<u>NETWORK LOAD BALANCING</u> and <u>FAILOVER CLUSTERING</u> IN WINDOWS SERVER 2008 R2

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NETWORK LOAD BALANCING and FAILOVER CLUSTERING IMPLEMENTATION





Generally it is seen that NLB is implemented between the Front End Web Servers and Failover Clustering is implemented for the back end database servers.

Please refer to the diagrams on the left side for example.

Network Load Balancing overview

The Network Load Balancing (NLB) service enhances the availability and scalability of Internet server applications such as those used on Web, FTP, firewall, proxy, virtual private network (VPN), and other mission-critical servers.

What are NLB clusters?

It is important to understand what a network load balanced cluster is and what it does. The cluster is made up of member hosts, and each host is bound to a public IP address (or addresses) which resolve to the cluster itself.

Each host in the cluster must have Network Load Balancing installed, and bound to the network interface(s) of choice.

When you initially install the cluster, you configure both an initial member host, and then the cluster settings.

An example Network Load Balancing Cluster:



Note how each host in the cluster has a network interface card which is bound to the cluster's IP address (10.0.0.100). So any request coming for Cluster A will turn to the nodes that belongs to the Cluster.

Installation and Configuration

1. Install Network Load Balancing

Open Server Manager, click on Features and then click on the Add Features link. In the "Add Features Wizard" scroll to, and select "Network Load Balancing":



Installation and Configuration

Installation will proceed to install the necessary components



NOTE: Network Load Balancing may also be installed from a command prompt with elevated privileges (right click on the command prompt in the Start menu and select *Run as administrator*) by running the **servermanagercmd -install nlb** command.

For example:

C:\Windows\system32>servermanagercmd -install nlb

..... Start Installation

Installation Result	s
Features Confirmation	The following roles, role services, or features were installed successfully:
Progress	
Results	Windows automatic updating is not enabled. To ensure that your newly-installed role or feature is automatically updated, turn on Windows Update in Control Panel.
	Network Load Balancing Ø Installation succeeded
	Print, a mail or save the installation report
	<previous next=""> Close Cancel</previous>
Add Features Wizard	
Installation	Recu
Features	The following roles, role services, or features were installed successfully:
Progress	Network Load Balancing 🕜 Installation succeeded 🔶
Results	
	Print, e-mail, or save the installation report

Installation and Configuration

Configuring NLB on NODE 1

Network Load Balanced clusters are built using the *Network Load Balancing Manager* which you can start from

Start -> All Programs -> Administrative Tools menu or from a command prompt by executing nlbmgr.

Under the Cluster Menu option select "New"

E2			Network Load Ra	ancing Manager				
U		File	Cluster Host (Options Help				
Person Per			e New	Clusters	Cluster configuration fo	r all known NLB clusters		
1-3			Connect to Ex	isting	Cluster name	Cluster IP address	Cluster IP subnet mask	Cluster mode
			Add Host					
been a			Delete		1			
			Properties		1			
			Refresh		1			
			Remove From	View	1			
			Control Hosts	•	1			
			Control Ports.		1			
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1 Tagenth Local Endancing Manager	2							
Distant Explore		Log	Entry Date	Time Clu	uster Host	Description		
Constand Prompt	ebilitatur.		0001 4/30/2009	9:38:26 PM		INLE Manager session started		
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<u></u>	Conjune	<u> </u>						<u> </u>
Carl News	THEORY							lte
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	Admenipative Tanks +					/		
	regularit Support							
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 All Programs 								
Search program and Nes 23	Lugoff [4]							

Installation and Configuration

Enter the first node in the cluster in form of IP Address or Host name

Press "Connect"

Please note that the nodes should be lying under the same domain of the existing network. Basically in the same subnet of the Network Adapter.

New Cluster : Connect X Connect to one host that is to be part of the new cluster and select the cluster interface Host: PL2008-01 Connect Connection status	New Cluster : Connect Connect to one host that is to be part of the new cluster and select the cluster interface Host: PL2008-01 Connection status Connected	X
Interfaces available for configuring a new cluster Interface name Interface IP	Interfaces available for configuring a new cluster Interface name Interface IP Local Area Connection 192.168.1.180	
<back next=""> Cancel Help</back>	< Back Next > Cancel Help	

- Enter the Priority ID as, 1 (each node in the NLB cluster should have a UNIQUE ID)
- Make sure the correct adapter was selected under "Dedicated IP Address"
- Select "Started" for the "Initial host state" (this tells NLB whether you want this node to participate in the cluster at startup)
- Press "Next"
- Press "Add"
- Enter the Cluster IP and Subnet mask
- Press "OK"

ew Cluster : Host Parameters	New Cluster : Cluster IP Addresses Add IP Address	×
Priority (unique host identifier): Dedicated IP addresses IP address Subnet mask 192.168.1.180 255.255.255.0	The cluster IP addresses are shared b The first IP addresses listed is considered heartbeats. Cluster IP addresses: Cluster IP addres	
Add Edit Remove	IP address IP v6 address: IP v6 address: IP v6 address: Image: Constraint of the second secon	
Initial host state Default state: Started Retain suspended state after computer restarts < Back	Add Edit Remove	

Installation and Configuration

You can add multiple IP Addresses for the cluster, enter as many as you want.

Make sure the "Cluster IP addresses" are correct

Press "Next"

- Select the IP Address for this cluster
- Enter the NLB address "PL2008-V.pintolake.net"
- Enter "Unicast" as the "Cluster operation mode". Well I am not discussing why I chose Unicast here
- Press "Next"

New Cluster : Cluster IP Addresses	X New Cluster : Cluster Parameters X
New Cluster IP addresses are shared by every member of the cluster for load balancing. The first IP address listed is considered the primary cluster IP address and used for cluster heartbeats. Cluster IP addresses: IP address Subnet mask 192.168.1.182 255.255.255.0	Cluster IP configuration IP address: 192.168.1.182 Subnet mask: 255.255.0 Full Internet name: PL2008-V pintolake.net Network address: 02-bf-c0-a8-01-b6 Cluster operation mode Cluster operation mode Cluster operation mode Cluster operation mode Cluster operation mode Cluster operation mode Cluster operation mode
Add Edit Remove	
< Back Next > Cancel Help	< Back Next > Cancel Help

Installation and Configuration

I am leaving all the default for the port rules; by default its set to all ports with Single affinity, which is sticky. For more information on Port Rules, I will discuss it later.

Press "Finish"

	Tou should see a couple of things in the NLD
New Cluster : Port Rules	Manager, this will let us know that this node
Defined port rules:	successfully converged on our new PL2008-
Cluster IP address Start End Prot Mode Priority Load Affinity	V.piniolake.net NLB Cluster
All 0 65535 Both Multiple Single	"Converged"
	Make sure you see a "succeeded" message in
	the log window
	Hetwork Load Balancing Manager File Cluster Hot Options Heb
Add Edit Remove	Image: Second Science of Contents of Contents in Cluster PL2008-V pintolake.net (192.168.1.182) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection) Image: PL2008-01(Local Area Connection)
Port rule description TCP and UDP traffic directed to any cluster IP address that arrives on ports 0 through 65535 is balanced across multiple members of the cluster according to the load weight	
of each member.Client IP addresses are used to assign client connections to a specific cluster host	Log Entry Date Time Okuster Host Description 0001 4/30/2009 9:38:26 PM NLB Manager session started Image: NLB Manager session started
	0002 4/30/2009 9:48:21 PM 192.168.1.182 PL2008-01 Begin configuration change 0003 4/30/2009 9:48:32 PM 192.168.1.182 PL2008-01 Wating for pending operation 2 0004 4/30/2009 9:48:43 PM 192.168.1.182 PL2008-01 Update 2:usceeded [double click for details] 0005 4/30/2009 9:48:43 PM 192.168.1.182 PL2008-01 End configuration change
Cancei Heip	

Vou chould ago a couple of things in the NILP

Installation and Configuration

Configuring NLB for NODE 2

- We will configure PL2008-02 from PL2008-01. If we wanted to configure this from PL2008-02 then we would need to connect to the PL2008-V cluster first then add the host to the cluster.
- Right click the cluster name "PL2008-V.pintolake.net" and select "Add Host to Cluster"

💋 Network Load Balancing Manager		Add Host to Cluster : Connect X
File Cluster Host Options Help	Host configuration information fo	Connect to the host that is to be added to the existing cluster Host: PL2008-02 Connect
PL2008-01(Local Area Connection)	Add Host To Cluster Delete Cluster Cluster Properties Refresh Remove From View Control Hosts	Connection status Interfaces available for configuring the cluster Interface name Interface IP
		< Back Next > Cancel Help

- This step is very important; each node in the NLB cluster should have a unique identifier. This identifier is used to identify the node in the cluster.
- Enter the Priority ID as, 2 (each node in the NLB cluster should have a UNIQUE ID)
- Make sure the correct adapter was selected under "Dedicated IP Address"
- Select "Started" for the "Initial host state" (this tells NLB whether you want this node to participate in the cluster at startup)
- Press "Next"
- Press "Finish"

		111	
Host to Cluster : Host Paramet	ters	X	Add Host to Cluster : Port Rules
Priority (unique host identifier):			Defined port rules:
Dedicated IP addresses			Cluster IP address Start End Prot Mode Priority Load Affi
IP address	Subnet mask		All 0 65535 Both Multiple Equal Sin
192.168.1.181	255.255.255.0		
,			Add Edit Rem
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Initial host state			TCP and UDP traffic directed to any cluster IP address that arrives on ports 0 throu
Defeuit states	atted		65535 is balanced equally across all members of the cluster.Client IP addresses are
			used to assign client connections to a specific cluster host.
Retain suspended state after co	omputer restarts		
			· · · · · · · · · · · · · · · · · · ·
< Back	Next > Cancel He	lp	< Back Finish Cancel H

- You should see a couple of things in the NLB Manager, this will let us know that both nodes successfully converged on our new PL2008-V.pintolake.net NLB Cluster
- Make sure that both node's status changes to "Converged"
- Make sure each node has a unique "host priority" ID
- Make sure each node is "started" under "initial host state"
- Make sure you see a "succeeded" message in the log window for the second node

🗆 🍰 Net	work Load Bala	ancing Clusters		Host configurat	Host configuration information for hosts in cluster PL2008-V pintolake net (192.168.1.182)							
8-54	PL2008-V.pint	olake.net (192.	168.1.182)	Host (Interface))	Status	Dedicated IP ad	dress Dec	dicated IP subnet mask	Host priority	Initial host sta	
	PL2008-0	1(Local Area Co 20 ocal Area Co	nnection)	PL2008-01(Local Area Conne	Converged	192.168.1.180	255	5.255.255.0	1	started	
	PL2008-0.	/(Local Area Co	nnection)	PL2008-02(Local Area Conne	Converged	192.168.1.181	255	5.255.255.0	2	started	
×												
an Cabra	Date	Time	Cluster	Host	Description							
og che y												
0001	4/30/2009	9:38:26 PM			NLB Manager sess	ion started						
0001 0002	4/30/2009 4/30/2009	9:38:26 PM 9:48:21 PM	192.168.1.182	PL2008-01	NLB Manager sess Begin configuratio	n change						
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0001 0002 0003 0004	4/30/2009 4/30/2009 4/30/2009 4/30/2009	9:38:26 PM 9:48:21 PM 9:48:25 PM 9:48:43 PM	192, 168, 1, 182 192, 168, 1, 182 192, 168, 1, 182	PL2008-01 PL2008-01 PL2008-01	NLB Manager sess Begin configuratio Waiting for pendin Update 2 succeed	ion started n change g operation 2 ed [double click f	or details]					
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- Testing
- Go to the command prompt and type "wlbs query", as you can see HOST 1 and HOST 2 converged successfully on the cluster. This means things are working well.
- Ping each server locally and remotely
- Ping the virtual IP locally and remotely you should do this three times from each location. If you cannot ping remotely you may need to add a static ARP entry in your switches and/or routers where the host machines reside
 - 1 Both nodes up
 - 2 Node 1 down
 - 3 Node 2 down

🖬 Administrator: C:\Windows\system32\cmd.exe	×
Microsoft Windows [Version 6.0.6001] Copyright <c> 2006 Microsoft Corporation. All rights reserved.</c>	-
C:\Users\Administrator>wlbs query WLBS Cluster Control Utility U2.5 (c) 1997-2007 Microsoft Corporation. Cluster 192.168.1.182 Host 1 has entered a converging state 2 time(s) since joining the cluster and the last convergence completed at approximately: 4/30/2009 9:55:39 PM Host 1 converged as DEFAULT with the following host(s) as part of the cluster: 1, 2	
C:\Users\Administrator>_	
	-

Although all editions of Windows Server 2008 include Network Load Balancing, only the <u>Enterprise Edition and the Datacenter Edition</u> include failover clustering capabilities to achieve higher levels of availability. A cluster allows you to establish high availability for general services or for specific applications. The Failover Cluster Management tool included with Windows Server 2008 enables you to create and manage clusters.

You need to take care of the following steps to implement clustering in your environment.

- Make sure your hardware is compatible with Windows Server 2008 clustering.
- Configure volumes on your shared storage connected and visible to both servers.
- Install the Failover Clustering feature on each of your intended cluster nodes.

Once you complete these steps, you can run the Failover Cluster Management console by going to **Start | Administrative Tools |** Failover Cluster Management.

Failover Clustering System Requirement:

- Windows Server 2008/R2: Failover Clustering feature is available with Windows Server 2008/R2 Enterprise/Data Center editions. You don't have this feature with the Standard edition of Windows Server 2008/R2.
- Domain role: All servers in the cluster must be in the same Active Directory domain.
- DNS: The servers in the cluster must be using Domain Name System (DNS) for name resolution.
- Account for administering the cluster : When you create a cluster or add servers to it, you must be logged on to the domain with an account that has administrator rights on all servers in that cluster (if the account is not a Domain Admins account, the account must be given the Create Computer Objects and Read All Properties permissions in the domain).
- **Servers :** Two identical servers in brand, model and configurations.
- Device Controllers (HBA): i/SCSI or Fiber, both also to be the identical.
- Storage : You must use shared storage that is compatible with Windows Server 2008 R2.

Configuration on Server A

- 1) To install Failover feature, open Server Manager, click on Start > Administrative Tools > Server Manager
- 2) Expand Features, and then click on Add Feature.



Configuration on Server A

3) The list of available features will be listed, select the **Failover Clustering** and click on **Next**



Configuration on Server B

Again on Server B, we will need to install Failover Clustering feature as well. Follow the previously mentioned steps in Server B as well.

Now that both servers have Failover Clustering feature installed on them, we can create the cluster on one of these server and join the other one to the cluster.

Now, we need to open and configure our cluster name, IP and nodes.

To open Failover Clustering, click on Start > Administrative Tools > Failover Cluster Manager

Please Note that This needs to be done on a single server only.

 The first step in creating a successful failover clustering, is by <u>validating</u> the existing systems and shared storage. This is done by selecting the option <u>Validate a Configuration.</u>



- The first step in creating a successful failover clustering, is by <u>validating</u> the existing systems and shared storage. This is done by selecting the option <u>Validate a Configuration</u>.
- When you click on **Validate a Configuration**, you will need to browse and add the Cluster nodes, these are the servers that will be part of the cluster, then click Next
- Choose to Run all tests and click Next. The available tests will be displayed in the confirmation window, click Next to begin validating your cluster.

Failover Cluster Manager		👹 Validate a Configur	ation Wizard		2
File Action View Help	Failover Cluster Manager Create failover clusters, validate hardware for potential failover clusters, and perform configuration changes to your failover clusters.	Confirmati	ion		
	Overview Afailover clutter is a set of independent computers that work together to increase the availability of services and applications. The cluttered servers (called nodes connected by physical cables and by software. If one of the nodes fails, another node begins to provide services (a process known as failover).	Before You Begin Select Servers or a Cluster	You are ready to start validation. Please confirm that the following settings are correct:		
	Clusters Validate a Configuration Wizard Managem To begin to user Select Servers or a Cluster Magang a dark	Testing Options Confirmation Validating	Servers to Test bcm-srv1.al-raitv.alraitv.com bcm-srv2.al-raitv.alraitv.com		
	Vandade a Server fou Begin Io validade a de de servers, add the names of at the servers. To test an existing outlier, add the names of the duster orone of its modes. To test an existing outlier, add the name of the duster orone of its modes. To test an existing outlier, add the name of the duster orone of its modes. To test an existing outlier, add the name of the duster orone of its modes. To test an existing outlier, add the name of the duster orone of its modes. To test an existing outlier, add the name of the duster orone of its modes. To test an existing outlier, add the name. Selected servers: Dom erv2 a restruction To test an existing outlier, add the name. To test and the name. To test and the name. To test and the name. To test an existing outlier, add the name. To test an existing outlier, add the name. To test an existing outlier, add the name. To test and the name. To test an existing outlier, add the name. To test an existing outlier, add the name. To test and the name. To test an existing outlier, add the name. To test and the name. To test an existing outlier, add the name. To test and the name. To test an existinge outlines and the nand the nand t	Summary	Tests Selected by the User List BIOS Information List Environment Variables List Fibre Channel Host Bus Adapters	Category Inventory Inventory Inventory	
	Enformenting Microsoft su		To continue, click Next. More about cluster validation tests		
	<previous next=""> Cancel</previous>			< <u>P</u> revious <u>N</u> ext > C	Cancel

• Review the validation report, as your configuration might have few issues with it and needs to be addressed before setting up your cluster.



- Now that the configuration is validated and you are ready to setup your cluster. Click on the second option, Create a Cluster, the wizard will launch, read it and then click Next.
- \triangleright
- You need to add the names of the servers you want to have in the cluster. You can start creating your cluster with a single server and then add other nodes in the future.

Browse to your servers and then once all the servers (nodes) are listed, click Next

🐺 Failover Cluster Manager				i 🖓 Cr	reate Cluster Wiz	ard			×
File Action View Help				-					
(= =) 🖬 🖬 🖬					🕌 Select Se	rvers			
Failover Cluster Manager	Failover Cluster Man	ager		10	00				
	Create failover clusters,	Create failover clusters, validate hardware for potential failover clusters, and perform configuration changes to your failover clusters.				Add the names of all the	e servers that you want to have	in the cluster. You must add at leas	st one server.
	* Overview			Jelec	a Dervers				
	A failover cluster is a set of independent computers that work together to increase the availability of services and applications. The clustered serviers (called nodes) are connected by physical cables and by software. If one of the nodes fails, another node begins to provide services (a process known as failover).				nistering the er	Enter server name:			Browse
	+ Chustore		Confi	rmation	Selected servers:	bcm-srv1.al-raitv.alraitv.com		Add	
	- Clusters	Create Cluster 10		Creat	ing New Cluster		bcm-srv2.al-raitv.alraitv.com		Bemove
	 Management 	ng create cluster wa		Sumn	nary				10000
	To begin to use failover clu Managing a cluster can inc R2.	Before Yo	bu Begin						
	Validate a Configuration Create a Cluster Manage a Cluster More Information Ealoyer cluster topics Ealoyer cluster comm Microsoft a speed page	Before You Begin Select Servers Validation Warning Access Point for Administering the Quarter Confirmation Creating New Ouster Summary	This witzard creates a cluster, which is a set of servers that work together to increase the availability of clustered services and applications. If one of the servers fails, another server begins hosting the clustered services and applications (b) process known as failowe). Before you run the Validate a Configuration we ensure that you'h hadware and hardware settings are compatible with failower clustering. Microsoft supports a cluster solution only if the complete configuration (servers, network, and state solution must be "Certified for Windows Server 2008 R2". You must be a local administrator on each of the servers you want to include in the cluster. To continue, click Net. Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of cluster solutions that have passed validation tests Microsoft support of solutions and the solutions that have passed validation tests Microsoft support of solutions and test of the solutions that have passed validation tests Microsoft support of solutions that have passe					< Previous Next >	Cancel

- After the servers are selected, you need to type a name and IP for your Cluster.
- On the Confirmation window, review your settings. The following will be displayed in this window: cluster name and IP address, selected servers name. If all info is proper, then click Next. Else click Previous and correct which setting needs to be adjusted.

🙀 Create Cluster Wizard		🎇 Create Cluster Wizard	
Access Point for Administering the Cluster		Confirmation	
Before You Begin Select Servers Access Point for Administering the Cluster Confirmation Creating New Cluster Summary	Type the name you want to use when administering the cluster. Cluster Ngme: BCMS-RV One or more IPv4 addresses could not be configured automatically. For each network to be used, make sure the network is selected, and then type an address. Networks Address Image: 192.168.180.0/24 192.168.180.0/24 192 More about the administrative Access Point for a cluster	Before You Begin Select Servers Access Point for Administering the Cluster Corfirmation Creating New Cluster Summary To continue, o	vto create a cluster. Il create your cluster with the following settings: BCMS-RV bcm-srv1.al-raitv.alraitv.com bcm-srv2.al-raitv.alraitv.com ss: 192.168.180.13
	<pre>_ Cancel</pre>		< Previous Next > Cancel

- After you click Next, creating the cluster will begin.
- The summary windows will be displayed after a successful setup of the cluster.

🖏 Create Cluster Wizard 🔀 🕺			🚏 Create Cluster Wi	🙀 Create Cluster Wizard	
Confirmation			Summary		
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	Cluster: Node: Node: IP Address:	BCMS-RV bcm-srv1.al-raitv.alraitv.com bcm-srv2.al-raitv.alraitv.com 192.168.180.13	Access Point for Administering the Cluster Confirmation Creating New Cluster Summary	Create Cluster Cluster: BCMS-RV Node: bcm-srv1.al-raitv.alraitv.com Node: bcm-srv2.al-raitv.alraitv.com Quorum: Node Majority	×
	To continue, click Next.	< <u>Previous</u> <u>N</u> ext > Cancel		To view the report created by the wizard, click View Report. To close this wizard, click Finish.	<u>V</u> jew Report

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- After you click Next, creating the cluster will begin.
- The summary windows will be displayed after a successful setup of the cluster.



Open Failover Cluster Manager and you will see your nodes and setting inside the MMC. Here you can configure your cluster, add new nodes, remove nodes, add more disk storage and so on.



In this article, I have created a two node cluster using both NLB and Failover Clustering feature which is available with Windows Server 2008 R2 Enterprise and Data Center editions. In this case I will be using Windows Server 2008 R2 Enterprise edition.

Jump over to my Video Tutorial.....

Thanks

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