

Configuring Network Load Balancing

LESSON

1

70-412 EXAM OBJECTIVE

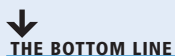
Objective 1.1 – Configure Network Load Balancing (NLB). This objective may include but is not limited to: Install NLB nodes; configure NLB prerequisites; configure affinity; configure port rules; configure cluster operation mode; upgrade an NLB cluster.

LESSON HEADING	EXAM OBJECTIVE
Understanding Fault Tolerance	
Configuring Network Load Balancing	
Configuring NLB Prerequisites	Configure NLB prerequisites
Installing NLB Nodes	Install NLB nodes
Configuring Port Rules	Configure port rules
Configuring Filtering Mode and Affinity	Configure affinity
Configuring Cluster Operation Mode	Configure cluster operation mode
Controlling Hosts in NLB	
Upgrading an NLB Cluster	Upgrade an NLB cluster

KEY TERMS

affinity	Internet Group Management Protocol	port rules
cluster	Multicast mode	stop action
convergence	multicast	unicast
drainstop	multicast mode	unicast mode
filter mode	Network Load Balancing (NLB)	
heartbeats	node	

■ Understanding Fault Tolerance



THE BOTTOM LINE

When a server goes down, it most likely causes your company to lose money. If your network contains an external website or database that controls your sales, ordering, inventory, or production, server downtime can be detrimental to these business needs. If it is an internal server, it might not allow your users to perform their jobs. In either case, your company loses money either through revenue or through productivity.

As a server administrator, you need to minimize downtime by identifying potential failures and taking steps to avoid those failures and to reduce their effects. High availability is a combination of technology, protocols, and redundant hardware that ensures a certain degree of operational continuity during a given measurement period while resisting disaster and failure. Generally, the term *downtime* is used to refer to periods when a system is unavailable. Availability is usually expressed as a percentage of uptime in a given year as shown in Table 1-1.

Table 1-1

Availability Guidelines

AVAILABILITY %	DOWNTIME PER YEAR	DOWNTIME PER MONTH
99%	3.65 days	7.20 hours
99.9% ("three nines")	8.76 hours	43.8 minutes
99.99% ("four nines")	52.6 minutes	4.32 minutes
99.999% ("five nines")	5.26 minutes	25.9 seconds
99.9999% ("six nines")	31.5 seconds	2.59 seconds

When designing servers and the services they provide, they are often assigned service level agreements (SLA), which state the level of availability those servers or services must maintain. Of course, to have a server design that can support five or six nines is much more expensive than supporting an availability of 99%.

If there is miscommunication about service-level expectations between the customer and the IT department, poor business decisions, unsuitable investment, levels, and customer dissatisfaction is likely to occur. Therefore, you need to express availability requirements clearly so that there are no misunderstandings about the implications.

To make a server more fault tolerant, you should first look at what components are the most likely to fail and implement technology to make a system less likely to fail. Some of the components that are made redundant within a system are usually the following:

- **Disks:** Use some form of RAID and hot spares.
- **Power supplies:** Use redundant power supplies.
- **Network cards:** Use redundant network cards.

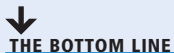
Although you can make these components fault tolerant, the entire server still won't be fault tolerant. Instead, you can use a cluster to provide server redundancy.

A **cluster** is a group of linked computers that work together as one computer. Based on the technology used, clusters can provide fault tolerance (often referred to as *availability*), load balancing, or both. If the system fails, including the processor, memory, or motherboard, a cluster that provides fault tolerance can still service requests.

The two most popular forms of clusters are failover clusters and load-balancing clusters. Common uses of clusters include:

- A load-balancing cluster for the front end that provides the web interface to the back-end servers.
- A failover cluster for back-end servers such as a database (such as SQL Server) or mail server (such as Exchange Server).

■ Configuring Network Load Balancing



Network Load Balancing (NLB) transparently distributes traffic across multiple servers by using virtual IP addresses and a shared name. With NLB, you gain fault tolerance and enhanced performance. It is often used with mission-critical web servers but can also be found with other types of servers.

A cluster has two or more servers, known as nodes. Each **node** runs a separate copy of the desired service application such as a web server, an FTP server, or a Secure Shell (SSH) / Remote Desktop Server. NLB is a scalable, high availability feature found in Windows Server 2012 and Windows Server 2012 R2. It is considered scalable because you add additional servers to meet increasing demand.

Windows Server 2012 NLB clusters can have between 2 and 32 nodes. When you create an NLB cluster, you create a virtual network address and adapter that is assigned to the entire cluster. As network requests are sent to the virtual network address, the requests are distributed across the nodes in the cluster. Based on your needs, you can configure the cluster to even out the requests or you can configure one node to be preferred over another node.

All hosts in the NLB cluster receive the incoming traffic. However, only one node in the cluster accepts the traffic and the other nodes drop the traffic. The node that accepts the traffic is determined by the configuration of port rules and affinity settings, which is configured later in this lesson.

If a node fails, the node will no longer be able to accept requests. However, no service is lost because the other nodes are available to accept the request. When the node comes back online, it will start accepting requests and the traffic will be distributed among the nodes.

NLB can detect the failure of cluster nodes by sending packets known as **heartbeats**. NLB cluster heartbeats are transmitted every second between nodes in the cluster. If a node misses five consecutive heartbeats, the node is automatically removed from the NLB cluster.

When a node is added or removed from a cluster, a process known as **convergence** occurs, in which the cluster determines its current configuration by building a membership of nodes and mapping clients requests based on the available nodes. Convergence can occur only if each node is configured with the same port rules.

Configuring NLB Prerequisites

Although editions of Windows Server 2012 R2 support NLB and NLB supports running different editions of Windows Server 2012 R2, it is best practice to use computers with similar hardware specifications that run the same version and edition of the Windows Server 2012 R2 operating system. However, if you are mixing Windows Server 2012 and Windows Server 2012 R2, you will need to manage the cluster from Windows Server 2012 R2 or administrative tools for Windows Server 2012 R2.

CERTIFICATION READY

Configure NLB prerequisites.
Objective 1.1

To support NLB, your systems must use the following requirements:

- All hosts in the cluster must reside on the same subnet.
- Within each cluster, all network adapters must be either multicast or unicast. You cannot have some nodes configured as multicast while other nodes are configured as unicast within a single cluster. We discuss multicast and unicast configuration later in the lesson.
- If unicast mode is used, the network adapter that is used to handle client-to-cluster traffic must support changing its media access control (MAC) address.
- The IP addresses assigned to the nodes must be static.

Although hosts can span multiple geographical areas, to achieve convergence successfully, the latency between nodes cannot exceed 250 milliseconds. If you need geographical dispersed NLB clusters, you should deploy an NLB cluster at each site and then use Domain Name System (DNS) round-robin to distribute traffic between sites.

Installing NLB Nodes

To install and configure an NLB node, you must first install NLB. Unlike most of the Windows components installed in the 70-410 and 70-411 exam, the NLB is a feature, and not a role. It is used to enhance other roles such as web services or Remote Desktop Services. After NLB is installed on each machine, you then have to create the cluster and add each host to the cluster.

CERTIFICATION READY

Install NLB nodes.

Objective 1.1

To add the NLB feature to a computer running Windows Server 2012 or Windows Server 2012 R2, you use Server Manager. After the NLB feature is installed, you can then use the NLB Manager to configure the NLB cluster. Because an NLB is made of multiple computers, you need to install NLB on each server that will be part of the cluster.



INSTALL THE NETWORK LOAD BALANCING FEATURE

GET READY. To install the Network Load Balancing feature, perform the following steps:

1. On the task bar, click the [Server Manager](#) button to open the *Server Manager*.
2. At the top of *Server Manager*, click [Manage](#) and click [Add Roles and Features](#). The *Add Roles and Feature Wizard* opens.
3. On the *Before you begin* page, click [Next](#).
4. Select [Role-based or feature-based installation](#) and then click [Next](#).
5. On the *Select destination server* page, click [Next](#).
6. On the *Select server roles* page, click [Next](#).
7. On the *Select features* page, click to select the [Network Loading Balancing](#) and click [Next](#).
8. When it asks you to add features required for NLB, click [Add Features](#).
9. On the *Select features* page, click [Next](#).
10. On the *Confirm installation selections* page, click [Install](#).
11. When the installation is complete, click [Close](#).

USING WINDOWS POWERSHELL

To install the NLB cluster and the NLB tools using Windows PowerShell, you can use the following command:

```
Add-WindowsFeature NLB,RSAT-NLB
```

To configure the NLB cluster, you must configure three types of the parameters:

- **Host parameters:** Defines what each node can do in an NLB cluster.
- **Cluster parameters:** Configures the NLB cluster as a whole.
- **Port rules:** Controls which ports the NLB cluster services and how requests are balanced across all servers.



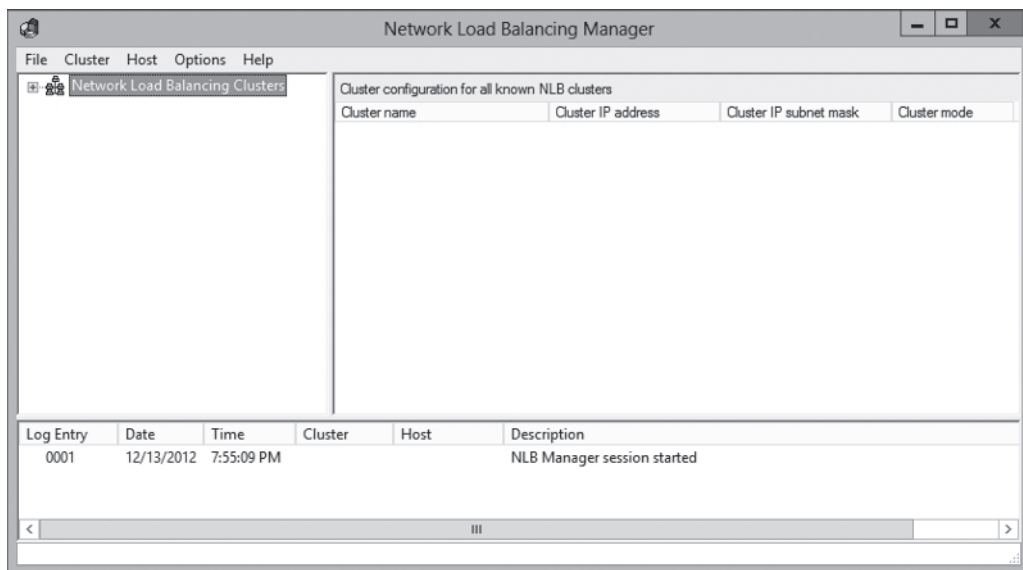
CREATE A WINDOWS SERVER 2012 OR WINDOWS SERVER 2012 R2 NLB CLUSTER

GET READY. To install the Remote Access Role, perform the following steps:

1. On the task bar, click the [Server Manager](#) button to open the *Server Manager*.
2. Click [Tools > Network Load Balancing Manager](#). The *Network Load Balancing Manager* opens as shown in Figure 1-1.

Figure 1-1

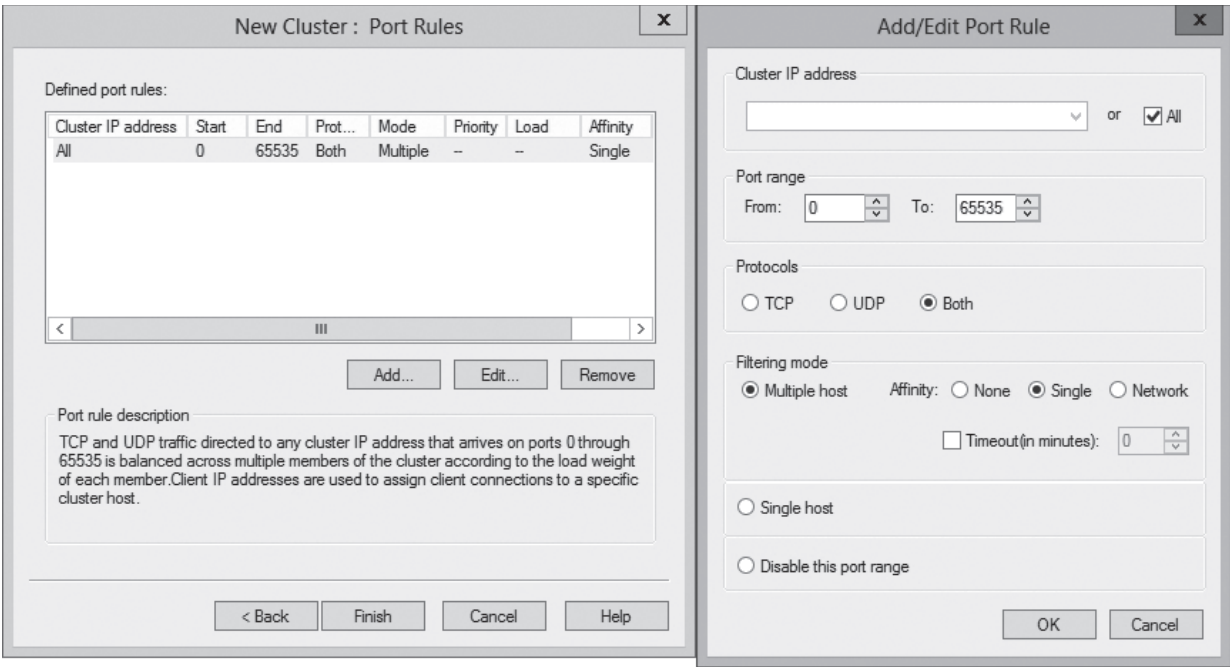
Opening the *Network Load Balancing Manager*



3. Right-click **Network Load Balancing Clusters** and click **New Cluster**. The *New Cluster: Connect Wizard* opens.
4. In the *Host* text box, type the name of the current server and click **Connect**.
5. The interface hosts the virtual IP address and receives the client traffic to load balance. Select an interface that you want to use for the cluster and click **Next**.
6. On the *Host parameters* page, you select a value in the *Priority (unique host identifier)* drop-down list. The parameter specifies a unique ID for each host. The host with the lowest priority handles all the cluster's network traffic not covered by a port rule.
7. In the *Dedicated IP addresses* section, verify that the dedicated IP address from the chosen interface is visible in the list and click **Next**.
8. On the *New Cluster: Cluster IP Addresses* page, click **Add to enter the cluster IP address shared by every host in the cluster**. NLB adds this IP address to each selected interface of all hosts chosen to be part of the cluster. Click **Next**.
9. On the *New Cluster: Cluster Parameters* page, type the full Internet name for the cluster. Then in the *Cluster operation mode* section, specify **Unicast**, **Multicast**, or **IGMP multicast**. Click **Next**.
10. On the *New Cluster: Port Rules* page, click **Edit** to open the *Add/Edit Port Rule* dialog box, as shown in Figure 1-2. Port rules define which incoming TCP/IP requests are balanced among the hosts in the NLB cluster. You can specify the cluster IP addresses or use the **All** option. In the *Port range* area, specify a range corresponding to the service you want to provide in the NLB cluster. For web access, use port 80 or 443. For Remote Desktop Services, use 3389.
11. In the *Filtering mode* area, select **Multiple host** if you want multiple hosts in the cluster to handle network traffic for the port rule. If you want a single host to handle the network traffic for the port rule, choose **Single host**.
12. If you choose *Multiple host*, you can select **None**, **Single**, or **Network**. If you want multiple connections from the same client IP address to be handled by different cluster hosts, select **None**. If you want NLB to direct multiple requests from the same client IP address to the same cluster host, select **Single** (which is the default). If you want NLB to direct multiple requests from the local subnet to the same cluster host, click **Network**. Click **OK** to close the *Add/Edit Port Rule* dialog box.

Figure 1-2

Specifying the port rules

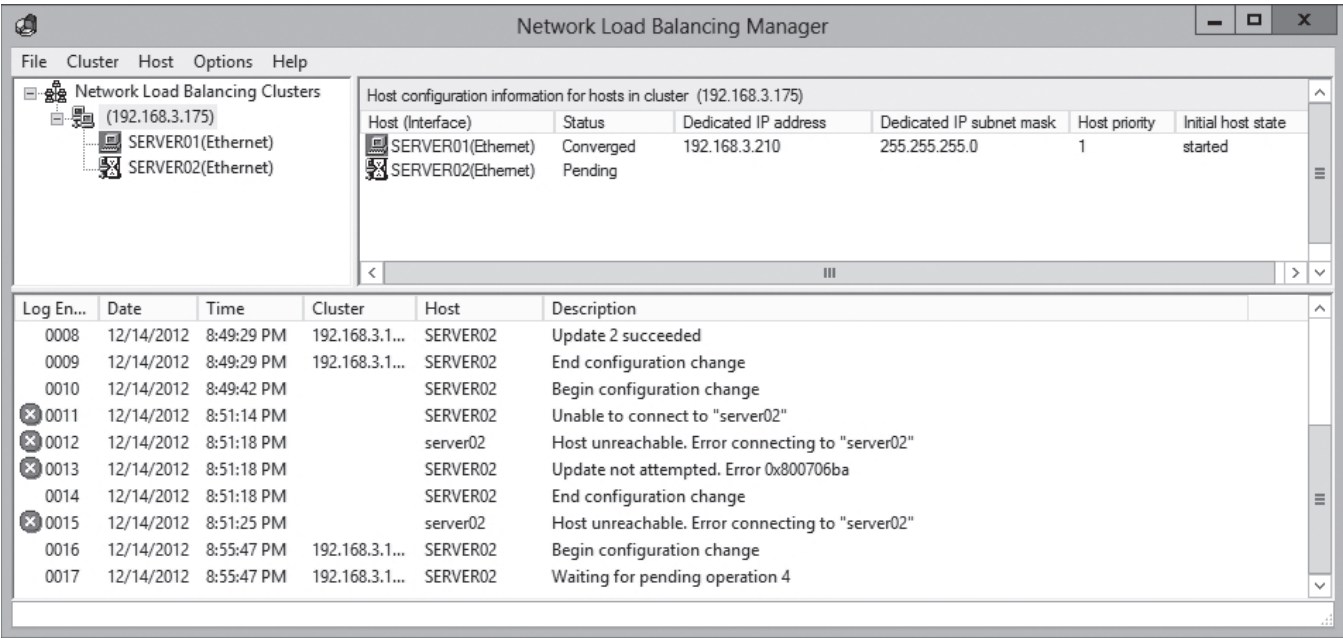


13. After you define the port rules, click [Finish](#).

To add additional hosts to the cluster, right-click the cluster in Network Load Balancing Manager and click *Add Host to Cluster*. You then select an interface for the cluster, configure the unique priority, and define port rules. After a host is added, convergence will occur (as shown in Figure 1-3). When convergence is complete, the host will participate in the cluster.

Figure 1-3

Showing a server (Server02) converging



**USING WINDOWS POWERSHELL**

You can configure and manage Network Load Balancing using the following cmdlets:

- **Add-NlbClusterNode**: Adds a new node to the NLB cluster.
- **Add-NlbClusterNodeDip**: Adds a dedicated IP address to an NLB cluster.
- **Add-NlbClusterPortRule**: Adds a new port rule to an NLB cluster.
- **Add-NlbClusterVip**: Adds a virtual IP address to an NLB cluster.
- **Disable-NlbClusterPortRule**: Disables a port rule on an NLB cluster or on a specific host in the cluster.
- **Enable-NlbClusterPortRule**: Enables a port rule on an NLB cluster or on a specific node in the cluster.
- **Get-NlbCluster**: Retrieves information about the NLB cluster object that is queried by the caller.
- **Get-NlbClusterDriverInfo**: Retrieves information about the NLB driver on the local machine.
- **Get-NlbClusterNode**: Retrieves information about the NLB cluster object that is queried by the caller.
- **Get-NlbClusterNodeDip**: Retrieves the dedicated IP address that is queried by the caller.
- **Get-NlbClusterNodeNetworkInterface**: Retrieves information about interfaces, including information about the NLB driver, on a host.
- **Get-NlbClusterPortRule**: Retrieves the port rule objects that are queried by the caller.
- **Get-NlbClusterVip**: Retrieves virtual IP addresses that are queried by the caller.
- **New-NlbCluster**: Creates an NLB cluster on the specified interface that is defined by the node and network adapter name.
- **New-NlbClusterIpv6Address**: Generates IPv6 addresses to create cluster virtual IP addresses or node dedicated IP addresses.
- **Remove-NlbCluster**: Deletes an NLB cluster.
- **Remove-NlbClusterNode**: Removes a node from the NLB cluster.
- **Remove-NlbClusterNodeDip**: Removes a dedicated IP address from an NLB cluster.
- **Remove-NlbClusterPortRule**: Removes a port rule from an NLB cluster.
- **Remove-NlbClusterVip**: Removes a virtual IP address from an NLB cluster.
- **Resume-NlbCluster**: Resumes all nodes in an NLB cluster.
- **Resume-NlbClusterNode**: Resumes the node in an NLB cluster that was suspended.
- **Set-NlbCluster**: Edits the configuration of an NLB cluster.
- **Set-NlbClusterNode**: Edits the NLB cluster node settings.
- **Set-NlbClusterNodeDip**: Edits the dedicated IP address of an NLB cluster.
- **Set-NlbClusterPortRule**: Edits the port rules for an NLB cluster.
- **Set-NlbClusterPortRuleNodeHandlingPriority**: Sets the host priority of a port rule for a specific NLB node.
- **Set-NlbClusterPortRuleNodeWeight**: Sets the load weight of a port rule for a specific NLB node.
- **Set-NlbClusterVip**: Edits the virtual IP address of an NLB cluster.
- **Start-NlbCluster**: Starts all nodes in an NLB cluster.
- **Start-NlbClusterNode**: Starts an NLB cluster node.
- **Stop-NlbCluster**: Stops all nodes of an NLB cluster.
- **Stop-NlbClusterNode**: Stops a node in an NLB cluster.
- **Suspend-NlbCluster**: Suspends all nodes of an NLB cluster.
- **Suspend-NlbClusterNode**: Suspends a specific node in an NLB cluster.

EXAMPLES FOLLOW:

To view or get information about nodes in a cluster, you use the following command:

```
Get-NlbClusterNode
```

To add a Server02 to the cluster on Server01, you use the following command:

```
Get-NlbCluster Server01 | Add-NlbClusterNode -NewNodeName Server02  
-NewNodeInterface vlan-1
```

(continued)

To change or set the primary IP address of the cluster, you use the following command:

```
Get-NlbCluster | Set-NlbCluster -ClusterPrimaryIP 172.24.100.100
```

To stop a node in the NLB cluster, you use the following command:

```
Stop-NlbClusterNode Server02
```

For more information about NLB Windows PowerShell commands, visit technet.microsoft.com.

Configuring Port Rules

Often after a cluster is created, you will need to further configure NLB. Most of these options are similar to the configuration that you performed while first creating the cluster. One of the items that you configured previously was the **port rules**, which specify how NLB directs traffic based on the port and protocol.

CERTIFICATION READY

Configure port rules.

Objective 1.1

With port rules, you can configure how requests to specific IP addresses and ports are directed by the NLB cluster. For example, you can load balance web traffic using TCP port 80 across all nodes in an NLB cluster, while directing all requests to TCP port 3389 to a specific host.

When you configure the port rules, you configure the following:

- The virtual IP address that the rule should apply to.
- The TCP or UDP port range that this rule should apply to.
- The protocols that this rule should apply to, including TCP, UDP, or both.
- The filtering mode that specifies how the cluster handles traffic, which is described by the port range and the protocols. Filtering mode is discussed in the next section.

To modify the port rules (including the filter mode and affinity), right-click the cluster in Network Load Balancing Manager and click *Properties*. When you click the *Port Rules* tab, select the defined port rule and click *Edit* to open the Add/Edit Port Rule dialog box.

Configuring Filtering Mode and Affinity

Affinity determines how the servers are going to balance the load. You use affinity settings when you use multiple hosts filter mode.

When you configure port rules, you first select the filter mode. The **filter mode** specifies which hosts can respond to requests. The filter mode includes the following:

- **Multiple hosts:** Permits all cluster hosts to actively respond to client requests. NLB nodes respond according to the weight assigned to each node. Because this allows the customizing of the affinity and load balancing, it is the most common mode used. Multiple host filtering increases availability and scalability, because you can increase capacity by adding nodes, and the cluster continues to function in the event of node failure.
- **Single host:** Allows only one cluster host (the host with the highest priority) in the cluster to actively respond to client requests. If the host fails, the host with the next highest priority takes over for the failed host. It is usually used to configure one host as the primary server and other hosts as backup servers. Single host rules increase availability, but do not increase scalability.
- **Disable:** Prevents the cluster from responding to a specific type of client traffic.

CERTIFICATION READY

Configure affinity.

Objective 1.1

If you choose the multiple host filtering mode, you can then configure the affinity. When you configure affinity, you can choose one of the three options:

- **None:** Any cluster node responds to any client request, even if the client is reconnecting after an interruption. This option is suitable for stateless application, where the server that is servicing the request does not have to remember the previous events to complete the request. As a result, the client can jump from one server to another within the cluster without problem.
- **Single:** A single cluster node handles all requests from a single client. This option is useful for stateful applications where the status of a process or transaction is maintained through the entire connection including when using SSL and e-commerce shopping cart applications.
- **Class C:** A single node responds to all requests from a class C network (a network with a subnet of 255.255.255.0), often found when used with multiple proxy servers. This type of server is often used with cookie-based affinity or when a common database or session state server is used.

Each node in a cluster must have identical port rules. The only exception is the load weight when in multiple-hosts filter mode and handling priority in single-host filter mode. If the port rules are not identical, the cluster will not converge.

To modify the port rules for an individual host, right-click the host in the left pane and click *Host Properties*. Then, click the *Port Rules* and click *Edit* to open the Add/Edit Port Rule dialog box (as shown in Figure 1-4). To specify a different load weight while in multiple host, click to deselect the *Equal* option and then specify the load weight. If you are in Single host, specify the handling priority.

Figure 1-4

Specifying a different load weight

When creating port rules, the number and type of rules must be the same for each host in the cluster. If a host attempts to join the cluster with a different number of rules than the other hosts, it is not accepted as part of the cluster, and the rest of the cluster continues to handle the traffic as before.

Configuring Cluster Operation Mode

On the Cluster Parameters tab, you configure the virtual IP address, subnet mask, and DNS name that the cluster will use. You also can configure the cluster operation mode, which specifies whether a multicast MAC address should be used for cluster operations.

CERTIFICATION READY

Configure cluster operation mode.
Objective 1.1

When a host communicates with another host, the host uses unicast or multicast packets. When communicating using **unicast**, each packet is sent to a single network destination identified by a unique address. In other words, a host sends packets to a single computer.

With **multicast**, packets are sent to multiple computers simultaneously in a single transmission from the source. In other words, when a host sends packets using multicasting, a single set of packets is sent to all computers at once. Copies are automatically created on routers, when the packet needs to go to different subnets. If you have five hosts on the same subnet, and two hosts on another subnet, one set of packets is sent from the source host. When the packets get to a router where the packets need to be sent through two different pathways, the packets are copied and sent to the two separate subnets. When the first set of packets gets sent to the subnet with five hosts, only one set of packets gets sent to all five hosts. The second set of packets gets sent to the subnet with two hosts, and only one set of packets gets sent to the two hosts.

When you configure an NLB cluster to use **unicast mode**, NLB replaces the network card's original MAC address and all cluster hosts use the same unicast MAC address. When you use unicast mode with a single network adapter on each node, the computer can communicate only with other computers within the same subnet. If you perform management tasks on the computer, you need to perform these tasks on a computer that is on the same TCP/IP subnet as the node, or you have to use a second network adapter and address. Lastly, if you use unicast mode, you can use separate virtual local area networks (VLANs) for cluster traffic and management traffic.

When an NLB host is in **multicast mode**, each NLB network adapter has two MAC addresses (the original MAC address and the virtual MAC address). However, when using multicast mode, some routers might see a unicast IP address with a multicast MAC address as an invalid packet and reject the update to the ARP table. If this happens, the network administrators might need to manually add ARP entries to the router.

In summary, if your system has two network cards, you should use unicast. If a server has only a single network card, you should use multicast mode.

Another mode available is the **Internet Group Management Protocol Multicast mode**, which is a special form of multicast mode that prevents the network switch from flooding with traffic. When you use IGMP multicast mode, traffic is forwarded only through the switch ports that are part of the NLB cluster. However, to use IGMP multicast mode, you need switch hardware that supports IGMP multicast mode.

To modify the cluster operation mode, right-click the cluster in the Network Load Balancing Manager and click *Cluster Properties*. On the Cluster Parameters, you can modify the cluster IP address, subnet mask, full Internet name, and cluster operation mode.

Controlling Hosts in NLB

As an administrator, you can manually add or remove nodes from an NLB cluster by using the Network Load Balancing Manager. You can also suspend and resume a cluster node and perform a drainstop.



To remove a node, you can perform a stop or a drainstop action. The **stop action** terminates all existing connections to the cluster node and stops the NLB service. The **drainstop** action blocks all new connections without terminating existing sessions. Therefore, to perform maintenance on an NLB node, which needs to be temporarily removed from the NLB cluster, you should choose drainstop so that connections are not prematurely stopped before the requests are completed. To control the host, you right-click the node, click *Control Host*, and select the appropriate option (Start, Stop, Drainstop, Suspend, or Resume).

Upgrading an NLB Cluster

There are two ways to upgrade a Windows Server 2008 R2 with SP1 or Windows Server 2012 NLB cluster to Windows Server 2012 R2. It includes upgrading all the hosts at one time or upgrading each host, one at a time.

CERTIFICATION READY

Upgrade an NLB cluster.

Objective 1.1

The quickest upgrade path is to take the entire cluster offline and perform a rolling upgrade. Of course, if you use this method, the cluster is not available. If you require no down-time, you can upgrade each individual cluster host, one at a time. As you upgrade each node, you should first perform a drainstop for the host so that any pending client requests are finished before the upgrade.

SKILL SUMMARY

IN THIS LESSON YOU LEARNED:

- High availability is a system design protocol and associated implementation that ensures a certain degree of operational continuity during a given measurement period.
- A cluster is a group of linked computers that work together as one computer. Based on the technology used, clusters can provide fault tolerance (often referred to as availability), load balancing, or both.
- The two most popular forms of clusters are failover clusters and load-balancing clusters.
- A load-balancing cluster for the front end provides the web interface to the back-end servers.
- A failover cluster for back-end servers such as a database (such as SQL Server) or mail server (such as Exchange Server).
- Network Load Balancing (NLB) transparently distributes traffic across multiple servers by using virtual IP addresses and a shared name. By using NLB, you gain fault tolerance and enhanced performance.
- A cluster has two or more servers, known as nodes.
- Each node runs a separate copy of the desired service application such as a web server, an FTP server or a SSH/Remote Desktop Server.
- NLB is able to detect the failure of cluster nodes by sending packets known as *heartbeats*.
- When a node is added or removed from a cluster, a process known as *convergence* occurs, in which the cluster determines its current configuration by building a membership of nodes and mapping clients requests based on the available nodes.

- To configure the NLB cluster, you must configure three types of the parameters: host parameters, cluster parameters, and port rules.
- Port rules specify how NLB directs traffic based on the port and protocol.
- Affinity determines how the servers balance the load. You use affinity settings when you use multiple hosts filter mode.
- For a system with two network cards, you should use unicast. If a server has only a single network card, you should use multicast mode.
- The drainstop action blocks all new connections without terminating existing sessions.
- To upgrade an NLB cluster to Windows Server 2012 R2, you can upgrade all the hosts at one time or upgrade each host, one at a time.

■ Knowledge Assessment

Multiple Choice

Select the correct answer for each of the following questions.

1. What is used to transparently distribute traffic equally across multiple servers by using virtual IP addresses and a shared name?
 - a. Network Load Balancing (NLB)
 - b. Failover cluster
 - c. DFS distribution
 - d. Site replication
2. Which of the following would use NLB to provide fault tolerance?
 - a. SQL databases
 - b. Exchange database
 - c. Websites
 - d. Shared folder
3. What is the maximum number of nodes that is supported in a Windows Server 2012 R2 NLB cluster?
 - a. 2
 - b. 8
 - c. 16
 - d. 32
4. What is used to detect the failure of cluster nodes?
 - a. autoconfig
 - b. whoami
 - c. Announcements
 - d. Heartbeats
5. When you add or remove a node from an NLB cluster, what must happen?
 - a. Adaptation
 - b. Reset
 - c. Convergence
 - d. Redefine



6. Which three types of parameters configure the NLB cluster?
 - a. Convergence rules
 - b. Balance parameters
 - c. Cluster parameters
 - d. Host parameters
 - e. Port rules
7. What specifies how NLB directs traffic based on the port and protocol?
 - a. Convergence rules
 - b. Balance parameters
 - c. Cluster parameters
 - d. Host parameters
 - e. Port rules
8. What determines how servers are balanced with NLB?
 - a. affinity
 - b. drainstop
 - c. state sequencing
 - d. convergence
9. Which mode allows an NLB cluster to use two MAC addresses for the NLB network adapter?
 - a. Unicast mode
 - b. Multicast mode
 - c. Internet Group Management Protocol multicast mode
 - d. Converging mode
10. Which action blocks all new connections without terminating existing sessions?
 - a. blocking
 - b. suspended
 - c. drainstop
 - d. multimode

Best Answer

Choose the letter that corresponds to the best answer. More than one answer choice may achieve the goal. Select the BEST answer.

1. Typically you would have port rules to be identical on all nodes on the cluster. What are the exceptions where the port rules don't have to be identical?
 - a. Handling priority
 - b. TCP, UDP, or both
 - c. Load weight
 - d. Ports
2. Which mode would you choose to configure affinity?
 - a. Multiple hosts
 - b. Single host
 - c. Disable
 - d. Converging host

3. You have a two-node NLB cluster. The cluster is intended to provide high availability and load balancing for the Contoso.com website. You have only the default port rule. Which two steps do you need to configure the NLB cluster to accept only HTTP traffic? (Choose two answers.)
 - a. Run the `vlbs disable all` command.
 - b. Delete the default port rule.
 - c. Create a new Allow rule for TCP port 80.
 - d. Change the default port rule to a disabled port range rule.
4. You have a two-node NLB cluster. The cluster is intended to provide high availability and load balancing for the Contoso.com website. You have a single port rule that evenly distributes HTTP traffic between Server01 and Server02. What do you need to evenly distribute HTTP traffic while having all HTTPS traffic to go Server01? (Choose two answers.)
 - a. On Server02, change the Handling priority for the TCP 443 to a value of 0.
 - b. On Server01, change the Handling priority option for the TCP 443 port rule to the value of 0.
 - c. In the properties for the cluster, create a new port rule for TCP 443 that has a filtering mode option set to a single host.
 - d. In the properties for the cluster, create a new port for port TCP 443 that has the filtering option set to a multiple host and the Affinity set to Single.
5. You have a server called Server01, which hosts the `http://www.contoso.com` and `https://www.contoso.com` websites. You created an NLB cluster using Server01 and Server02. What must you do to ensure that users can connect to the `https://www.contoso.com` website without any security warnings?
 - a. Make sure both servers point to the same Enterprise CA.
 - b. Create a new digital certificate on Server02 for `www.contoso.com`.
 - c. Export the SSL certificate from Server01 and import the SSL certificate to Server02.
 - d. Create an image of the website on Server01 and import into Server02.

Matching and Identification

1. Match the description with the appropriate term. Not all items will be used and items can be used more than once.

_____ a)	Uses two MAC addresses for a host
_____ b)	Only forwards traffic through the switch ports that are part of the NLB cluster
_____ c)	Gracefully shuts down a node in the NLB cluster
_____ d)	Uses only the host with the highest priority to respond
_____ e)	Replaces the network card's original MAC address with the cluster MAC address

 1. Internet Group Management Protocol multicast mode
 2. drainstop
 3. multicast mode
 4. single host
 5. unicast mode
 6. port rule
2. Which of the following would you configure when configuring port rules?

_____ a)	Filtering mode
_____ b)	Convergence mode
_____ c)	Virtual IP address
_____ d)	TCP or UDP port range
_____ e)	TCP, UDP, or both
_____ f)	drainstop



3. Identify the type of cluster (NLB or Failover) that you would use for a particular type of server.
- ☐ a) File server
 - ☐ b) DHCP server
 - ☐ c) Exchange back-end/mailbox server
 - ☐ d) Exchange front-end/CAS server
 - ☐ e) Web server
 - ☐ f) SQL server
4. Which of the following are prerequisites for NLB?
- ☐ a) The MAC address must be user programmable.
 - ☐ b) All network adapters must be multicast or unicast.
 - ☐ c) You must use static addresses.
 - ☐ d) Servers cannot be geographically dispersed.
 - ☐ e) The adapter must handle client-to-cluster traffic.
 - ☐ f) All hosts in the cluster must reside on the same subnet.

Build a List

1. Identify the basic steps, in order, to create an NLB cluster in Windows Server 2012 R2. Not all steps will be used.
- ☐ Specify the priority of the host.
 - ☐ Create port rules.
 - ☐ Configure convergence parameters.
 - ☐ Type the name of the current server and click Connect.
 - ☐ Specify failover options.
 - ☐ Specify a cluster IP address.
 - ☐ Specify the Internet name for the cluster.

■ Business Case Scenarios

Scenario 1-1: Upgrading an NLB Cluster

You are the administrator for several web servers that make up the NLB cluster. They run on servers with Windows Server 2008 R2. Explain the best way to upgrade the NLB cluster to Windows Server 2012 R2 without any downtime.

Scenario 1-2: Creating a Fault-Tolerant Website

You are the administrator for the contoso.com website. Recently, the server hosting the corporate websites had a failure that caused the server to go down for a short period of time while the server was being fixed. In the future, you need to take steps to avoid any hardware failure that would cause the websites to go down. What should you do?