1. About this Guide

This guide details the steps required to configure a load balanced Leostream environment utilizing Loadbalancer.org appliances. It covers the configuration of the load balancers and also any Leostream 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 Leostream. For full specifications of available models please refer to https://www.loadbalancer.org/products.

Some features may not be supported in all cloud platforms due to platform specific limitations, please check with Loadbalancer.org support for further details.

3. Loadbalancer.org Software Versions Supported

- V8.3.8 and later

4. Leostream Software Versions Supported

- Leostream Connection Broker – 9.0 and later
- Leostream Gateway – 2.0 and later

5. Leostream

Leostream provides the critical remote desktop connection management technology required for organizations to build successful large-scale remote access solutions for physical, virtual, and cloud-hosted desktops. The Leostream Platform is the industry’s most widely deployed vendor-independent remote desktop connection management solution, enabling enterprises to integrate the complex array of clients, hosting platforms, guest operating systems, and display protocols required for successful VDI, hosted desktop, and application deployments.

6. Leostream Platform Components

- **Connection Broker**: The main application that manages the hosted desktop environment. The Connection Broker is the central management layer for configuring your deployment, including inventorying and provisioning desktops, assigning and connecting users to these desktops, and defining the end-user experience. The Connection Broker also includes a web portal for users to access their hosted resources.

- **Leostream Gateway**: An optional application that provides HTML5-based clientless remote access for users connecting to their remote desktop. The Leostream Gateway also provides gateway functionality for protocols such as RDP, HP ZCentral Remote Boost, NICE DCV, and Mechdyne TGX, to connect users to desktops that are hosted in a network that is isolated from the user’s client device.

- **Leostream Agent**: When installed on the remote desktop, the Leostream Agent provides the Connection Broker with insight into the connection status of remote users, including when they log out, disconnect, or are idle on their desktop. The Agent also manages enhancements such as USB device passthrough and network printer redirection. The Leostream Agent is available for Microsoft Windows, Linux, and macOS operating systems.
• **Leostream Connect**: A software client provided by Leostream that allows users to log into your Leostream environment and access their hosted resources from fat or thin clients. Using Leostream Connect, you can repurpose existing desktops and laptops as client devices, lowering the cost of VDI deployments. Some thin clients provide built-in Leostream Connect clients.

The Leostream Connection Broker and Gateway are deployed onto Linux hosts.

The Leostream Client and Agent can be deployed onto Windows, Linux, and Mac hosts.

7. Load Balancing Leostream

**Note**  
It’s highly recommended that you have a working Leostream environment first before implementing the load balancer.

**Load Balancing & HA Requirements**  
For high availability and scalability, it is recommended that multiple Leostream Gateway servers and multiple Connection Broker servers are deployed in load balanced clusters.

**Persistence (aka Server Affinity)**  
Source IP address based persistence is required to successfully load balance a Leostream deployment. This is true for load balancing Leostream gateway servers and for load balancing connection brokers.

**Virtual Service (VIP) Requirements**  
To provide load balancing and HA for Leostream, the following VIP is required:

- Leostream Gateway Service

Optionally, an additional VIP may be required as follows:

- Leostream Connection Broker Service

**Port Requirements**  
For the purposes of this guide, the focus will be on the RDP, PCoIP, and HP ZCentral remote protocols. Leostream is also compatible with a plethora of other different remote connection protocols, however. Refer to the official Leostream documentation for further details.

The following table shows the ports that are load balanced:

<table>
<thead>
<tr>
<th>Port</th>
<th>Protocols</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>TCP/HTTP</td>
<td>HTTP Logon to Leostream Service</td>
</tr>
<tr>
<td>443</td>
<td>TCP/HTTPS</td>
<td>HTTPS Logon to Leostream Service</td>
</tr>
<tr>
<td>3389</td>
<td>TCP/UDP/RDP</td>
<td>(Optional) Connection to RDP Hosts</td>
</tr>
<tr>
<td>42966</td>
<td>TCP/UDP/HP RGS</td>
<td>(Optional) ZCentral Remote Boost (Formerly HP Remote Graphics Software)</td>
</tr>
<tr>
<td>Port</td>
<td>Protocols</td>
<td>Use</td>
</tr>
<tr>
<td>-------</td>
<td>---------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>4172</td>
<td>TCP/UDP/PCoIP</td>
<td>(Optional) PC-over-IP Remote Display Protocol</td>
</tr>
<tr>
<td>50001</td>
<td>TCP/PCoIP</td>
<td>(Optional) PC-over-IP Remote Display Protocol</td>
</tr>
<tr>
<td>50002</td>
<td>TCP/PCoIP</td>
<td>(Optional) PC-over-IP Remote Display Protocol</td>
</tr>
</tbody>
</table>

**Note** Optional protocols are dependent on the remote desktop protocol in use for client connections.

8. Deployment Concept

Leostream can be deployed in two different ways that can be load balanced.

**Multiple Leostream Gateways Connecting to a Single Leostream Connection Broker**

**Step 1: Authentication**
(Single Leostream Connection Broker)

**Step 2: Remote Connection**
(Single Leostream Connection Broker)
VIPs = Virtual IP Addresses

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.

Multiple Leostream Gateways Connecting to a Cluster of Leostream Connection Brokers

Step 1: Authentication
(Clustered Leostream Connection Brokers)

Step 2: Remote Connection
(Clustered Leostream Connection Brokers)

VIPs = Virtual IP Addresses

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.
Leostream Gateway Configuration

Carry out the following instructions on each gateway server:

1. Change the ARP behaviour of the server by following the instructions in the section Solving the ARP Problem for Linux of the appendix.

2. Open an SSH connection to the Leostream Gateway host.

3. Run the command leostream-gateway --broker <BROKER_VIP_L4>
   - Non-clustered connection broker deployment: Use the IP address / FQDN of the connection broker server.
   - Clustered connection broker deployment: Use the VIP address of the connection broker virtual service.

   ```
   [root@localhost ~]# leostream-gateway --broker 192.168.98.237
   Connection Broker forwarding is enabled
   ```

4. Run the command leostream-gateway --info to confirm that the connection broker has been added to the configuration.

   ```
   [root@localhost ~]# leostream-gateway --info
   OS is CentOS 7
   Port range is 20001-23000
   Gateway version is 2.0.0.18
   The VPN is OFF
   Connection Broker forwarding is ON to 192.168.98.237
   Azure Broker forwarding is OFF
   Guacamole is ENABLED
   This Gateway is attached to a Connection Broker
   ```

Leostream Connection Broker Configuration

Carry out the following instructions on each connection broker server:

1. Change the ARP behaviour of the server by following the instructions in the section Solving the ARP Problem for Linux of the appendix.

2. Connect to the connection broker server via browser and login as an admin user.

3. From the left hand menu, expand Setup, navigate to Gateways, and click on Add Gateway Cluster as the top of the main window.
4. Set the name of the cluster.

5. Choose the option **All Gateways in this cluster**.

6. In the text box **Public IP address or FQDN of the external load balancer**, put in the VIP address of the connection broker virtual service.

7. **Set Method for routing display protocol traffic through this Leostream gateway** to **From random gateway port to protocol-specific desktop port**.

8. Click **Save** to commit the changes.
9. On the Gateways page, click **Add Gateway**.
10. Select the gateway cluster created in the previous step from the drop-down list.

11. Set Public IP address or FQDN for use in Protocol Plans as the VIP address of the gateway virtual service.

12. Set IP address or FQDN used for Connection Broker communications to this Gateway as real server’s own IP address / FQDN.

13. Click Save to commit the changes.
14. Repeat the *Add Gateway* process to add additional Leostream Gateways as required.

15. From the left hand menu, navigate to *Configuration > Protocol Plans*.

16. Click on *Edit* next to the *Default* plan.
17. For each protocol in use, set the **Gateway** to the gateway cluster created previously.

18. Save the changes.

**Leostream Agent Configuration**

For each Leostream agent installed, the agent should be configured with either the connection broker VIP address or the (solo) connection broker’s IP address / FQDN in a *non-clustered environment*. This should be set as the **Trusted Connection Broker Address**, like so:
Leostream Connect Client Configuration

Leostream Connect clients must be configured as described below, depending on the specific platform in use.

Windows Clients

1. Open the Leostream Connect client.

2. Right-click on the Leostream icon in the Windows taskbar and click on Options...

3. Click on the Broker tab and set the Address to the VIP address of the gateway service.

Java Clients

1. Navigate to the location of (directory that contains) the LeostreamConnect.jar file.

2. Create or edit a file named lc.conf that contains the following minimum contents:
trace_level=ERROR,WARN,INFO,TRACE,DIAG
rdp_path=/usr/bin/remmina
connection_broker_auto_discovery=false
recent_brokers=192.168.98.231
connection_broker_address=<GW_VIP_L4>

where GW_VIP_L4 is the VIP address of the gateway service.

Note Set the rdp_path variable to the location of the preferred RDP client.

9. Loadbalancer.org Appliance – the Basics

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 The Virtual Appliance - Hypervisor Deployment and the ReadMe.txt text file included in the VA download for more detailed information on deploying the VA using various Hypervisors.

Note For the VA, 4 NICs are included but only eth0 is connected by default at power up. If the other NICs are required, these should be connected using the network configuration screen within the Hypervisor.

Initial Network Configuration
After boot up, follow the instructions on the console to configure the IP address, subnet mask, default gateway, DNS and other network settings.

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

Accessing the WebUI
The WebUI is accessed using a web browser. By default, user authentication is based on local Apache .htaccess files. User administration tasks such as adding users and changing passwords can be performed using the WebUI menu option: Maintenance > Passwords.

Note A number of compatibility issues have been found with various versions of Internet Explorer and Edge. The WebUI has been tested and verified using both Chrome & Firefox.
If required, users can also be authenticated against LDAP, LDAPS, Active Directory or Radius. For more information please refer to External Authentication.

1. Using a browser, access the WebUI using the following URL:


2. Log in to the WebUI:

   - **Username:** loadbalancer
   - **Password:** <configured-during-network-setup-wizard>

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

Once logged in, the WebUI will be displayed as shown below:
The WebUI for the VA is shown, the hardware and cloud appliances are very similar. The yellow licensing related message is platform & model dependent.

3. You'll be asked if you want to run the Setup Wizard. If you click Accept the Layer 7 Virtual Service configuration wizard will start. If you want to configure the appliance manually, simple click Dismiss.

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
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.

10. Appliance Configuration for Leostream

Configuring VIP 1 - Leostream Gateway Service
Configuring the Virtual Service (VIP)
1. Using the web user interface, navigate to Cluster Configuration > Layer 4 – Virtual Services and click on Add a new Virtual Service.
2. Define the Label for the virtual service as required, e.g. GW_VIP_L4.
3. Set the Virtual Service IP Address field to the required IP address, e.g. 192.168.98.238.
4. Set the Ports field to cover the remote desktop protocols in use, e.g. 80,443,3389,4172,42966,50001,50002.
5. Set the Protocol to TCP/UDP.
7. Click Update to create the virtual service.

Layer 4 - Add a new Virtual Service

<table>
<thead>
<tr>
<th>Virtual Service</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Label</td>
<td>GW_VIP_L4</td>
</tr>
<tr>
<td>IP Address</td>
<td>192.168.98.238</td>
</tr>
<tr>
<td>Ports</td>
<td>80,443,3389,4172,42966,50001,50002</td>
</tr>
<tr>
<td>Protocol</td>
<td>TCP/UDP</td>
</tr>
<tr>
<td>Forwarding Method</td>
<td>Direct Routing</td>
</tr>
</tbody>
</table>

8. Click Modify next to the newly created VIP.
9. Ensure that the Persistence Enable checkbox is checked.
10. Set the Health Checks Check Type to Negotiate.
11. Set the *Check Port* to 443.
12. Set the *Protocol* to HTTPS.
13. Set the *Request to send* to `/app/system/ping`
14. Set the *Response expected* to OK
15. Click *Update*.

**Persistence**
- **Enable**: 
- **Timeout**: 300 seconds
- **Granularity**: 

**Health Checks**
- **Check Type**: Negotiate
- **Check Port**: 443
- **Protocol**: HTTPS
- **Virtual Host**: 
- **Request to send**: `/app/system/ping`
- **Response expected**: OK

---

**Defining the Real Servers (RIPs)**

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on *Add a new Real Server* next to the newly created VIP.
2. Define the *Label* for the real server as required, e.g. GW01.
3. Set the *Real Server IP Address* field to the required IP address, e.g. 192.168.98.231.
4. Click *Update*.
5. Repeat these steps to add additional Leostream Gateways as real servers as required.
Important
This virtual service should only be configured in a deployment with multiple, clustered Leostream Connection Brokers. If operating with a single Leostream Connection Broker then skip setting up this service.

Configuring VIP 2 - Leostream Connection Broker Service

Configuring the Virtual Service (VIP)

1. Using the web user interface, navigate to Cluster Configuration > Layer 4 – Virtual Services and click on Add a new Virtual Service.

2. Define the Label for the virtual service as required, e.g. BROKER_VIP_L4.

3. Set the Virtual Service IP Address field to the required IP address, e.g. 192.168.98.237.

4. Set the Ports field to 80,443.

5. Set the Protocol to TCP.

6. Set the Forwarding Method to Direct Routing.

7. Click Update to create the virtual service.
8. Click **Modify** next to the newly created VIP.

9. Ensure that the **Persistence Enable** checkbox is checked.

10. Set the **Health Checks Check Type** to **Negotiate**.

11. Set the **Check Port** to **443**.

12. Set the **Protocol** to **HTTPS**.

13. Set the **Request to send** to `/index.pl?action=cb_status`

14. Set the **Response expected** to **CB_IS_OK**

15. Click **Update**.
Defining the Real Servers (RIPs)

1. Using the web user interface, navigate to Cluster Configuration > Layer 4 – Real Servers and click on Add a new Real Server next to the newly created VIP.

2. Define the Label for the real server as required, e.g. BRK01.

3. Set the Real Server IP Address field to the required IP address, e.g. 192.168.98.230.

4. Click Update.

5. Repeat these steps to add additional Leostream Connection Brokers as real servers as required.

11. Testing & Verification

For additional general guidance please also refer to Testing Load Balanced Services.
Testing the Load Balanced Gateway Service

The load balanced Leostream gateway service can be tested by using it.

1. Use SSH to connect to both Leostream gateway hosts as the root user.
2. Execute the command `leostream --conn` to view current connections.

   
   ![Screenshot of leostream-gateway --conn output]

3. Use a web browser to connect to the Leostream gateway virtual service and log in using appropriate authorised credentials.

4. Select a client to connect to.

5. Open the downloaded file in an RDP client and enter appropriate credentials (if SSO isn’t enabled).
6. A connection should be successfully established to the remote client, via the gateway virtual service configured on the load balancer.
7. On the Leostream gateway hosts, re-execute the command `leostream --conn` and the active connection should be listed.

```
[root@localhost ~]# leostream-gateway --conn
```  

<table>
<thead>
<tr>
<th>Desktop</th>
<th>Port</th>
<th>Dport</th>
<th>Source address</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.168.98.235</td>
<td>3389</td>
<td>3389</td>
<td>192.168.65.185</td>
<td>de8e9319ea66b1dcb2579ec285f17bb4</td>
</tr>
</tbody>
</table>

8. Use a web browser to connect to the Leostream connection broker service (if configured).

9. In the menu on the left, navigate to `Resources > Desktops`.

10. A `Release` option should be visible next to the client that has been connected to.

11. Repeat these tests using Leostream connection clients, if applicable.
Using System Overview
The System Overview can be viewed in the WebUI. It shows a graphical view of all VIPs & RIPs (i.e. the web 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 both web servers are healthy and available to accept connections:

<table>
<thead>
<tr>
<th>VIRTUAL SERVICE</th>
<th>IP</th>
<th>PORTS</th>
<th>CONNS</th>
<th>PROTOCOL</th>
<th>METHOD</th>
<th>MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW_VIP_L4</td>
<td>192.168.98.238</td>
<td>80,443,338..</td>
<td>0</td>
<td>TCP/UDP</td>
<td>Layer 4</td>
<td>DR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REAL SERVER</th>
<th>IP</th>
<th>PORTS</th>
<th>WEIGHT</th>
<th>CONNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW01</td>
<td>192.168.98.231</td>
<td>80,443,338..</td>
<td>100</td>
<td>Drain</td>
</tr>
<tr>
<td>GW02</td>
<td>192.168.98.232</td>
<td>80,443,338..</td>
<td>100</td>
<td>Drain</td>
</tr>
</tbody>
</table>

| BROKER_VIP_L4   | 192.168.98.237 | 80,443 | 0     | TCP      | Layer 4 | DR   |

12. 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

13. Further Documentation

14. Conclusion
Loadbalancer.org appliances provide a very cost effective solution for highly available load balanced Leostream environments.
15. Appendix

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 should be configured first, then the Secondary should be added. Once the Primary and Secondary are paired, all load balanced services configured on the Primary are automatically replicated to the Secondary over the network using SSH/SCP.

Note
For Enterprise Azure, the HA pair should be configured first. In Azure, when creating a VIP using an HA pair, 2 private IPs must be specified – one for the VIP when it’s active on the Primary and one for the VIP when it’s active on the Secondary. Configuring the HA pair first, enables both IPs to be specified when the VIP is created.

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.

Note
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:

<table>
<thead>
<tr>
<th>WebUI Main Menu Option</th>
<th>Sub Menu Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Configuration</td>
<td>Hostname &amp; DNS</td>
<td>Hostname and DNS settings</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>Network Interface</td>
<td>All network settings including IP address(es), bonding configuration and VLANs</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>Routing</td>
<td>Routing configuration including default gateways and static routes</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>System Date &amp; time</td>
<td>All time and date related settings</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>Physical – Advanced</td>
<td>Various settings including Internet Proxy, Management Gateway,</td>
</tr>
<tr>
<td></td>
<td>Configuration</td>
<td>Firewall connection tracking table size, NIC offloading, SMTP relay,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>logging and Syslog Server</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>Security</td>
<td>Appliance security settings</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>SNMP Configuration</td>
<td>Appliance SNMP settings</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>Graphing</td>
<td>Appliance graphing settings</td>
</tr>
<tr>
<td>Local Configuration</td>
<td>License Key</td>
<td>Appliance licensing</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Software Updates</td>
<td>Appliance software update management</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Firewall Script</td>
<td>Appliance firewall (iptables) configuration</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Firewall Lockdown Wizard</td>
<td>Appliance management lockdown settings</td>
</tr>
</tbody>
</table>

To add a Secondary node - i.e. create a highly available clustered pair:
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.*

3. Specify the IP address and the `loadbalancer` user’s password for the Secondary (peer) appliance as shown above.

4. Click *Add new node.*

5. The pairing process now commences as shown below:

6. Once complete, the following will be displayed on the Primary appliance:
7. To finalize the configuration, restart heartbeat and any other services as prompted in the blue 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.

Solving the ARP Problem 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 following command to an appropriate start-up script such as /etc/rc.local on each of your Real Servers. If Real Servers are serving multiple VIPs, add additional iptables rules for each VIP.

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

```
e.g.
iptables -t nat -A PREROUTING -d 10.0.0.21 -j REDIRECT
```

Note | 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.

Note | 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.

Note | 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 1-4 below on each Real Server.

**Step 1 of 4: 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`:

```bash
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
```

**Note** Adjust the commands shown above to suit the network configuration of your servers.

**Step 2 of 4: re-configure DAD on the Real Servers (this step can be skipped for IPv4 Virtual Services)**

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

```bash
net.ipv6.conf.lo.dad_transmits=0
net.ipv6.conf.lo.accept_dad=0
```

**Step 3 of 4: apply these settings**

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

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

**Step 4 of 4: 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`.

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

*for IPv6 addresses use:*

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

**Note** You can check if this command added the VIP successfully using the command:

```
ip addr ls
```

You can remove the VIP from the loopback adapter using the command:
ip addr del dev lo <IPv4-VIP>/32

Steps 1, 2 & 3 can be replaced by writing directly to the required files using the following commands (run as root at the command line), this is temporary until the next reboot:

```bash
Note

<table>
<thead>
<tr>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>echo 1 &gt; /proc/sys/net/ipv4/conf/all/arp_ignore</td>
</tr>
<tr>
<td>echo 1 &gt; /proc/sys/net/ipv4/conf/eth0/arp_ignore</td>
</tr>
<tr>
<td>echo 1 &gt; /proc/sys/net/ipv4/conf/eth1/arp_ignore</td>
</tr>
<tr>
<td>echo 2 &gt; /proc/sys/net/ipv4/conf/all/arp_announce</td>
</tr>
<tr>
<td>echo 2 &gt; /proc/sys/net/ipv4/conf/eth0/arp_announce</td>
</tr>
<tr>
<td>echo 2 &gt; /proc/sys/net/ipv4/conf/eth1/arp_announce</td>
</tr>
<tr>
<td>echo 0 &gt; /proc/sys/net/ipv6/conf/lo/accept_dad</td>
</tr>
</tbody>
</table>
```

**Method 3 (using firewalld)**

In some newer versions of Linux, iptables is being deprecated in favour of firewalld. The following command can be used on each Real Server to resolve the ARP issue using firewalld:

```bash
firewall-cmd --permanent --direct --add-rule ipv4 nat PREROUTING 0 -d <VIP> -j REDIRECT
```

e.g.

```bash
firewall-cmd --permanent --direct --add-rule ipv4 nat PREROUTING 0 -d 10.0.0.50 -j REDIRECT
```

**Note** Change the IP address to be the same as your Virtual Service.

To apply the new configuration, reload the firewall rules:

```bash
firewall-cmd --reload
```

The current permanent configuration will become the new firewalld runtime configuration as well as the configuration at the next system start.
## 16. Document Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Change</th>
<th>Reason for Change</th>
<th>Changed By</th>
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<tbody>
<tr>
<td>1.0.0</td>
<td>1 Jan 2021</td>
<td>Initial version</td>
<td></td>
<td>DT, AH</td>
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About Loadbalancer.org

Loadbalancer.org's mission is to ensure that its clients' businesses are never interrupted. The load balancer experts ask the right questions to get to the heart of what matters, bringing a depth of understanding to each deployment. Experience enables Loadbalancer.org engineers to design less complex, unbreakable solutions - and to provide exceptional personalized support.

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