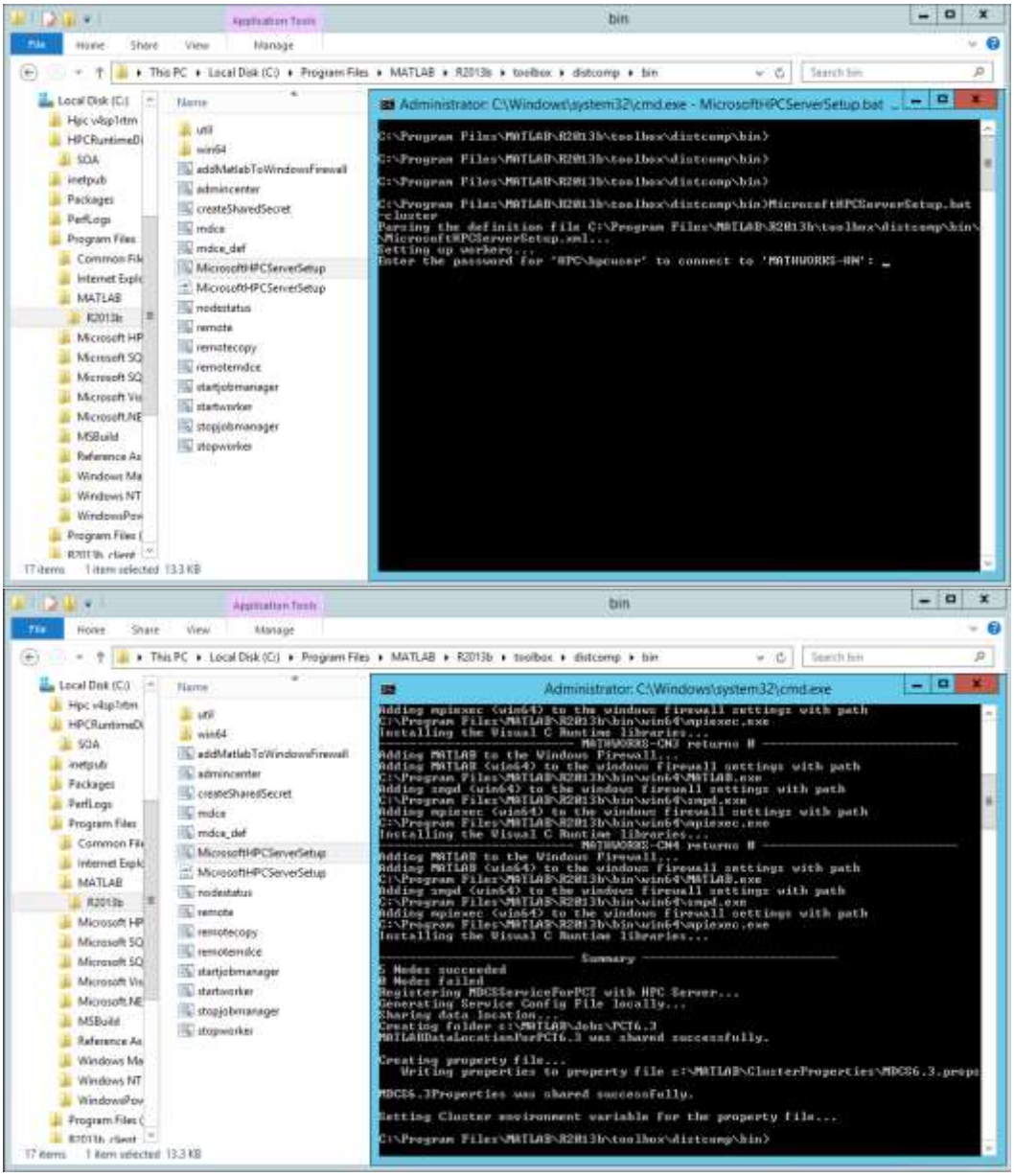
Step 4: Configure for HPC cluster

Follow this step to configure your MDCS to work with HPC cluster. In the following instructions, <*matlabroot*> refers to the MDCS installation location. The default location is *C:\Program Files\MATLAB\R2013b*.

1. Open a command window with administrator privileges and run the following file command.

```
<matlabroot>\toolbox\distcomp\bin\MicrosoftHPCServerSetup.bat -cluster
```

2. Enter the required information during the configuration.



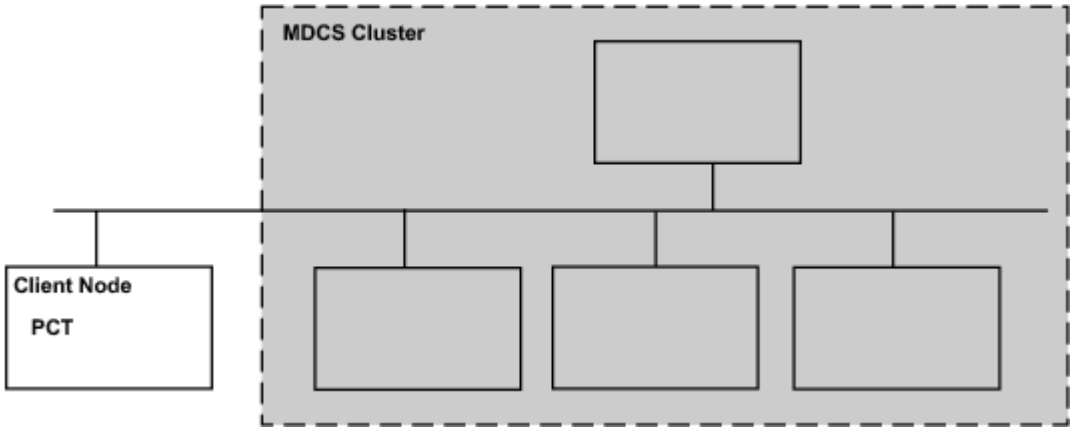
NOTE

This command performs some of the setup required for all machines in the cluster. If new compute nodes are added to the cluster, this step must be run again to configure new compute nodes. For more details, see Configure Cluster for Microsoft Windows HPC Server in the MathWorks Documentation Center.

Configure the MATLAB client node

You install Parallel Computing Toolbox (PCT) software on the Microsoft Azure virtual machine that you use to write MATLAB applications. This is called the *client* node.

This figure shows the installations that you must perform on client nodes.



NOTE

Alternatively, you can install MATLAB and PCT on your head node instead of on a new client node. You can write MATLAB applications on your head node. If you do so, you can skip Step 1 and Step 2, and start from Step 3.

Step 1: Create the client node

You create the client node in the same way you created the compute node in Step 12: Create compute nodes. After you create the virtual machine, follow the same steps as the ones for the compute node to join the client node to the domain and add the domain user as the local Administrator.

Step 2: Install HPC Pack client utilities

Download the HPC Pack setup files from the Microsoft Download Center to the client computer, and choose the setup option for the HPC Pack client utilities. Alternatively, you can download and install a compatible version of the client utilities redistributable package from the Microsoft Download Center.

Step 3: Install MATLAB and Parallel Computing Toolbox

On the client node from which you will write applications to submit jobs to the cluster, install the MATLAB and Parallel Computing Toolbox products.

The installation procedure for the MATLAB and PCT are similar to the installation of MDCS.

1. Open the MathWorks website in Internet Explorer, and sign in with your MathWorks account.
2. In the **Licenses Manage** page, select the license for the products and download the R2013b version.

3. Run setup.exe on the virtual machine, and follow the wizard to complete the installation.

If you need help with this step, you can find instructions for the current release at Installation, Licensing, and Activation in the MathWorks Documentation Center. These instructions include steps for installing, licensing, and activating your installation.

NOTE

The MATLAB and PCT licenses are not included in the license for MDCS. You have to purchase licenses for MATLAB and PCT separately.

Step 4: Configure the client node for HPC cluster

Follow this step to configure your client node to work with HPC cluster. In the following instructions, <*matlabroot*> refers to the MATLAB installation location. The default location is *C:\Program Files\MATLAB\R2013b*.

1. Open a command window with administrator privileges and run the following file command

```
<matlabroot>\toolbox\distcomp\bin\MicrosoftHPCServerSetup.bat - client
```

This command performs some of the setup required for a client machine.

NOTE

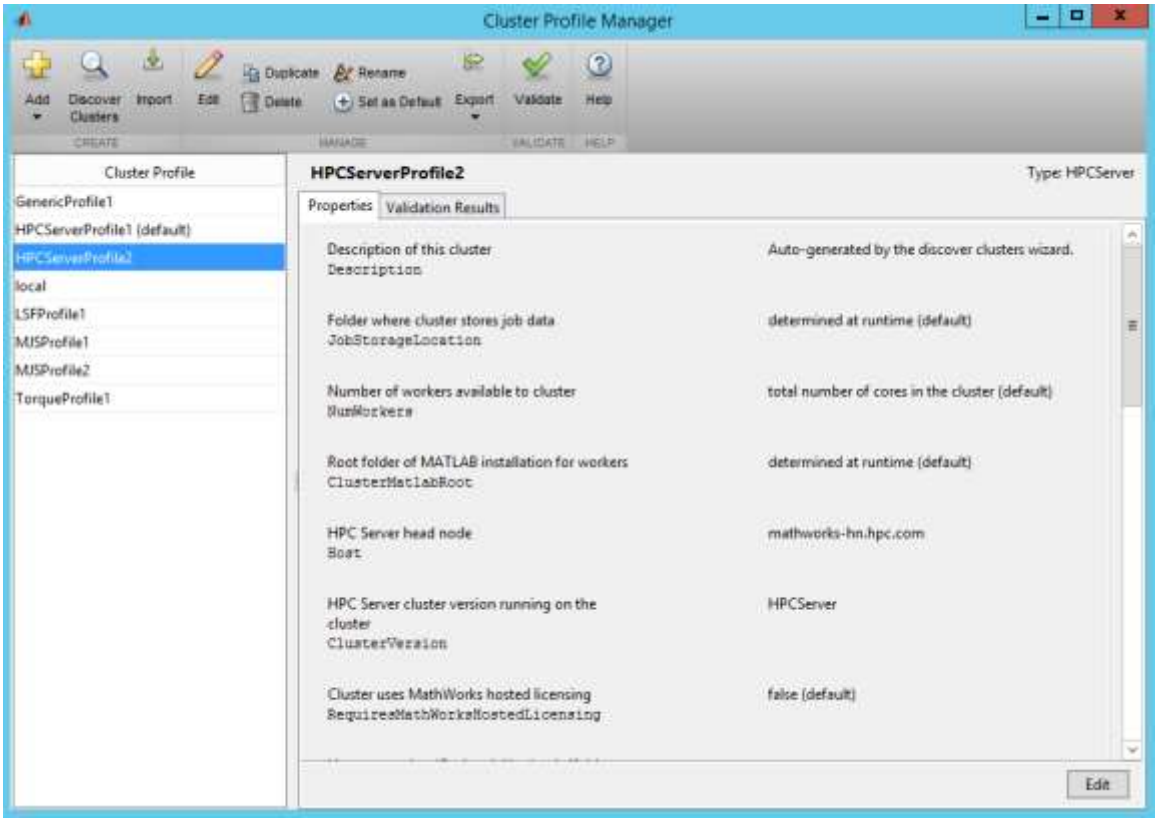
For more details, see Configure Client Computer for HPC Server 2008 in the MathWorks Documentation Center.

Step 5: Validate the installation using HPC cluster

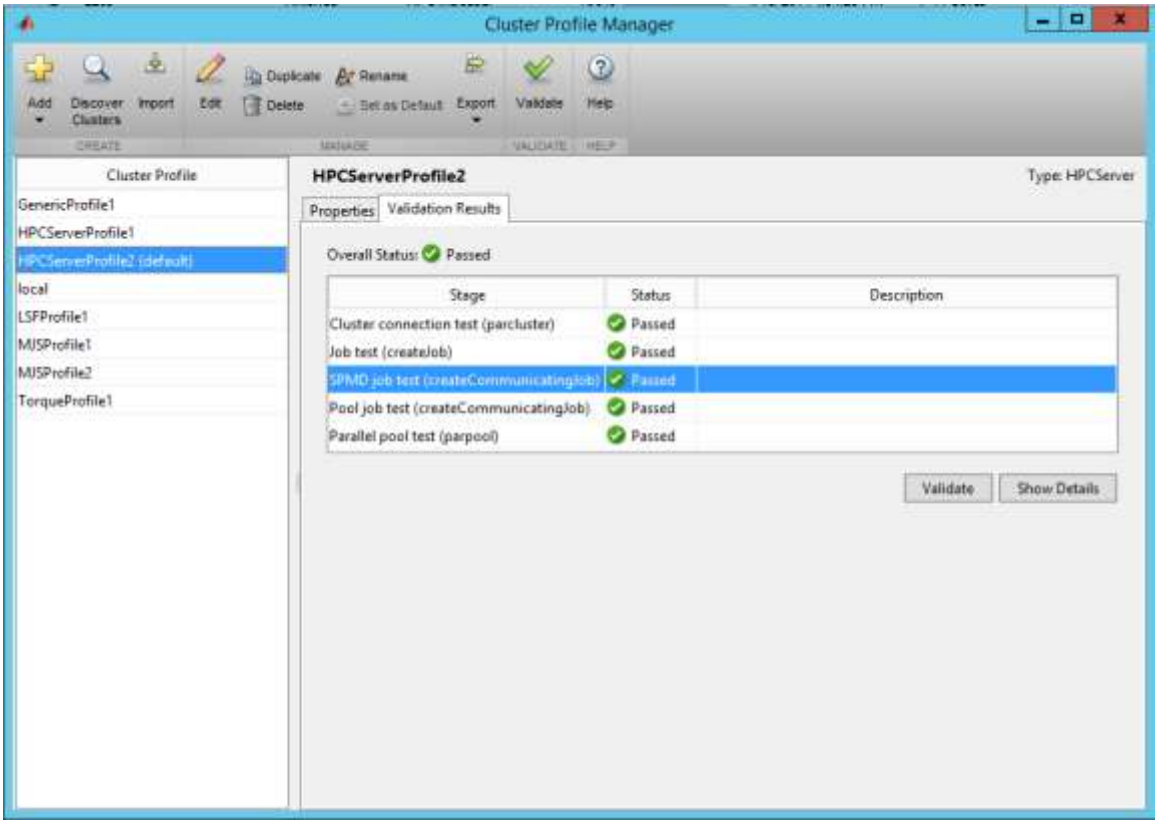
This step verifies that your parallel computing products are installed and configured correctly for using Windows HPC Server.

1. Open MATLAB on the client node. On the **Home** tab in the **Environment** area, select **Parallel** > **Manage Cluster Profiles** to start the Cluster Profile Manager.
2. Create a new <*HPCServerProfile*> in the Cluster Profile Manager by selecting **Add** > **Custom** > **HPC Server**.
3. With the new profile selected in the list, click **Edit** to edit the profile.
4. Enter <*head-node-name*> in **Host**.
   Select *HPCServer* at **ClusterVersion**.
   Select *false* at **UseSOAJobSubmission**.

5. Click **Done** to save the profile.



6. Click **Validate** on the tool bar to run the validation program. The **Validation Results** tab shows the output. The following figure shows the results of a profile that passed all validation tests.



You can find detailed instructions for this step at Validate Installation Using Microsoft Windows HPC Server in the MathWorks Documentation Center.

Step 6: Run a demo application

We will run a demo application of MATLAB using the <*HPCServerProfile*> created in the previous step.

1. Open MATLAB on the client node. On the **Home** tab in the **Environment** area, select **Parallel** > **Current Cluster** > ***<HPCServerProfile>***.

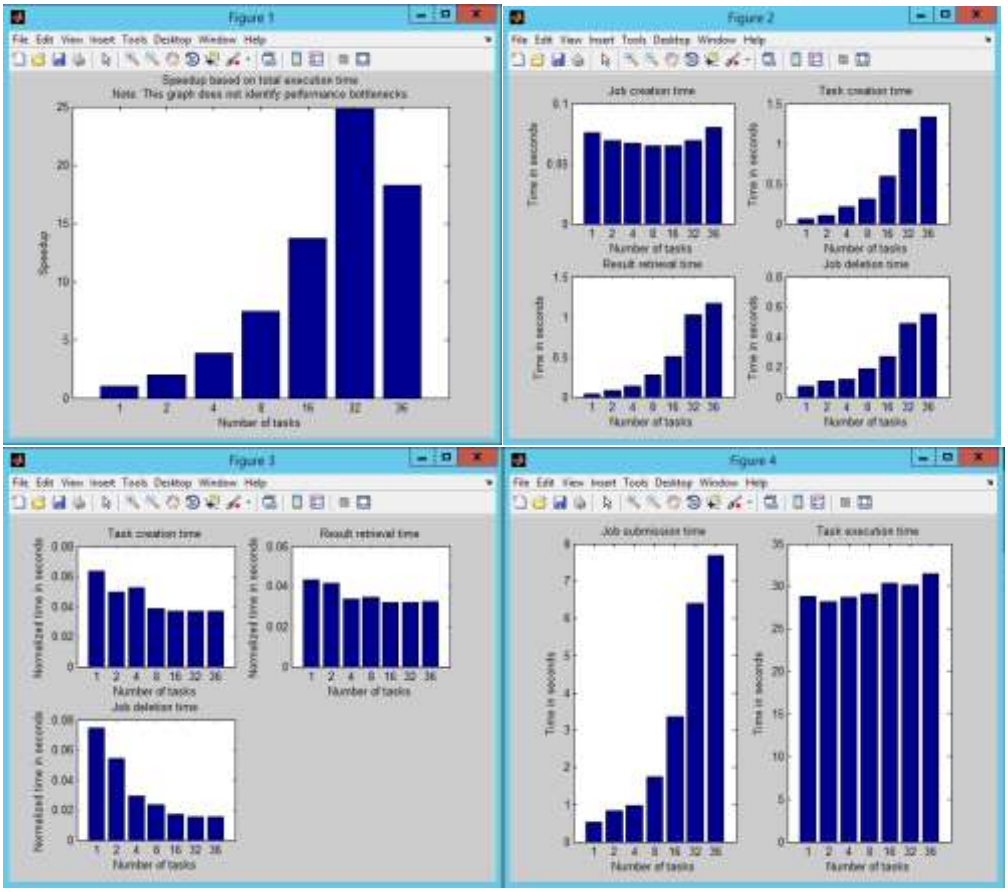
```
paralleldemo_distribjob_bench
```

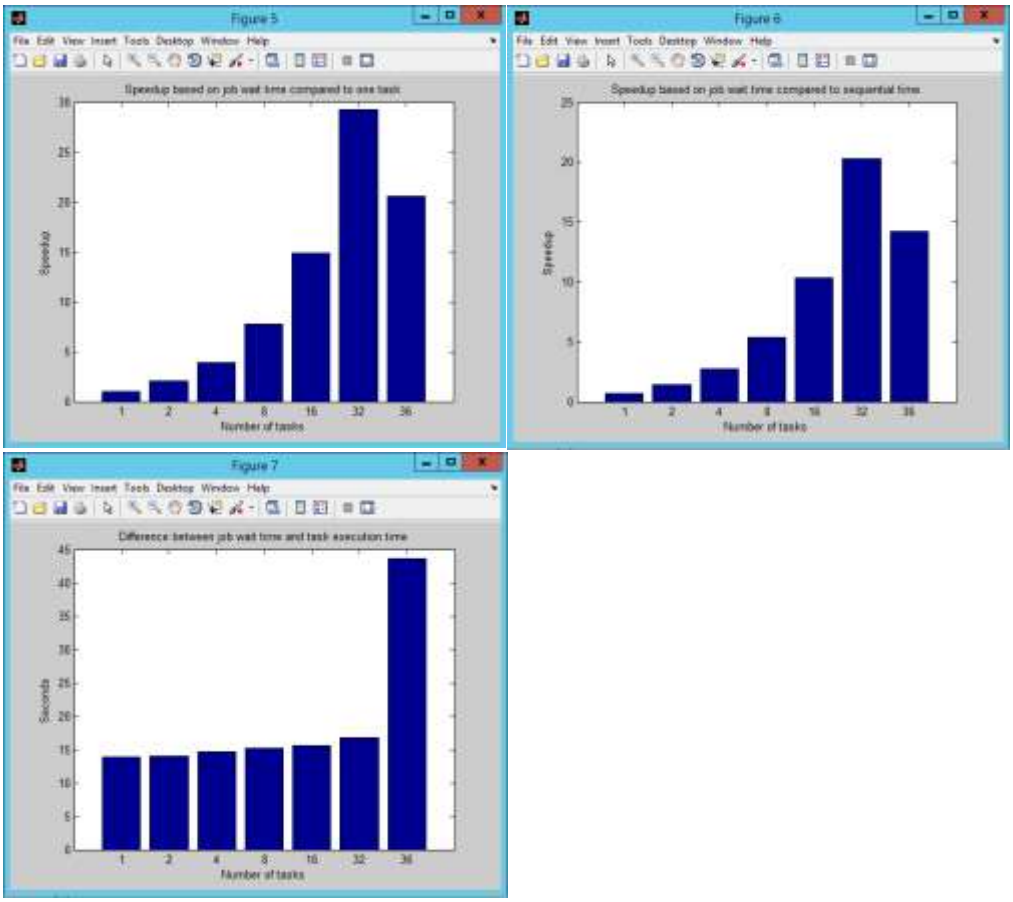
2. In the command window, type the following command and press Enter.

3. Wait for the command running over, and see the results of the demo application.

```
>> paralleldemo_distribjob_bench
Starting weak scaling timing.  Submitting a total of 35 jobs.
Job wait time with 1 task(s): 41.958666 seconds
Job wait time with 2 task(s): 43.211042 seconds
Job wait time with 4 task(s): 43.587579 seconds
Job wait time with 8 task(s): 43.283415 seconds
Job wait time with 16 task(s): 44.356036 seconds
Job wait time with 32 task(s): 74.716061 seconds
Job wait time with 36 task(s): 103.282912 seconds
Sequential execution time: 29.813407 seconds
Starting strong scaling timing.  Submitting a total of 35 jobs.
Job wait time with 1 task(s): 41.963800 seconds
Job wait time with 2 task(s): 28.161607 seconds
Job wait time with 4 task(s): 22.138668 seconds
Job wait time with 8 task(s): 22.776615 seconds
Job wait time with 16 task(s): 19.472753 seconds
Job wait time with 32 task(s): 28.285649 seconds
Job wait time with 36 task(s): 30.780203 seconds
Starting parallel pool (parpool) using the 'HPCServerProfile2' profile ... connected to 36 workers.
Parallel pool using the 'HPCServerProfile2' profile is shutting down.
Execution time with parfor using 36 workers: 1.048003 seconds
Speedup based on strong scaling with parfor using 36 workers: 28.447820
```

The result figures of the demo application:





References

- Microsoft HPC Pack in a Windows Azure Virtual Machine
- Microsoft HPC Pack: Getting Started
- Microsoft HPC Pack 2012 R2 Download Link
- MathWorks Documentation Center