

# Load Balancing GE HealthCare Centricity Cardio Workflow

Version 1.0



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### 1. About this Guide

This guide details the steps required to configure a load balanced GE HealthCare Centricity Cardio Workflow (CCW) environment utilizing Loadbalancer.org appliances. It covers the configuration of the load balancers and also any CCW configuration changes that are required to enable load balancing.

# 1.1. Acronyms Used in the Guide

Acronym	Description
CCW	Centricity Cardio Workflow
CCG	Centricity Clinical Gateway
CCG_IB	Centricity Clinical Gateway Inbound
EMR	Electronic Medical Record

# 2. Prerequisites

- 1. Have access to the VMware Hypervisor environment to enable the Loadbalancer.org Virtual Appliance (VA) to be deployed and configured.
- 2. Have sufficient available Hypervisor CPU and memory resources to allocate to the VA based on the required throughput for details refer to Virtual Hardware Resource Requirements.
- 3. Ensure that firewalls and other network devices are configured to allow management and other required access to the VA for details of all ports used refer to Ports Used by the Appliance.
- 4. Ensure that firewalls and other network devices are configured to allow client/test access to all Virtual Services (VIPs).
- 5. Ensure that firewalls and other network devices are configured to allow load balancer access to all CCW servers.
- 6. Have IP addresses for the VA and all required Virtual Services.
- 7. Have access to the CCW servers to enable the ARP problem to be solved for Layer 4 DR mode VIPs for details refer to Configuring CCW for Load Balancing.

# 3. Software Versions Supported

# 3.1. Loadbalancer.org Appliance

• V8.9.0 & later

#### 3.2. GE HealthCare CCW

All versions

# 4. Load Balancing CCW



8 Note

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

### 4.1. Virtual Services (VIP) Requirements

To provide load balancing and HA for CCW, the following VIPs are required:

Refere nce	VIP Name	Mode	Port(s)	Persistence Mode	Health Check
VIP 1	CCW_WEB_443	L7 SNAT	443	Source IP	Connect to Port
VIP 2	CCW_WEB_8443	L7 SNAT	8443	HTTP Cookie	Connect to Port
VIP 3	CCW_WEB_44301	L7 SNAT	44301	Source IP	Connect to Port
VIP 4	CCW_WEB_8070-49200-49201	L7 SNAT	8070, 49200, 49201	Source IP	Connect to Port
VIP 5	CCW_NOTIFICATION	L7 SNAT	44300	Last Successful	HTTPS (GET)
VIP 6	CCW_DICOMSERVICE_VS	L4 DR	104	None	DICOM C-Echo
VIP 7	CCW_DICOMSERVER_VS	L4 DR	1230	None	DICOM C-Echo
VIP 8	CCW_DICOM_1115	L4 DR	1115	None	DICOM C-Echo
VIP 9	CCW_DICOM_1299	L4 DR	1299	None	DICOM C-Echo
VIP 10	CCG_IB_2101	L7 SNAT	2101	Last Successful	Connect to Port
VIP 11	CCG_IB_2102	L7 SNAT	2102	Last Successful	Connect to Port
VIP 12	EMR_INBOUND	L7 SNAT	4001	Last Successful	Connect to Port
VIP 13	PORT_EMR_IB	L7 SNAT	4002	Last Successful	Connect to Port
VIP 14	PORT_CCG_IB_2103	L7 SNAT	2103	Last Successful	Connect to Port
VIP 15	PORT_CCG_IB_2104	L7 SNAT	2104	Last Successful	Connect to Port

#### 4.2. Last Successful Persistence

With this persistence mode, traffic will always be sent to the same server until that server fails. When used together with the **First** scheduler, traffic will initially always be sent to the first server in the list. If the first server fails, traffic will then be sent to the second server in the list, etc. When the first server is brought back on-line, traffic will continue to be sent to the second server until either the stick table is cleared or the second server is halted.

8 Note

For details on how to clear a stick table, please refer to Last Successful - Clearing the Stick Table.

# 5. Ports Used by the Appliance

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

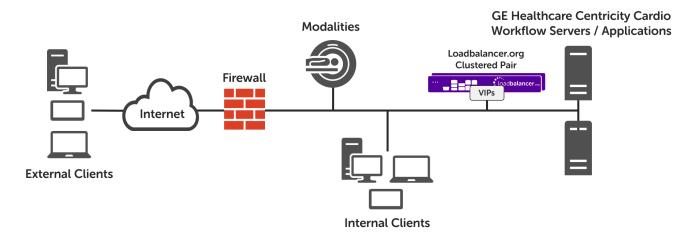


Protocol	Port	Purpose
TCP	22 *	SSH
TCP & UDP	53 *	DNS / GSLB
TCP & UDP	123	NTP
TCP & UDP	161 *	SNMP
UDP	6694	Heartbeat between Primary & Secondary appliances in HA mode
TCP	7778	HAProxy persistence table replication
TCP	9000 *	Gateway service (Centralized/Portal Management)
TCP	9080 *	WebUI - HTTP (disabled by default)
TCP	9081 *	Nginx fallback page
TCP	9443 *	WebUI - HTTPS
TCP	25565 *	Shuttle service (Centralized/Portal Management)

8 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.

# 6. Deployment Concept



VIP = Virtual IP Address

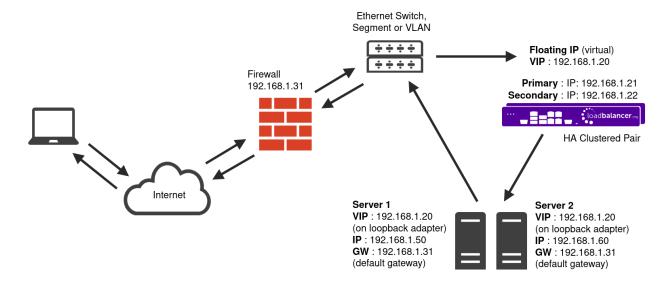
# 7. Load Balancer Deployment Methods

For CCW, both layer 4 DR mode and layer 7 SNAT mode are used. These modes are described below and are used for the configurations presented in this guide.

# 7.1. Layer 4 DR Mode

Layer 4 DR (Direct Routing) mode is a very high performance solution that requires little change to your existing infrastructure.





- DR mode works by changing the destination MAC address of the incoming packet to match the selected Real Server on the fly which is very fast.
- When the packet reaches the Real Server it expects the Real Server to own the Virtual Services IP address (VIP). This means that each Real Server (and the load balanced application) must respond to both the Real Server's own IP address and the VIP.
- The Real Server should not respond to ARP requests for the VIP. Only the load balancer should do this.
   Configuring the Real Server in this way is referred to as "Solving the ARP Problem". For more information please refer to DR Mode Considerations.
- On average, DR mode is 8 times quicker than NAT mode for HTTP and much faster for other applications such as Remote Desktop Services, streaming media and FTP.
- The load balancer must have an interface in the same subnet as the Real Servers to ensure layer 2 connectivity which is required for DR mode to operate.
- The VIP can be brought up on the same subnet as the Real Servers or on a different subnet provided that the load balancer has an interface in that subnet.
- Port translation is not possible with DR mode, e.g. VIP:80 → RIP:8080 is not supported.
- DR mode is transparent, i.e. the Real Server will see the source IP address of the client.

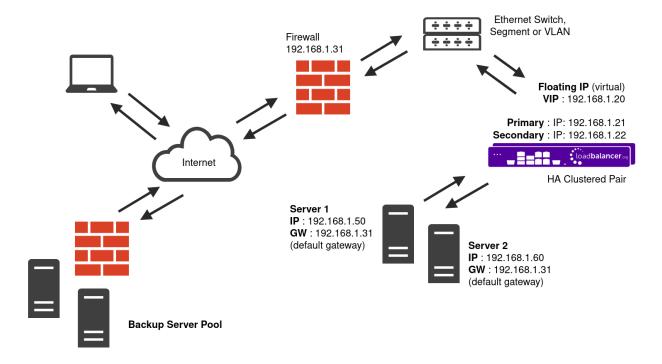
8 Note

For additional information on how the MAC address is modified in relation to the traffic flow between the load balancer, the load balanced backend servers and the Modality, please refer DR Mode Packet Manipulation in the appendix.

# 7.2. 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. Configuring CCW for Load Balancing

# 8.1. Layer 7 SNAT Mode

Layer 7 SNAT mode VIPs do not require any mode specific configuration changes to the load balanced Real Servers (CCW Servers).

# 8.2. Layer 4 DR Mode



Layer 4 DR mode VIPs require the "ARP problem" to be solved on each load balanced Real Server (CCW Server). This enables DR mode to work correctly.

The "ARP problem" must be solved on each Real Server associated with the following VIPs:

- VIP 6 CCW\_DICOMSERVICE\_VS
- VIP 7 CCW\_DICOMSERVER\_VS
- VIP 8 CCW\_DICOM\_1115
- VIP 9 CCW\_DICOM\_1299

Detailed steps on solving the "ARP problem" for Windows 2012 and later are presented below.

#### 8.2.1. Windows Server 2012 & Later

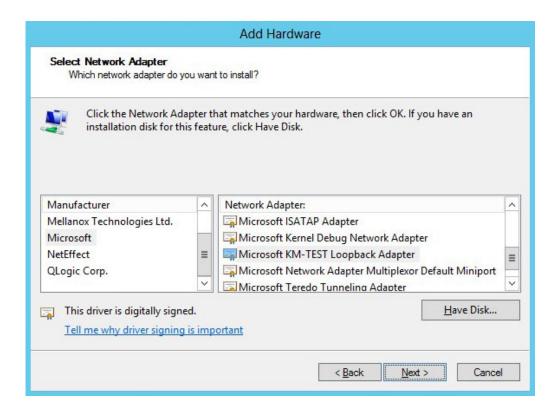
Windows Server 2012 and later support Direct Routing (DR) mode through the use of the Microsoft Loopback Adapter that must be installed and configured on each load balanced (Real) Server. The IP address configured on the Loopback Adapter must be the same as the Virtual Service (VIP) address. This enables the server to receive packets that have their destination set as the VIP address. If a Real Server is included in multiple DR mode VIPs, an IP address for each VIP must be added to the Loopback Adapter.

In addition, the strong/weak host behavior must be configured on each Real Server. The weak host model allows packets with any IP to be sent or received via an interface. The strong host model only allows packets with an IP belonging to the interface to be sent or received.

(!) Important The following 3 steps must be completed on **all** Real Servers associated with the VIP.

#### 8.2.1.1. Step 1 of 3: Install the Microsoft Loopback Adapter

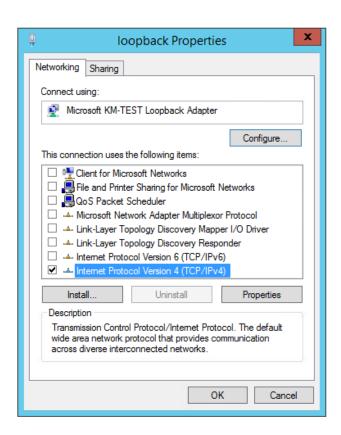
- 1. Click **Start**, then run **hdwwiz** to start the Hardware Installation Wizard.
- 2. Once the Wizard has started, click Next.
- 3. Select Install the hardware that I manually select from a list (Advanced), click Next.
- 4. Select Network adapters, click Next.



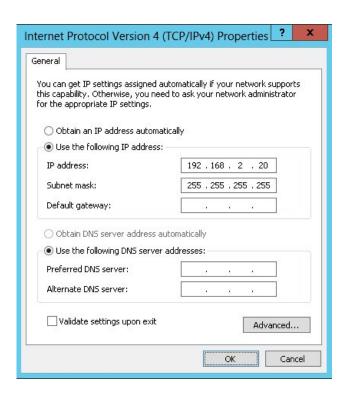
- 5. Select Microsoft & Microsoft KM-Test Loopback Adapter, click Next.
- 6. Click **Next** to start the installation, when complete click **Finish**.

#### 8.2.1.2. Step 2 of 3: 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. Uncheck all items except Internet Protocol Version 4 (TCP/IPv4) as shown below:



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



- Note 192.168.2.20 is an example, make sure you specify the correct VIP address.
- Note If a Real Server is included in multiple DR mode VIPs, an IP address for each VIP must be

6. Click **OK** then click **Close** to save and apply the new settings.

#### 8.2.1.3. Step 3 of 3: Configure the strong/weak host behavior

The strong/weak host behavior can be configured using either of the following 2 methods:

- Option 1 Using network shell (netsh) commands
- Option 2 Using PowerShell cmdlets

The commands in this section assume that the LAN Adapter is named "**net**" and the Loopback Adapter is named "**loopback**" as shown in the example below:



(!) Important

Either adjust the commands to use the names allocated to your LAN and loopback adapters, or rename the adapters before running the commands. Names are case sensitive so make sure that the interface names used in the commands match the adapter names exactly.

#### Option 1 - Using Network Shell (netsh) Commands

To configure the correct strong/weak host behavior run the following commands:

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

#### Option 2 - Using PowerShell Cmdlets

```
{\tt Set-NetIpInterface - InterfaceAlias \ loopback - WeakHostReceive \ enabled - WeakHostSend \ enabled - DadTransmits \ 0 \ - AddressFamily \ IPv4}
```

Set-NetIpInterface -InterfaceAlias net -WeakHostReceive enabled -AddressFamily IPv4

# 9. Appliance Installation & Configuration for CCW

#### 9.1. Overview



For CCW deployments, 2 load balancer appliances must be installed and configured and then paired to create an active/passive HA clustered pair.

The following is an overview of the installation and configuration process:

- 1. Deploy 2 Virtual Appliances refer to Section 9.2
- 2. Configure the management IP address and other network settings on **both** appliances refer to Section 9.3
- 3. Run a software update check on **both** appliances refer to Section 9.5
- 4. Configure the appliance security mode on **both** appliances refer to Section 9.6
- 5. Verify network connections and configure any additional settings on **both** appliances refer to Section 9.7
- 6. Configure the required load balanced services on the **Primary** appliance refer to Section 9.8
- 7. Restart services on the **Primary** appliance refer to Section 9.8.18
- 8. Verify that everything is working as expected on the **Primary** appliance refer to Section 10
- 9. Configure the HA Pair on the **Primary** appliance this will replicate all load balanced services to the Secondary appliance, once configured the Secondary appliance will be kept in-sync automatically refer to Section 11
- 10. Configure any required optional settings on both appliances refer to Section 12

# 9.2. Virtual Appliance Installation

#### 9.2.1. Download & Extract the Appliance

- 1. Download the Virtual Appliance.
- 2. Unzip the contents of the file to your chosen location.

#### 9.2.2. Virtual Hardware Resource Requirements

By default, the GE HealthCare appliance is allocated the following resources:

- 4 vCPUs
- 8GB RAM
- 20GB disk

These settings can be left at their default values unless advised otherwise.

### 9.2.3. VMware vSphere Client

The steps below apply to VMware ESX/ESXi & vSphere Client v6.7 and later.

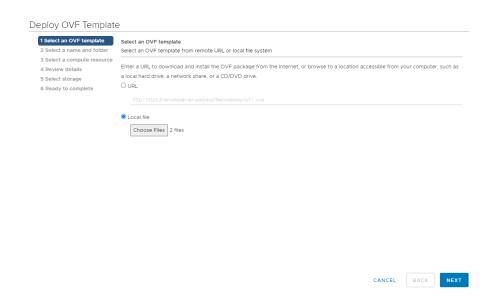
#### 9.2.3.1. Upgrading to the latest Hardware Version

When the appliance is deployed, the virtual hardware version is set to 11. This enables compatibility with ESX version 6.0 and later. You can upgrade to a later hardware version if required.

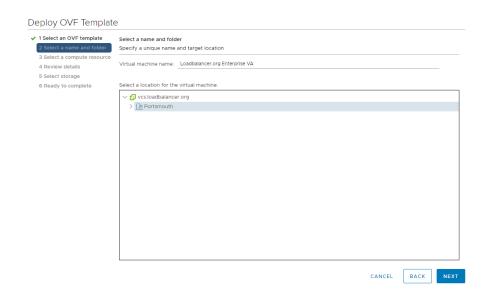


#### 9.2.3.2. Installing the Appliance using vSphere Client

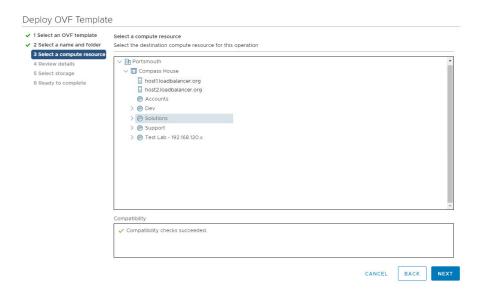
- 1. Right-click the inventory object where the appliance is to be located and select **Deploy OVF Template**.
- 2. In the **Select an OVF Template** screen, select the **Local File** option, click **Browse**, navigate to the download location, select the **.ova** file and click **Next**.



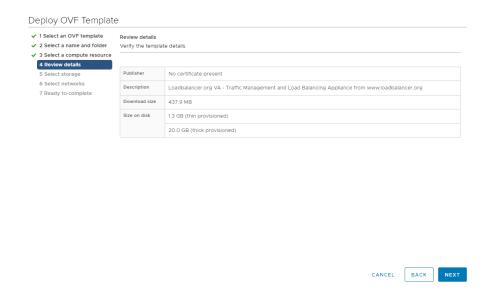
- 3. In the **Select a name and folder** screen, type a suitable name for the appliance this can be up to 80 characters in length.
- 4. Select the required location for the appliance by default this will be the location of the inventory object from where the wizard was started and click **Next**.



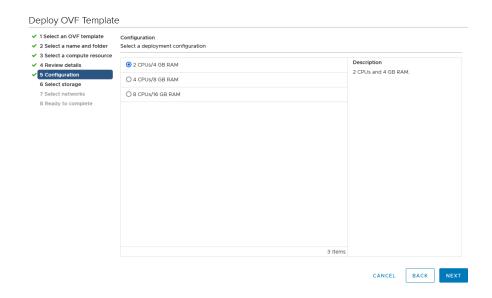
5. In the **Select a compute resource** screen, select the required compute resource for the appliance - by default this will be the inventory object from where the wizard was started and click **Next**.



6. In the Review details screen, verify the template details and click Next.

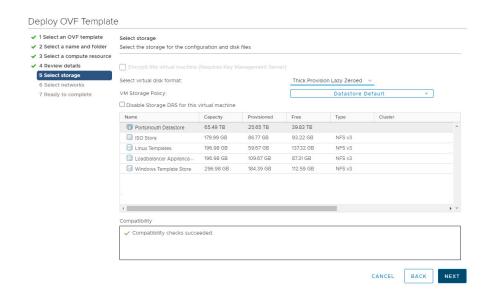


- 7. In the Configuration screen, select the required CPU/RAM deployment configuration and click Next.
- Note These settings can be changed after deployment if needed.

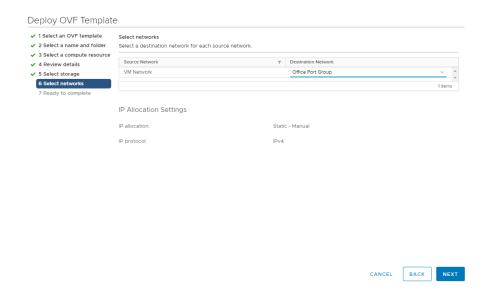


- 8. In the **Select Storage** screen, first select the required storage location for the appliance.
- 9. Now select the required disk format and click Next.
  - Note

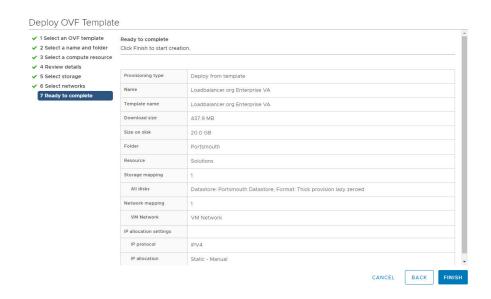
    Loadbalancer.org recommends selecting a thick provision format. By default the appliance disk is 20GB.



 In the Select Networks screen, select the required destination network using the drop-down next to VM Network and click Next.



11. In the **Ready to complete** screen, review the settings and click **Finish** to create the virtual appliance. To change a setting, use the **Back** button to navigate back through the screens as required.



#### 9.2.3.3. Configure Network Adapters

The appliance has 4 network adapters. By default only the first adapter is connected which is the requirement for GE HealthCare deployments. This will be **eth0** when viewed in the appliance WebUI.

#### 9.2.3.4. Start the Appliance

Now power up the appliance.

# 9.3. Configuring Initial Network Settings

After power up, the following startup message is displayed on the appliance console:

```
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/
```

As mentioned in the text, to perform initial network configuration, login as the "setup" user at the appliance console.

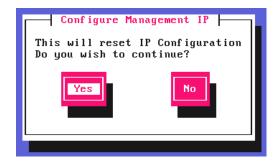
Once logged in, the Network Setup Wizard will start automatically. This will enable you to configure the management IP address and other network settings for the appliance.

login to the console:

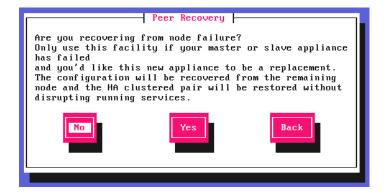
**Username:** setup **Password:** setup

A series of screens will be displayed that allow network settings to be configured:

In the Configure Management IP screen, leave Yes selected and hit <ENTER> to continue.



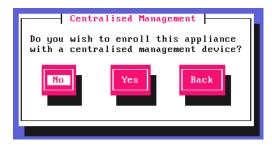
In the **Peer Recovery** screen, leave **No** selected and hit <ENTER> to continue.



In the Centralized Management screen, if you have been provided with Management Server details select Yes,



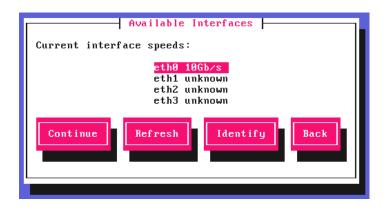
otherwise leave No selected, then hit <ENTER> to continue.



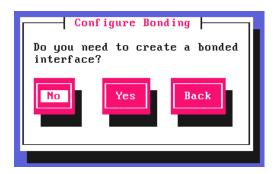
8 Note

For information on how to modify Centralized Management settings via the WebUI, please refer to Portal Management & Appliance Adoption.

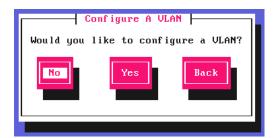
In the Available Interfaces screen, a list of available interfaces will be displayed, hit <ENTER> to continue.



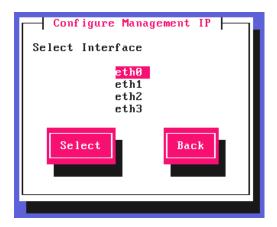
In the **Configure Bonding** screen, leave **No** selected, then hit <ENTER> to continue.



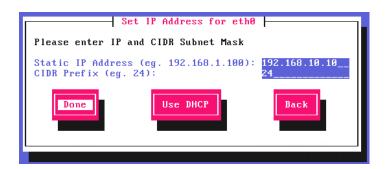
In the Configure a VLAN screen, leave No selected, then hit <ENTER> to continue.



In the Configure Management IP screen, select eth0 and hit <ENTER> to continue.



In the **Set IP address** screen, specify the required management address in the **Static IP Address** & **CIDR Prefix** fields, select **Done** and hit <ENTER> to continue.



Note A subnet mask such as 255.255.255.0 is not valid, in this case enter 24 instead.

In the **Configure Default Gateway** screen, enter the required *Default Gateway IP Address*, select **Done** and hit <ENTER> to continue.



In the **Configure DNS Servers** screen, configure the required DNS server(s), select **Done** and hit <ENTER> to continue.

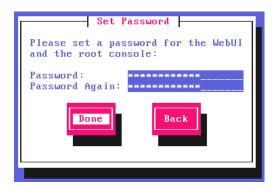


In the **Set Password** screen, hit <ENTER> to continue.

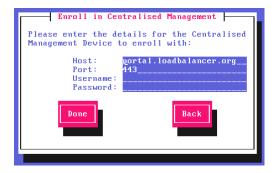




Enter the *Password* you'd like to use for the **loadbalancer** WebUI user account and the **root** Linux user account. Repeat the password, select **Done** and hit <ENTER> to continue.



If you selected **Yes** when asked if you want to enroll for Centralized Management, you'll now be prompted for the details. Default values for the *Host* and *Port* are set and can be changed if required. Enter the *Username* and *Password* for the management server account you'd like the appliance to be associated with, select **Done** and hit <ENTER> to continue.



In the **Summary** screen, check all settings. If everything is correct, leave **Configure** selected and hit <ENTER> to continue. All settings will be applied. If you need to change a setting, use the **Back** button.

```
Interface: eth0
IP Address: 192.168.10.10/24
Default Gateway: 192.168.10.250
DNS Server/s: 8.8.8.8
You will be able to access the web interface from: https://192.168.10.10:9443

Configure

Start Over

Back
```

Once the configuration has been written, the **Configuration Complete** screen and message will be displayed. Click **OK** to exit the wizard and return to the command prompt.



### 9.4. 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.

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

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

refer to Service Socket Addresses.

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.

If you need to change the port, IP address or protocol that the WebUI listens on, please

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

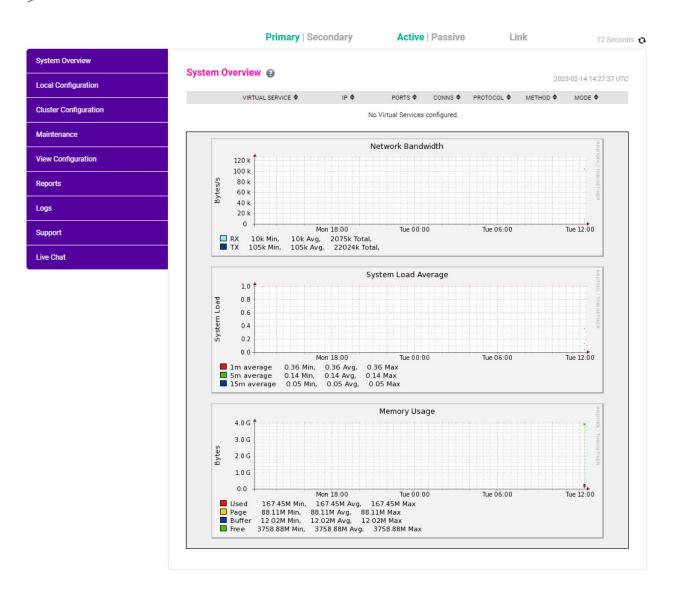
Username: loadbalancer

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:





#### 9.4.1. 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

# 9.5. Appliance Software Update

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

#### 9.5.1. 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



#### 9.5.2. Checking for Updates using Online Update

8 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.

#### 9.5.3. Using Offline Update

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

8 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:



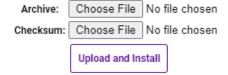
- 1. Using the WebUI, navigate to: Maintenance > Software Update.
- 2. Select Offline Update.
- 3. The following screen will be displayed:

#### 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.



- 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.

### 9.6. Configuring the Appliance Security Mode

To enable shell commands to be run from the WebUI, the appliance Security Mode must be configured:

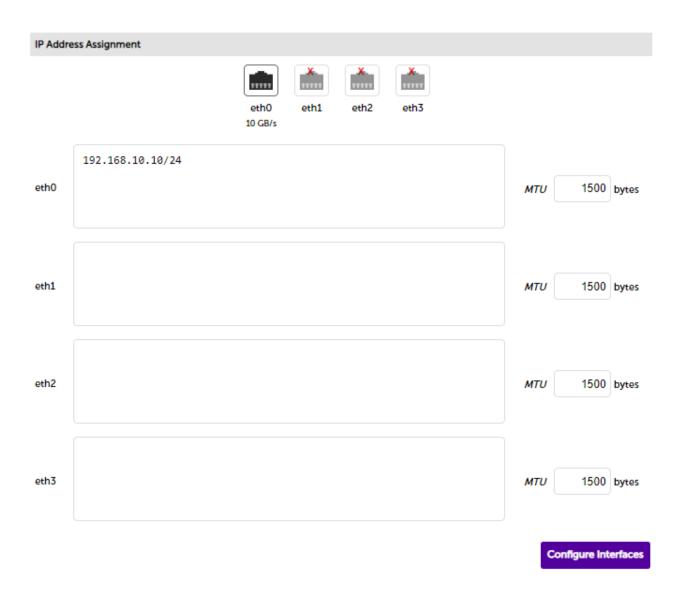
- 1. Using the WebUI, navigate to: Local Configuration > Security.
- 2. Set Appliance Security Mode to Custom.
- 3. Click Update.

# 9.7. Appliance Network Configuration

The standard CCW network configuration requires 1 network adapter.

#### 9.7.1. Verify Network Connections

- 1. Verify that the adapter is connected to the appropriate virtual switch/network using the Hypervisor management tool.
- 2. Using the appliance WebUI navigate to: Local Configuration > Network Interface Configuration.



3. Verify that the network is configured as required.

Note
The IP address/CIDR prefix for **eth0** was set during the Network Setup Wizard and will be shown here, e.g. **192.168.10.10/24**.

#### 9.7.2. Configuring Hostname & DNS

- 1. Using the WebUI, navigate to: Local Configuration > Hostname & DNS.
- 2. Set the required *Hostname* and *Domain Name*.
- 3. Configure additional DNS servers if required.
- 4. Click Update.

#### 9.7.3. Configuring NTP

- 1. Using the WebUI, navigate to: Local Configuration > System Date & Time.
- 2. Select the required *System Timezone*.
- 3. Define the required NTP servers.

4. Click Set Timezone & NTP.

### 9.8. Configuring Load Balanced Services

#### 9.8.1. Custom Health Check Configuration

Customized **DICOM C-Echo** health checks are used for VIP3, VIP4, VIP5 and VIP6. To configure these custom checks follow the steps below:



#### 9.8.1.1. C\_Echo-104

- 1. Using the WebUI, navigate to Cluster Configuration > Health Check Scripts and click Add New Health Check.
- 2. Enter the following details:



- Specify an appropriate *Label* for the health check, e.g. **C\_Echo-104**.
- Set Type to Virtual Service.
- Using the *Template* dropdown select **DICOM-C-ECHO** from the list.
- Change the following lines in the script to suit your requirements:



3. Click **Update** to save the new health check script.

#### 9.8.1.2. C\_Echo-1115

- 1. Using the WebUI, navigate to Cluster Configuration > Health Check Scripts and click Add New Health Check.
- 2. Enter the following details:



- Specify an appropriate *Label* for the health check, e.g. **C\_Echo-1115**.
- Set *Type* to **Virtual Service**.
- Using the *Template* dropdown select **DICOM-C-ECHO** from the list.
- Change the following lines in the script to suit your requirements:

```
aet=LOADBALANCER
aec=LB-SCP
```

3. Click **Update** to save the new health check script.

#### 9.8.1.3. C\_Echo-1230

- 1. Using the WebUI, navigate to Cluster Configuration > Health Check Scripts and click Add New Health Check.
- 2. Enter the following details:



- Specify an appropriate Label for the health check, e.g. C\_Echo-1230.
- Set Type to Virtual Service.
- Using the *Template* dropdown select **DICOM-C-ECHO** from the list.
- Change the following lines in the script to suit your requirements:



3. Click **Update** to save the new health check script.

#### 9.8.1.4. C\_Echo-1299

- 1. Using the WebUI, navigate to Cluster Configuration > Health Check Scripts and click Add New Health Check.
- 2. Enter the following details:



- Specify an appropriate Label for the health check, e.g. C\_Echo-1299.
- Set Type to Virtual Service.
- Using the *Template* dropdown select **DICOM-C-ECHO** from the list.
- Change the following lines in the script to suit your requirements:

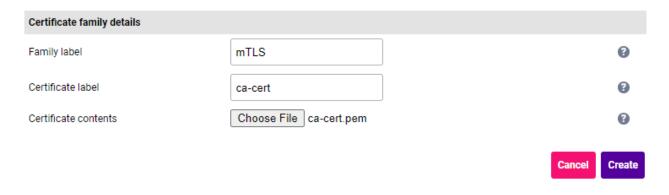
```
aet=LOADBALANCER
aec=LB-SCP
```

3. Click **Update** to save the new health check script.

#### 9.8.2. CA Certificate Family & Client Certificate Configuration for mTLS

#### Create the CA Certificate Family:

- 1. Using the WebUI, navigate to *Cluster Configuration > CA Certificate Families*.
- 2. Click **Create Family** and enter the following details:

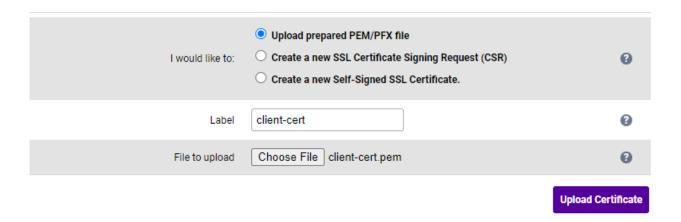


- Specify an appropriate Family label, e.g. mTLS.
- Specify an appropriate *Certificate label*, e.g. **ca-cert**.
- Click Choose File and select the relevant PEM file.
- 3. Click Create.

#### Add the Client Certificate:

- 1. Using the WebUI, navigate to Cluster Configuration > SSL Certificate.
- 2. Click Add a new SSL Certificate.

- 3. Select the **Upload prepared PEM/PFX file** option.
- 4. Enter the following details:

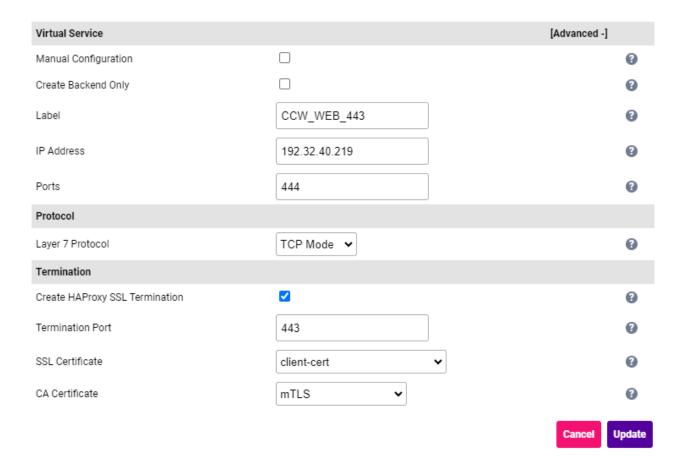


- Specify an appropriate *label* (name), e.g. client-cert.
- Click Choose File and select the relevant PEM or PFX file.
- 5. Click Upload Certificate.

#### 9.8.3. VIP 1 - CCW\_WEB\_443

#### 9.8.3.1. Virtual Service (VIP) Configuration

- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 Virtual Services* and click **Add a new Virtual Service**.
- 2. Click [Advanced].
- 3. Enable (check) the Create HAProxy SSL Termination checkbox.
- 4. Enter the following details:

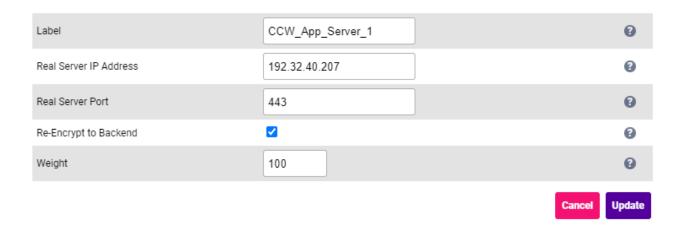


- Specify an appropriate Label for the Virtual Service, e.g. CCW\_WEB\_443.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 444.
- Set the Layer 7 Protocol to TCP Mode.
- In the *Termination* section:
  - Set the Termination Port to 443.
  - Set the SSL Certificate to client-cert.
  - Set the CA Certificate to mTLS.
- 5. Click **Update** to create the Virtual Service.
- 6. Now click **Modify** next to the newly created VIP.
- 7. Scroll to the *Persistence* section.
  - Ensure that the *Persistence Mode* is set to **Source IP**.
- 8. Scroll to the Health Checks section.
  - Ensure that the *Health\_Check* is set to **Connect to Port**.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.3.2. Define the Associated Real Servers (RIPs)



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

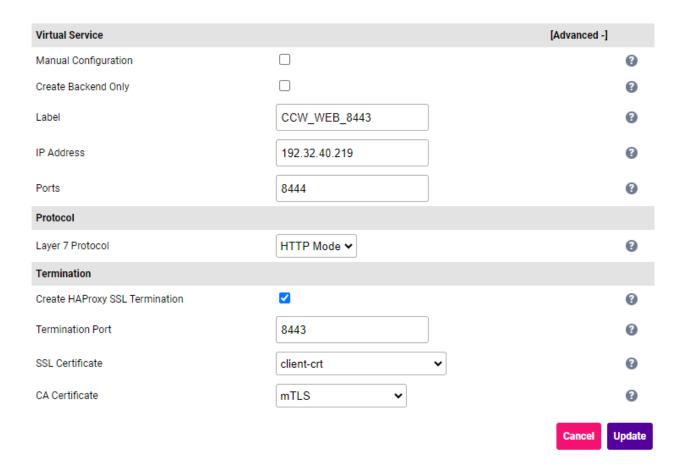


- Specify an appropriate *Label* for the RIP, e.g. **CCW\_App\_Server\_1**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.207.
- Set the Real Server Port field to 443.
- Enable (check) the *Re-Encrypt to Backend* checkbox.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Now click **Modify** next to the newly created RIP.
- 6. Set the Verify Server Certificate to mTLS.
- 7. Set the Send Client Certificate to client-cert.
- 8. Repeat these steps to add additional Real Server(s).

### 9.8.4. VIP 2 - CCW\_WEB\_8443

#### 9.8.4.1. Virtual Service (VIP) Configuration

- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 Virtual Services* and click **Add a new Virtual Service**.
- 2. Click [Advanced].
- 3. Enable (check) the Create HAProxy SSL Termination checkbox.
- 4. Enter the following details:

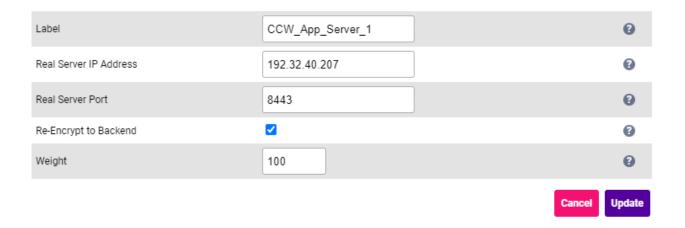


- Specify an appropriate Label for the Virtual Service, e.g. CCW\_WEB\_8443.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 8444.
- Set the Layer 7 Protocol to HTTP Mode.
- In the *Termination* section:
  - Set the Termination Port to 8443.
  - Set the SSL Certificate to client-cert.
  - Set the CA Certificate to mTLS.
- 5. Click **Update** to create the Virtual Service.
- 6. Now click **Modify** next to the newly created VIP.
- 7. Scroll to the *Persistence* section.
  - Set the *Persistence Mode* to **HTTP Cookie**.
- 8. Scroll to the *Health Checks* section.
  - Ensure that the *Health\_Check* is set to **Connect to Port**.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.4.2. Define the Associated Real Servers (RIPs)



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

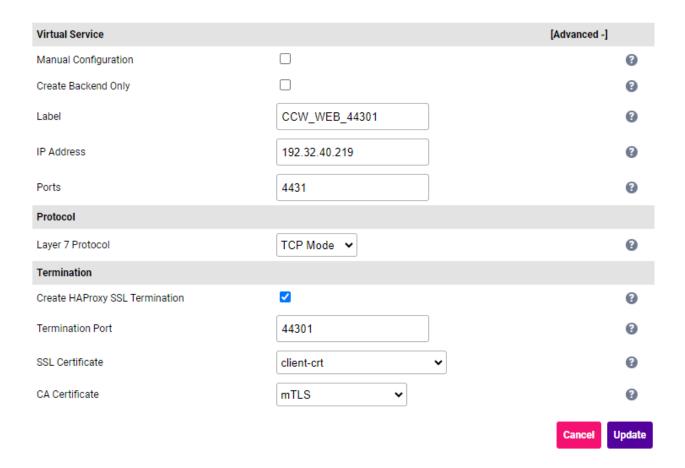


- Specify an appropriate *Label* for the RIP, e.g. **CCW\_App\_Server\_1**.
- Set the *Real Server IP Address* field to the required IP address, e.g. **192.32.40.207**.
- Set the Real Server Port field to 8443.
- Enable (check) the Re-Encrypt to Backend checkbox.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Now click **Modify** next to the newly created RIP.
- 6. Set the Verify Server Certificate to mTLS.
- 7. Set the Send Client Certificate to client-cert.
- 8. Repeat these steps to add additional Real Server(s).

#### 9.8.5. VIP 3 - CCW\_WEB\_44301

#### 9.8.5.1. Virtual Service (VIP) Configuration

- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 Virtual Services* and click **Add a new Virtual Service**.
- 2. Click [Advanced].
- 3. Enable (check) the Create HAProxy SSL Termination checkbox.
- 4. Enter the following details:

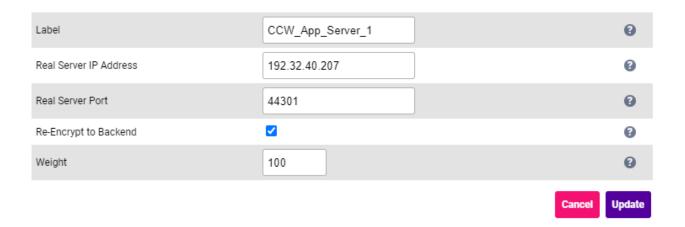


- Specify an appropriate *Label* for the Virtual Service, e.g. **CCW\_WEB\_44301**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 4431.
- Set the Layer 7 Protocol to TCP Mode.
- In the *Termination* section:
  - Leave the Termination Port set to 44301.
  - Set the SSL Certificate to client-cert.
  - Set the CA Certificate to mTLS.
- 5. Click **Update** to create the Virtual Service.
- 6. Now click **Modify** next to the newly created VIP.
- 7. Scroll to the *Persistence* section.
  - Ensure that the *Persistence Mode* is set to **Source IP**.
- 8. Scroll to the Health Checks section.
  - Ensure that the *Health\_Check* is set to **Connect to Port**.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.5.2. Define the Associated Real Servers (RIPs)



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

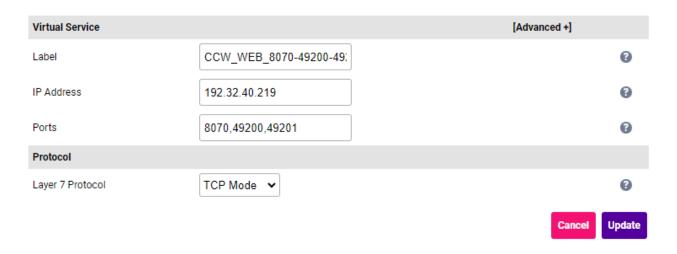


- Specify an appropriate *Label* for the RIP, e.g. **CCW\_App\_Server\_1**.
- Set the *Real Server IP Address* field to the required IP address, e.g. **192.32.40.207**.
- Set the Real Server Port field to 44301.
- Enable (check) the Re-Encrypt to Backend checkbox.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Now click **Modify** next to the newly created RIP.
- 6. Set the Verify Server Certificate to mTLS.
- 7. Set the Send Client Certificate to client-cert.
- 8. Repeat these steps to add additional Real Server(s).

#### 9.8.6. VIP 4 - CCW\_WEB\_8070-49200-49201

#### 9.8.6.1. Virtual Service (VIP) Configuration

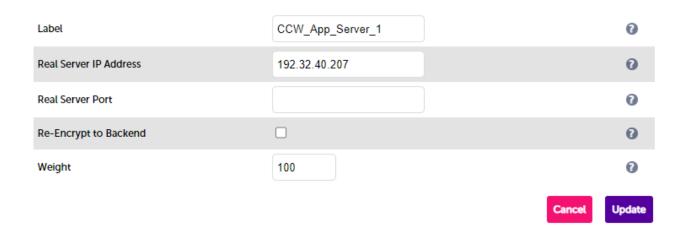
- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 Virtual Services* and click **Add a new Virtual Service**.
- 2. Enter the following details:



- Specify an appropriate Label for the Virtual Service, e.g. CCW\_WEB\_8070-49200-49201.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the *Ports* field to **8070,49200,49201**.
- Set the Layer 7 Protocol to TCP Mode.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the *Persistence* section.
  - Ensure that the *Persistence Mode* is set to **Source IP**.
- 6. Scroll to the *Health Checks* section.
  - Ensure that the *Health\_Check* is set to **Connect to Port**.
- 7. Leave all other settings at their default value.
- 8. Click **Update**.

#### 9.8.6.2. Define the Associated Real Servers (RIPs)

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

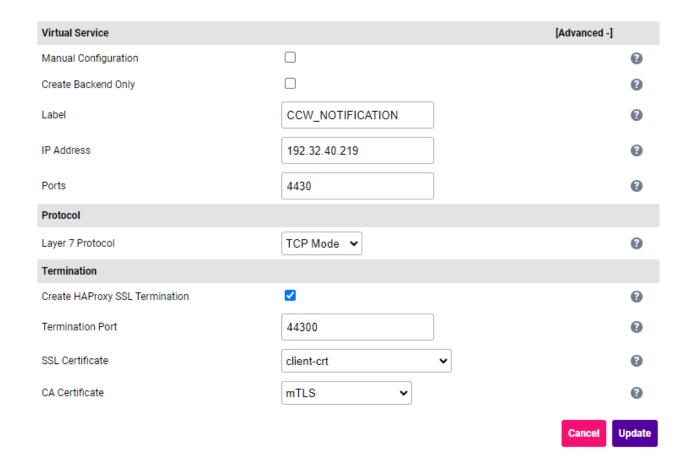


- Specify an appropriate *Label* for the RIP, e.g. **CCW\_App\_Server\_1**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.207.
- Leave the Real Server Port field blank.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.7. VIP 5 - CCW\_NOTIFICATION

#### 9.8.7.1. Virtual Service (VIP) Configuration

- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 Virtual Services* and click **Add a new Virtual Service**.
- 2. Click [Advanced].
- 3. Enable (check) the Create HAProxy SSL Termination checkbox.
- 4. Enter the following details:



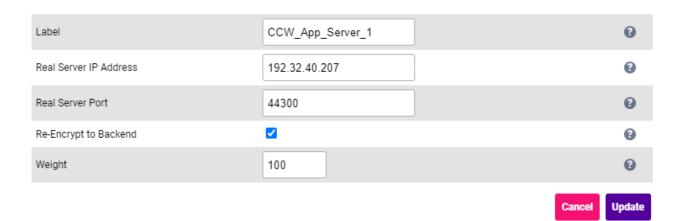
- Specify an appropriate *Label* for the Virtual Service, e.g. **CCW\_NOTIFICATION**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 4430.
- Set the Layer 7 Protocol to TCP Mode.



- In the *Termination* section:
  - Leave the Termination Port set to 44300.
  - Set the SSL Certificate to client-cert.
  - Set the CA Certificate to mTLS.
- 5. Click **Update** to create the Virtual Service.
- 6. Now click **Modify** next to the newly created VIP.
- 7. Scroll to the **Connection Distribution Method** section.
  - Set the Balance Mode to First.
- 8. Scroll to the *Persistence* section and click [Advanced].
  - Set the Persistence Mode to Last Successful.
  - Set the timeout to 720.
- 9. Scroll to the Health Checks section.
  - Set the Check Type to Negotiate HTTPS (GET).
  - Set Request to send to /api/health/.
  - Set the Response expected drop-down to Equals and the value to allServicesOperative.
- 10. Scroll down to the Other section and click [Advanced].
  - Enable (check) the *Timeout* checkbox.
  - Set Client Timeout and Real Server Timeout to 12h (12 hours).
- 11. Leave all other settings at their default value.
- 12. Click **Update**.

#### 9.8.7.2. Define the Associated Real Servers (RIPs)

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

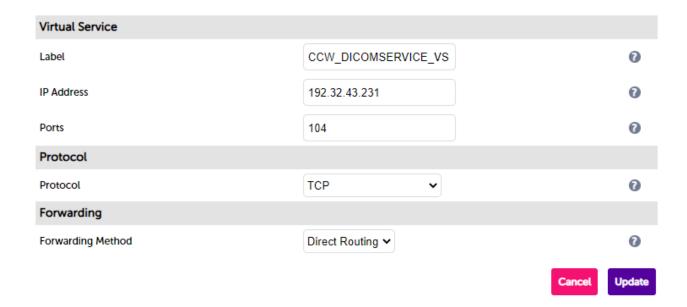


- Specify an appropriate *Label* for the RIP, e.g. **CCW\_App\_Server\_1**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.207.
- Set the Real Server Port field to 44300.
- Enable (check) the *Re-Encrypt to Backend* checkbox.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Now click **Modify** next to the newly created RIP.
- 6. Set the Verify Server Certificate to mTLS.
- 7. Set the **Send Client Certificate** to **client-cert**.
- 8. Repeat these steps to add additional Real Server(s).

#### 9.8.8. VIP 6 - CCW\_DICOMSERVICE\_VS

#### 9.8.8.1. Virtual Service (VIP) Configuration

- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 4 Virtual Services* and click **Add a new Virtual Service**.
- 2. Enter the following details:



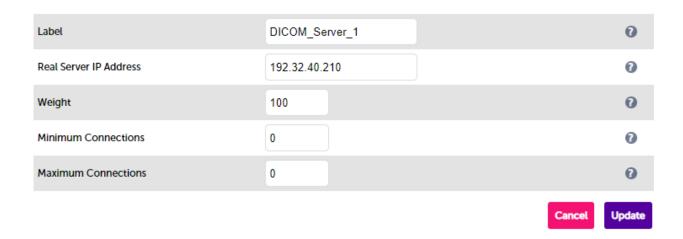
- Specify an appropriate *Label* for the Virtual Service, e.g. **CCW\_DICOMSERVICE\_VS**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.43.231.
- Set the Ports field to 104.
- Leave the *Protocol* set to **TCP**.
- Set the Forwarding Method set to Direct Routing.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.



- 5. Scroll to the *Persistence* section.
  - Ensure that the *Enable* checkbox is unchecked (disabled).
- 6. Scroll to the Health Checks section.
  - Set Check Type to External Script.
  - Set External Script to the health check created above, e.g. C\_Echo-104.
- 7. Leave all other settings at their default value.
- 8. Click **Update**.

#### 9.8.8.2. Define the Associated Real Servers (RIPs)

- 1. Using the WebUI, navigate to: *Cluster Configuration > Layer 4 Real Servers* and click **Add a new Real**Server next to the newly created VIP.
- 2. Enter the following details:

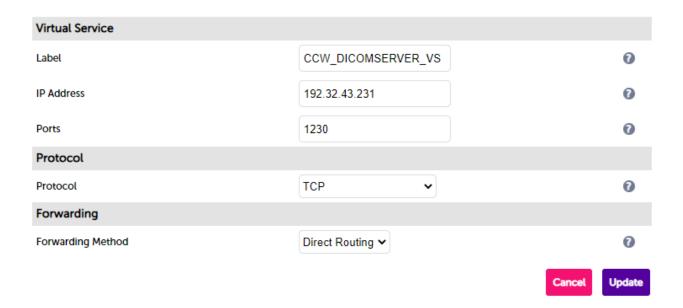


- Specify an appropriate *Label* for the RIP, e.g. **DICOM\_Server\_1**.
- Change the Real Server IP Address field to the required IP address, e.g. 192.32.40.210.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.9. VIP 7 - CCW\_DICOMSERVER\_VS

#### 9.8.9.1. Virtual Service (VIP) Configuration

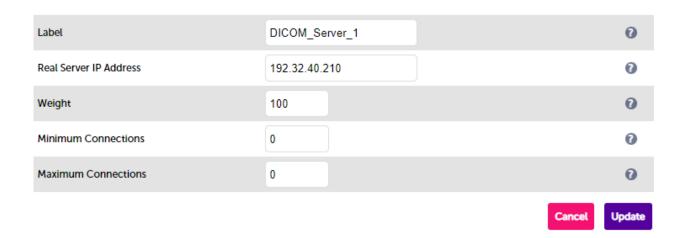
- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 4 Virtual Services* and click **Add a new Virtual Service**.
- 2. Enter the following details:



- Specify an appropriate Label for the Virtual Service, e.g. CCW\_DICOMSERVER\_VS.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.43.231.
- Set the Ports field to 1230.
- Leave the *Protocol* set to **TCP**.
- Set the Forwarding Method set to Direct Routing.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the *Persistence* section.
  - Ensure that the *Enable* checkbox is unchecked (disabled).
- 6. Scroll to the *Health Checks* section.
  - Set Check Type to External Script.
  - Set External Script to the health check created above, e.g. C\_Echo-1230.
- 7. Leave all other settings at their default value.
- 8. Click Update.

#### 9.8.9.2. Define the Associated Real Servers (RIPs)

- 1. Using the WebUI, navigate to: *Cluster Configuration > Layer 4 Real Servers* and click **Add a new Real**Server next to the newly created VIP.
- 2. Enter the following details:

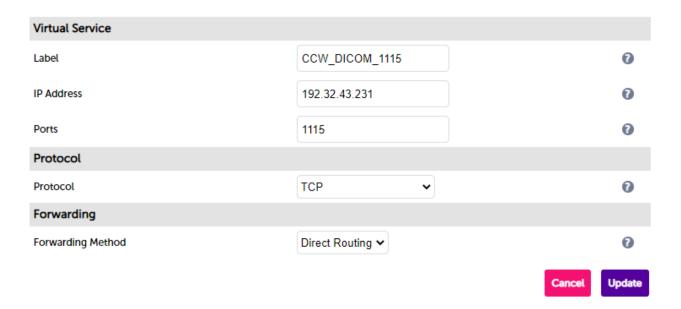


- Specify an appropriate *Label* for the RIP, e.g. **DICOM\_Server\_1**.
- Change the Real Server IP Address field to the required IP address, e.g. 192.32.40.210.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.10. VIP 8 - CCW\_DICOM\_1115

#### 9.8.10.1. Virtual Service (VIP) Configuration

- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 4 Virtual Services* and click **Add a new Virtual Service**.
- 2. Enter the following details:

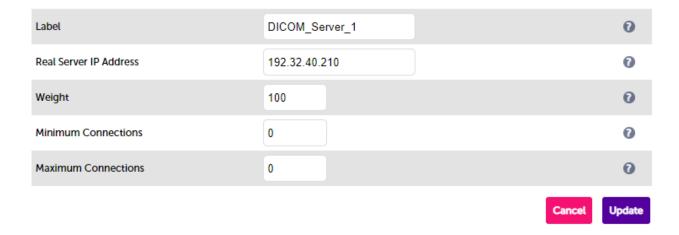


- Specify an appropriate *Label* for the Virtual Service, e.g. **CCW\_DICOM\_1115**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.43.231.
- Set the Ports field to 1115.

- Leave the *Protocol* set to **TCP**.
- Set the Forwarding Method set to Direct Routing.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the **Persistence** section.
  - Ensure that the *Enable* checkbox is unchecked (disabled).
- 6. Scroll to the *Health Checks* section.
  - Set Check Type to External Script.
  - Set External Script to the health check created above, e.g. C\_Echo-1115.
- 7. Leave all other settings at their default value.
- 8. Click Update.

#### 9.8.10.2. Define the Associated Real Servers (RIPs)

- 1. Using the WebUI, navigate to: *Cluster Configuration > Layer 4 Real Servers* and click **Add a new Real**Server next to the newly created VIP.
- 2. Enter the following details:



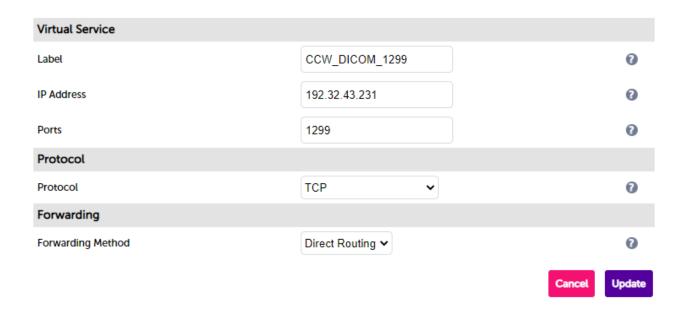
- Specify an appropriate *Label* for the RIP, e.g. **DICOM\_Server\_1**.
- Change the Real Server IP Address field to the required IP address, e.g. 192.32.40.210.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.11. VIP 9 - CCW\_DICOM\_1299

#### 9.8.11.1. Virtual Service (VIP) Configuration

1. Using the WebUI, navigate to *Cluster Configuration > Layer 4 - Virtual Services* and click **Add a new Virtual Service**.

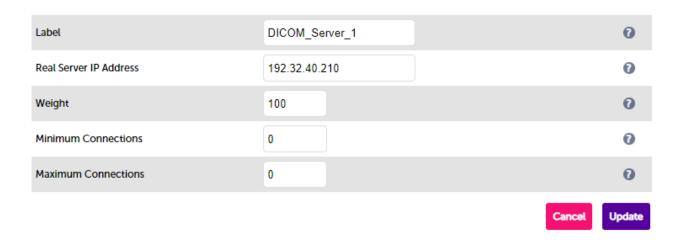
#### 2. Enter the following details:



- Specify an appropriate *Label* for the Virtual Service, e.g. **CCW\_DICOM\_1299**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.43.231.
- Set the Ports field to 1299.
- Leave the *Protocol* set to **TCP**.
- Set the Forwarding Method set to Direct Routing.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the *Persistence* section.
  - Ensure that the *Enable* checkbox is unchecked (disabled).
- 6. Scroll to the *Health Checks* section.
  - Set Check Type to External Script.
  - Set External Script to the health check created above, e.g. C\_Echo-1299.
- 7. Leave all other settings at their default value.
- 8. Click Update.

#### 9.8.11.2. Define the Associated Real Servers (RIPs)

- 1. Using the WebUI, navigate to: *Cluster Configuration > Layer 4 Real Servers* and click **Add a new Real**Server next to the newly created VIP.
- 2. Enter the following details:

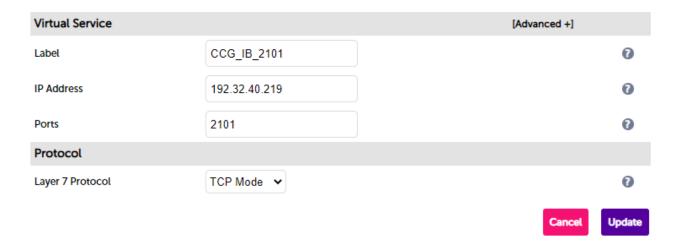


- Specify an appropriate *Label* for the RIP, e.g. **DICOM\_Server\_1**.
- Change the Real Server IP Address field to the required IP address, e.g. 192.32.40.210.
- 3. Leave all other settings at their default value.
- 4. Click **Update**.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.12. VIP 10 - CCG\_IB\_2101

#### 9.8.12.1. Virtual Service (VIP) Configuration

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

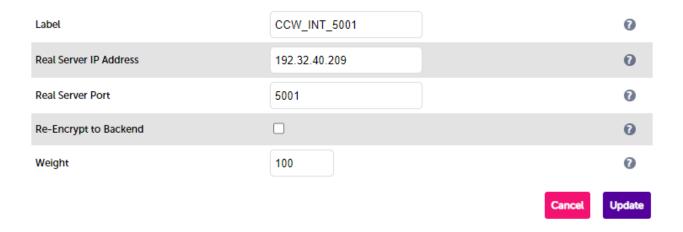


- Specify an appropriate *Label* for the Virtual Service, e.g. **CCG\_IB\_2101**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the *Ports* field to **2101**.
- Set the Layer 7 Protocol to TCP Mode.
- 3. Click **Update** to create the Virtual Service.

- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the Connection Distribution Method section.
  - Set the Balance Mode to First.
- 6. Scroll to the Persistence section.
  - Set the Persistence Mode to Last Successful.
- 7. Scroll to the *Health Checks* section.
  - Set the Health Check to Connect to Port.
- 8. Scroll to the Fallback Server section.
  - Click the [Advanced] option and select (check) the Disable Fallback Server option.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.12.2. Define the Associated Real Servers (RIPs)

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



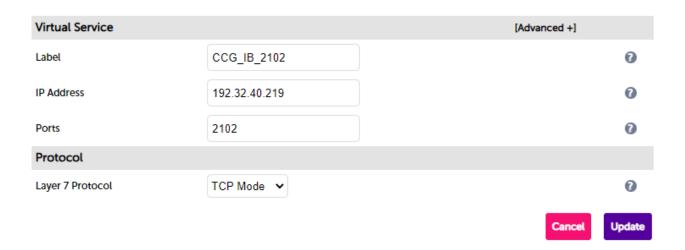
- Specify an appropriate *Label* for the RIP, e.g. **CCW\_INT\_5001**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.209.
- Set the Real Server Port field to 5001.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.13. VIP 11 - CCG\_IB\_2102

#### 9.8.13.1. Virtual Service (VIP) Configuration

1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 - Virtual Services* and click **Add a new Virtual Service**.

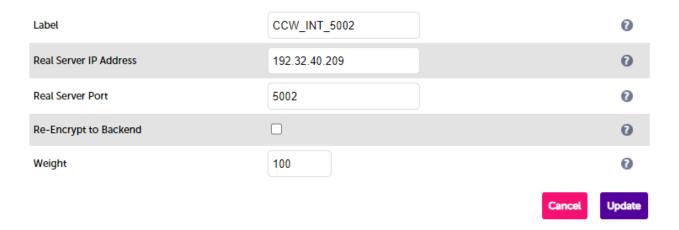
#### 2. Enter the following details:



- Specify an appropriate Label for the Virtual Service, e.g. CCG\_IB\_2102.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 2102.
- Set the Layer 7 Protocol to TCP Mode.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the Connection Distribution Method section.
  - Set the Balance Mode to First.
- 6. Scroll to the *Persistence* section.
  - Set the Persistence Mode to Last Successful.
- 7. Scroll to the *Health Checks* section.
  - Set the Health Check to Connect to Port.
- 8. Scroll to the Fallback Server section.
  - Click the [Advanced] option and select (check) the Disable Fallback Server option.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.13.2. Define the Associated Real Servers (RIPs)

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

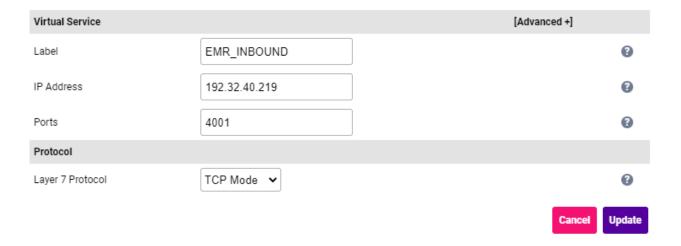


- Specify an appropriate *Label* for the RIP, e.g. **CCW\_INT\_5002**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.209.
- Set the *Real Server Port* field to **5002**.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.14. VIP 12 - EMR\_INBOUND

#### 9.8.14.1. Virtual Service (VIP) Configuration

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



- Specify an appropriate *Label* for the Virtual Service, e.g. **EMR\_INBOUND**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the *Ports* field to **4001**.
- Set the Layer 7 Protocol to TCP Mode.



- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the Connection Distribution Method section.
  - Set the Balance Mode to First.
- 6. Scroll to the Persistence section.
  - Set the Persistence Mode to Last Successful.
- 7. Scroll to the *Health Checks* section.
  - Set the Health Check to Connect to Port.
- 8. Scroll to the Fallback Server section.
  - Click the [Advanced] option and select (check) the Disable Fallback Server option.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.14.2. Define the Associated Real Servers (RIPs)

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



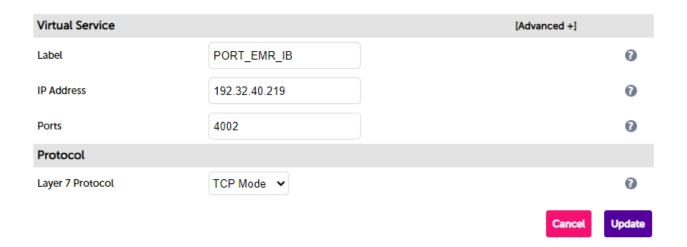
- Specify an appropriate *Label* for the RIP, e.g. **CLOVERLEAF\_OB**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.233.
- Set the Real Server Port field to 2101.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.15. VIP 13 - PORT\_EMR\_IB

#### 9.8.15.1. Virtual Service (VIP) Configuration



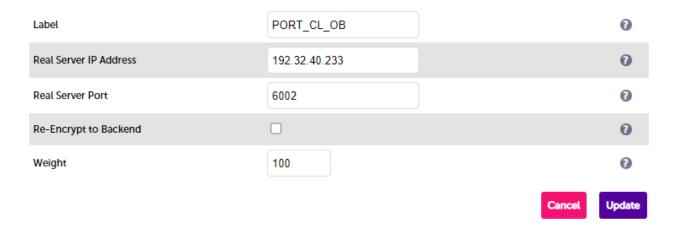
- 1. Using the WebUI, navigate to *Cluster Configuration > Layer 7 Virtual Services* and click **Add a new Virtual Service**.
- 2. Enter the following details:



- Specify an appropriate *Label* for the Virtual Service, e.g. **Port\_EMR\_IB**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 4002.
- Set the *Layer 7 Protocol* to **TCP Mode**.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the Connection Distribution Method section.
  - Set the Balance Mode to First.
- 6. Scroll to the Persistence section.
  - Set the Persistence Mode to Last Successful.
- 7. Scroll to the *Health Checks* section.
  - Set the *Health Check* to **Connect to Port**.
- 8. Scroll to the Fallback Server section.
  - Click the [Advanced] option and select (check) the Disable Fallback Server option.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.15.2. Define the Associated Real Servers (RIPs)

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

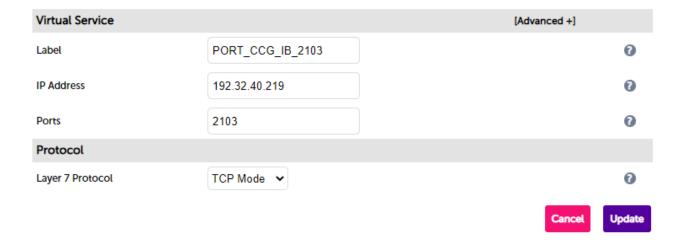


- Specify an appropriate *Label* for the RIP, e.g. **PORT\_CL\_OB**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.233.
- Set the Real Server Port field to 6002.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.16. VIP 14 - PORT\_CCG\_IB\_2103

#### 9.8.16.1. Virtual Service (VIP) Configuration

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

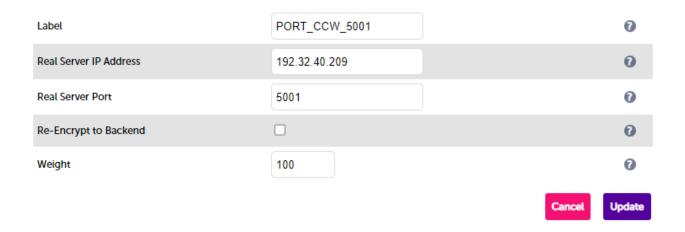


- Specify an appropriate *Label* for the Virtual Service, e.g. **PORT\_CCG\_IB\_2103**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 2103.
- Set the Layer 7 Protocol to TCP Mode.

- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the *Connection Distribution Method* section.
  - Set the Balance Mode to First.
- 6. Scroll to the Persistence section.
  - Set the Persistence Mode to Last Successful.
- 7. Scroll to the *Health Checks* section.
  - Set the Health Check to Connect to Port.
- 8. Scroll to the Fallback Server section.
  - Click the [Advanced] option and select (check) the Disable Fallback Server option.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.16.2. Define the Associated Real Servers (RIPs)

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



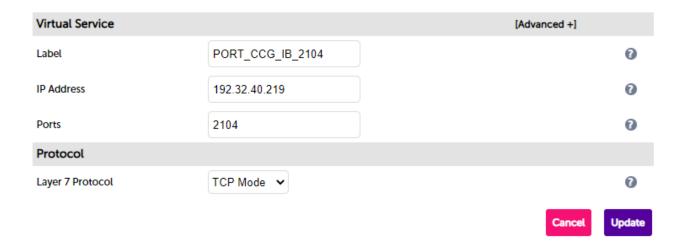
- Specify an appropriate *Label* for the RIP, e.g. **Port\_CCW\_5001**.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.209.
- Set the *Real Server Port* field to **5001**.
- 3. Leave all other settings at their default value.
- 4. Click **Update**.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.17. VIP 15 - PORT\_CCG\_IB\_2104

#### 9.8.17.1. Virtual Service (VIP) Configuration



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



- Specify an appropriate *Label* for the Virtual Service, e.g. **PORT\_CCG\_IB\_2104**.
- Set the Virtual Service IP Address field to the required IP address, e.g. 192.32.40.219.
- Set the Ports field to 2104.
- Set the Layer 7 Protocol to TCP Mode.
- 3. Click **Update** to create the Virtual Service.
- 4. Now click **Modify** next to the newly created VIP.
- 5. Scroll to the Connection Distribution Method section.
  - Set the Balance Mode to First.
- 6. Scroll to the Persistence section.
  - Set the Persistence Mode to Last Successful.
- 7. Scroll to the *Health Checks* section.
  - Set the *Health Check* to **Connect to Port**.
- 8. Scroll to the Fallback Server section.
  - Click the **[Advanced]** option and select (check) the *Disable Fallback Server* option.
- 9. Leave all other settings at their default value.
- 10. Click Update.

#### 9.8.17.2. Define the Associated Real Servers (RIPs)

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

Label	CCW_INT_5002		0
Real Server IP Address	192.32.40.209		0
Real Server Port	5002		0
Re-Encrypt to Backend			0
Weight	100		0
		Cancel	Update

- Specify an appropriate Label for the RIP, e.g. CCW\_INT\_5002.
- Set the Real Server IP Address field to the required IP address, e.g. 192.32.40.209.
- Set the Real Server Port field to 5002.
- 3. Leave all other settings at their default value.
- 4. Click Update.
- 5. Repeat these steps to add additional Real Server(s).

#### 9.8.18. 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.

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



If one of the servers within a cluster fails its health check, that server will be colored red and the cluster will be colored yellow as shown below:

<u> </u>	CCW_DICOMSERVICE	192.32.43.231	104	0	ТСР	Layer 4	DR	9,44
	REAL SERVER	IP	PORTS	WEIGHT	CONNS			
1	DICOM Server 1	192.32.40.210	104	100	0	Drain	Halt	8.41
+	DICOM Server 2	192.32.40.211	104	100	0	Drain	Halt	PAW

If the services are up (green) verify that clients can connect to the VIPs and access all services.



Once you have completed the verification process, continue to the next section and add a Secondary appliance to form the HA (active/passive) clustered pair.

# 11. 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.

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.

## 11.1. 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

WebUI Main Menu Option	Sub Menu Option	Description
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.

## 11.2. Configuring the HA 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*.

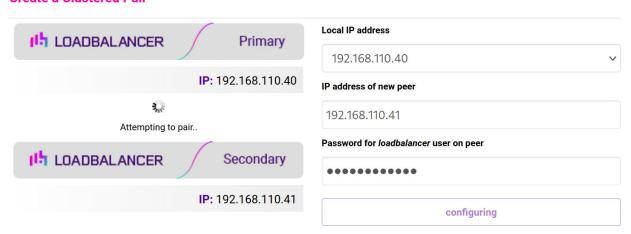
# Local IP address 192.168.110.40 IP address of new peer 192.168.110.41 Password for loadbalancer user on peer

3. Specify the IP address and the *loadbalancer* user's password for the Secondary (peer) appliance as shown in the example above.

Add new node

- 4. Click Add new node.
- 5. The pairing process now commences as shown below:

#### **Create a Clustered Pair**

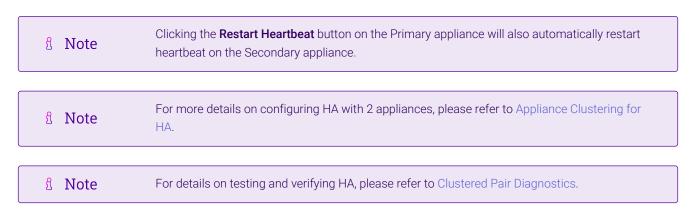


6. Once complete, the following will be displayed on the Primary appliance:

#### **High Availability Configuration - primary**



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.



## 11.3. Last Successful - Clearing the Stick Table

VIP6 to VIP11 use the persistence type **Last Successful** which is described here. As mentioned, to allow traffic to be sent to the first server once it's back online, either the VIP's stick table must be cleared or the second server must be halted.

#### To Clear a Stick Table:

- 1. Using the WebUI, navigate to: Reports > Layer 7 Stick Table.
- 2. Select the relevant VIP using the drop-down.
- 3. Click Clear Table.

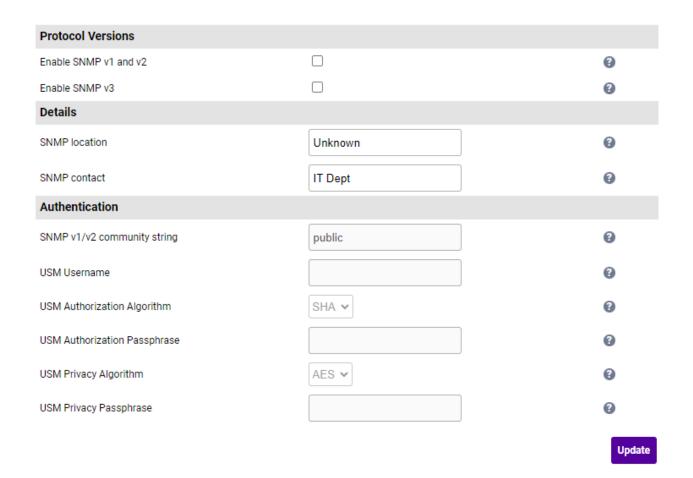
# 12. Optional Appliance Configuration

# 12.1. SNMP Configuration

The appliance supports SNMP v1, v2 and v3.

To configure SNMP:

1. Using the WebUI, navigate to: Local Configuration > SNMP Configuration.



- 2. Enable the required SNMP version(s).
- 3. Enter the required **SNMP location** and **SNMP contact**.
- 4. For SNMP v1 & v2:
  - Enter the required SNMP v1/v2 community string.
- 5. For SNMP v3:
  - Specify the *USM Username*.
  - Select the required USM Authorization Algorithm.
  - Specify the USM Authorization Passphrase, it should be at least 8 characters.
  - Select the required USM Privacy Algorithm.
  - Specify USM Privacy Passphrase, it should be at least 8 characters.
- 6. Click Update.

8 Note

7. Restart SNMPD using the **Restart SNMPD** button at the top of the screen.

please refer to SNMP Reporting.

Valid characters for the Community string, USM Username, USM Authorization Passphrase and USM Privacy Passphrase fields are: a-z A-Z 0-9 [] # ~ \_ \*! = - \$ % ? {} @ :; ^

For more information about the various OIDs and associated MIBs supported by the appliance,

8 Note

If you need to change the port, IP address or protocol that SNMP listens on, please refer to Service Socket Addresses.

## 12.2. Configuring Email Alerts for Virtual Services

Email alerts can be configured for layer 4 and layer 7 Virtual Services. This enables emails to be sent when one or more of the associated Real Servers fail their health check and also when they subsequently start to pass their health check.

#### 12.2.1. Layer 4

For layer 4 Virtual Services, settings can be configured globally for all VIPs or individually per VIP.

#### 12.2.1.1. Global Layer 4 Email Settings

Once configured, these settings apply to all layer 4 VIPs by default.

To configure global email alert settings for layer 4 services:

1. Using the WebUI, navigate to: Cluster Configuration > Layer 4 Advanced Configuration.



2. Enter an appropriate email address in the *Email Alert Source Address* field.

```
e.g. lb1@loadbalancer.org
```

3. Enter an appropriate email address in the *Email Alert Destination Address* field.

```
e.g. alerts@loadbalancer.org
```

4. Click Update.

#### 12.2.1.2. VIP Level Settings

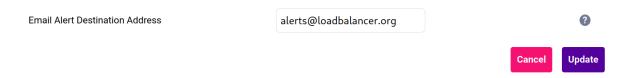


Once configured, these settings apply to the individual VIP.

To configure VIP level email alerts:



- 1. Using the WebUI, navigate to: *Cluster Configuration > Layer 4 Virtual Service* and click **Modify** next to the VIP to be configured.
- 2. Scroll down to the Fallback Server section.



3. Enter an appropriate email address in the *Email Alert Destination Address* field.

```
e.g. alerts@loadbalancer.org
```

4. Click Update.

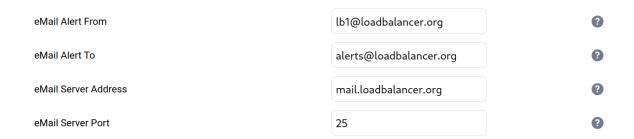
Note
You can set the *Email Alert Source Address* field as explained above if required to configure a default source address.

#### 12.2.2. Layer 7

For layer 7 services, email settings are configured globally for all VIPs.

To configure global email alert settings for layer 7 services:

1. Using the WebUI, navigate to: Cluster Configuration > Layer 7 Advanced Configuration.



2. Enter an appropriate email address in the eMail Alert From field.



3. Enter an appropriate email address in the eMail Alert To field.

```
e.g. alerts@loadbalancer.org
```

4. Enter an appropriate IP address/FQDN in the eMail Server Address field.

```
e.g. mail.loadbalancer.org
```

5. Enter an appropriate port in the *eMail Server Port* field.

e.g. 25

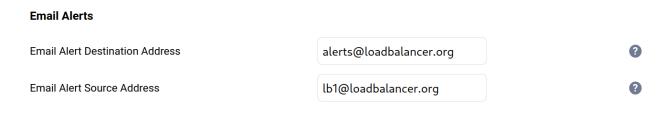
6. Click **Update**.

## 12.3. Configuring Email Alerts for Heartbeat

Email alerts can be setup for heartbeat once a clustered pair has been configured. This enables alerts to be sent when the primary/secondary communication state has changed. This can occur when the secondary appliance takes over from the primary, when the primary takes over from the secondary and also when there is a communication issue between the 2 appliances.

To configure email alert settings for Heartbeat:

- 1. Using the WebUI, navigate to: *Cluster Configuration > Heartbeat Configuration*.
- 2. Scroll down to the **Email Alerts** section.



- 3. Enter an appropriate email address in the *Email Alert Destination Address* field.
- 4. Enter an appropriate email address in the *Email Alert Source Address* field.
- 5. Click Modify Heartbeat Configuration.

# 12.4. Configuring a Smart Host (SMTP relay)

For Heartbeat (and layer 4 services), email alerts are sent from the load balancer directly to the mail server defined in the destination domain's DNS MX record by default. Alternatively, a custom smart host (mail relay server) can be specified. A smart host is an email server through which approved devices can send emails. Where possible, we recommend that you use a smart host for email alerts as this often helps improve the deliverability of emails.

To configure a Smart Host:

- 1. Using the WebUI, navigate to: Local Configuration > Physical Advanced Configuration.
- 2. Scroll down to the SMTP Relay section.
- 3. Specify the FQDN or IP address of the Smart Host.
- 4. Click **Update**.
- 8 Note By default the *Smart Host* is set as the destination email domain's DNS MX record when the *Email Alert Destination Address* is configured. It must either be left at its default setting or a

# 13. Technical Support

If you require any assistance please contact support@loadbalancer.org.

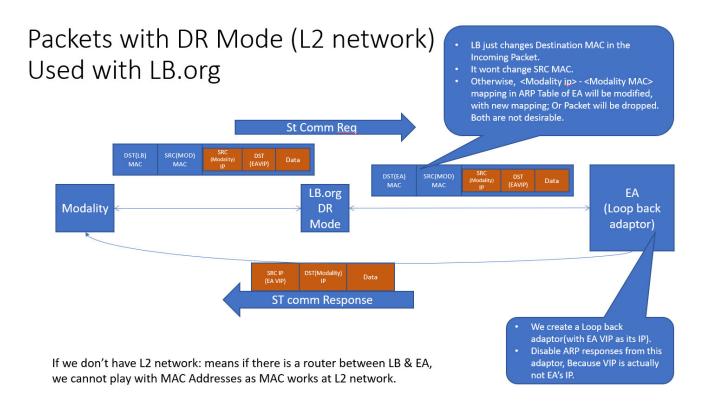
# 14. Further Documentation

For additional information, please refer to the Administration Manual.

# 15. Appendix

## 15.1. DR Mode Packet Manipulation

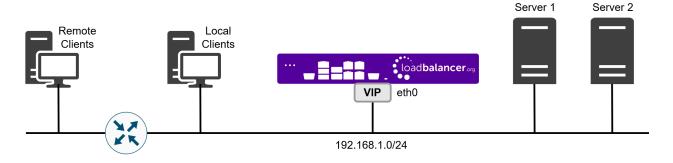
The following diagram shows the traffic flow between the load balancer, the load balanced backend servers and the Modality and how the destination MAC address is modified.



# 15.2. Enabling Layer 7 Transparency

If you require the source IP address of the client to be seen by the CCW servers, TProxy must be enabled. When TProxy is enabled, it's important to be aware of the topology requirements for TProxy to operate correctly. Both one-arm and two-arm topologies are supported:

#### 15.2.1. TProxy Topology Requirements - One-arm Deployments



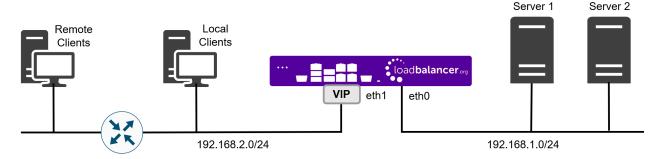
- Here, the VIP is brought up in the same subnet as the Real Servers.
- To support remote clients, the default gateway on the Real Servers must be an IP address on the load balancer and routing on the load balancer must be configured so that return traffic is routed back via the router.

8 Note

For an HA clustered pair, a floating IP should be added to the load balancer and used as the Real Server's default gateway. This ensures that the IP address can "float" (move) between Primary and Secondary appliances.

 To support local clients, return traffic would normally be sent directly to the client bypassing the load balancer which would break TProxy. To address this, the routing table on the Real Servers must be modified to force return traffic to go via the load balancer in the same way as one-arm NAT mode. For more information please refer to One-Arm (Single Subnet) NAT Mode.

#### 15.2.2. TProxy Topology Requirements - Two-arm Deployments



- Here, 2 subnets are used. The VIP is located in one subnet and the load balanced Real Servers are located in the other. The load balancer requires 2 interfaces, one in each subnet.
- The default gateway on the Real Servers must be an IP address on the load balancer.
- For an HA clustered pair, a floating IP should be added to the load balancer and used as the Real Server's default gateway. This ensures that the IP address can "float" (move) between Primary and Secondary appliances.
- Clients can be located in the same subnet as the VIP or any remote subnet provided they can route to the VIP.

To enable TProxy for a particular layer 7 VIP:

- Click Modify next to the HAProxy VIP.
- Scroll down to the Other section and click [Advanced].
- Enable (check) Transparent Proxy.
- Click Update.

#### 15.2.3. Configuring a floating IP Address for the CCW Server's Default Gateway

For layer 7 SNAT mode with transparency, a floating IP address is used as the default gateway for the Real Servers.

- 1. Using the Appliance WebUI, navigate to: Cluster Configuration > Floating IPs.
- 2. Enter the required address in the *New Floating IP* field, e.g. 192.168.114.250.

New Floating IP 192.168.114.250

Add Floating IP

3. Click Add Floating IP.

(!) Important

The default gateway of each CCW Server that is a Real Server for a layer 7 SNAT mode transparent VIP should be set to use this address.

# 16. Document Revision History

Version	Date	Change	Reason for Change	Changed By
1.0	26 September 2023	Initial version		RJC





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