**PreDeployment of UACluster2**

**Abstract**

This manual describes preinstallation steps for UACluster2 system installation: hardware and system requirements, appropriate infrastructure creation and all necessary components setup.

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# Requirements of UACluster2 installation

## Hardware requirement of physical host

Requirements of physical hosts are based on hardware [requirements](http://technet2.microsoft.com/windowsserver/en/library/daa42629-fbbd-45dc-9f39-afd00aec71991033.mspx) of Windows server 2008 R2 operating system installation with consideration of they will hosts Windows server 2008 R2 with HPC pack, which requires x64-based processor, supporting hardware-based virtualization for deployment on virtual machines and requirement of memory will double. The following list outlines the hardware requirements of physical hosts:

Processor with x64-based architecture and hardware-based virtualization:

* Minimum: 2 GHz.
* Recommended: faster than 2 GHz.

RAM:

* Minimum: 2GB.
* Recommended: 4 GB or more.

Available disk space:

* Minimum: 50 GB.
* Recommended: 80 GB or more.

Drive:

* DVD-ROM drive.

Network adapters:

* Gigabit Ethernet for best performance.
* Drivers for Windows 2008 Server (x64) OS should be available.

This is a minimum requirements of physical host for Compute Nodes. But for best performance of HPC and later improvement they may support four core processor, not less than 4 GB RAM and two-channel mode, network loading by PXE protocol.

**Requirements of network equipments consist of switches which will be:**

* Support data transfer by 1000Base-T standard.
* Provide connection of the Head and all compute nodes and additional services servers for additional equipment, +10% redundant ports and connection to other switches should be available, if cluster extension is planned. It is recommended to select switches supporting 10Gbit/s extension port.
* Have the best possible values of switching performance, throughput by data volume and packet number transmitted per second, and delays.

## Software requirements

The UACluater2 system is based on Microsoft HPC Pack 2008 R2. So the following list outlines the software requirements of Head Node and Compute Nodes in Windows HPC Server 2008 R2 cluster:

* Windows Server 2008 R2 HPC Edition or another 64-bit edition of Windows Server 2008 R2 for Head Node;
* Windows Server 2008 R2 HPC Edition or another 64-bit edition of Windows Server 2008 R2, Windows Server 2008 HPC Edition or another 64-bit edition of Windows Server 2008 for Compute Nodes and Physical hosts;
* Microsoft HPC Pack 2008 R2.

## Network infrastructure

Minimum required set of network services includes:

* **Active Directory –** LDAP-compatible implementation of distributed directory service of Windows server operating systems. It is designed for centralized network resources access control. This service is required for cluster system operation.
* **DNS –** domain name service, that is standard service of Windows Server 2008 network and part of TCP/IP protocol stack. The service is designed for conversion of symbol names of network nodes and resources into IP-address and vice versa. This service is required for Active Directory service operation.
* **DHCP** **–** the service of dynamic node configuration. Is used for automatic delivery of network settings. This service is required for cluster system operation, especially for operation under PXE protocol.

If you don’t have this services in you network infrastructure, you can see how to install and configure them in deployment chapter.

# Deployment of Microsoft HPC

## Installation of operating system on physical hosts

* Install OS on physical hosts.
* [Add roll hyper-V on physical hosts](http://technet.microsoft.com/en-us/library/cc732470(WS.10).aspx#BKMK_step1).

## Installation of Active Directory Domain Service with DNS

If you don't have Active Directory Domain Service with DNS services in your existing network infrastructure or you would like to create another one for cluster purpose, you have to install them on one selected physical host by following the next steps:

Start **→** Server Manager **→** Roles **→** Roles Summary **→** Add Roles **→** Active Directory Domain Services **→** Next **→** Next **→** Install **→** Close this wizard and launch the Active Directory Domain Services Installation Wizard (if you skip this step, launch dcpromo.exe from command line) **→** Next **→** Create a new domain in a new forest **→** Next →FQDN of the forest root domain: **<**your domain name**> →** Next **→** Windows Server 2008 R2 **→** Next **→** DNS server **→** Next **→** Yes **→** Next **→** Password**: <**your\_admin\_password**> →** Confirm password**: <**your\_admin\_password**> →** Next **→** Next **→** Finish **→** Restart Now.

[Read for more details how to install AD DS](http://technet.microsoft.com/en-us/library/cc755258(WS.10).aspx).

[Read for more details how to work with AD DS](http://technet.microsoft.com/en-us/library/cc758915(WS.10).aspx).

## Virtual machines and virtual network creation and configuration

This cluster realization will be deploy on virtual machines.

### Virtual network creation

Start **→** Server Manager **→** Roles **→** Hyper-V **→** Hyper-V Manager **→** <host\_name> **→** Action **→** Virtual Network Manager **→** New Virtual Network **→** External **→** Add **→** Name**: <**HUB> **→** OK**.**

[Read for more details how to create virtual network.](http://technet.microsoft.com/en-us/library/cc732470(WS.10).aspx#BKMK_step3)

### Virtual machine creation

Start **→** Server Manager **→** Roles **→** Hyper-V **→** Hyper-V Manager → <host\_name> **→** Action **→** New **→** Virtual Machine **→** Next **→** Name: <virtual\_machine’s\_name> **→** Next **→** Memory: (minimum 512 MB for compute nodes and 1024 MB for head node) **→** Next **→** Connection : <HPC\_Network> **→** Next **→** Create a virtual hard disk **→** Name: <hard\_drive\_name.vhd> **→** Location (folder, where your virtual machine’s hard drive will be store) **→** Size: (minimum 20 GB for compute nodes and 50 GB for head node, dependently where user’s files will be store) **→** Next **→** Install an operating system from a boot CD/DVD-ROM Image file(.iso): (Path to image of windows server 2008 installation disk) **→** Next **→** Start virtual Machine after if it is created **→** Finish.

Then continue OS installation on virtual machine.

[Read for more details how to create virtual machine](http://technet.microsoft.com/en-us/library/cc732470(WS.10).aspx#BKMK_step3).

Open the virtual machine’s setting and configure network and other settings.

### Compute Nodes virtual infrastructure creation with Power Shell script

Firstly, download a self-extracting archive CreateVM.exe, which will create all virtual machines and network for your cluster.

Secondly, configure your virtual machine's setting in config.txt file:

* name for virtual machines;
* processor cores number, which virtual machines will be use (not more than real cores number on physical hosts);
* RAM quantity (not more than real RAM quantity on physical hosts);
* virtual hard drive size (hard drive will be stored on default folder for virtual machines);
* list of host's IP addresses where virtual machines will be located.

Third, launch CreateVM.bat file.

Virtual switch that will be created during script execution will be named as HUB and bound to network adapter with referred above IP addresses. If there is virtual switch bounded to that adapter already, virtual machines will be connected to existing switch.

For further virtual machines configuration, use Microsoft Hyper-V Manager or, for more facility, VMClusterManager utility.

## Head Node Deployment

### Network and system parameters configuration:

Manually create virtual machine for Head Node hosting following the steps [described above](#_To_create_virtual).

Configure this virtual machine with second network adapter connected to internal virtual network.

Install Windows Server 2008 R2 operating system.

Assign Head Node name as HNODE and first IP address from selected range for cluster on one network adapter connected to external virtual network.

For example, if you network segment is 192.168.0.0/24, gateway is 192.168.0.1, select a IP address range for cluster started with 192.168.0.40/24 and configure Head Node with IP settings: IP address 192.168.0.40, mask 255.255.255.0, gateway 192.168.0.1, DNS server with IP address where your DNS is logically located.

Configure another network adapter with any right configuration.

### HPC Package installation and configuration:

Mount image with HPC Pack in Hyper-V HNODE settings on physical host and launch setup.exe on virtual machine.

Then follow next installation steps:

Next → Next → Create New Compute Cluster → Next → Create new database instance → Next → Next → Windows Update → Next → Install → Finish.

Then HPC Cluster Manager console will start. If it doesn’t, launch HPC Cluster Manager: Start **→** All Programs **→** Microsoft HPC Pack **→** HPC Cluster Manager to configure your cluster.

In TO DO List select the first topology with isolated computing units in a private network. In this case, network (Public and Private) roles will be played by the appropriate network connections of the HNode.

From TO DO section deactivate network screen (Windows Firewall), enter credentials for cluster administration, configure compute nodes names and create node template for compute node deployment.

[Read for more details how to configure Head Node](http://technet.microsoft.com/en-us/library/cc947593(WS.10).aspx).

## Compute Nodes Deployment

There are two methods of compute nodes deployment:

### Hard drive cloning from one to many compute nodes.

This method consists of creating and configuring one compute node and then copy they hard drive to other nodes.

Installation steps:

* Create virtual machines for compute nodes.
* Install OS on one compute node.
* Configure node’s name and IP address.
* Join node to domain.
* Install HPC Package with selected point Join Existing Compute Cluster.
* Launch from command line system utility **sysprep** with options **generalize** and **shutdown**.
* Copy virtual hard drive to other compute node and connect it in Hyper-V Node settings.
* Start compute nodes and finish configuration.
* In HPC Cluster Manager console on Head Node apply default template for new nodes and take it online.

Automatic deployment with WDS.

This method consists of creating of new virtual machines with Power Shell script or manually with selected **Legacy Network Adapter** as network adapter. In BIOS settings select **Boot from network** and use a HPC Pack WDS Deployment.

Installation steps:

* In Head Node create template for WDS deployment.
* Turn on virtual compute nodes with VMClusterManager utility.
* In Head Node on HPC Cluster Manager console apply template for unknown nodes.
* Take compute nodes online.

[Read for more details how to configure Compute Nodes](http://technet.microsoft.com/en-us/library/cc972889(WS.10).aspx).

[Read how to configure and submit jobs](http://technet.microsoft.com/en-us/library/cc947639(WS.10).aspx).