

Load Balancing Microsoft SQL Server

Version 1.0.0



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1. About this Brief

This brief outlines the steps required to configure a load balanced Microsoft SQL Server environment utilizing Loadbalancer.org appliances. It covers the configuration of the load balancers and also any Microsoft SQL Server configuration changes that are required to enable load balancing.

For more information about initial appliance deployment, network configuration and using the Web User Interface (WebUI), please also refer to the [Administration Manual](#).

2. Loadbalancer.org Appliances Supported

All our products can be used with Microsoft SQL Server. For full specifications of available models please refer to <https://www.loadbalancer.org/products>.

Some features may not be available or fully supported in all cloud platforms due to platform specific limitations. For more details, please refer to the "Main Differences to our Standard (Non-Cloud) Product" section in the appropriate cloud platform [Quick Start Guide](#) or check with Loadbalancer.org support.

3. Software Versions Supported

3.1. Loadbalancer.org Appliance

- V8.9.1 and later

Note

The screenshots used throughout this document aim to track the latest Loadbalancer.org software version. If you're using an older version, or the very latest, the screenshots presented here may not match your WebUI exactly.

3.2. Microsoft SQL Server

- 2012 and later

4. Microsoft SQL Server

Microsoft SQL Server is a relational database management system (RDBMS) that supports a wide variety of transaction processing, business intelligence (BI) and data analytics applications in corporate IT environments.

5. Load Balancing Microsoft SQL Server

Note

It's highly recommended that you have a working Microsoft SQL Server environment first before implementing the load balancer.

5.1. Read / Write Database Access

If all SQL servers have identical copies of the database and only provide read access, load balancing is straight forward and read requests can be directed at any server.



When data is also written to the database, an appropriate synchronisation technology must be used to ensure that all SQL servers are kept in sync following each write operation. Also, depending on the particular synchronisation method, it may be required that write operations are handled by one particular server whilst read operations can be handled by any server.

Various database synchronisation methods are supported, the most appropriate depends on the version of SQL server, the read & write transaction workload, IT infrastructure and the available budget:

- **Replication** - for more information refer to [SQL Server Replication](#)
- **Log shipping** - for more information refer to [About log shipping \(SQL Server\)](#)
- **Mirroring** - for more information refer to [Database Mirroring \(SQL Server\)](#)
- **Always On Failover Clustering** - for more information refer to [Always On Failover Cluster Instances \(SQL Server\)](#)
- **Always On Availability Groups** - for more information refer to [What is an Always On availability group](#)

The configuraton presented in this guide assumes that only read operations are supported, or the synchronisation method in use allows read & write operations from/to any SQL server.

5.2. Virtual Service (VIP) Requirements

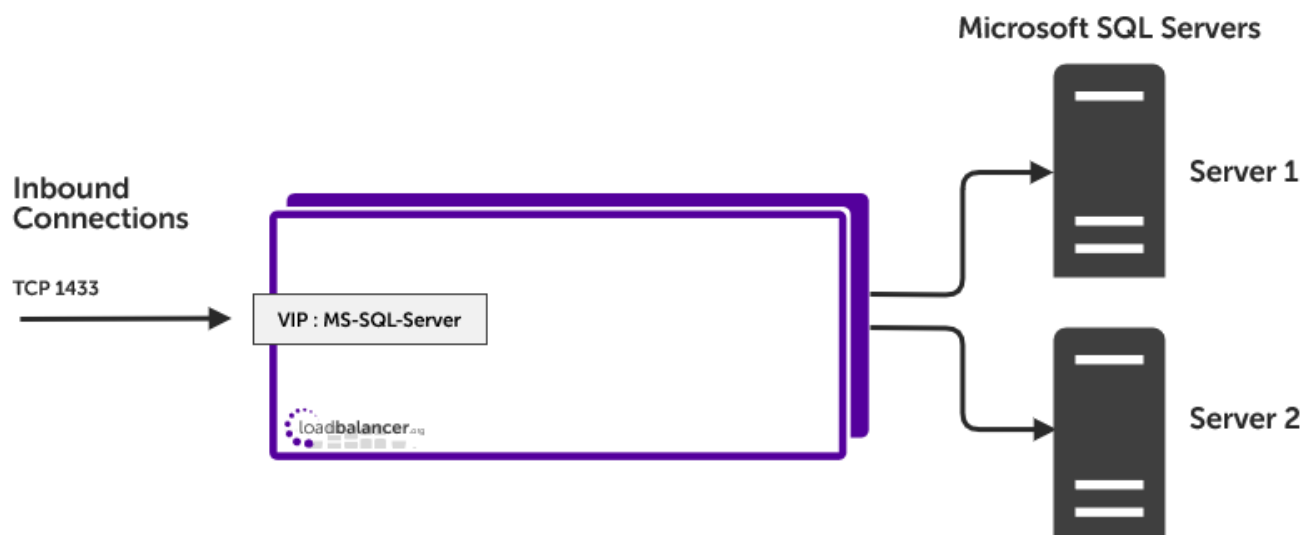
To provide load balancing and HA for Microsoft SQL Server, the following VIP is required:

Reference	VIP Name	Mode	Port(s)	Persistence Mode	Health Check
VIP1	MS-SQL-SERVER	L7 SNAT	1433	Source IP	Connect to Port *

Note

A more robust SQL Server health check can be used if preferred that reads and verifies data from the database. For more details, please refer to [SQL Server Health Check](#).

6. Deployment Concept



Note

The load balancer can be deployed as a single unit, although Loadbalancer.org recommends a clustered pair for resilience & high availability. Please refer to the section [Configuring HA - Adding a Secondary Appliance](#) in the appendix for more details on configuring a clustered pair.

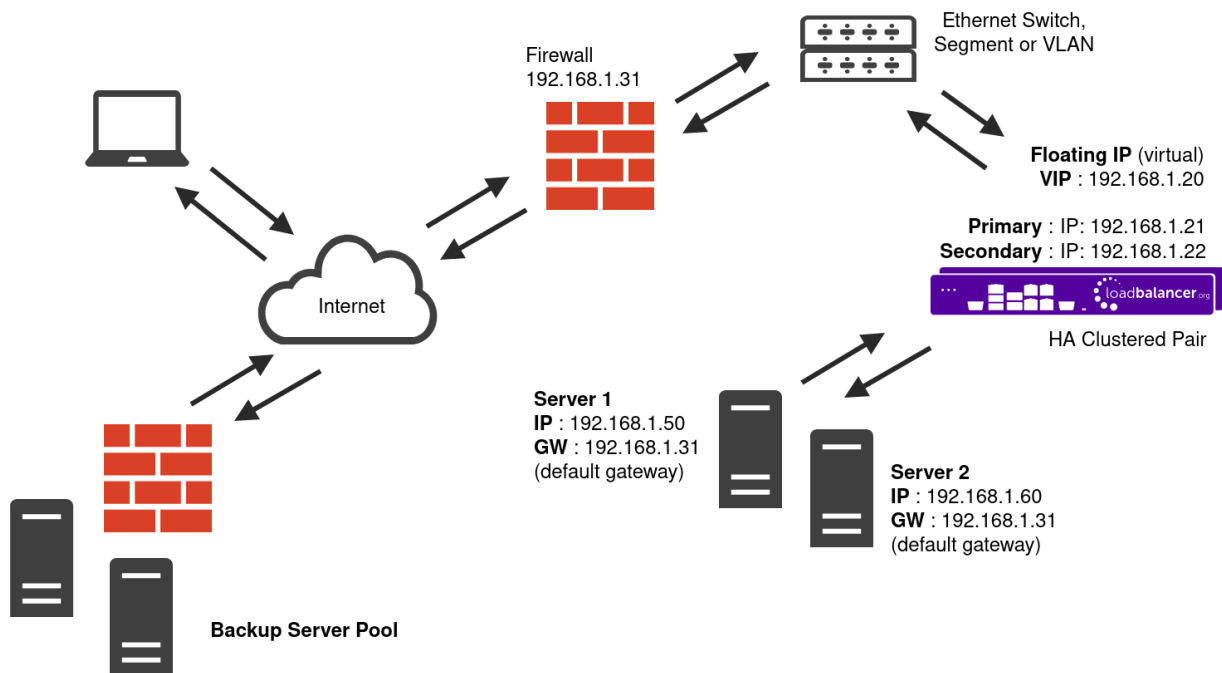
7. Load Balancer Deployment Methods

The load balancer can be deployed in 4 fundamental ways: *Layer 4 DR mode*, *Layer 4 NAT mode*, *Layer 4 SNAT mode*, and *Layer 7 SNAT mode*.

For Microsoft SQL Server, layer 7 SNAT mode is recommended. This mode is described below and is used for the configurations presented in this guide.

7.1. Layer 7 SNAT Mode

Layer 7 SNAT mode uses a proxy (HAProxy) at the application layer. Inbound requests are terminated on the load balancer and HAProxy generates a new corresponding request to the chosen Real Server. As a result, Layer 7 is typically not as fast as the Layer 4 methods. Layer 7 is typically chosen when either enhanced options such as SSL termination, cookie based persistence, URL rewriting, header insertion/deletion etc. are required, or when the network topology prohibits the use of the layer 4 methods.



- Because layer 7 SNAT mode is a full proxy, any server in the cluster can be on any accessible subnet including across the Internet or WAN.
- Layer 7 SNAT mode 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 balancer's own IP address by default, or any other local appliance IP address if preferred (e.g. the VIP address). This can be configured per layer 7 VIP. If required, the load balancer can be configured to provide the actual client IP address to the Real Servers in 2 ways. Either by inserting a header that contains the client's source IP address, or by modifying the Source Address field of the IP

packets and replacing the IP address of the load balancer with the IP address of the client. For more information on these methods please refer to [Transparency at Layer 7](#).

- Layer 7 SNAT mode can be deployed using either a one-arm or two-arm configuration. For two-arm deployments, **eth0** is normally used for the internal network and **eth1** is used for the external network although this is not mandatory.
- Requires no mode-specific configuration changes to the load balanced Real Servers.
- Port translation is possible with Layer 7 SNAT mode, e.g. VIP:80 → RIP:8080 is supported.
- You should not use the same RIP:PORT combination for layer 7 SNAT mode VIPs and layer 4 SNAT mode VIPs because the required firewall rules conflict.

8. Loadbalancer.org Appliance – the Basics

8.1. Virtual Appliance

A fully featured, fully supported 30 day trial is available if you are conducting a PoC (Proof of Concept) deployment. The VA is currently available for VMware, Virtual Box, Hyper-V, KVM, XEN and Nutanix AHV and has been optimized for each Hypervisor. By default, the VA is allocated 2 vCPUs, 4GB of RAM and has a 20GB virtual disk. The Virtual Appliance can be downloaded [here](#).

Note

The same download is used for the licensed product, the only difference is that a license key file (supplied by our sales team when the product is purchased) must be applied using the appliance's WebUI.

Note

Please refer to [Virtual Appliance Installation](#) and the ReadMe.txt text file included in the VA download for additional information on deploying the VA using the various Hypervisors.

Note

The VA has 4 network adapters. For VMware only the first adapter (**eth0**) is connected by default. For HyperV, KVM, XEN and Nutanix AHV all adapters are disconnected by default. Use the network configuration screen within the Hypervisor to connect the required adapters.

8.2. Initial Network Configuration

After boot up, follow the instructions on the appliance console to configure the management IP address, subnet mask, default gateway, DNS servers and other network and administrative settings.

Important

Be sure to set a secure password for the load balancer, when prompted during the setup routine.

8.3. Accessing the Appliance WebUI

The WebUI is accessed using a web browser. By default, users are authenticated using Apache authentication. Users can also be authenticated against LDAP, LDAPS, Active Directory or Radius - for more information, please refer to [External Authentication](#).

Note

There are certain differences when accessing the WebUI for the cloud appliances. For details,



please refer to the relevant [Quick Start / Configuration Guide](#).

1. Using a browser, navigate to the following URL:

<https://<IP-address-configured-during-the-network-setup-wizard>:9443/lbadmin/>

 **Note**

You'll receive a warning about the WebUI's SSL certificate. This is due to the default self signed certificate that is used. If preferred, you can upload your own certificate - for more information, please refer to [Appliance Security Features](#).

 **Note**

If you need to change the port, IP address or protocol that the WebUI listens on, please refer to [Service Socket Addresses](#).

2. Log in to the WebUI using the following credentials:

Username: loadbalancer

Password: <configured-during-network-setup-wizard>

 **Note**

To change the password, use the WebUI menu option: *Maintenance > Passwords*.

Once logged in, the WebUI will be displayed as shown below:

Primary | Secondary Active | Passive Link 15 Seconds ↻

System Overview

Local Configuration

Cluster Configuration

Maintenance

View Configuration

Reports

Logs

Support

Live Chat

WARNING: YOUR TRIAL IS DUE TO EXPIRE IN 30 DAYS.

Buy with confidence. All purchases come with a 90 day money back guarantee. Already bought? Enter your license key [here](#)

Buy Now

System Overview ? 2024-03-15 16:27:21 UTC

Would you like to run the Setup Wizard?

Accept
Dismiss

VIRTUAL SERVICE ⌵ IP ⌵ PORTS ⌵ CONNS ⌵ PROTOCOL ⌵ METHOD ⌵ MODE ⌵

No Virtual Services configured.

Network Bandwidth

Bytes/s

Thu 18:00 Fri 00:00 Fri 06:00 Fri 12:00

■ RX 3k Min, 4k Avg, 32675k Total
■ TX 6k Min, 7k Avg, 56693k Total

System Load Average

System Load

Thu 18:00 Fri 00:00 Fri 06:00 Fri 12:00

■ 1m average 0.00 Min, 0.12 Avg, 0.60 Max
■ 5m average 0.00 Min, 0.06 Avg, 0.21 Max
■ 15m average 0.00 Min, 0.02 Avg, 0.08 Max

Memory Usage

- You'll be asked if you want to run the Setup Wizard which can be used to configure layer 7 services. Click **Dismiss** if you're following a guide or want to configure the appliance manually or click **Accept** to start the wizard.

Main Menu Options

System Overview - Displays a graphical summary of all VIPs, RIPs and key appliance statistics

Local Configuration - Configure local host settings such as IP address, DNS, system time etc.

Cluster Configuration - Configure load balanced services such as VIPs & RIPs

Maintenance - Perform maintenance tasks such as service restarts and taking backups

View Configuration - Display the saved appliance configuration settings

Reports - View various appliance reports & graphs

Logs - View various appliance logs

Support - Create a support download, contact the support team & access useful links

Live Chat - Start a live chat session with one of our Support Engineers



8.4. Appliance Software Update

To ensure that the appliance(s) are running the latest software version, we recommend a software update check is performed.

Determining the Current Software Version

The software version is displayed at the bottom of the WebUI as shown in the example below:

Copyright © Loadbalancer.org Inc. 2002 – 2024
ENTERPRISE VA Max - v8.11.1

English ▼

Checking for Updates using Online Update

Note

By default, the appliance periodically contacts the Loadbalancer.org update server and checks for updates. An update check can also be manually triggered as detailed below.

1. Using the WebUI, navigate to: **Maintenance > Software Update**.
2. Select **Online Update**.
3. If the latest version is already installed, a message similar to the following will be displayed:

Information: Version v8.11.1 is the current release. No updates are available

4. If an update is available, you'll be presented with a list of new features, improvements, bug fixes and security related updates.
5. Click **Online Update** to start the update process.

Note

Do not navigate away whilst the update is ongoing, this may cause the update to fail.

6. Once complete (the update can take several minutes depending on download speed and upgrade version) the following message will be displayed:

Information: Update completed successfully.

7. If services need to be reloaded/restarted or the appliance needs a full restart, you'll be prompted accordingly.

Using Offline Update

If the load balancer does not have access to the Internet, offline update can be used.



Note

Please contact support@loadbalancer.org to check if an update is available and obtain the latest offline update files.

To perform an offline update:

1. Using the WebUI, navigate to: **Maintenance > Software Update**.
2. Select **Offline Update**.
3. The following screen will be displayed:

Software Update

Offline Update

The following steps will lead you through offline update.

1. Contact **Loadbalancer.org support** to obtain the offline update archive and checksum.
2. Save the archive and checksum to your local machine.
3. Select the archive and checksum files in the upload form below.
4. Click *Upload and Install* to begin the update process.

Archive: No file chosen

Checksum: No file chosen

4. Select the *Archive* and *Checksum* files.
5. Click **Upload and Install**.
6. If services need to be reloaded/restarted or the appliance needs a full restart, you'll be prompted accordingly.

8.5. Ports Used by the Appliance

By default, the appliance uses the following TCP & UDP ports:

Protocol	Port	Purpose
TCP	22 *	SSH
TCP & UDP	53 *	DNS / GSLB
TCP & UDP	123	NTP
TCP & UDP	161 *	SNMP
UDP	6694	Heartbeat between Primary & Secondary appliances in HA mode
TCP	7778	HAProxy persistence table replication
TCP	9000 *	Gateway service (Centralized/Portal Management)
TCP	9080 *	WebUI - HTTP (disabled by default)
TCP	9081 *	Nginx fallback page



Protocol	Port	Purpose
TCP	9443 *	WebUI - HTTPS
TCP	25565 *	Shuttle service (Centralized/Portal Management)

Note

The ports used for SSH, GSLB, SNMP, the WebUI, the fallback page, the gateway service and the shuttle service can be changed if required. For more information, please refer to [Service Socket Addresses](#).

8.6. HA Clustered Pair Configuration

Loadbalancer.org recommend that load balancer appliances are deployed in pairs for high availability. In this guide a single unit is deployed first, adding a secondary unit is covered in the section [Configuring HA - Adding a Secondary Appliance](#) of the appendix.

9. Appliance Configuration for Microsoft SQL Server

9.1. VIP1 - MS-SQL-SERVER

Configuring the Virtual Service (VIP)

- Using the WebUI, navigate to *Cluster Configuration > Layer 7 – Virtual Services* and click on **Add a new Virtual Service**.
- Enter the following details:

Virtual Service		[Advanced +]
Label	<input type="text" value="MS-SQL-Server"/>	?
IP Address	<input type="text" value="192.168.110.100"/>	?
Ports	<input type="text" value="1433"/>	?
Protocol		[Advanced +]
Layer 7 Protocol	<input type="text" value="TCP Mode"/>	?

- Specify the *Label* for the virtual service, e.g. **MS-SQL-Server**.
- Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.110.100**.
- Set the *Ports* field to **1433**.
- Set the *Layer 7 Protocol* to **TCP Mode**.
- Click **Update** to create the Virtual Service.
- Now click **Modify** next to the newly created VIP.



9. Scroll to the *Persistence* section.
 - Ensure that the *Persistence Mode* is set to Source IP.
10. Scroll to the *Health Checks* section.
 - For a simple check, leave *Health Check* set to **Connect to Port**.
 - For a more robust check, refer to the steps in [SQL Server Health Check](#).
11. Click **Update**.

Defining the Real Servers (RIPs)

1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP.
2. Enter the following details:

Label	<input type="text" value="SQL-Server1"/>	?
Real Server IP Address	<input type="text" value="192.168.110.160"/>	?
Real Server Port	<input type="text" value="1433"/>	?
Re-Encrypt to Backend	<input type="checkbox"/>	?
Weight	<input type="text" value="100"/>	?

3. Define the *Label* for the real server as required, e.g. **SQL-Server1**.
4. Set the *Real Server IP Address* field to the required IP address, e.g. **192.168.110.160**.
5. Set the *Real Server Port* field to **1433**.
6. Click **Update**.
7. Repeat these steps to add additional Real Servers as required.

9.2. Finalizing the Configuration

To apply the new settings, HAProxy must be reloaded. This can be done using the button in the "Commit changes" box at the top of the screen or by using the *Restart Services* menu option:

1. Using the WebUI, navigate to: *Maintenance > Restart Services*.
2. Click **Reload HAProxy**.

10. Testing & Verification






Note

For additional guidance on diagnosing and resolving any issues you may have, please also refer to [Diagnostics & Troubleshooting](#).



10.1. Using System Overview

The System Overview can be viewed in the WebUI. It shows a graphical view of all VIPs & RIPv (i.e. the Microsoft SQL Server servers) and shows the state/health of each server as well as the state of the cluster as a whole. The example below shows that the Virtual Service and all three application servers are healthy and available to accept connections:

	MS-SQL-Server	192.168.110.100	1433	0	TCP	Layer 7	Proxy	
	<i>REAL SERVER</i>	<i>IP</i>	<i>PORTS</i>	<i>WEIGHT</i>	<i>CONNS</i>			
	SQL-Server1	192.168.110.160	1433	100	0	Drain	Halt	
	SQL-Server2	192.168.110.161	1433	100	0	Drain	Halt	

10.2. Access the Database/Application

First ensure that any DNS records that are used to access the database are updated so that the FQDN resolves to the **MS-SQL-Server** VIP. Then verify that you're able to successfully access the database/application.

11. Technical Support

For more details about configuring the appliance and assistance with designing your deployment please don't hesitate to contact the support team using the following email address: support@loadbalancer.org.

12. Further Documentation

For additional information, please refer to the [Administration Manual](#).

13. Appendix

13.1. Configuring HA - Adding a Secondary Appliance

Our recommended configuration is to use a clustered HA pair of load balancers to provide a highly available and resilient load balancing solution. We recommend that the Primary appliance is fully configured first, then the Secondary appliance can be added to create an HA pair. Once the HA pair is configured, load balanced services must be configured and modified on the Primary appliance. The Secondary appliance will be automatically kept in sync.

 **Note**

For Enterprise Azure, the HA pair should be configured first. For more information, please refer to the Azure Quick Start/Configuration Guide available in the [documentation library](#)

The clustered HA pair uses Heartbeat to determine the state of the other appliance. Should the active device (normally the Primary) suffer a failure, the passive device (normally the Secondary) will take over.

Non-Replicated Settings

A number of settings are not replicated as part of the Primary/Secondary pairing process and therefore must be manually configured on the Secondary appliance. These are listed by WebUI menu option in the table below:

WebUI Main Menu Option	Sub Menu Option	Description
Local Configuration	Hostname & DNS	Hostname and DNS settings
Local Configuration	Network Interface Configuration	Interface IP addresses, bonding configuration and VLANs
Local Configuration	Routing	Default gateways and static routes
Local Configuration	System Date & time	Time and date related settings
Local Configuration	Physical – Advanced Configuration	Various appliance settings
Local Configuration	Portal Management	Portal management settings
Local Configuration	Security	Security settings
Local Configuration	SNMP Configuration	SNMP settings
Local Configuration	Graphing	Graphing settings
Local Configuration	License Key	Appliance licensing
Maintenance	Backup & Restore	Local XML backups
Maintenance	Software Updates	Appliance software updates
Maintenance	Fallback Page	Fallback page configuration
Maintenance	Firewall Script	Firewall (iptables) configuration
Maintenance	Firewall Lockdown Wizard	Appliance management lockdown settings

⚠ Important

Make sure that where any of the above have been configured on the Primary appliance, they're also configured on the Secondary.

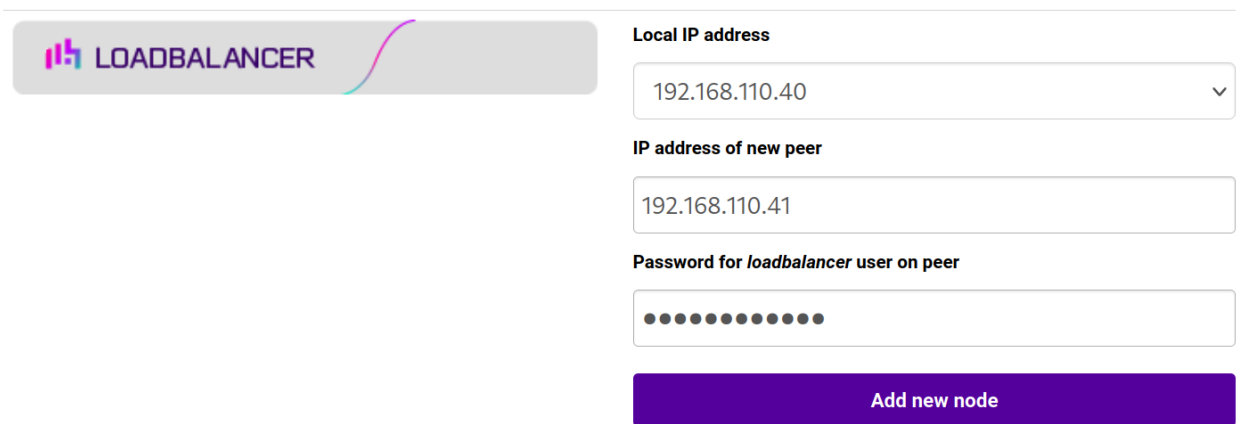
Configuring the HA Clustered Pair

📌 Note

If you have already run the firewall lockdown wizard on either appliance, you'll need to ensure that it is temporarily disabled on both appliances whilst performing the pairing process.

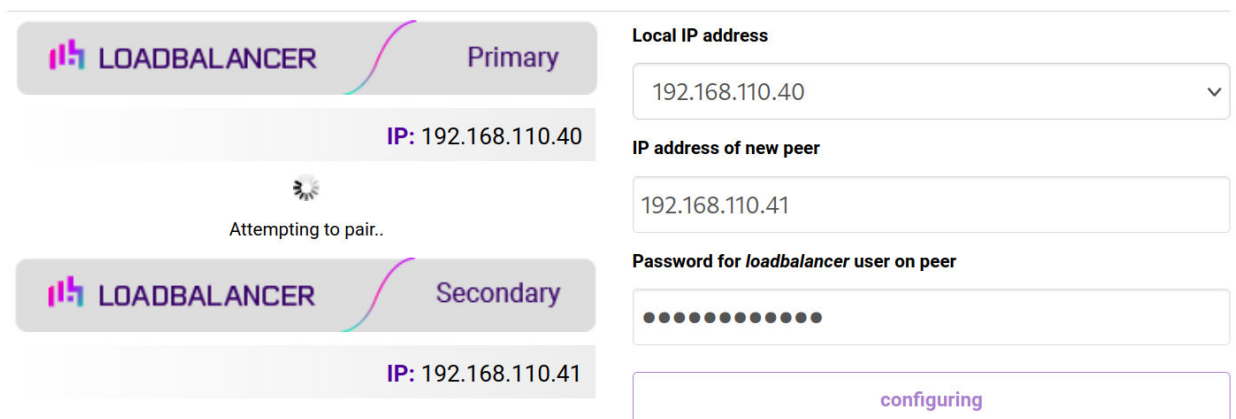
1. Deploy a second appliance that will be the Secondary and configure initial network settings.
2. Using the WebUI on the Primary appliance, navigate to: *Cluster Configuration > High-Availability Configuration*.

Create a Clustered Pair



3. Specify the IP address and the *loadbalancer* user's password for the Secondary (peer) appliance as shown in the example above.
4. Click **Add new node**.
5. The pairing process now commences as shown below:

Create a Clustered Pair



6. Once complete, the following will be displayed on the Primary appliance:

High Availability Configuration - primary

The screenshot displays a configuration interface for a High Availability (HA) setup. It features two Loadbalancer nodes: a Primary node with IP 192.168.110.40 and a Secondary node with IP 192.168.110.41. A prominent red button labeled 'Break Clustered Pair' is located at the top right of the configuration area.

7. To finalize the configuration, restart heartbeat and any other services as prompted in the "Commit changes" message box at the top of the screen.

Note

Clicking the **Restart Heartbeat** button on the Primary appliance will also automatically restart heartbeat on the Secondary appliance.

Note

For more details on configuring HA with 2 appliances, please refer to [Appliance Clustering for HA](#).

Note

For details on testing and verifying HA, please refer to [Clustered Pair Diagnostics](#).

13.2. SQL Server Health Check

Follow the steps below to configure a more robust health check. This reads and verifies data from a table in the database to verify SQL server health.

1. First, follow [these steps](#) to install the SQL Server health check on the load balancer.
2. Next, using the WebUI, navigate to *Cluster Configuration > Health Check Scripts*.
3. Click **Add New Health Check**.
4. Specify a **Name** for the health check, e.g. **SQL-Server**.
5. Ensure **Type** is set to **Virtual Service**.
6. Using the **Template** dropdown, select **ms-sql-check**.
7. Click **Update**.
8. Now click **Modify** next to the **MS-SQL-Server** VIP created earlier.
9. Scroll to the **Health Checks** section and change the **Health Check** to **External Script**.
10. Using the **Check Script** dropdown, select the health check script just created.
11. Click **Update**.
12. To apply the new settings, reload HAProxy using the button in the "Commit changes" box at the top of the screen.

14. Document Revision History

Version	Date	Change	Reason for Change	Changed By
1.0.0	10 April 2024	Initial version		AG, RJC





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About Loadbalancer.org

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