



Appliance Quick Start Guide

v7.5

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Loadbalancer.org Terminology

<u>Acronym</u>	<u>Terminology</u>
Load Balancer	An IP based traffic manager for server clusters
VIP	The Virtual IP address that a cluster is contactable on (Virtual Server/Service) <i>N.B. Prior to v7.5 a VIP is known as a 'Virtual Server', from v7.5 onwards it's known as a 'Virtual Service'</i>
RIP	The Real IP address of a back-end server in the cluster (Real Server)
GW	The Default Gateway for a back-end server in the cluster
WUI	Web User Interface
Floating IP	An IP address shared by the master & slave load balancer when in a high-availability configuration (shared IP)
Layer 4	Part of the seven layer OSI model, descriptive term for a network device that can route packets based on TCP/IP header information
Layer 7	Part of the seven layer OSI model, descriptive term for a network device that can read and write the entire TCP/IP header and payload information at the application layer
DR	Direct Routing is a standard load balancing technique that distributes packets by altering only the destination MAC address of the packet
NAT	Network Address Translation – Standard load balancing technique that changes the destination of packets to and from the VIP (external subnet to internal cluster subnet)
SNAT	Source Network Address Translation – Load balancer acts as a proxy for all incoming & outgoing traffic
(HAProxy)	
SSL Termination	The SSL certificate is installed on the load balancer in order to decrypt HTTPS traffic on behalf of the cluster
(Pound & STunnel)	
MASQUERADE	Descriptive term for standard firewall technique where internal servers are represented as an external public IP address. Sometimes referred to as a combination of SNAT & DNAT rules
One Arm	The load balancer has one physical network card connected to one subnet
Two Arm	The load balancer has two network interfaces connected to two subnets – this may be achieved by using two physical network cards or by assigning two addresses to one physical network card
Eth0	Usually the internal interface also known as Gb0
Eth1	Usually the external interface also known as Gb1

What is a Virtual IP Address?

Most load balancer vendors use the term Virtual IP address (VIP) to describe the address that the cluster is accessed from. It's important to understand that the Virtual IP address (VIP) refers to both the physical IP address and also to the logical load balancer configuration. Likewise the real IP (RIP) address refers to both the Real Servers physical IP address and its representation in the logical load balancer configuration.

What is a Floating IP Address?

The floating IP address is shared by the master and slave load balancer when in a high-availability configuration. The network knows that the master controls the floating IP address and all traffic will be sent to this address. The logical VIP matches this address and is used to load balance the traffic to the application cluster. If the master has a hardware failure then the slave will take over the floating IP address and seamlessly handle the load balancing for the cluster.

N.B. In scenarios that only have a master load balancer there can still be a floating IP address, but in this case it would remain active on the master unit only.

What are Your Objectives?

It's important to have a clear focus on your objectives and the required outcome for the successful implementation of your load balancing solution. If the objective is clear and measurable, you know when you have achieved the goal.

Load balancers have a number of flexible features and benefits for your technical infrastructure and applications. The first question to ask is:

Are you looking for increased performance, reliability, ease of maintenance or all three?

Performance	A load balancer can increase performance by allowing you to utilize several commodity servers to handle the workload of one application
Reliability	Running an application on one server gives you a single point of failure. Utilizing a load balancer moves the point of failure to the load balancer. At Loadbalancer.org we advise that you only deploy load balancers as clustered pairs to remove this single point of failure
Maintenance	Using the appliance, you can easily bring servers on and off line to perform maintenance tasks, without disrupting your users



In order to achieve all three objectives of performance, reliability & maintenance in a web based application, your application must handle persistence correctly (see page 49 for more details).

What is the Difference Between a One-Arm and a Two-Arm Configuration?

The number of 'arms' is normally a descriptive term for how many physical connections (Ethernet interfaces) are used to connect a device to a network. It's very common for a load balancer that uses a routing method (NAT) to have a two-arm configuration. Proxy based load balancers (SNAT) commonly use a one-arm configuration.

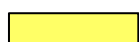
One-Arm	The load balancer has one physical network card connected to one subnet
Two-Arm	The load balancer has two network interfaces connected to two subnets – this can be achieved by using two physical network cards or by assigning two addresses to one physical network card

What Load Balancing Methods are Supported?

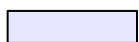
The Loadbalancer.org appliance is one of the most flexible load balancers on the market. The design of the appliance allows different load balancing modules to utilize the core high availability framework of the appliance. Multiple load balancing methods can be used at the same time or in combination with each other.

Layer 4	DR (Direct Routing)	Ultra-fast local server based load balancing <i>Requires handling the ARP issue on the Real Servers</i>	1 ARM
Layer 4	NAT (Network Address Translation)	Fast Layer 4 load balancing, the appliance becomes the default gateway for the Real Servers	2 ARM
Layer 4	TUN	Similar to DR but works across IP encapsulated tunnels	1 ARM
Layer 7	SSL Termination (Pound & STunnel)	Usually required in order to process cookie persistence in HTTPS streams on the load balancer <i>Processor intensive</i>	1 or 2 ARM
Layer 7	SNAT (Source Network Address Translation: HAProxy)	Layer 7 allows great flexibility including full SNAT and WAN load balancing, cookie insertion and URL switching <i>Not as fast as Layer 4</i>	1 or 2 ARM

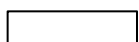
Key:



Recommended for high performance fully transparent and scalable solutions



Recommended if HTTP cookie persistence is required, also used for several Microsoft applications such as Exchange, Sharepoint, Terminal Services (Connection Broker & RDP Cookie persistence) that use SNAT mode



Only required for Direct Routing implementation across routed networks (rarely used)

Loadbalancer.org Recommendation:

Where feasible, one-arm direct routing (DR) mode is our recommended method because it's a very high performance solution with little change to your existing infrastructure.



Sometimes it's not possible to use DR mode. The two most common reasons being: if the application cannot bind to the RIP & VIP at the same time; or if the host operating system cannot be modified to handle the ARP problem (see page 29-44 for more details).

A second option is Network Address Translation (NAT) mode. This is a fairly high performance solution but it requires the implementation of a two-arm infrastructure with an internal and external subnet to carry out the translation (the same way a firewall works). Network engineers with experience of hardware load balancers will have often used this method.

The third option is Source Network Address Translation (SNAT) mode using HAProxy. If your application requires that the load balancer handles cookie insertion, RDP cookies, Session Broker integration or SSL termination then this option is appropriate. This can be deployed in one-arm or two-arm mode and does not require any changes to the application servers. HAProxy is a high-performance solution that operates as a full proxy, but due to this it cannot perform as fast as the layer 4 solutions.



If your application doesn't maintain its own state information then you may need to use cookie insertion to maintain server persistence (affinity).

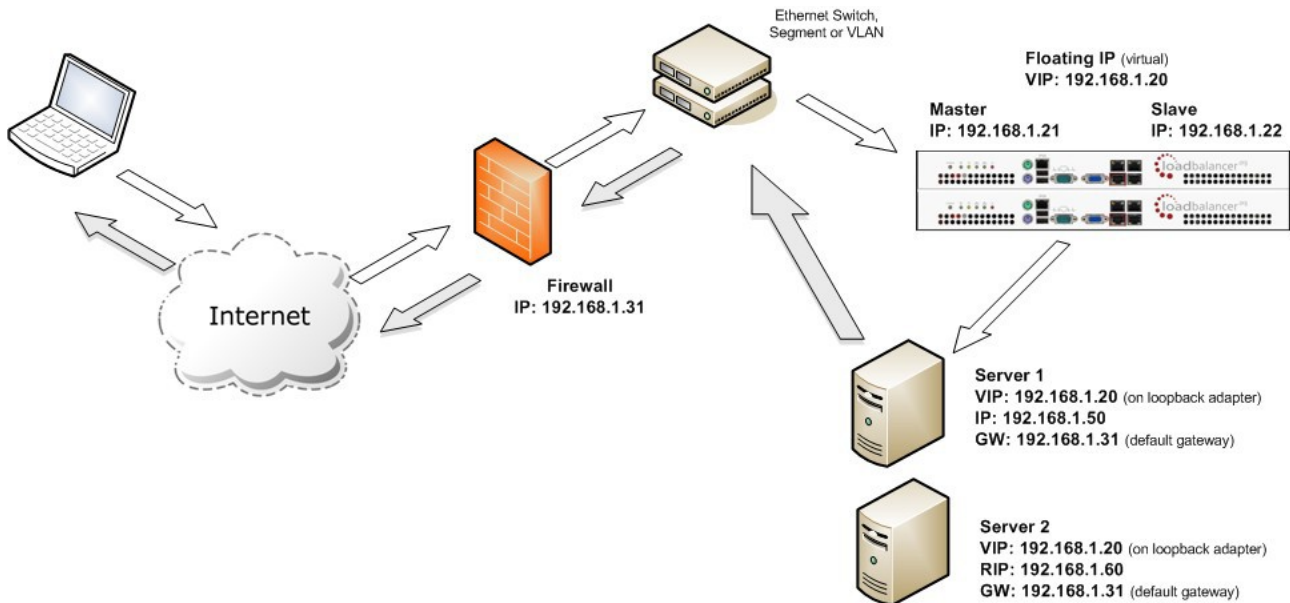
The following sections describe these configurations in more details.



IMPORTANT NOTE – If you are using Microsoft Windows Real Servers (i.e. back-end servers) make sure that Windows NLB (Network Load Balancing) is completely disabled to ensure that this does not interfere with the operation of the load balancer.

Direct Routing (DR)

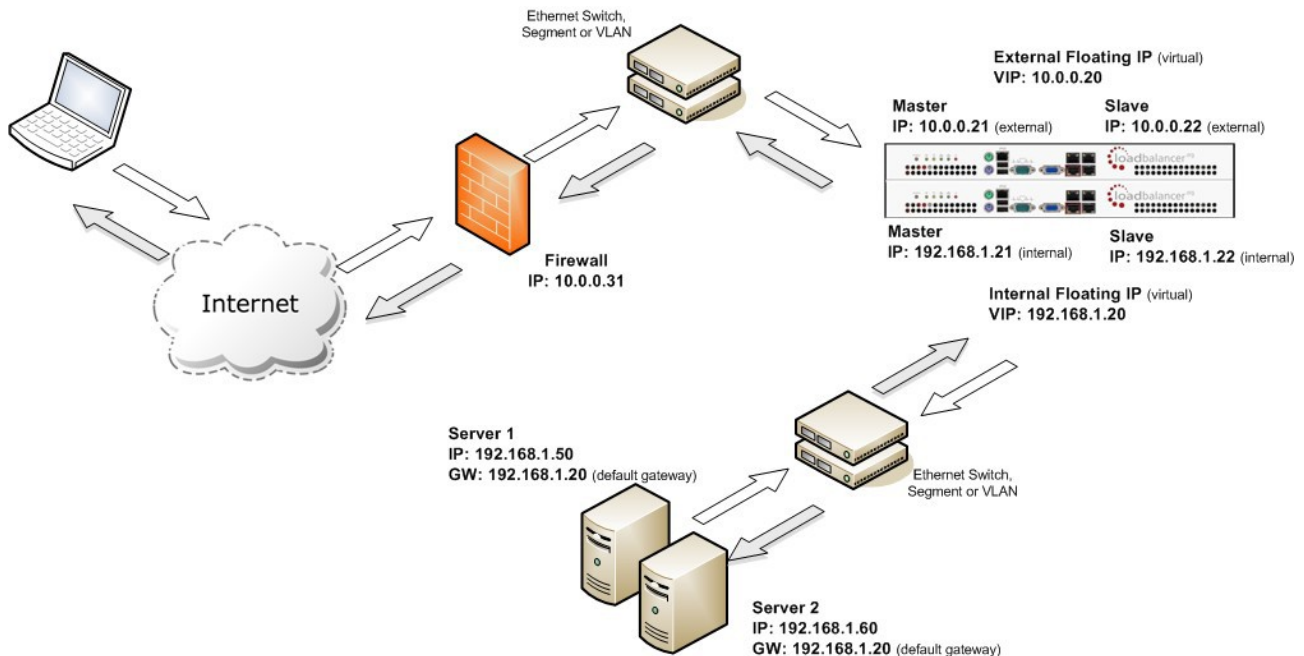
One-arm direct routing (DR) mode is a very high performance solution that requires little change to your existing infrastructure. N.B. Brocade & A10 Networks call this Direct Server Return and F5 call it N-Path.



- Direct Routing works by changing the destination MAC address of the incoming packet on the fly which is very fast
- However, this means that when the packet reaches the Real Server it expects it to own the VIP. This means you need to make sure the Real Server responds to both its own IP and the VIP, but does not respond to ARP requests for the VIP. Please refer to page 29-44 for more details on resolving the ARP problem
- On average, DR mode is 8 times quicker than NAT for HTTP, 50 times quicker for Terminal Services and much, much faster for streaming media or FTP
- Load balanced services can be configured directly on the interface (normally eth0) with no additional IP address. However, when using a clustered pair, all load balanced Virtual Servers/Services must be configured on a floating IP to enable failover & failback between master & slave
- The Virtual Server/Service and Real Servers must be in the same switch fabric / logical network. They can be on different subnets, provided there are no router hops between them. If multiple subnets are used, an IP address in each subnet must be defined on the load balancer
- Port translation is not possible in DR mode i.e. having a different RIP port than the VIP port
- DR mode is transparent, i.e. the Real Server will see the source IP address of the client
- Administration of the load balancer is via any active IP address (on port 9080)

Network Address Translation (NAT)

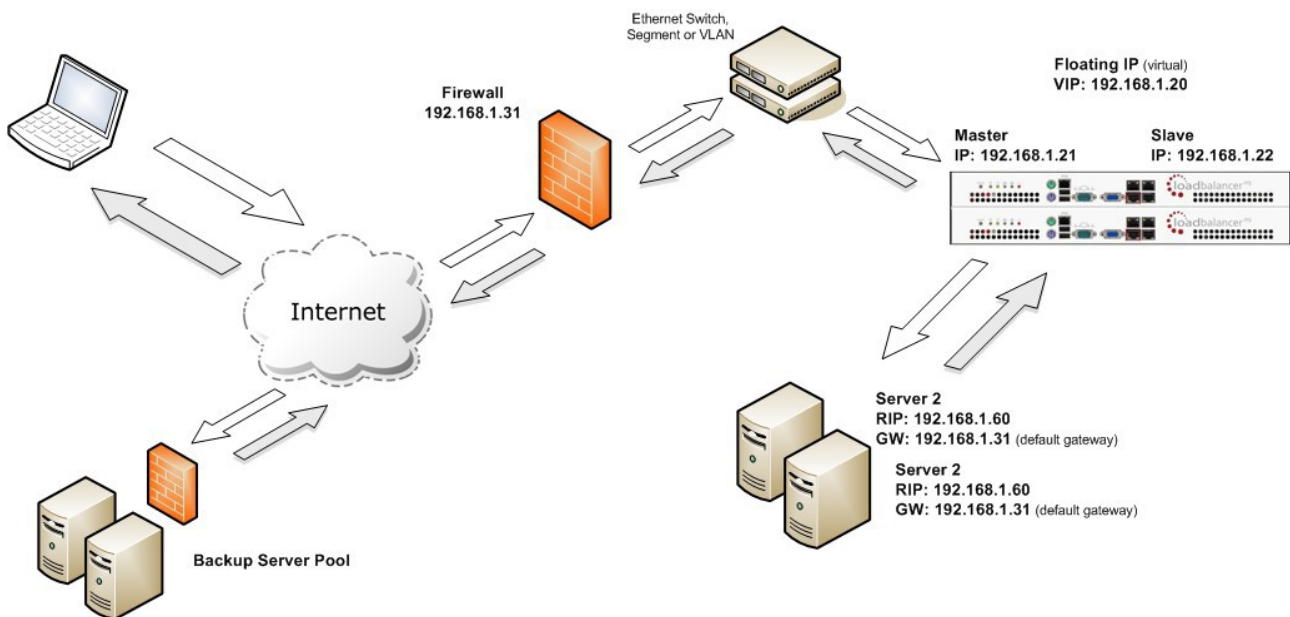
Sometimes it's not possible to use DR mode. The two most common reasons being: if the application cannot bind to the RIP & VIP at the same time; or if the host operating system cannot be modified to handle the ARP problem. The second choice is Network Address Translation (NAT) mode. This is also a high performance solution but it requires the implementation of a two arm infrastructure with an internal and external subnet to carry out the translation (the same way a firewall works).



- In two-arm NAT mode the load balancer translates all requests from the external Virtual Server/Service to the internal Real Servers
- Normally eth0 is used for the *internal* network and eth1 is used for the *external* network although this is not mandatory. If the Real Servers require Internet access, Autonat should be enabled using the WUI option: *Cluster Configuration > Layer 4 – Advanced Configuration*, select the external interface
- When the wizard is used, Real Servers are automatically given access to the Internet through the load balancer (via Auto-NAT)
- The Real Servers must have their default gateway configured to point at the load balancer. When master & slave units are used, a floating IP must be used to enable failover
- Load balanced services can be configured directly on the interface (normally eth0) with no additional IP address. However, when using a clustered pair all load balanced Virtual Servers/Services must be configured on a floating IP to enable failover & failback between master & slave
- Normally the Virtual Server/Service and Real Servers should be located on different subnets within the same logical network (i.e. no router hops) and the load balancer should have an IP address in each subnet. *N.B. It is possible to have Real and Virtual Servers/Services in the same subnet – please search for 'One-Arm (Single Subnet) NAT Mode' in the administration manual. N.B. It is possible to have the IIS servers located on routed subnets, but this would require a customized routing configuration on the IIS servers and is not recommended*
- If you want Real Servers to be accessible on their own IP address for non-load balanced services, e.g. SMTP or RDP, you will need to setup individual SNAT and DNAT firewall script rules for each Real Server. Please search for '*Enabling Access to non Load-Balanced Services*' in the administration manual for more details
- NAT mode is transparent, i.e. the Real Server will see the source IP address of the client
- Administration of the load balancer is via any active IP address (on port 9080)
- Port translation is possible in NAT mode, i.e. VIP:80 → RIP8080 is allowed

Source Network Address Translation (SNAT)

If your application requires that the load balancer handles cookie insertion then you need to use the SNAT configuration. This mode is also used with numerous Microsoft applications such as Exchange, Sharepoint, Lync etc.



This mode has the advantage of a one arm configuration and does not require any changes to the application servers. However, since the load balancer is acting as a full proxy it doesn't have the same raw throughput as the layer 4 methods.

The network diagram for the Layer 7 HAProxy SNAT mode is very similar to the Direct Routing example except that no re-configuration of the Real Servers is required. The load balancer proxies the application traffic to the servers so that the source of all traffic becomes the load balancer.

- As with other modes a single unit does not require a Floating IP, although it is recommended to make adding a slave unit easier
- SNAT is a full proxy and therefore load balanced Real Servers do not need to be changed in any way
- Because SNAT is a full proxy any server in the cluster can be on any accessible subnet including across the Internet or WAN
- SNAT is not transparent by default, i.e. the Real Servers will not see the source IP address of the client, they will see the load balancers IP address. If required, this can be solved by either enabling TProxy on the load balancer, or for HTTP, using X-forwarded-For headers. Please search for '*Using Transparent Proxy*' and '*Set X-Forwarded-For Header*' in the administration manual for more details.



For detailed configuration examples using various modes, please refer to chapter 10 of the full administration manual available at the following URL:

<http://www.loadbalancer.org/pdf/loadbalanceradministrationv7.pdf>

High-Availability Configuration of two Loadbalancer.org Appliances

Loadbalancer.org's recommended configuration is to use a clustered pair of load balancers to provide a highly available and resilient load balancing solution. In this configuration, the pair communicates via a heartbeat to determine if the master node is active. Should the master node suffer a failure, the slave will immediately take over any resources hosted on the shared floating IP addresses.



Using a single load balancer introduces a single point of failure for your infrastructure so it is strongly recommended to use two appliances in a clustered pair.

Clustered Pair Configuration Methods

There are two ways to configure a clustered pair; either by using the wizard or configuring the units manually.

Using the Wizard

If the wizard is used, the slave is configured first and then the master. This ensures that both units can first communicate via the selected link and also that settings that are configured on the master and correctly replicated to the slave.



For more details on using the wizard and an example, please refer to pages 24-25.

Manual Configuration

If the master is configured first without using the wizard and the slave is added later, the following points should be considered:

- The role of the unit to be used as the slave must be set to 'slave' using the drop-down located under *Local Configuration > Hostname & DNS* in the WUI. Once updated, the hostname will be automatically set to 'lbslave'. This can also be changed to a custom value if required
- The IP address of the slave must be defined on the master using the *Slave Load Balancer Address* field located under *Cluster Configuration > Heartbeat Configuration* in the WUI
- The *Synchronize Configuration with peer* option located under *Maintenance > Backup & Restore* in the WUI should be used to force replication to the slave so both units are correctly synchronized
- Once the IP address is set and synchronization has occurred, heartbeat must be restarted on the master unit as directed. This can be done using the WUI option: *Maintenance > Restart Services* and clicking **Restart Heartbeat**



For more details please refer to the section *Adding a Slave Unit after the Master has been Configured* in the full administration manual.

Virtual Appliance

The following sections detail the various VA's available, where they can be downloaded and how they are deployed.

Supported Hypervisors

Currently, the Virtual appliance is available for the following hypervisors:

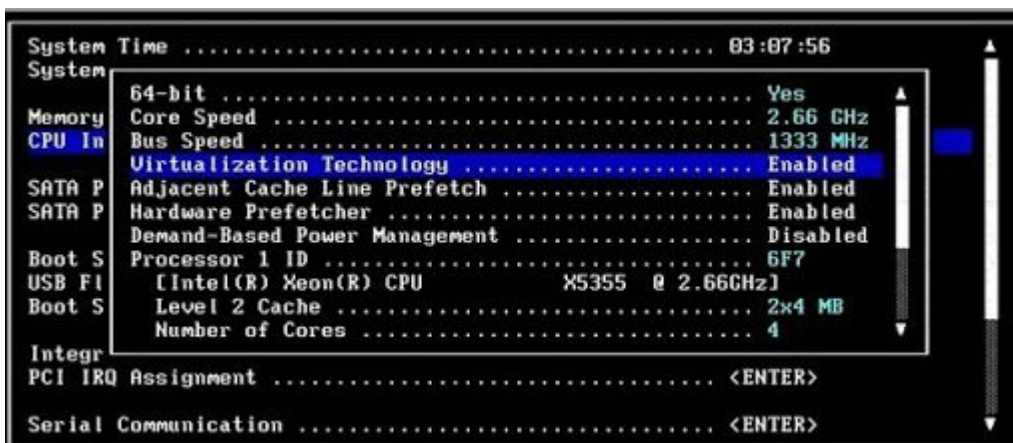
- VMware (Player/Workstation/Server & vSphere ESX/ESXi)
- Microsoft Hyper-V

Host Requirements

To run the Loadbalancer.org Enterprise VA (whatever Hypervisor is being used) the following basic server specifications must be met:

- A compatible 64bit CPU
- Virtual Technology hardware support – either Intel-VT or AMD-V compliant CPU's

For an Intel based server, VT must be enabled in the BIOS as shown in the example below:



If your server is unable to support 64bit guests, an error message will be displayed when attempting to start the VA.

Downloading the Appliance

All downloads are accessible from the following location:

<http://www.loadbalancer.org/downloads.php>

*N.B. To access the downloads you'll need to enter your name & email address, select the Hypervisor type (VMware or Hyper-V) and specify the application that you'll be load balancing. Once the required details are entered, click **Submit**, we'll then send you an email that includes the various links.*

Any information provided is 100% confidential. We may follow up with an email to see how you are getting on with the trial and offer assistance but under no circumstances will Loadbalancer.org send you other promotional material or share your information with a third party.

VMware Hypervisors

Three downloads are available as listed below:

1) VMware Player, Server & Workstation

- Download **LBVMv7.zip** (virtualHW.version = 4)
- For VMware server v2.x you can highlight the VA after import and select Upgrade to Hardware v7, for VMware Player, Workstation & Server v1.x no further steps are required

2) vSphere 4.x & ESX 4.x / ESXi 4.x and vSphere 5.x & ESXi 5.x

- Download **LBVMESXv7.zip** (ovf v1.0, hardware v7)

3) Virtual Infrastructure Client 2.5.x & ESX 3.x / ESXi 3.x

In this case you have two choices:

- Download **LBVMESXv7_ovf0.9.zip** (ovf v0.9, hardware v4)
or
- Download **LBVMv7.zip** and use the converter for your environment to convert to a compatible VA



NOTE: Due to Vmxnet3 driver compatibility limitations with the various versions of ESX & ESXi only the LBVMESXv7.zip download uses the Vmxnet3 network drivers. The other downloads use E1000 drivers.

Deploying the Virtual Appliance

1. Download & extract the appropriate file (see previous section)
2. deploy the VA -
 - For VMware Server use: **Virtual Machine > Add VM to Inventory**
 - For vSphere use: **File > Deploy ovf Template**
 - For Virtual Infrastructure use: **File > Virtual Appliance > Import**
3. Start the Virtual Appliance, allow a minute for booting
4. Now refer to page 22 onwards for details on setting up the network

VMware Tools

The latest versions of all drivers that are installed when VMware tools are deployed are included by default in the Appliances kernel. Therefore, VMware tools do not need to be installed.

These drivers are kept up to date through periodic updates that are made available for the appliance via Loadbalancer.org's online software update feature.

Microsoft Hyper-V

One download is available as listed below, this can be used for all versions of Hyper-V.

1) Windows 2008 R2 & Windows 2012

- Download **LBVMHYPER-Vv7.zip**

2) Windows 2012 R2 & Later

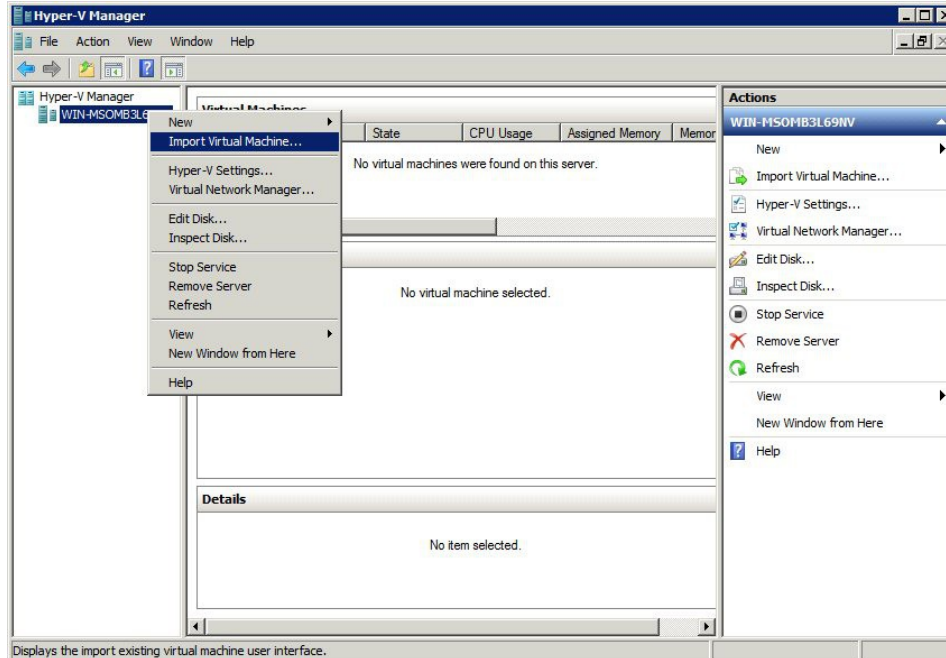
- Download **LBVMHYPER-V3v7.zip**

Deploying the Virtual Appliance

The following two sections explain how the appliance is deployed under Windows 2008 and Windows 2012.

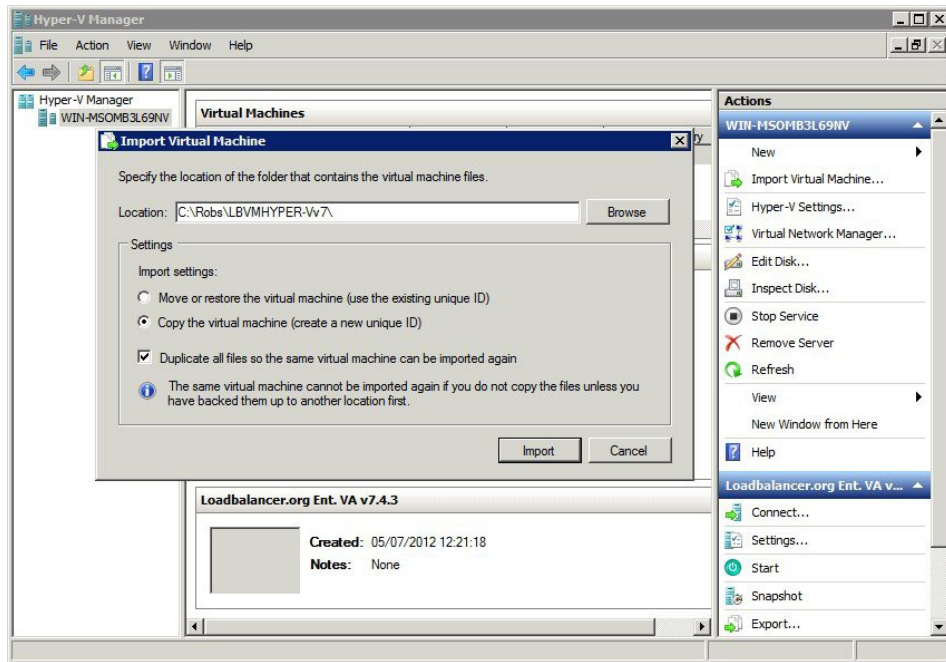
Windows 2008 R2

1. Download & extract the compressed archive
2. Start Hyper-V Manager, then using the right-click menu or the Actions pane select **Import Virtual Machine** as shown below:

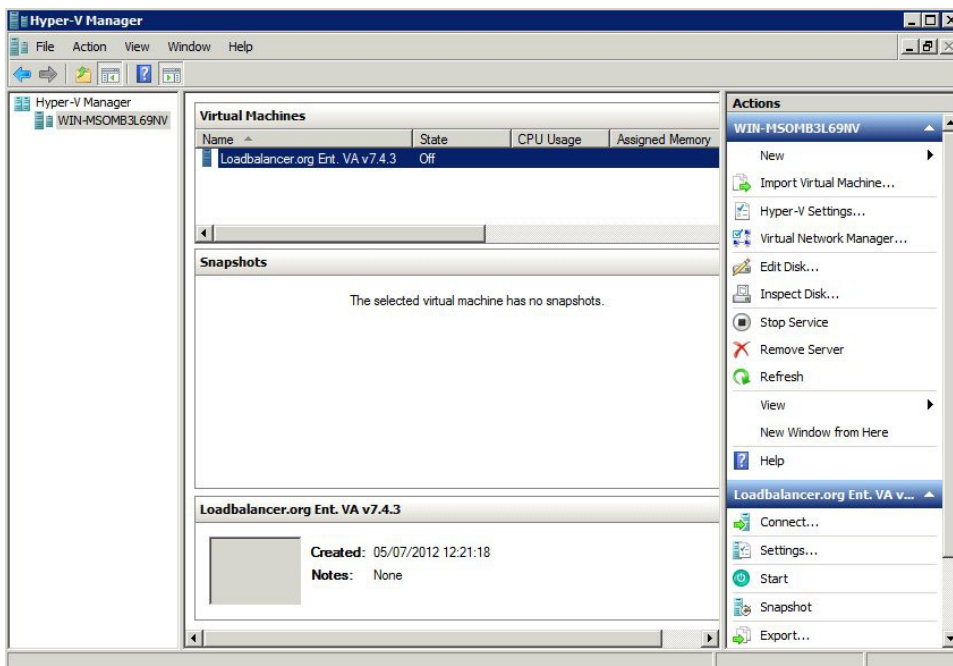


3. Click **Next**

4. Browse to the location of the extracted download and select the folder LBVMHYPER-Vv7 as shown below:



5. Select the option "Copy the virtual machine (create a new unique ID)" and also select the "Duplicate all files so the same virtual machine can be imported again" check-box, click **Import**
6. The import will now start, once complete the new appliance will appear in the Virtual Machine list as shown below:



7. The appliance has 4 NIC cards, to connect these right-click the appliance and select **Settings** then for each Network Adapter select the required network
8. Right-click and select **Start** to power up the appliance, allow a minute to boot
9. Now refer to page 22 onwards for details on setting up the network

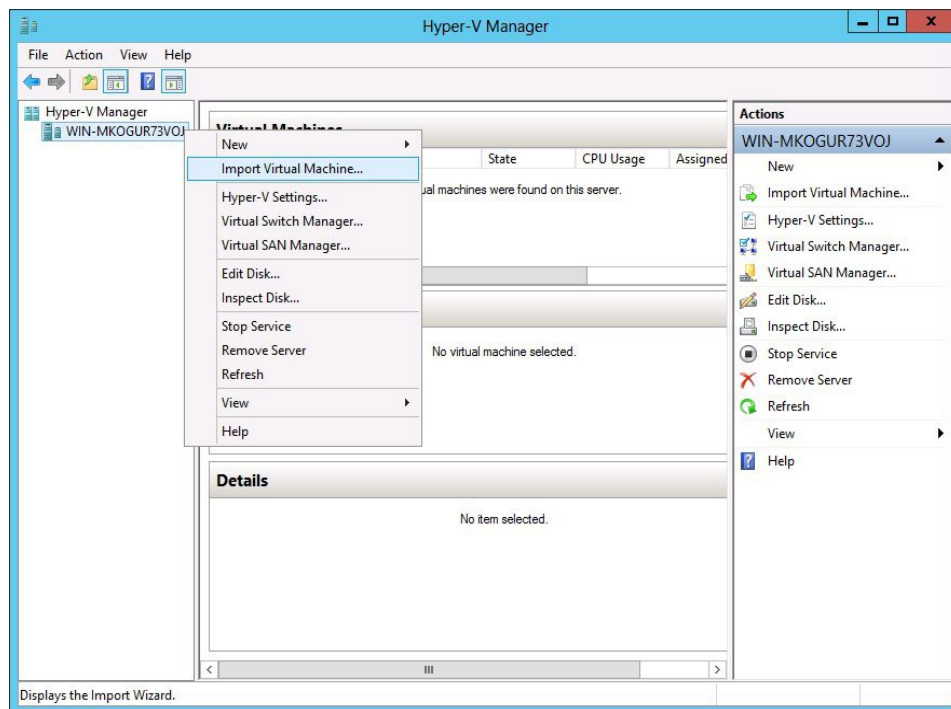
If you're deploying a clustered pair, you'll first need to do one of the following steps before importing the second virtual machine. If this is not done, the second virtual machine cannot be deployed because the disk from the first import already exists, and there will therefore be a conflict:

- Shutdown the first VM and modify the name of the disk
or
- Change the default file location using the Hyper-V *Settings* option in the Actions pane

Once one of the above steps is done, repeat steps 2-9 above to create the second virtual machine.

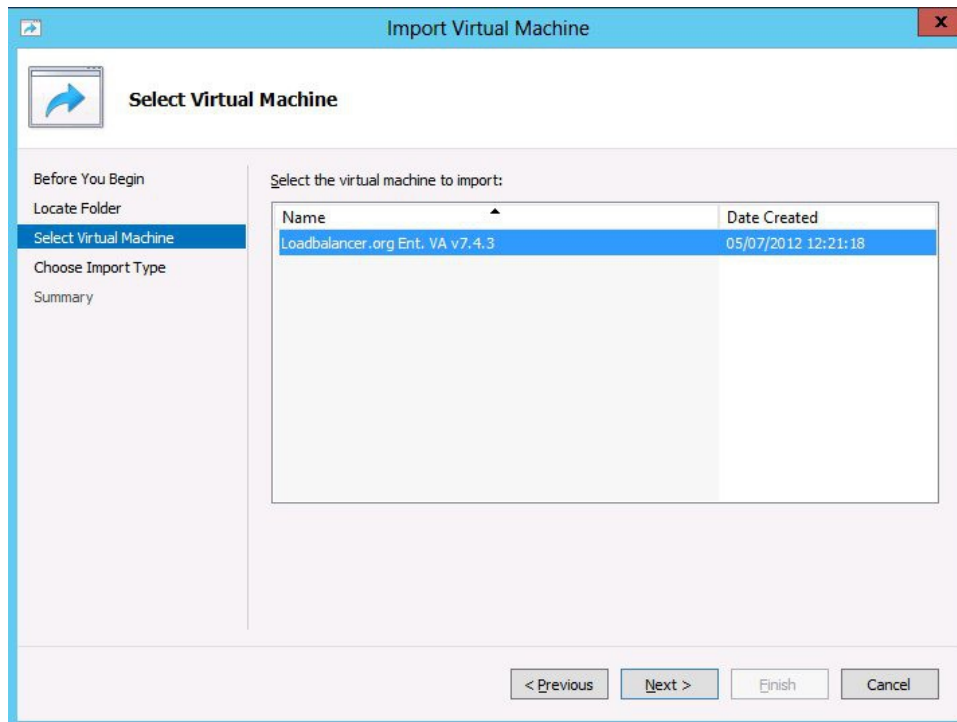
Windows 2012

1. Download & extract the compressed archive
2. Start Hyper-V Manager, then using the right-click menu or the Actions pane select **Import Virtual Machine** as shown below:

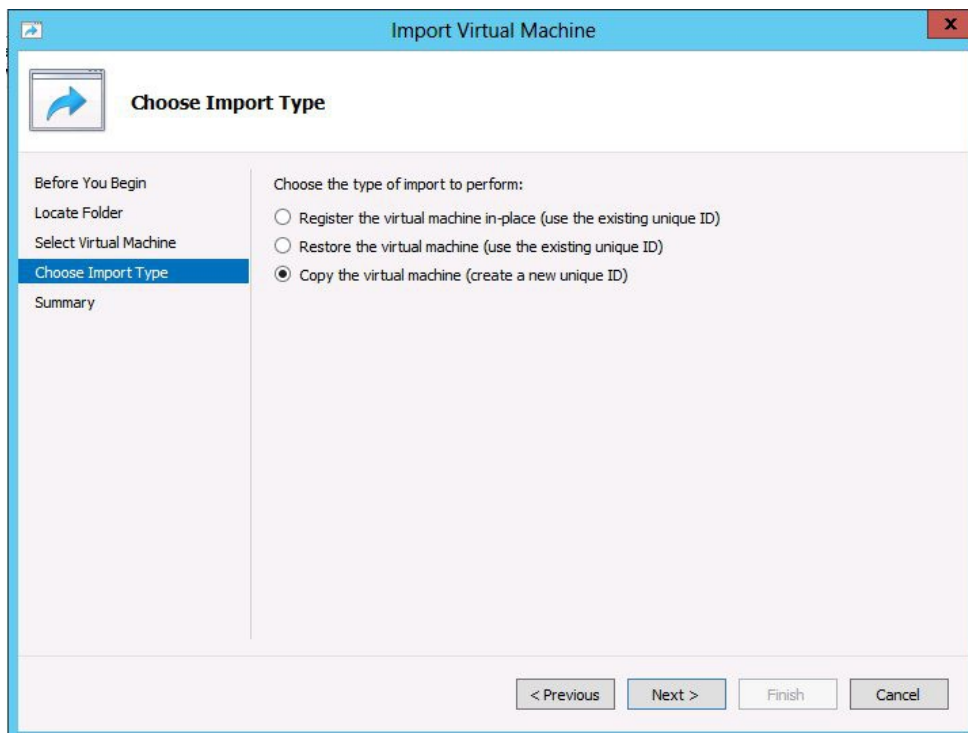


3. Click **Next**
4. Now browse to the location of the extracted download and select the folder LBVMHYPER-Vv7

5. Click **Next**, the following screen will be displayed:



6. Click **Next**, the following screen will be displayed:



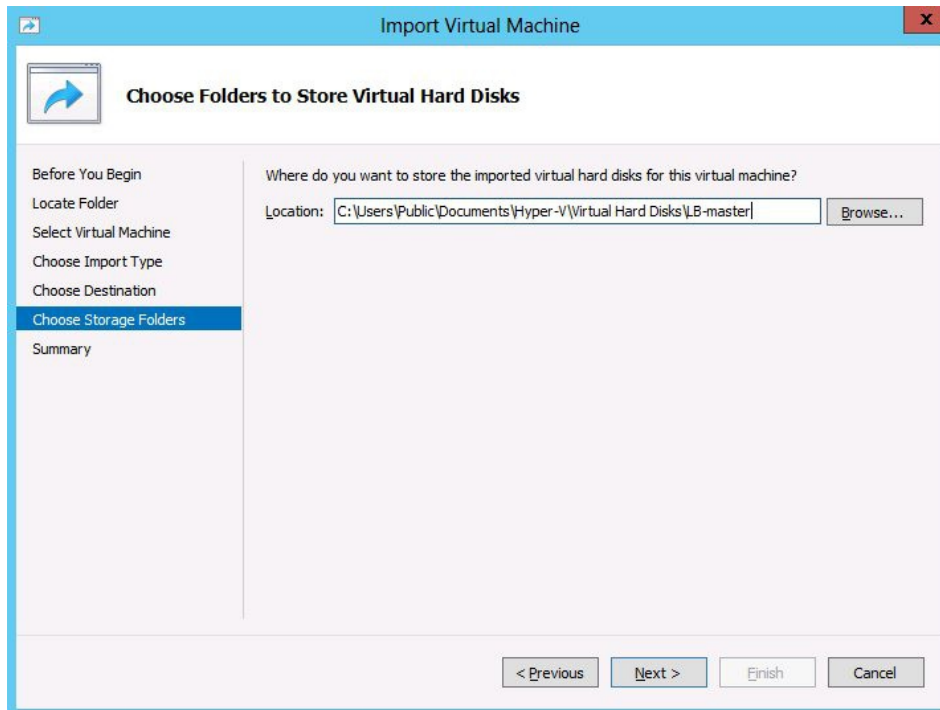
7. Make sure that 'Copy the virtual machine (create a new unique ID)' is selected and click **Next**, the following screen will be displayed:

The screenshot shows the 'Import Virtual Machine' wizard window. The title bar says 'Import Virtual Machine'. The main window has a blue header with a blue arrow icon and the text 'Choose Folders for Virtual Machine Files'. On the left, there is a vertical list of steps: 'Before You Begin', 'Locate Folder', 'Select Virtual Machine', 'Choose Import Type', 'Choose Destination' (which is highlighted in blue), 'Choose Storage Folders', and 'Summary'. The main area contains the following text: 'You can specify new or existing folders to store the virtual machine files. Otherwise, the wizard imports the files to default Hyper-V folders on this computer, or to folders specified in the virtual machine configuration.' Below this text is a checkbox labeled 'Store the virtual machine in a different location' which is currently unchecked. There are three text input fields, each with a 'Browse...' button to its right. The first field is labeled 'Virtual machine configuration folder:' and contains the text 'C:\ProgramData\Microsoft\Windows\Hyper-V\'. The second field is labeled 'Snapshot store:' and contains the text 'C:\ProgramData\Microsoft\Windows\Hyper-V'. The third field is labeled 'Smart Paging folder:' and contains the text 'C:\ProgramData\Microsoft\Windows\Hyper-V\'. At the bottom of the window, there are four buttons: '< Previous', 'Next >', 'Finish', and 'Cancel'.

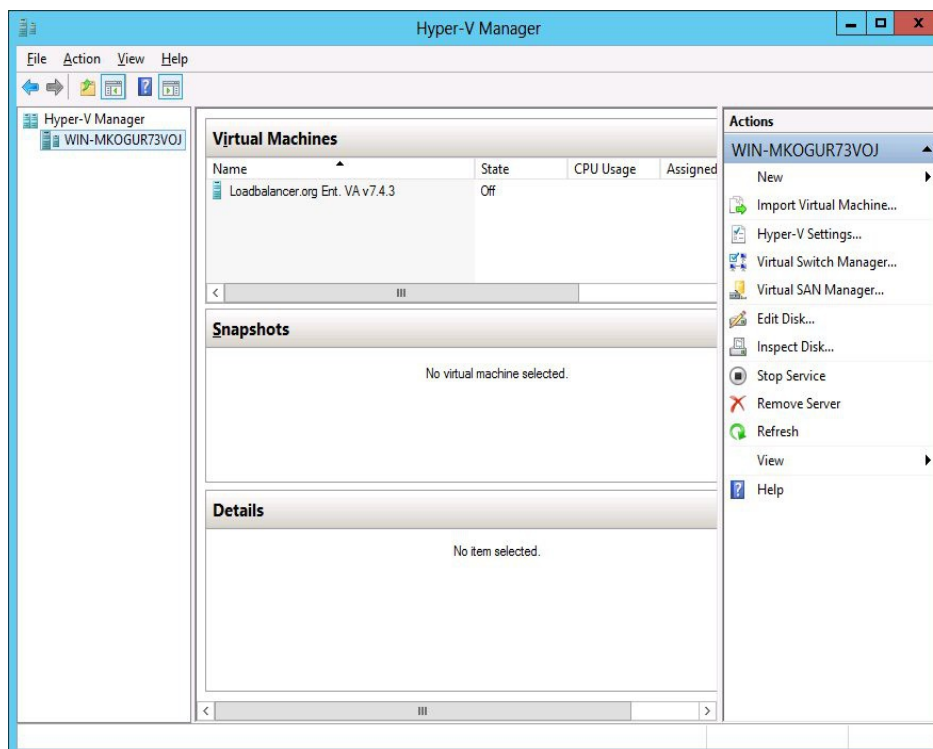
8. Tick the check-box 'Store the Virtual Machine in different location', then define a suitable location for the virtual machines files, e.g. :

This screenshot is similar to the previous one, but the checkbox 'Store the virtual machine in a different location' is now checked. Additionally, the text input fields now contain a specific path: 'C:\ProgramData\Microsoft\Windows\Hyper-V\LB-master'. The 'Browse...' buttons are still present next to each field. The rest of the interface, including the step list on the left and the navigation buttons at the bottom, remains the same.

9. Click **Next**, then define a location for the hard disk files, e.g. :



10. click **Next**, then click **Finish** to complete the import process. Once complete, the load balancer will appear in the Virtual Machines list as shown below:



11. The appliance has 4 NIC cards, to connect these right-click the appliance and select Settings then for each Network Adapter select the required network
12. Highlight the new load balancer and start it either by using the right-click menu or the Actions pane

13. Now refer to page 22 onwards for details on setting up the network

If you're deploying a clustered pair, repeat steps 2-13 for the slave unit, making sure that a different folder location is selected in steps 8 & 9.

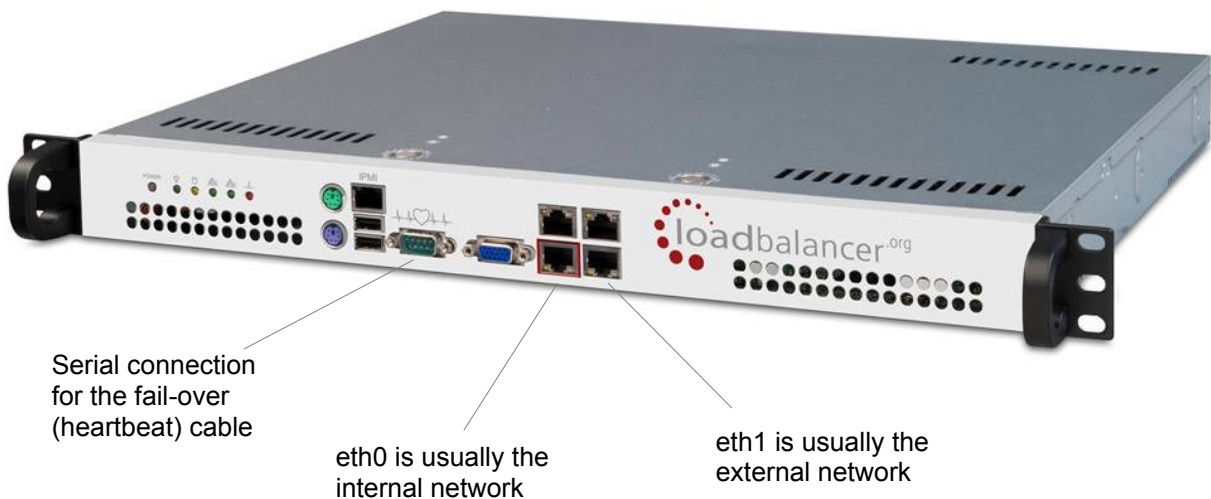
Linux Integration Services

The latest versions of all required drivers that are installed when Linux Integration Services are deployed are included by default in the Appliances kernel. Therefore, the installation of Linux Integration Services on the VA is not required.

These drivers are kept up to date through periodic updates that are made available for the appliance via Loadbalancer.org's online software update feature.

Physical Appliance (For Reference)

- Remove all packaging
- Rack mount the appliance if required
- The power supply is an auto sensing unit (100v to 240v)
- Connect the power lead from the power socket to the mains or UPS
- Connect a network cable from the switch to one of the Ethernet ports – typically *eth0* but this is not mandatory
- If using a two-armed configuration connect another cable to a second Ethernet port – typically *eth1* but this is not mandatory (*N.B. the Enterprise and Enterprise R16 have 2 ports, the MAX and 10G have 4 ports*)
- For a clustered hardware pair connect a serial cable (1 supplied with each appliance) between the two appliances – if this is not possible (e.g. different rack) heartbeat must be configured to use ucast over the network
- Attach a monitor to the VGA port and keyboard to the USB or PS/2 port
- Check mains power is on and press the power switch to start the appliance (the fans should start & front panel LED's should light)
- Allow a minute for booting



N.B. The above image shows the Enterprise MAX, for connecting other models please refer to the Appendix.

Initial Network Interface Configuration

By default the load balancer is pre-configured with the following IP address & subnet mask:

192.168.2.21 / 255.255.255.0

This default address can be changed at the console in two ways:

- Using the built-in Network Setup Wizard
- Using traditional Linux commands

Using the Network Setup Wizard

To run the wizard, login to the console of the appliance as the 'setup' user. This is explained in the initial console start-up message as shown below:

```
Welcome to the Loadbalancer.org appliance.

To perform initial network configuration, log in to the console as
Username: setup
Password: setup

To access the web interface and wizard, point your browser at
http://192.168.2.21:9080/
or
https://192.168.2.21:9443/

lbmaster login: _
```

- login to the console:
Username: setup
Password: setup
- Once logged in, enter the IP address /mask, default gateway & DNS servers at the prompts as shown below:

```
Loadbalancer.org basic network set up

Static IP address (eg. 192.168.0.26)      : 192.168.67.23/18
Default gateway (eg. 192.168.0.1)        : 192.168.64.1
DNS Servers
    Primary (eg. 192.168.0.250)          : 192.168.64.1
    Secondary (Leave blank to omit)       :
```

After the required settings have been entered, a summary will be presented along with details of how to access the WUI as shown below:

```
Summary of settings
  Static IP address:      192.168.67.23/18
  Default gateway:       192.168.64.1
  DNS servers:           192.168.64.1

You may now connect the eth0 network interface to your switch, and
continue configuration through the web interface on:

    http://192.168.67.23:9080/lbadmin/

Press any key...
```

As mentioned in the text the IP address is now configured for interface eth0.

IP addresses for the other interfaces can now be configured using the WUI option: *Local Configuration > Network Interface Configuration* (to access the WUI please refer to pages 24 and 26) or by using Linux commands as explained in the following section.

Using Linux Commands

To set the IP address, login to the console or an SSH session as root:

Username: root
Password: loadbalancer

set the IP address using the following command:

```
ip addr add <IP address>/<mask> dev eth0
```

e.g.

```
ip addr add 192.168.1.100/24 dev eth0
```

set the default gateway using the following command:

```
route add default gw <IP address> <interface>
```

e.g.

```
route add default gw 192.168.1.254 eth0
```

N.B. Setting the IP address in this way is temporary, the IP address *MUST* be set via the WUI to make this permanent otherwise settings will be lost after a reboot

Accessing the Web User Interface (WUI)

- Using a web browser, access the WUI using the following URL:

http://192.168.2.21:9080/lbadmin/

(replace 192.168.2.21 with your IP address if it's been changed)

N.B. If you prefer you can use the HTTPS administration address:

https://192.168.2.21:9443/lbadmin/

(replace 192.168.2.21 with your IP address if it's been changed)

- Login to the WUI:

Username: loadbalancer

Password: loadbalancer

- Once logged in, you'll be asked if you want to run the web based setup wizard. The wizard asks a series of questions in order to setup the appliance with an initial basic configuration. If you prefer to configure the appliance manually, simple select 'no' to the question.

CLUSTER CONFIGURATION >

The Loadbalancer.org Setup Wizard has not been run yet. You can run it now or anytime later with
Cluster Configuration > Setup Wizard

Do you want to run it now?

☐ yes ☐ no

Configuring the Loadbalancer.org Appliance Using the Web Based Wizard

The wizard can be used to setup a single layer 4 DR mode or NAT mode Virtual Service with a single Real Server. The wizard can be used for both single unit deployments and clustered pair deployments. *N.B. The wizard cannot currently be used to configure layer 7 services*

Outline steps – Single unit deployments:

- Set the IP address using one of the methods described earlier
- Using the WUI run the Wizard (*Cluster Configuration > Setup Wizard*)

Outline steps – Clustered pair deployments:

- Set the IP address on both units using one of the methods described earlier
- For hardware appliances connect the serial cable between both units
- Using the WUI on the slave unit run the Wizard (*Cluster Configuration > Setup Wizard*)
- Now run the Wizard on the master unit to complete the process

Example Answers Using the Wizard for a Two-Arm NAT Configuration (Single Unit)

The following example covers setting up a layer 4 NAT mode Virtual Service with one Real Server. Additional Virtual Services (VIPs) and Real Servers (RIPs) can then be added using the WUI.

SETUP WIZARD

Is this unit part of an HA-pair?

☐ yes ☒ no

Will the load balancer form part of a one armed set-up (i.e. same subnet as servers)?

☐ yes ☒ no

Then the load balancer will form part of a two-armed set-up. (See Quickstart guide for further explanation.)

We will now configure the load balancer's network interfaces:

Enter the IP address for the INTERNAL interface eth0 (CIDR format):

192.168.2.120/24

Enter the IP address for the EXTERNAL interface eth1 (CIDR format):

10.0.0.120/16

Now we will configure the DNS and gateway settings for the load balancer.

Enter the IP address of the default gateway IP v4:

10.0.0.1

Enter the IP address of the default gateway IP v6:

Enter the IP address of the nameserver:

10.0.0.1

Enter the IP address of the second nameserver:

Now we will configure the first Virtual Service.

Enter the port number for the Virtual Service:

80

Enter the IP address of the first Real Server (backend):

192.168.2.60

Please check that all your settings are correct!

Submit

Check that your settings are correct and click **Submit**. Once the wizard is complete the load balancer is configured and ready to use.

For NAT mode – as used in this example, you must also configure the Real Server to use the appliance as its default gateway. For a single unit this can be done by setting the gateway to be the appliance's internal interface. Once this is done you can test the Virtual Service from the external network. By default, the wizard uses the IP address of the external interface for the VIP, 10.0.0.120 in this example.

You can now use the *Cluster Configuration* menu option in the WUI to easily add more Virtual Services or Real Servers to your configuration as explained on pages 27 & 28.

N.B. When using the wizard, heartbeat is configured to use the serial link. When configuring manually (i.e. without the wizard) the default method is ucast over the network, but this can be changed as required.

To restore manufacturer's settings use the WUI option: *Maintenance > Backup & Restore > Restore Manufacturer's Defaults*. *N.B. this will reset the IP address to 192.168.2.21/24.*

25

Appliance Configuration Using the Web User Interface



For a clustered pair, all configuration must be carried out on the master unit, the slave unit will then be synchronized automatically via the network.

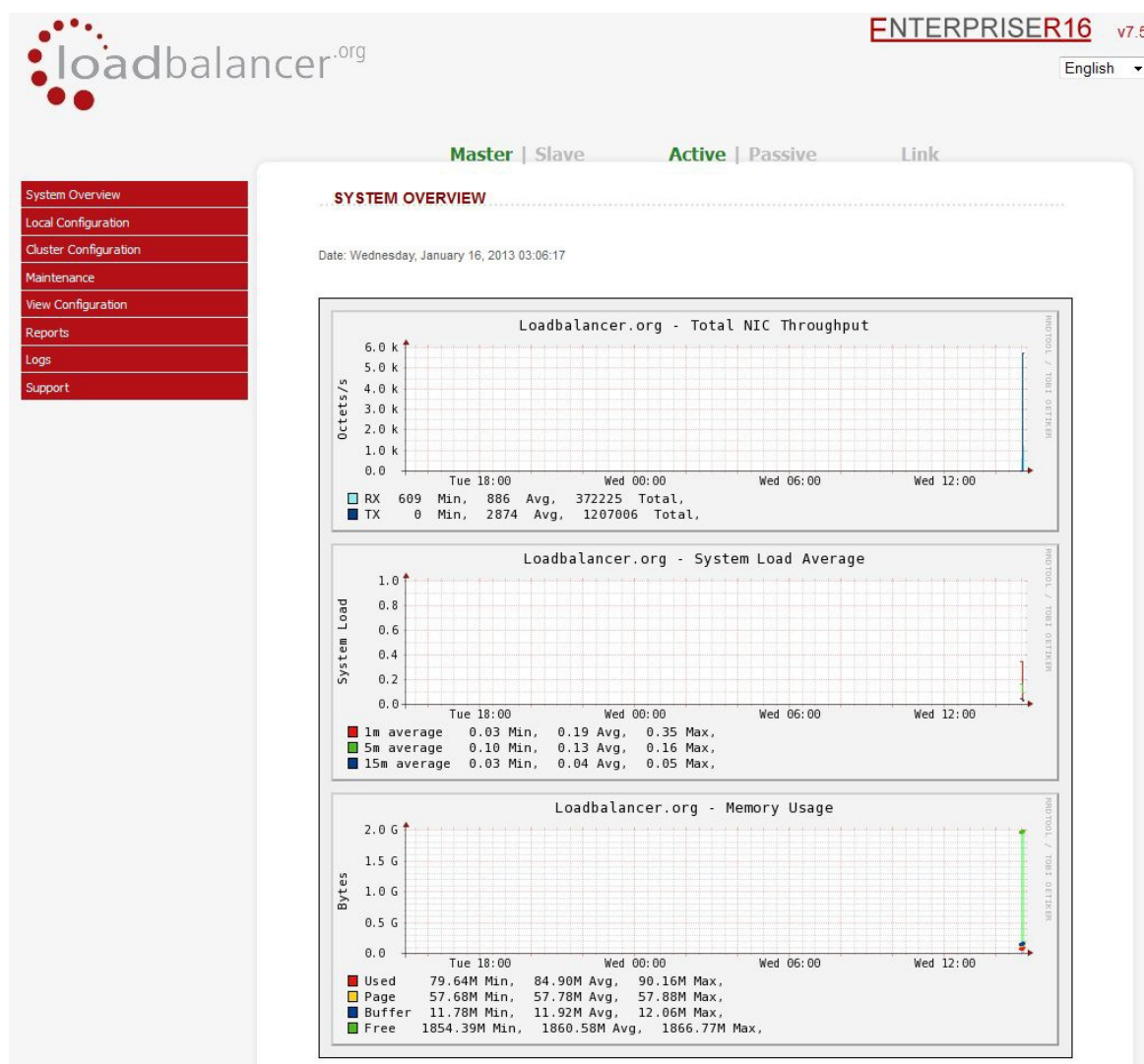
If you have already used the web based wizard, then you will already be using the WUI. From here all administration tasks can be carried out. If not, access the WUI as follows:

With a web browser access the WUI: ***http://192.168.2.21:9080/lbadmin/***

(replace 192.168.2.21 with the correct IP address)

log in to the WUI: ***Username:*** loadbalancer
Password: loadbalancer

N.B. If you prefer you can use the HTTPS administration address: ***https://192.168.2.21:9443/lbadmin/***



All administration tasks can be carried out through the web interface. If root access to the appliance is required for any reason via the console or a SSH session, the following default credentials should be used:

root credentials: ***Username:*** root
Password: loadbalancer

Adding Virtual Services

If used, the wizard sets up a single Virtual Service (VIP). Extra VIPs can be added using the WUI.

To add a layer 4 VIP:

- In the WUI select *Cluster Configuration > Layer 4 – Virtual Services*

N.B. If the wizard was used, you'll see the VIP that was created by the wizard as shown below

LAYER 4 - VIRTUAL SERVICES

[Add a new Virtual Service]

VIP1	10.0.0.120	Port 80/tcp	NAT	[Modify]	[Delete]
------	------------	-------------	-----	------------	------------

- Click [Add a new Virtual Service]

CLUSTER CONFIGURATION > ADD A NEW VIRTUAL SERVICE

Label	<input type="text" value="VIP Name"/>	?
Virtual Service IP address	<input type="text" value="10.0.0.20"/>	?
Virtual Service Ports	<input type="text" value="80"/>	?
Forwarding Method	<input type="text" value="Direct Routing"/>	?
Persistent	<input type="text" value="no"/>	?
Protocol	<input type="text" value="TCP"/>	?
<input type="button" value="Update"/>		

- Define the required settings for the new VIP:
 - Enter the Label, IP address and port(s) for the VIP
 - Select the required forwarding method
 - Enable persistence if required
 - Set the protocol (normally TCP)

Adding Real Servers

If used, the wizard sets up a single Real Server (RIP). Extra RIPs can be added using the WUI.

To add a layer 4 RIP:

- Select *Cluster Configuration > Layer 4 – Real Servers*

N.B. If the wizard was used, you'll see the RIP that was created by the wizard as shown below

LAYER 4 - REAL SERVERS

VIP1	10.0.0.120	Port 80/tcp	NAT	[Add a new Real Server]
RIP1	192.168.2.60		Weight 1	[Modify] [Delete]

- Click [Add a new Real Server]

CLUSTER CONFIGURATION > ADD A NEW REAL SERVER

Label	<input type="text" value="RIP Name"/>	?
Real Server IP Address	<input type="text" value="IPAddress"/>	?
Real Server Port	<input type="text"/>	?
Weight	<input type="text" value="1"/>	?
Minimum Connections	<input type="text" value="0"/>	?
Maximum Connections	<input type="text" value="0"/>	?
<input type="button" value="Update"/>		

- Define the required settings for the new RIP:

- Enter the Label, IP address and port for the RIP

N.B. For DR mode the port field would not be shown since port redirection is not possible in this mode

- Set the weight – this defaults to 1. If Real Servers have different performance specifications, then the weight can be adjusted – a higher number means more traffic is sent to that server
- Leave the Minimum & Maximum Connections set to 0 for unrestricted

Configuring the Real Servers

Depending on the deployment method (DR, NAT or SNAT) used, the actual physical servers may need additional configuration to allow the load balancer to operate correctly. The following sections define what is needed for the each mode.

Configuring the Real Servers for Layer 4 NAT Mode

If you are using a two-arm NAT load balancing method, the Real Server configuration is a simple case of configuring the load balancer as the default gateway. Normally, a floating IP address is added using *Cluster Configuration > Floating IPs*. This is important when a master / slave configuration is used to allow failover & failback of the default gateway address.



Failure to correctly configure the Real Servers default gateway is the most common mistake when using NAT mode.

Configuring the Real Servers for Layer 4 DR Mode

If you are using the one-arm DR load balancing method, each Real Server requires the ARP problem to be solved. All Real Servers must be configured to respond to the VIP address **AND** the RIP address. This is because in DR mode load balanced traffic arrives on the VIP address, whilst other traffic such as health-checks, administration traffic etc. uses the Real Server's IP address.

Detecting the ARP Problem

Attempt to connect to the VIP and then use *Reports > Layer 4 Current Connections* to check whether the connection state is SYN_RECV as shown below. If it is, this is normally a good indication that the ARP problem has not been correctly solved.

REPORTS > LAYER 4 CURRENT CONNECTIONS

```
IPVS connection entries
pro expire state      source          virtual         destination
TCP 00:51  SYN_RECV  192.168.2.7:64763  192.168.2.109:80  192.168.2.99:80
```

Resolving ARP Issues for Linux

Method 1 (using iptables)

You can use iptables (netfilter) on each Real Server to re-direct incoming packets destined for the Virtual Service IP address. To make this permanent, simply add the command to an appropriate start-up script such as /etc/rc.local. If the Real Server is serving multiple VIPs, add additional iptables rules for each VIP.

```
iptables -t nat -A PREROUTING -p tcp -d <VIP> -j REDIRECT
```

e.g.

```
iptables -t nat -A PREROUTING -p tcp -d 10.0.0.21 -j REDIRECT
```

(Change the IP address to be the same as your Virtual Service)

This means redirect any incoming packets destined for 10.0.0.21 (the Virtual Service) locally, i.e. to the primary address of the incoming interface on the Real Server.



Method 1 may not always be appropriate if you're using IP-based virtual hosting on your web server. This is because the iptables rule above redirects incoming packets to the primary address of the incoming interface on the web server rather than any of the virtual hosts that are configured. Where this is an issue, use method 2 below instead.

Also, Method 1 does not work with IPv6 Virtual Services, use method 2 below instead.

Method 2 (using arp_ignore sysctl values)

This is the preferred method as it supports both IPv4 and IPv6. Each Real Server needs the loopback adapter to be configured with the Virtual Services IP address. This address must not respond to ARP requests and the web server also needs to be configured to respond to this address. To set this up follow steps 1-3 below.

Step 1: re-configure ARP on the Real Servers (this step can be skipped for IPv6 Virtual Services)

To do this add the following lines to /etc/sysctl.conf:

```
net.ipv4.conf.all.arp_ignore=1
net.ipv4.conf.eth0.arp_ignore=1
net.ipv4.conf.eth1.arp_ignore=1
net.ipv4.conf.all.arp_announce=2
net.ipv4.conf.eth0.arp_announce=2
net.ipv4.conf.eth1.arp_announce=2
```

Step 2: apply these settings

Either reboot the Real Server or run the following command to apply these settings:

```
/sbin/sysctl -p
```

Step 3: add the Virtual Services IP address to the loopback adapter

Run the following command for each VIP. To make this permanent, simply add the command to an appropriate startup script such as /etc/rc.local.

```
ip addr add dev lo <IPv4-VIP>/32
```

for IPv6 addresses use:

```
ip addr add dev lo <IPv6-VIP>/128
```

N.B. Steps 1 & 2 can be replaced by writing directly to the required files using the following commands:

(temporary until the next reboot)

```
echo 1 > /proc/sys/net/ipv4/conf/all/arp_ignore
echo 1 > /proc/sys/net/ipv4/conf/eth0/arp_ignore
echo 1 > /proc/sys/net/ipv4/conf/eth1/arp_ignore
echo 2 > /proc/sys/net/ipv4/conf/all/arp_announce
echo 2 > /proc/sys/net/ipv4/conf/eth0/arp_announce
echo 2 > /proc/sys/net/ipv4/conf/eth1/arp_announce
```


Resolving ARP issues for Solaris & MAC OS X / BSD

Solaris:

With Solaris the loopback interface does not respond to ARP requests so you just add your VIPs to it.

```
ifconfig lo0:1 plumb  
ifconfig lo0:1 VIP netmask 255.255.255.255 up
```

You will need to add this to the startup scripts for your server.

MAC OS X or BSD:

OS X is BSDish, so you need to use BSDish syntax:

```
ifconfig lo0 alias VIP netmask 255.255.255.255 -arp up
```

You will need to add this to the startup scripts for your server.



Failure to correctly configure the Real Servers to handle the ARP problem is the most common mistake in DR mode configurations.

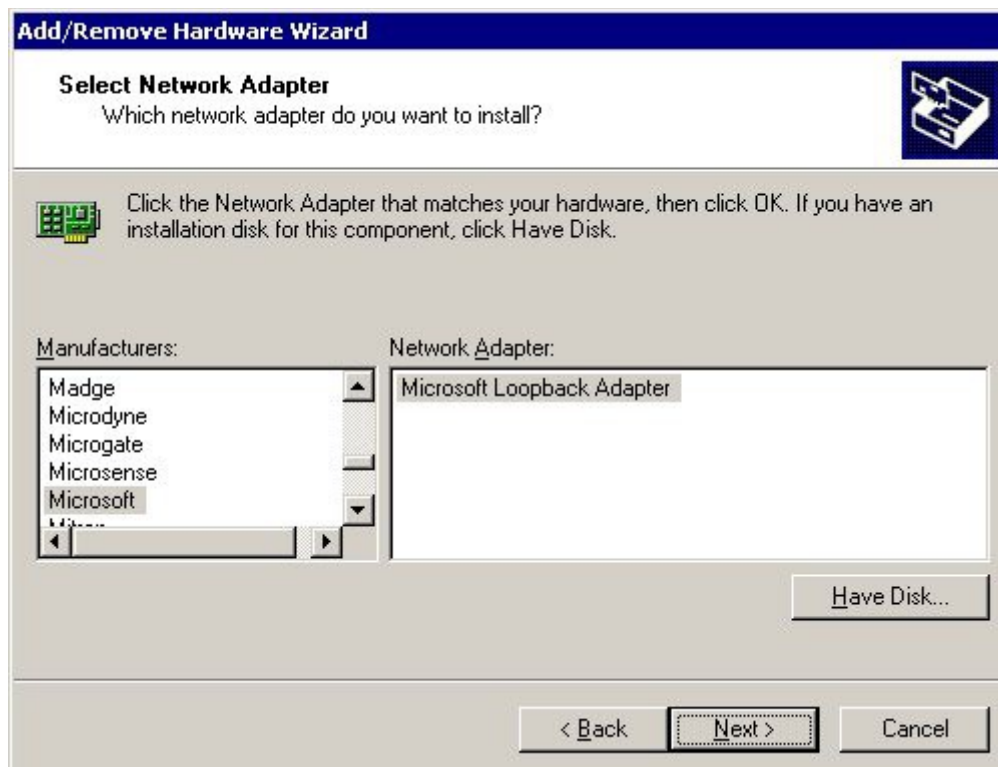
Resolving ARP issues for Windows Servers

Windows Server 2000

Windows Server 2000 supports the direct routing (DR) method through the use of the MS Loopback Adapter to handle the traffic. The IP address on the Loopback Adapter must be set to be the same as the Virtual Services IP address (VIP). If the Real Server is included in multiple VIPs, you can add additional IP addresses to the Loopback Adapter that correspond to each VIP.

Step 1: Install the Microsoft Loopback Adapter

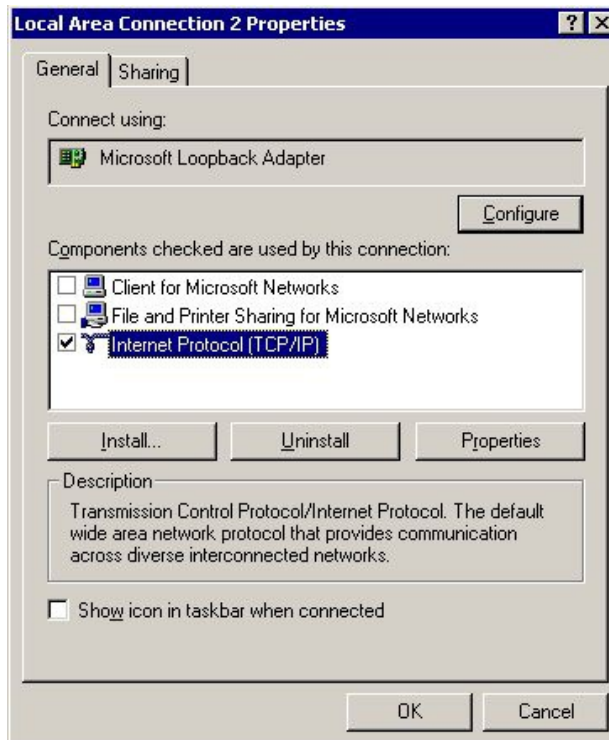
1. Open the Control Panel and double-click **Add/Remove Hardware**
2. Once the Hardware Wizard opens, click **Next**
3. Select **Add/Troubleshoot a device**, click **Next**
4. Once the device list appears, select **Add a new device** at the top of the list, click **Next**
5. Select **No, I want to select the hardware from a list**, click **Next**
6. Scroll down the list and select **Network Adapters**, click **Next**
7. Select **Microsoft & Microsoft Loopback Adapter**, click **Next** as shown below



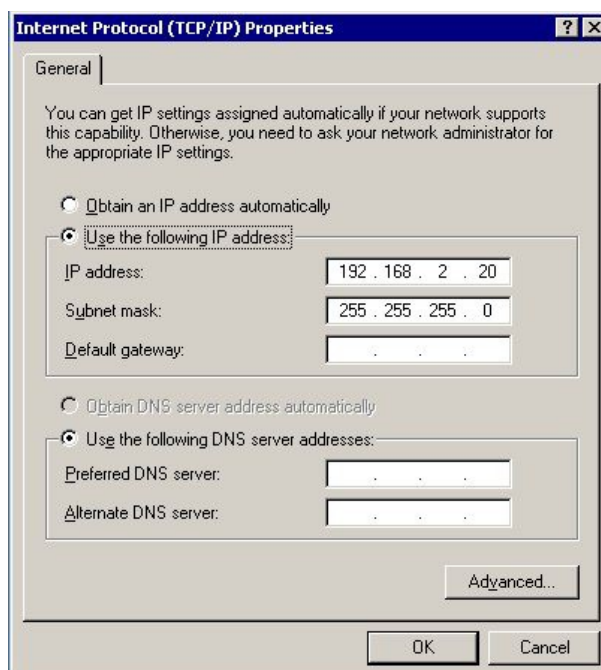
8. Click **Next** to start the installation, when complete click **Finish**

Step 2: Configure the Loopback Adapter

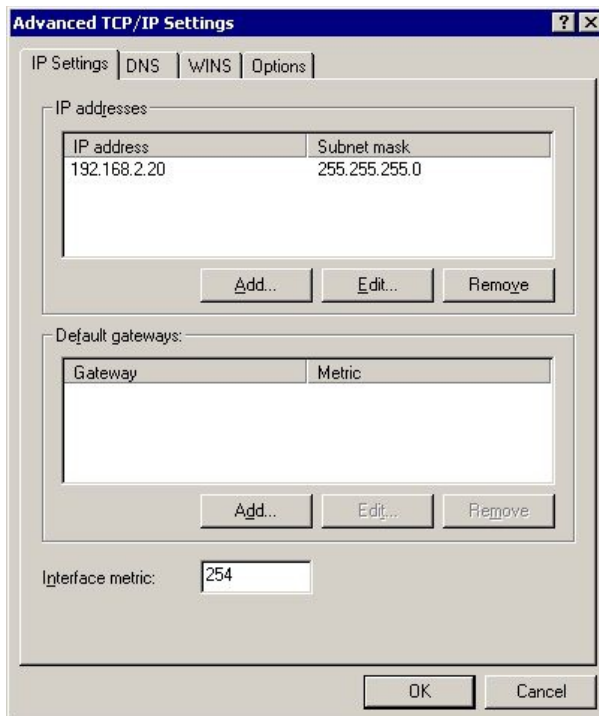
1. Open the Control Panel and double-click **Network and Dial-up Connections**
2. Right-click the new Loopback Adapter and select **Properties**
3. Un-check all items except **Internet Protocol (TCP/IP)** as shown below



4. Select **Internet Protocol (TCP/IP)**, click **Properties** and configure the IP address and mask to be the same as the Virtual Service IP address (VIP), e.g. 192.168.2.20/24 as shown below



- Click **Advanced** and change the **Interface metric** to 254 as shown below, this prevents the adapter responding to ARP requests for the VIP address



- Click **OK** on Advanced Settings, TCP/IP Properties and Connection Properties to save and apply the new settings
- Repeat the above steps for all other Windows 2000 Real Servers

Windows Server 2003

Windows server 2003 supports the direct routing (DR) method through the use of the MS Loopback Adapter to handle the traffic. The IP address on the Loopback Adapter must be set to be the same as the Virtual Services IP address (VIP). If the Real Server is included in multiple VIPs, you can add additional IP addresses to the Loopback Adapter that correspond to each VIP.

Step 1: Install the Microsoft Loopback Adapter

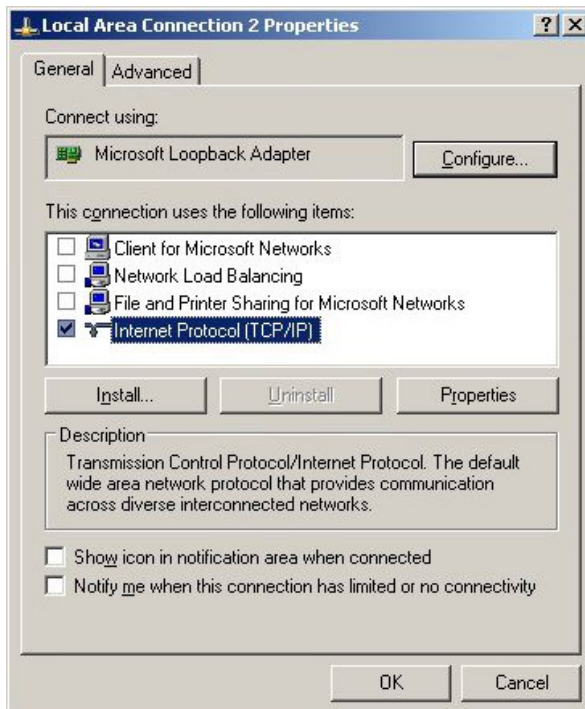
1. Open the Control Panel and double-click **Add Hardware**
2. Once the Hardware Wizard opens, click **Next**
3. Select **Yes, I have already connected the hardware**, click **Next**
4. Scroll to the bottom of the list, select **Add a new hardware device**, click **Next**
5. Select **Install the hardware that I manually select from a list (Advanced)**, click **Next**
6. Select **Network adapters**, click **Next**
7. Select **Microsoft & Microsoft Loopback Adapter**, click **Next** as shown below



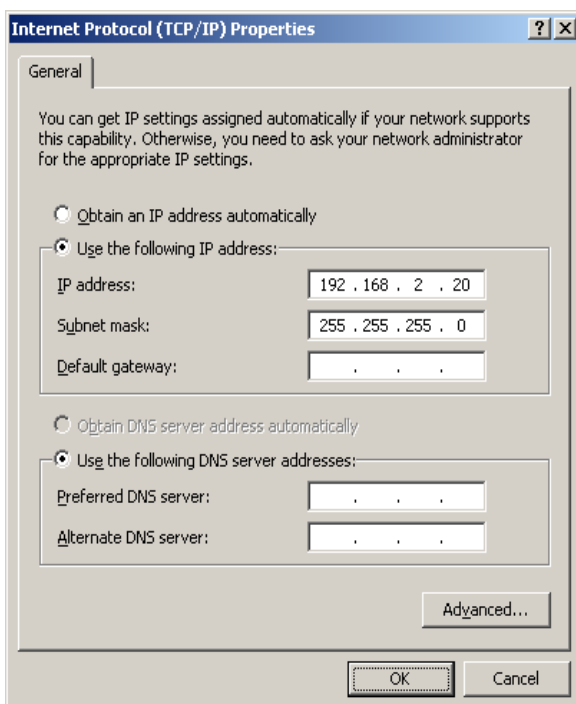
8. Click **Next** to start the installation, when complete click **Finish**

Step 2: Configure the Loopback Adapter

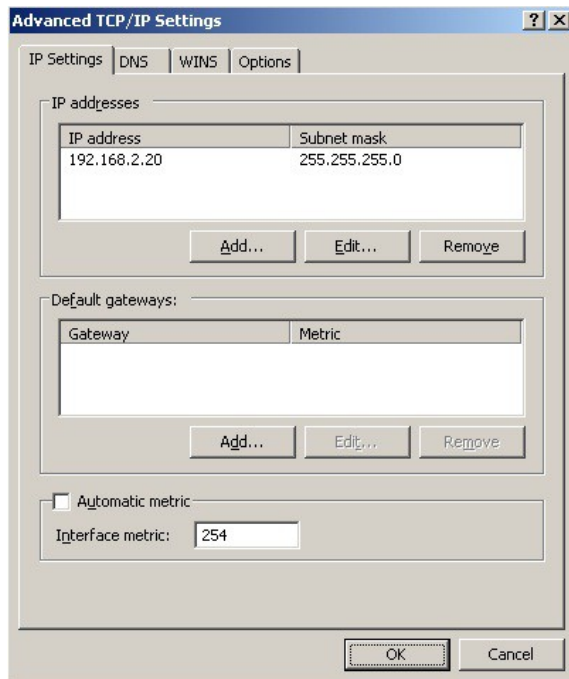
1. Open the Control Panel and double-click **Network Connections**
2. Right-click the new Loopback Adapter and select **Properties**
3. Un-check all items except **Internet Protocol (TCP/IP)** as shown below



4. Select **Internet Protocol (TCP/IP)**, click **Properties** and configure the IP address and mask to be the same as the Virtual Service (VIP), e.g. 192.168.2.20/24 as shown below



- Click **Advanced**, un-check **Automatic metric** and change **Interface metric** to 254 as shown below, this prevents the adapter responding to ARP requests for the VIP address



- Click **OK** on Advanced Settings & TCP/IP Properties, then click **Close** on Connection Properties to save and apply the new settings
- Now repeat the above process for all other Windows 2003 Real Servers



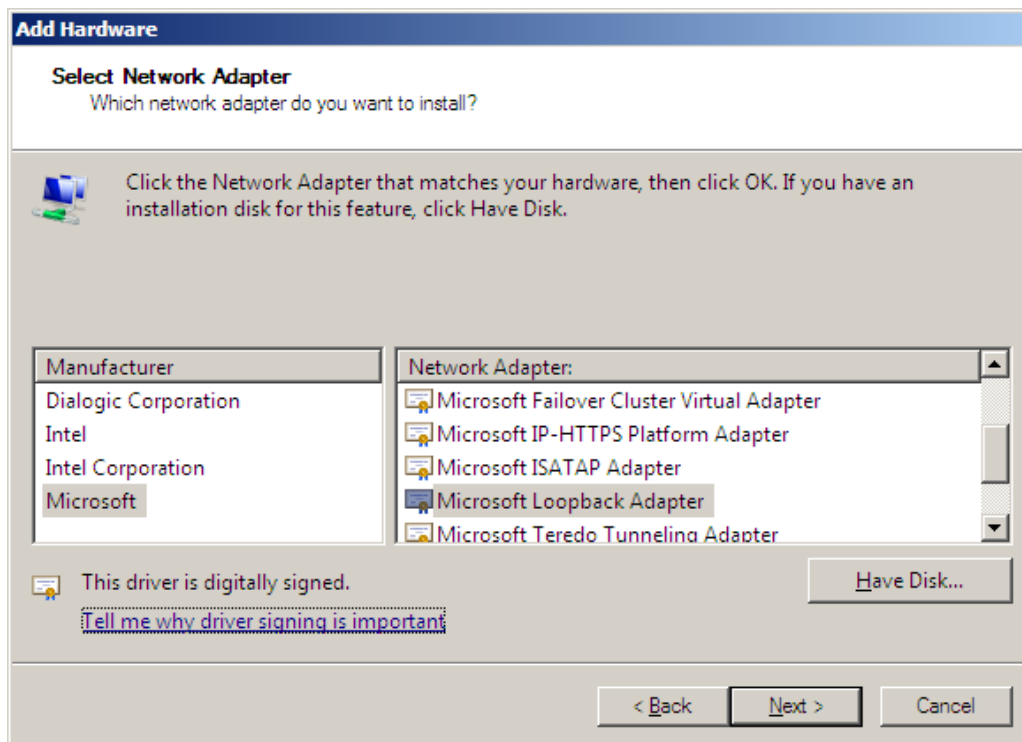
For Windows server 2003 SP1 & later, if you have enabled the built-in firewall, you will need to create an exception to enable access to the web server. This exception by default will allow traffic on both the network and Loopback Adapters.

Windows server 2008

The basic concept is the same as for Windows 2000 / 2003. However, additional steps are required to set the strong / weak host behavior. This is used to either block or allow interfaces receiving packets destined for a different interface on the same server. As with Windows 2000 / 2003, if the Real Server is included in multiple VIPs, you can add additional IP addresses to the Loopback Adapter that correspond to each VIP.

Step 1: Install the Microsoft Loopback Adapter

1. Click **Start**, then run **hdwwiz** to start the Hardware Installation Wizard
2. When the Wizard has started, click **Next**
3. Select **Install the hardware that I manually select from a list (Advanced)**, click **Next**
4. Select **Network adapters**, click **Next**
5. Select **Microsoft & Microsoft Loopback Adapter**, click **Next**

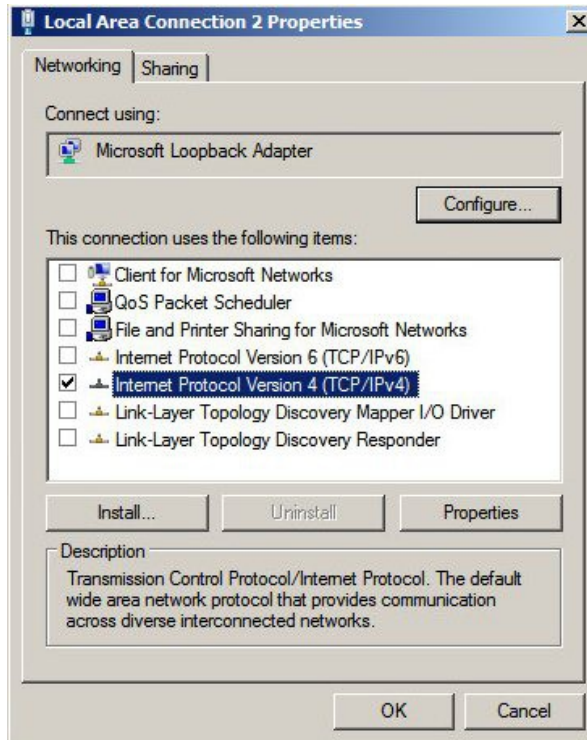


6. Click **Next** to start the installation, when complete click **Finish**

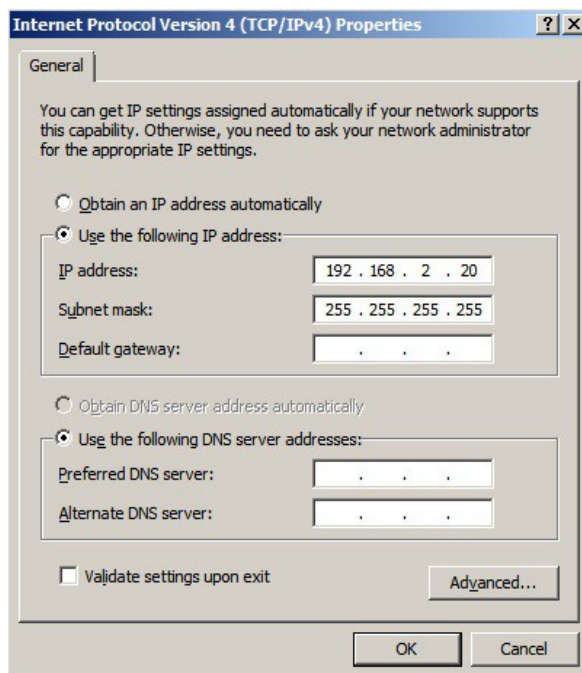
Step 2: Configure the Loopback Adapter

1. Open Control Panel and click **View Network status and tasks** under **Network and internet**
2. Click **Change adapter settings**
3. Right-click the new Loopback Adapter and select **Properties**

4. Un-check all items except **Internet Protocol Version 4 (TCP/IPv4)** as shown below



5. Select **Internet Protocol Version (TCP/IPv4)**, click **Properties** and configure the IP address to be the same as the Virtual Service (VIP) with a subnet mask of 255.255.255.255, e.g. 192.168.2.20 / 255.255.255.255 as shown below



6. Click **OK** on TCP/IP Properties, then click **Close** on Connection Properties to save and apply the new settings
7. Now repeat the above process on the other Windows 2008 Real Servers

N.B. For Windows 2008, it's not necessary to modify the interface metric on the advanced tab and should be left set to Automatic

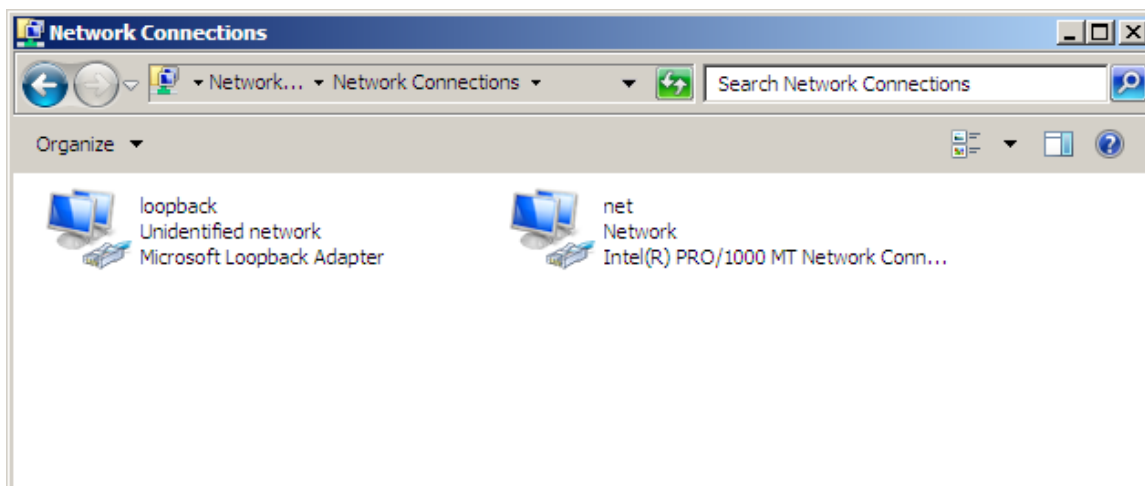
Step 3: Configure the strong / weak host behavior

Windows Server 2000 and Windows Server 2003 use the weak host model for sending and receiving for all IPv4 interfaces and the strong host model for sending and receiving for all IPv6 interfaces. You cannot configure this behavior. The Next Generation TCP/IP stack in Windows 2008 and later supports strong host sends and receives for both IPv4 and IPv6 by default. To ensure that the Windows 2008 is running in the correct mode to be able to respond to the VIP, the following commands must be run on each Real Server:

```
netsh interface ipv4 set interface "net" weakhostreceive=enabled
netsh interface ipv4 set interface "loopback" weakhostreceive=enabled
netsh interface ipv4 set interface "loopback" weakhostsend=enabled
```

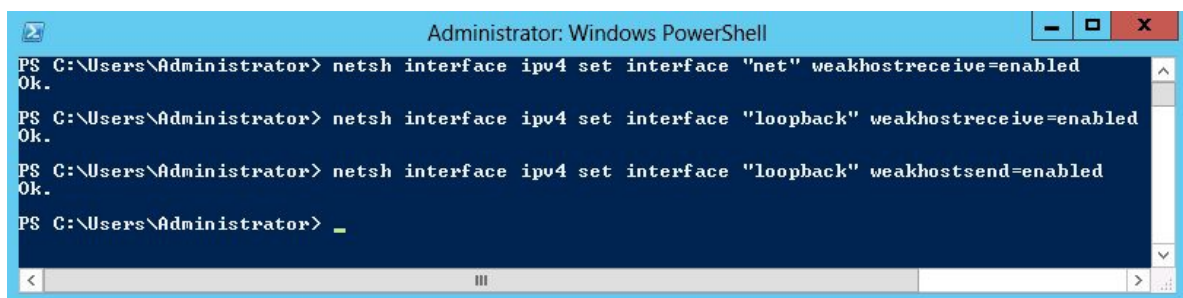
For these commands to work, the LAN connection NIC must be named "net" and the loopback NIC must be named "loopback" as shown below. If you prefer to leave your current NIC names, then the commands above must be modified accordingly. For example, if your network adapters are named "LAN" and "LOOPBACK", the commands required would be:

```
netsh interface ipv4 set interface "LAN" weakhostreceive=enabled
netsh interface ipv4 set interface "LOOPBACK" weakhostreceive=enabled
netsh interface ipv4 set interface "LOOPBACK" weakhostsend=enabled
```



N.B. The names for the NICs are case sensitive, so make sure that the name used for the interface and the name used in the commands match exactly.

1. Start Powershell or use a command Window to run the 3 netsh commands as shown below

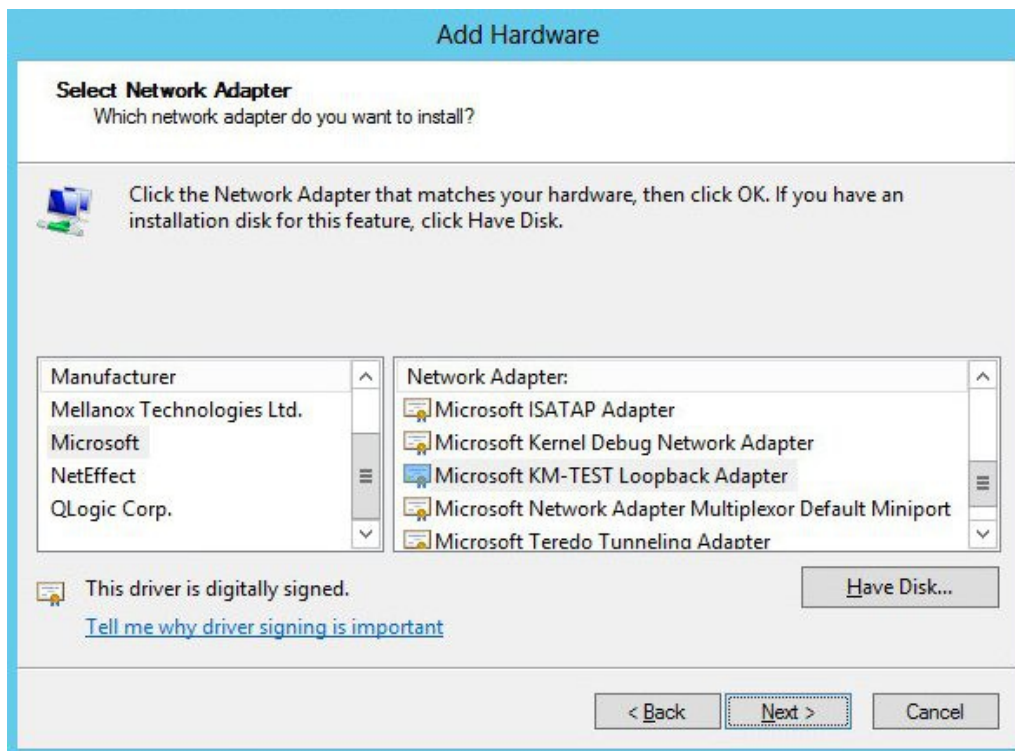


2. Now repeat these 3 commands on the other Windows 2008 Real Servers

The basic concept is the same as for Windows 2000 / 2003. However, additional steps are required to set the strong / weak host behavior. This is used to either block or allow interfaces receiving packets destined for a different interface on the same server. As with Windows 2000 / 2003 / 2008, if the Real Server is included in multiple VIPs, you can add additional IP addresses to the Loopback Adapter that correspond to each VIP.

Step 1: Install the Microsoft Loopback Adapter

1. Click **Start**, then run **hdwwiz** to start the Hardware Installation Wizard
2. When the Wizard has started, click **Next**
3. Select **Install the hardware that I manually select from a list (Advanced)**, click **Next**
4. Select **Network adapters**, click **Next**
5. Select **Microsoft & Microsoft KM-Test Loopback Adapter**, click **Next**

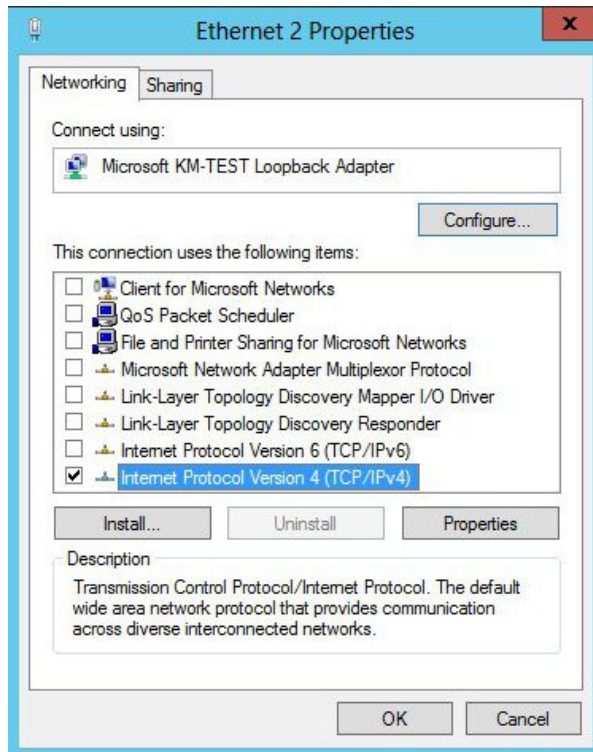


6. Click **Next** to start the installation, when complete click **Finish**

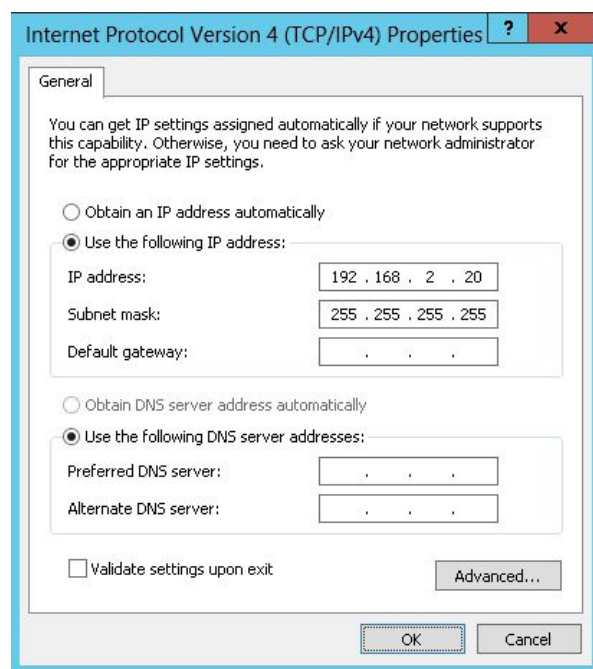
Step 2: Configure the Loopback Adapter

1. Open Control Panel and click **Network and Sharing Center**
2. Click **Change adapter settings**
3. Right-click the new Loopback Adapter and select **Properties**

4. Un-check all items except **Internet Protocol Version 4 (TCP/IPv4)** as shown below



5. Select **Internet Protocol Version (TCP/IPv4)**, click **Properties** and configure the IP address to be the same as the Virtual Service (VIP) with a subnet mask of 255.255.255.255, e.g. 192.168.2.20 / 255.255.255.255 as shown below



6. Click **OK** on TCP/IP Properties, then click **Close** on Ethernet Properties to save and apply the new settings
7. Now repeat the above process on the other Windows 2012 Real Servers

N.B. For Windows 2012, it's not necessary to modify the interface metric on the advanced tab and should be left set to Automatic

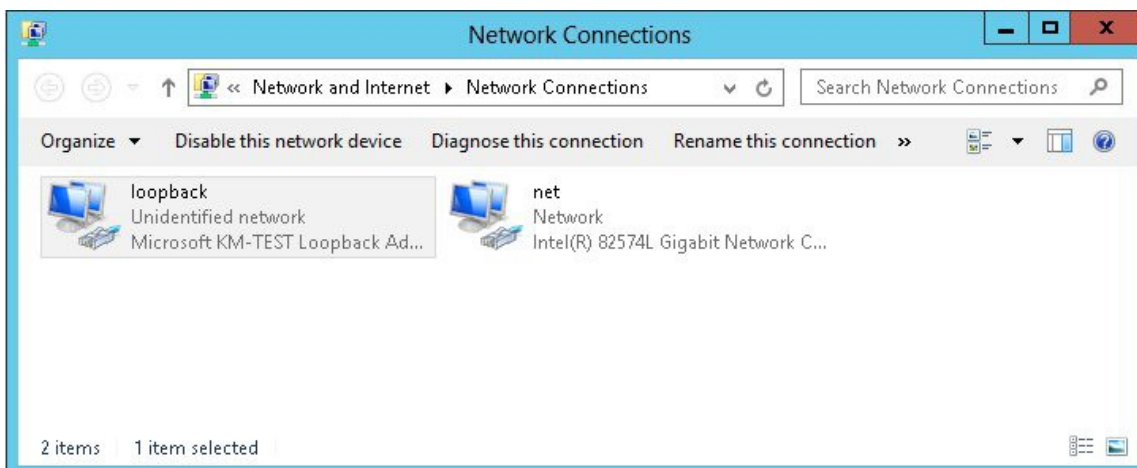
Step 3: Configure the strong / weak host behavior

Windows Server 2000 and Windows Server 2003 use the weak host model for sending and receiving for all IPv4 interfaces and the strong host model for sending and receiving for all IPv6 interfaces. You cannot configure this behavior. The Next Generation TCP/IP stack in Windows 2008 and later supports strong host sends and receives for both IPv4 and IPv6 by default. To ensure that the Windows 2008 is running in the correct mode to be able to respond to the VIP, the following commands must be run on each Real Server:

```
netsh interface ipv4 set interface "net" weakhostreceive=enabled
netsh interface ipv4 set interface "loopback" weakhostreceive=enabled
netsh interface ipv4 set interface "loopback" weakhostsend=enabled
```

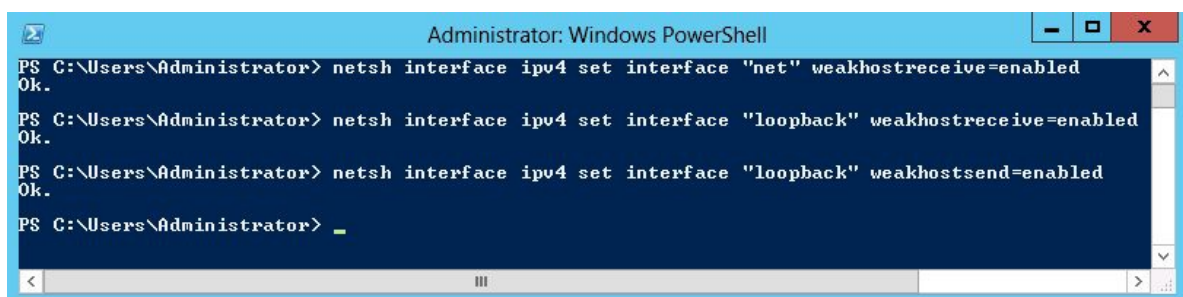
For these commands to work, the LAN connection NIC must be named "net" and the loopback NIC must be named "loopback" as shown below. If you prefer to leave your current NIC names, then the commands above must be modified accordingly. For example, if your network adapters are named "LAN" and "LOOPBACK", the commands required would be:

```
netsh interface ipv4 set interface "LAN" weakhostreceive=enabled
netsh interface ipv4 set interface "LOOPBACK" weakhostreceive=enabled
netsh interface ipv4 set interface "LOOPBACK" weakhostsend=enabled
```



N.B. The names for the NICs are case sensitive, so make sure that the name used for the interface and the name used in the commands match exactly.

1. Start Powershell or use a command Window to run the 3 netsh commands as shown below



2. Now repeat these 3 commands on the other Windows 2012 Real Servers

Verifying netsh Settings for Windows 2008 & 2012

To verify that settings have been configured correctly, run the following command on each Real Server to clearly list the settings that have been applied to the interface:

```
netsh interface ipv4 show interface <interface name>
```

i.e.

for the 'loopback' adapter run: `netsh interface ipv4 show interface loopback`

for the 'net' adapter run: `netsh interface ipv4 show interface net`

e.g.

```
C:\Users\Administrator>netsh interface ipv4 show interface loopback
```

```
Interface loopback Parameters
```

```
-----
IfLuid                : ethernet_9
IfIndex               : 15
State                 : connected
Metric               : 30
Link MTU              : 1500 bytes
Reachable Time        : 28500 ms
Base Reachable Time   : 30000 ms
Retransmission Interval : 1000 ms
DAD Transmits         : 3
Site Prefix Length    : 64
Site Id               : 1
Forwarding            : disabled
Advertising           : disabled
Neighbor Discovery     : enabled
Neighbor Unreachability Detection : enabled
Router Discovery      : dhcp
Managed Address Configuration : enabled
Other Stateful Configuration : enabled
Weak Host Sends       : enabled
Weak Host Receives    : enabled
Use Automatic Metric  : enabled
Ignore Default Routes : disabled
Advertised Router Lifetime : 1800 seconds
Advertise Default Route : disabled
Current Hop Limit     : 0
Force ARPND wake up patterns : disabled
Directed MAC wake up patterns : disabled
```

```
C:\Users\Administrator>
```

This shows that the settings have been applied correctly.



For Windows server 2008 / 2012, if you want to leave the built-in firewall enabled, you'll either need to enable the relevant default firewall exceptions or create your own to enable access to the web server. By default these exceptions will allow traffic on both the network and loopback adapters.



Failure to correctly configure the Real Servers to handle the ARP problem is the most common problem in DR configurations.

Configuring the Real Server for Layer 7 SNAT Mode

When using Layer7 (HAProxy) Virtual Services, no changes are required to the Real Servers.

IPv6 Support

The appliance fully supports IPv6. This allows Virtual Services to be configured using IPv4 addresses or IPv6 addresses. It's also possible to mix IPv4 and IPv6 addresses on a single appliance as illustrated below:

LOCAL CONFIGURATION > NETWORK INTERFACE CONFIGURATION

Bonding

Bond eth0 & eth1 as bond0: ☐ ? **Bond Interfaces**

VLAN

Interface: eth0 ▼ ? **Add VLAN**

VLAN ID: 1 ?

IP Address Assignment

eth0	192.168.67.23/18 fde6:d14c:3089:1::382/120
eth1	10.12.1.1/16 fde6:d14c:3089:1::384/120

Configure Interfaces

Once the required addresses are defined, use the **Configure Interfaces** button to apply the new settings.

Testing Load Balanced Services

For example, to test a web server based configuration, add a page to each web servers root directory e.g. test.html and put the server name on this page for easy identification during the tests.

Use two or more clients to do the testing. Open up a web browser on each test client and enter the URL for the VIP e.g. **http://192.168.1.20**.

Each client should see a different server name because of the load balancing algorithm in use i.e. they are being load balanced across the cluster.

Why test using two clients? If you use a single client it will most likely keep on hitting the same server for multiple requests. This is to do with the way that the load balancing algorithms are optimized.


Connection Error Diagnosis


If you're unable to connect when trying to access the VIP then:


1. Make sure that the device is active. This can be checked in the WUI. For a typical deployment, the status bar should report **Master & Active** as shown below:

Master | Slave Active | Passive

2. Also check *View Configuration > Network Configuration* to verify that the VIP is active on the load balancer, if not check *Logs > Heartbeat* for errors.
3. Check *System Overview* and make sure that none of your VIPs are highlighted in red. If they are, the entire cluster is down (i.e. both Real Servers). Green indicates a healthy cluster, yellow indicates that your cluster may need attention (one or more of the Real Servers may be down), and blue indicates a Real Server has been deliberately taken offline (by using either Halt or Drain).

Label: HTTP-Cluster IP: 192.168.110.150 Method: Layer 4 Ports: 80 Mode: DR Protocol: TCP 

Label: RDP-Cluster IP: 192.168.110.152 Method: Layer 4 Ports: 3389 Mode: DR Protocol: TCP 

Label: FTP-Cluster IP: 192.168.110.154 Method: Layer 4 Ports: 21 Mode: DR Protocol: TCP 

4. If the VIP is still not working, for Layer 4 VIPs check *Reports > Layer 4 Current Connections* to view the current traffic in detail. Any connections marked as SYN_RECV imply incorrect Real Server configuration:

- if using Layer 4 DR mode see pages 29-44 on solving the ARP problem
- If using Layer 4 NAT mode make sure that the Real Servers use the load balancer as their GW

For Layer 7 VIPs, check *Reports > Layer 7 Status*. The default credentials required are:

username: loadbalancer
password: loadbalancer

This will open a second tab in the browser and display a statistics report as shown in the example below:

Statistics Report for pid 3261

> General process information

pid = 3261 (process #1, nbproc = 1)
uptime = 0d 0h00m42s
system limits: memmax = unlimited; ulimit-n = 81000
maxsock = 80024; maxconn = 40000; maxpipes = 0
current conns = 1; current pipes = 0/0; conn rate = 2/sec
Running tasks: 1/5; idle = 100 %

active UP
active UP, going down
active DOWN, going up
active or backup DOWN
active or backup DOWN for maintenance (MAINT)
backup UP
backup UP, going down
backup DOWN, going up
not checked

Note: UP with load-balancing disabled is reported as "NOLB".

Display option:

- [Hide 'DOWN' servers](#)
- [Refresh now](#)
- [CSV export](#)

External resources:

- [Primary site](#)
- [Updates \(v1.6\)](#)
- [Online manual](#)

L7		Queue		Session rate			Sessions				Bytes		Denied		Errors		Warnings		Server											
		Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Downtime	Thrtle
Frontend		0	0	15	-	0	4	40 000	56	56	21 696	3 385 782	0	0	0	0	0	0	0	0	0	OPEN								
backup		0	0	-	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0			1	-	Y				-
RIP1		0	0	-	0	16	0	2	-	56	56	21 696	3 385 782	0	0	0	0	0	0	0	42s UP	L4OK in 0ms	1	Y	-	0	0	0	0s	
Backend		0	0	0	16	0	2	4 000	56	56	21 696	3 385 782	0	0	0	0	0	0	0	0	42s UP		1	1	1		0	0s		

	stats																																	
	Queue			Session rate			Sessions				Bytes		Denied		Errors			Warnings		Server														
	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle								
Frontend				2	4	-	1	1	2 000	8		1 464	33 111	0	0	4											OPEN							
Backend	0	0		0	0		0	0	200	0	0	1 464	33 111	0	0		0	0	0	0						42s UP			0	0	0		0	








System Overview

Using *System Overview* check that when you Halt one of the Real Servers the connections are redirected to the other server in the cluster.

Remove the network cable from one of the web servers or stop the web service / process, wait a few seconds (for the load balancer to detect the change) and then refresh the browsers on both clients. They should now both switch to the same server (since one has been removed from the load balancing list).

Replace the network cable, wait a few seconds and then refresh the browsers again. After a few refreshes they should again show different web servers.

The *System Overview* will also show the updated status as these tests are performed:

Label: HTTP-Cluster		IP: 192.168.110.150	Method: Layer 4	Ports: 80	Mode: DR	Protocol: TCP	
Rip Label	IP	Ports	Weight				
Alpha	192.168.110.237	80	1	Drain	Halt		
Bravo	192.168.110.238	80	0	Online	Halt		
Charlie	192.168.110.239	80	1	Drain	Halt		

In this example:

'**Alpha**' is green which indicates that the Real Server is operating normally.

'**Bravo**' is blue, this indicates that the Real Server has been either Halted or Drained. In this example Drain has been used. If Halt was used, 'Halt' would be displayed in the Weight column rather than a weight of 0.

'**Charlie**' is down (red). This implies that the Real Server has failed a health check. This can be investigated using *Logs > Layer 4* or *Logs > Layer 7* as appropriate. If you know the Real Server should be active, you may need to increase the health check time-outs using *Cluster Configuration > Layer 4 – Advanced Configuration* or for Layer 7 VIPs using *Cluster Configuration > Layer 7 – Advanced Configuration*.

Using Logs & Reports

The appliance includes several logs and reports that are very useful when diagnosing issues. Both are available as main menu options in the WUI. Details of both can be found in chapter 12 of the administration manual available here: <http://www.loadbalancer.org/pdf/loadbalanceradministrationv7.pdf>

Testing High-Availability for a Loadbalancer.org HA-Pair

To test fail-over of a clustered pair, once fully configured power down the master and check that the slave unit takes over all the floating IP(s). If fail-over to the slave unit does not occur correctly, check *Logs > Heartbeat* on both nodes for any errors.



It's very important to verify that master / slave failover occurs correctly before going live. This proves the resilience of the cluster and makes you aware of the failover / failback process. Please refer to chapter 8 in the administration manual for more details.



When testing load balancer fail-over, don't just pull the serial cable out. This will not cause a fail-over but will cause a split brain (i.e. both units active) to occur. It's also possible to configure fail-over on network failure but this is not enabled by default. To enable this, a ping node must be configured under *Cluster Configuration > Heartbeat Configuration*.

The status of the appliance is shown at the top of the screen. For a working pair, the normal view is shown below:



This shows that the master unit is active and that the heartbeat link is up between master & slave.

Other states:

Master Slave	Active Passive	Link	this is a master unit, it's active, no slave unit has been defined
Master Slave	Active Passive	Link	this is a master unit, it's active, a slave has been defined but the link to the slave is down. Action: check & verify the heartbeat configuration
Master Slave	Active Passive	Link	this is a slave unit, it's active (a failover from the master has occurred) and the heartbeat link to the master has been established
Master Slave	Active Passive	Link	this is a master unit, a slave unit has been defined, but the link is down (e.g. serial cable unplugged) so the state cannot be determined. In this case the floating IP's may be active on both units. Action: check & verify the heartbeat configuration, check the serial cable (if applicable), check heartbeat logs & if required restart heartbeat on both units
Master Slave	Active Passive	Link	this is the master unit, a slave unit has been defined on the master, but the link is down (e.g. serial cable unplugged) so the state cannot be determined. In this case the heartbeat service has probably stopped on both units. Action: check & verify the heartbeat configuration, check the serial cable (if applicable), check heartbeat logs & if required restart heartbeat on both units

N.B. Restarting heartbeat will cause a temporary outage of all load balanced services

Does Your Application Cluster Correctly Handle its Own State?



Load balancers work most effectively if the application servers are completely stateless. This means that if a web server fails and is automatically taken out of the cluster; then all the current user sessions will be transferred to other servers in the cluster without the users needing to re login to the application again. ***If your application doesn't have a persistent data store then you can't have seamless fail over for your back-end servers.***

Do your web servers store persistent information on local drives?

- Images (jpeg, png, gif etc.)
- Files (html, php, asp etc.)

If so, these files either need to be on shared storage such as an NFS/CIFS mount, or they need to be replicated to all of the nodes in the cluster.

Replication Solutions for Shared Data

On UNIX you can use the RSYNC command to replicate files, on Windows Server you can use RSYNC as well but you may prefer ROBOCOPY that's included by default in newer versions of Windows Server or in the resource kit for older versions. Usually you will upload your content to one master server and then replicate it to the other servers in the cluster.

Solutions for Session Data

Standard ASP and PHP session data is stored locally by default, leaving your session data in a local store will prevent you from implementing seamless application server fail-over in your cluster. If an application server fails, all of the local session data will be lost and your user will need to re-log in and possibly lose shopping baskets etc.

This problem is easily resolvable by implementing a shared persistent data store for the cluster. This is usually either done with a shared back-end database or a shared memory solution.

Persistence (aka Affinity)

Persistence is a feature that is required by many web applications. Once a user has interacted with a particular server all subsequent requests are sent to the same server thus persisting to that particular server. It is normally required when the session state is stored locally to the web server as opposed to a database.

What do You do if Your Application is not Stateless?

Some applications require state to be maintained such as:

- Terminal Services / Remote Desktop Services
- SSH
- FTP (upload)
- SMTP (incoming)

You may also find that you are unable to modify your HTTP/HTTPS based application to handle shared session data.

For these cases, you can use persistence based on source IP address. You lose the ability to have transparent fail-over, but you do still get increased capacity and manageability. This persistence problem occurs with all load balancers and all vendors use standard methods and technologies to mitigate the issue.

Loadbalancer.org Persistence Options

- Source IP (subnet)
- Cookie (Active or Passive)
- SSL session ID
- Microsoft Connection Broker / Session Broker Integration

The standard Layer 4 persistence method is source IP persistence, you can handle millions of persistent connections at Layer 4. Just modify your Virtual Service to be persistent if you require source IP persistence.

Cookies are a Layer 7 based persistence method that can offer more even traffic distribution and also handle any clients where the source IP address may change during the session (e.g. mega proxies).

SSL session ID based persistence is useful in certain circumstances, although due to the way some browsers operate – notably Internet Explorer, the session ID can be renegotiated frequently which effectively breaks the persistence.

Loadbalancer.org Technical Support

If you have any questions regarding the appliance don't hesitate to contact the support team support@loadbalancer.org or your local reseller.

For more details please refer to our full administration manual which is available at:
<http://www.loadbalancer.org/pdf/files/loadbalanceradministrationv7.pdf>

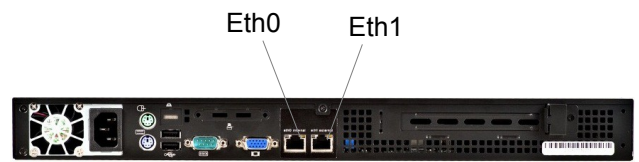
Appendix

Company Contact Information

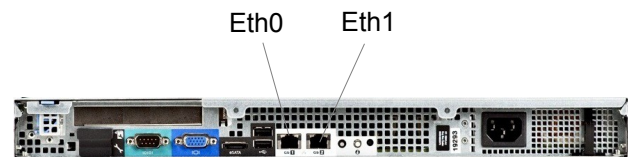
Website	URL : www.loadbalancer.org
North America (US)	<p>Loadbalancer.org, Inc. 270 Presidential Drive Wilmington, DE 19807 USA</p> <p>Tel : +1 866.229.8562 (24x7) Fax : +1 302.213.0122 Email (sales) : sales@loadbalancer.org Email (support) : support@loadbalancer.org</p>
North America (Canada)	<p>Loadbalancer.org Ltd 300-422 Richards Street Vancouver, BC V6B 2Z4 Canada</p> <p>Tel : +1 604.629.7575 Fax : +1 302.213.0122 Email (sales) : sales@loadbalancer.org Email (support) : support@loadbalancer.org</p>
Europe (UK)	<p>Loadbalancer.org Ltd. Portsmouth Technopole Kingston Crescent Portsmouth PO2 8FA England, UK</p> <p>Tel : +44(0)870 4438779 (24x7) Fax : +44(0)870 4327672 Email (sales) : sales@loadbalancer.org Email (support) : support@loadbalancer.org</p>
Europe (Germany)	<p>Loadbalancer.org GmbH Alt Pempelfort 2 40211 Düsseldorf Germany</p> <p>Tel : +49 (0)30 920 383 6494 Fax : +49 (0)30 920 383 6495 Email (sales) : vertrieb@loadbalancer.org Email (support) : support@loadbalancer.org</p>

Front & Rear Panel Layouts

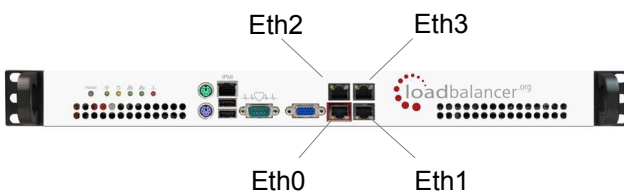
Enterprise / Enterprise R16 – Supermicro



Enterprise – Dell



Enterprise Max – Supermicro



Enterprise Max / 10G – Dell

