LOADBALANCER

DEPLOYMENT GUIDE

Load Balancing INFINITT PACS

Version 1.2.0

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1. About this Guide

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

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

3. Software Versions Supported

3.1. Loadbalancer.org Appliance

- V8.9.1 and later

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

3.2. INFINITT PACS

- All versions

4. INFINITT PACS

INFINITT PACS is an award-winning, web-based image management system. It provides a streamlined reading work-flow and scalable and expandable architecture, as well as optional virtualized server architecture for highest availability and disaster recovery.

5. Load Balancing INFINITT PACS

> **Note** It's highly recommended that you have a working INFINITT PACS environment first before implementing the load balancer.

5.1. Load Balancing & HA Requirements

The function of the load balancer is to distribute inbound connections across a cluster of INFINITT PACS nodes,

to provide a highly available and scalable service. Five virtual services are used to load balance the different aspects of INFINITT PACS.

5.2. Persistence (aka Server Affinity)

All virtual services (VIPs) should be configured to use source IP address-based server affinity in order to function correctly.

For the INFINITT PACS Web VIP, HTTP cookie-based persistence can be used in combination with source IP address. This means that, in the event that the HTTP cookie persistence method should fail, persistence will fall back to using source IP addresses.

5.3. Virtual Service (VIP) Requirements

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

- INFINITT Web
- DICOM
- QUERY
- MWL
- INFINITT Check

5.4. Port Requirements

The following table shows the ports that are load balanced:

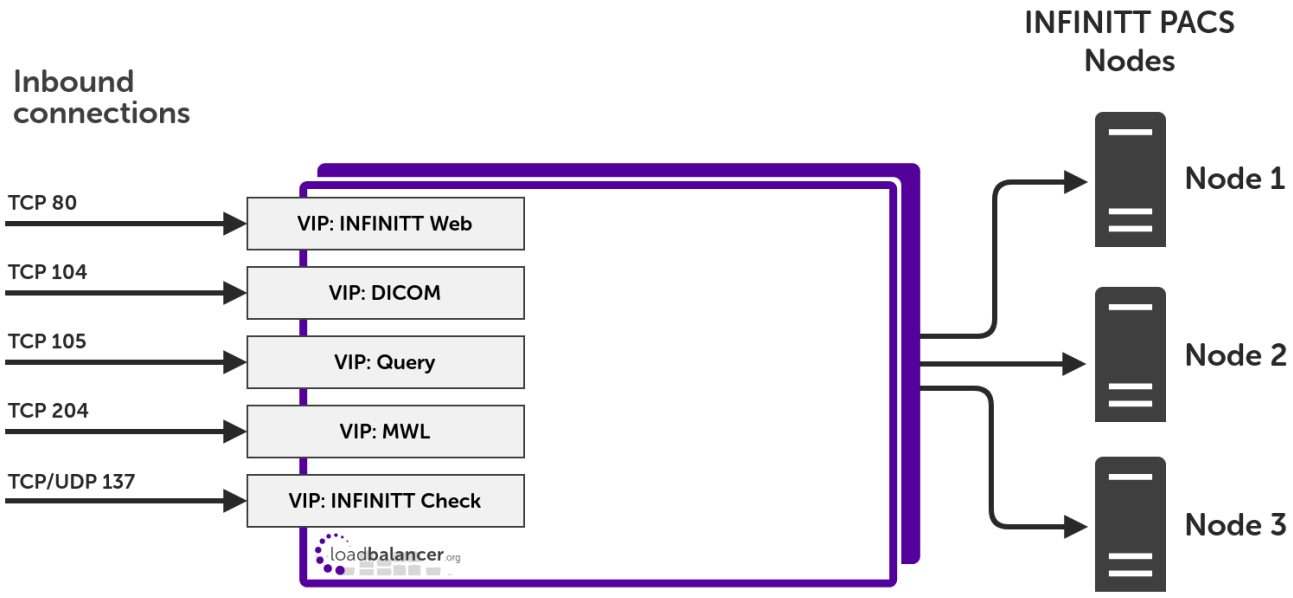
Port	Protocols	Use
80	TCP/HTTP	Web Portal Access
104	TCP/DICOM	DICOM Communication
105	TCP/DICOM	DICOM Query Communication
137	UDP/NetBIOS	NetBIOS Name Service for Health Checking
204	TCP	Modality Worklist Communication

5.5. Health Checks

The INFINITT Web service uses the ***Negotiate HTTP (HEAD)*** health check to confirm in a meaningful way that both the TCP port and the web service itself are running and accessible. The remaining virtual services use the ***Connect to Port*** health check.

A dedicated "INFINITT Check" virtual service is used to pass client NetBIOS name service health checks through to the back end INFINITT PACS servers.

6. Deployment Concept



VIP = **V**irtual **IP** Address

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

7. Loadbalancer.org Appliance – the Basics

7.1. Virtual Appliance

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

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

> **Note** Please refer to Virtual Appliance Installation and the ReadMe.txt text file included in the VA download for additional information on deploying the VA using the various Hypervisors.

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

7.2. Initial Network Configuration

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

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

7.3. Accessing the Appliance WebUI

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

> **Note** There are certain differences when accessing the WebUI for the cloud appliances. For details, please refer to the relevant Quick Start / Configuration Guide.

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

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

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

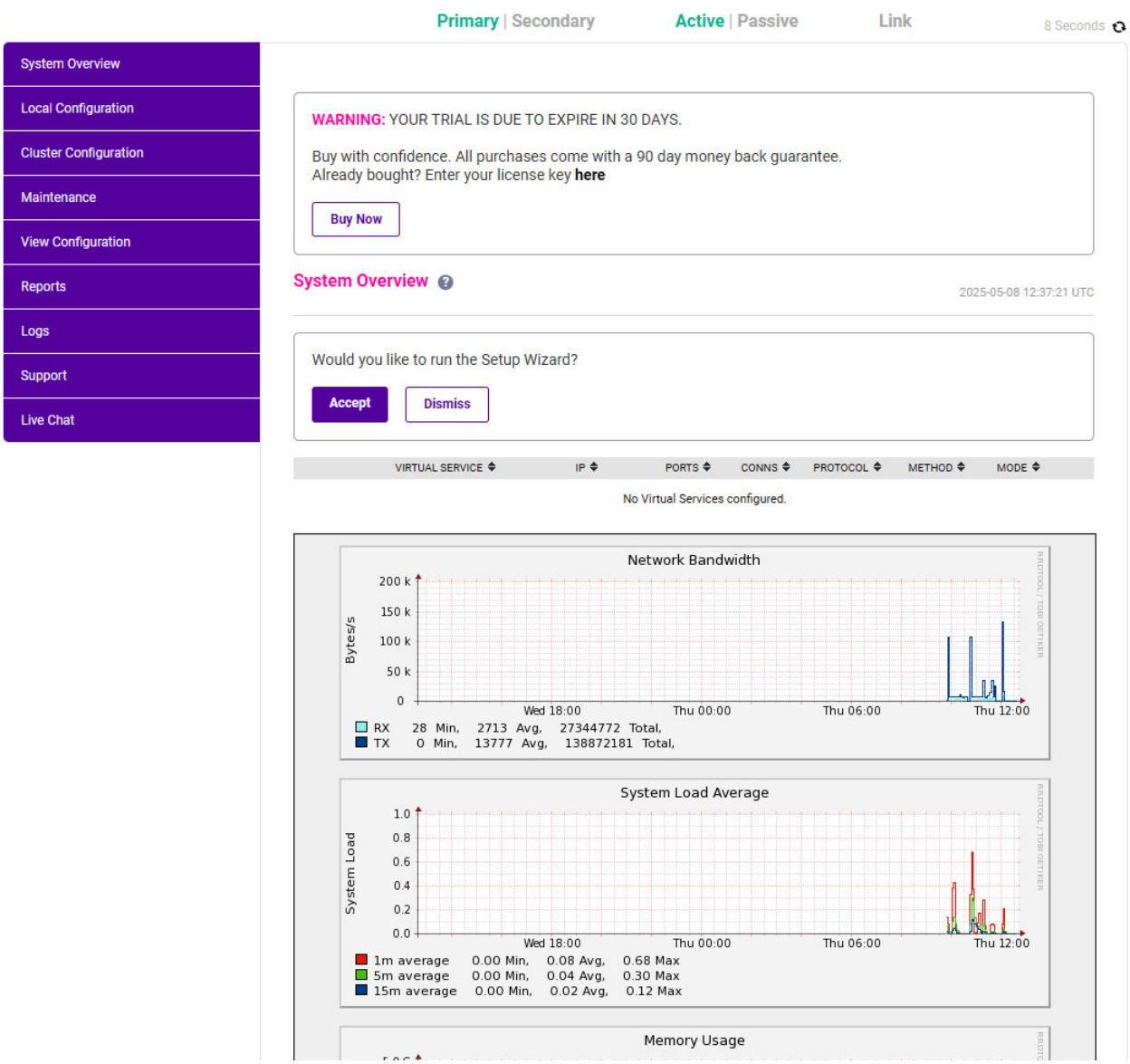
   > **Note** If you need to change the port, IP address or protocol that the WebUI listens on, please refer to Service Socket Addresses.

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

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

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

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



3. You'll be asked if you want to run the Setup Wizard. Click **Dismiss** if you're following a guide or want to configure the appliance manually. Click **Accept** to start the Setup Wizard.

> **Note** The Setup Wizard can only be used to configure Layer 7 services.

7.3.1. 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 creating 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

7.4. Appliance Software Update

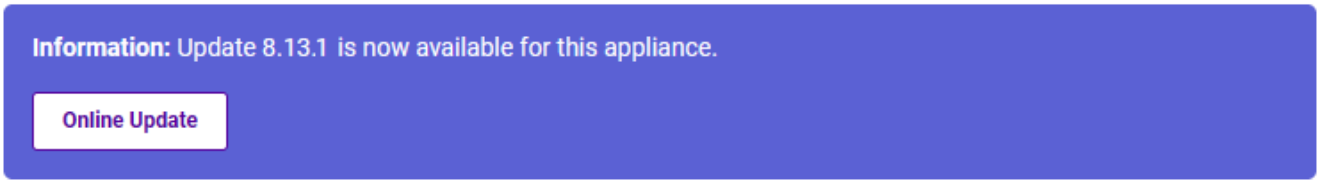
We recommend that the appliance is kept up to date to ensure that you benefit from the latest bug fixes, security updates and feature improvements. Both online and offline update are supported.

> **Note** For full details, please refer to Appliance Software Update in the Administration Manual.

> **Note** Services may need to be restarted/reloaded after the update process completes or in some cases a full appliance restart may be required. We therefore recommend performing the update during a maintenance window.

7.4.1. Online Update

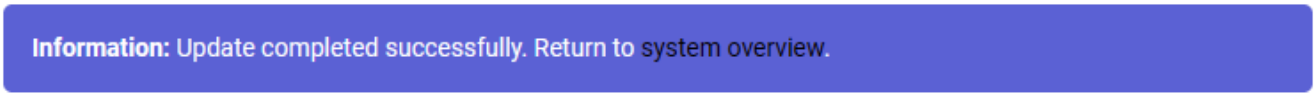
The appliance periodically contacts the Loadbalancer.org update server (**update.loadbalancer.org**) and checks for updates. This is the default behavior and can be disabled if preferred. If an update is found, a notification similar to the example below will be displayed at the top of the WebUI:



Click **Online Update**. A summary of all new features, improvements, bug fixes and security updates included in the update will be displayed. Click **Update** at the bottom of the page to start the update process.

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

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



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

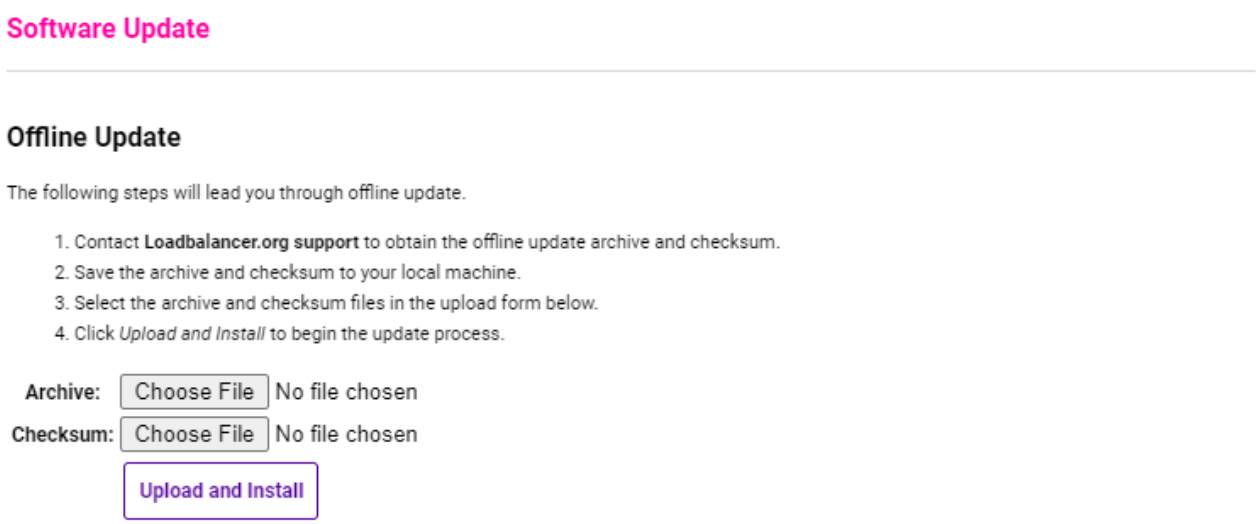
7.4.2. Offline Update

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

To check for the latest version, please refer to our product roadmap page available here. To obtain the latest offline update files contact support@loadbalancer.org.

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:



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.

7.5. 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)

> **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.

7.6. HA Clustered Pair Configuration

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

8. Appliance Configuration for INFINITT PACS

8.1. The Duplicate Service Function

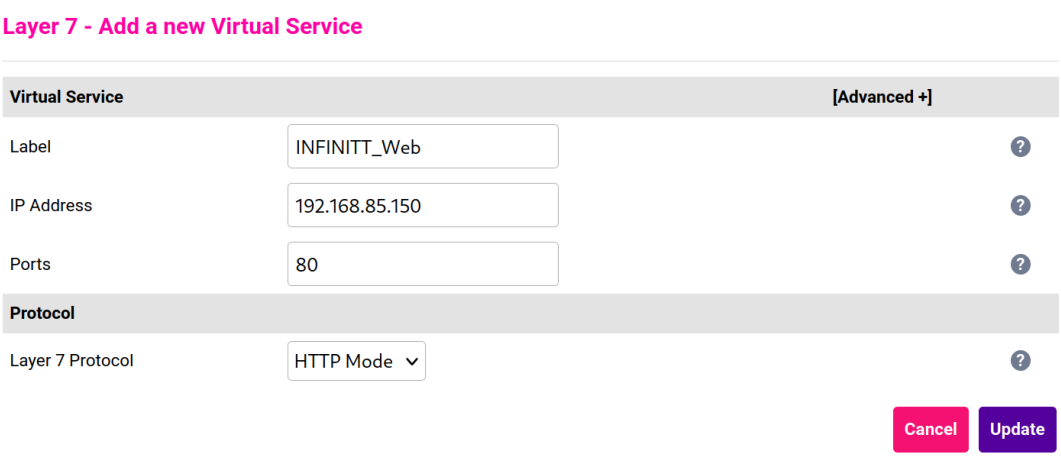
The instructions throughout this section make use of the *Duplicate Service* function. This allows an existing virtual service to be "duplicated", along with all real servers associated to that service. This can save a considerable amount of time when configuring the load balancer to work with a product like INFINITT PACS, where multiple virtual services are required which all share the same pool of back end servers.

> ⚠ Warning
>
> **Care must be taken** as the *Duplicate Service* function is a double-edged sword: configuration errors can easily propagate throughout an entire deployment. A misconfigured virtual service that is "duplicated" can spread misconfiguration throughout the whole setup.

8.2. Configuring VIP 1 – INFINITT Web

8.2.1. Configuring the Virtual Service (VIP)

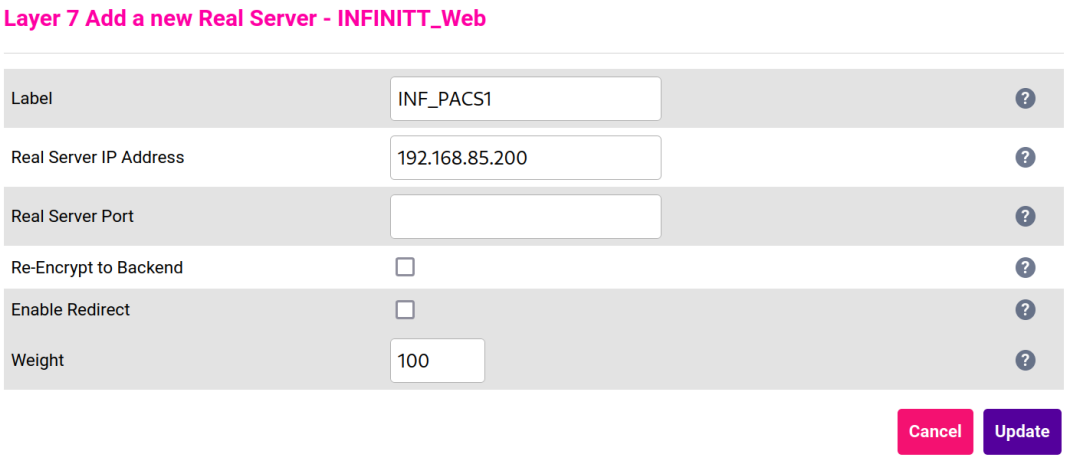
1. Using the web user interface, navigate to *Cluster Configuration > Layer 7 – Virtual Services* and click on **Add a new Virtual Service**.
2. Define the *Label* for the virtual service as required, e.g. **INFINITT_Web**.
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.150**.
4. Set the *Ports* field to **80**.
5. Set the *Layer 7 Protocol* to **HTTP Mode**.
6. Click **Update** to create the virtual service.



7. Click **Modify** next to the newly created VIP.
8. Set *Persistence Mode* to **HTTP Cookie and Source IP**.
9. Set *Health Checks* to **Negotiate HTTP (HEAD)**.
10. Leave ***Request to send*** empty as the load balancer will by default look for a "200 OK" response, which is desired in this instance.
11. Click **Update**.

8.2.2. Defining the Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 7 – 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. **INF_PACS1**.
3. Set the *Real Server IP Address* field to the required IP address, e.g. **192.168.85.200**.
4. Click **Update**.
5. Repeat these steps to add additional INFINITT PACS nodes as real servers as required.

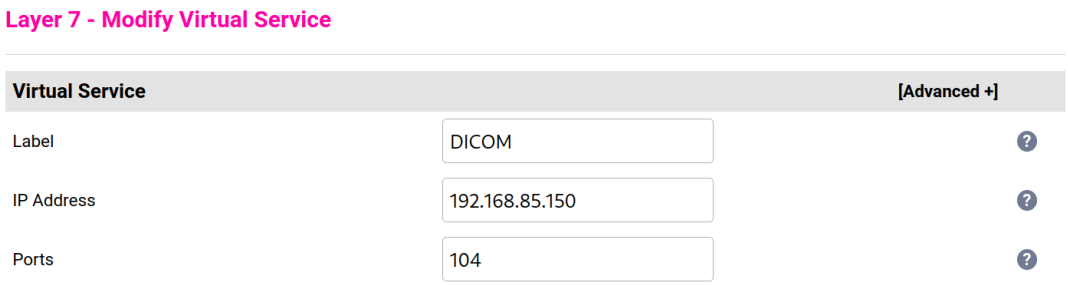


8.3. Configuring VIP 2 – DICOM

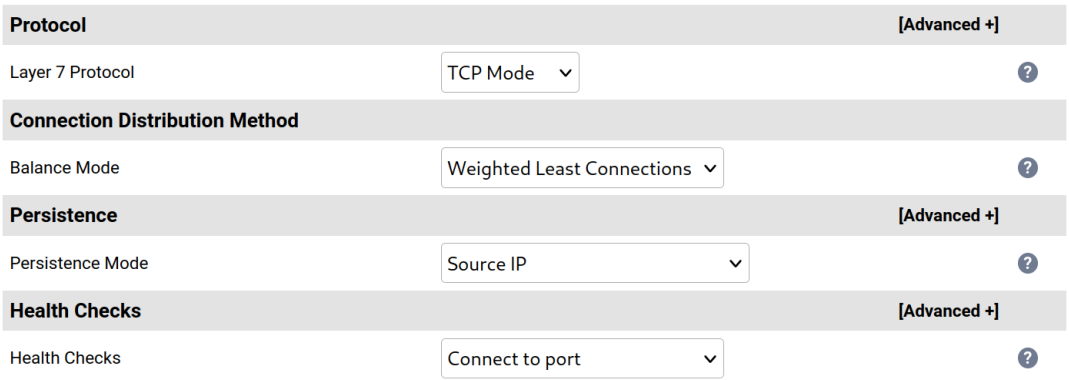
8.3.1. Configuring the Virtual Service (VIP)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 7 – Virtual Services* and click **Modify** next to the previously created INFINITT Web VIP.
2. Click **Duplicate Service** and confirm when prompted.

3. Define the *Label* for the new virtual service as required, e.g. **DICOM**.
4. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.150**.
5. Set the *Ports* field to **104**.



6. Set *Persistence Mode* to **Source IP**.
7. Set *Health Checks* to **Connect to port**.
8. Set the *Layer 7 Protocol* to **TCP Mode**.



> **Caution** It is **important to verify** that the *Persistence Mode*, *Health Checks*, and *Layer 7 Protocol* have been correctly set. If these steps are skipped then these configuration errors will propagate throughout the rest of the configuration.

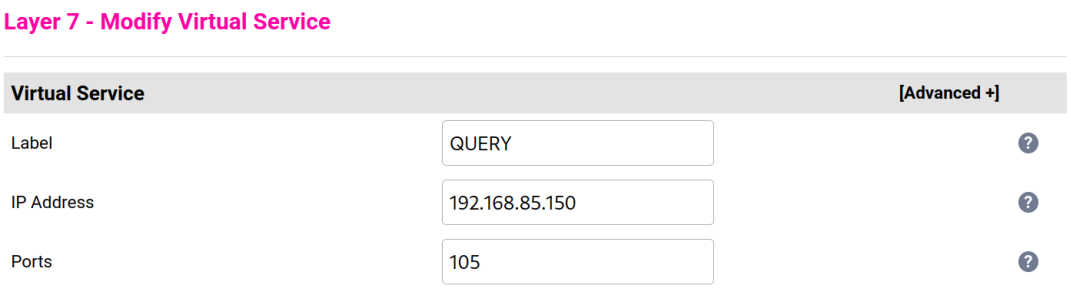
9. Click **Update**.

8.4. Configuring VIP 3 – QUERY

8.4.1. Configuring the Virtual Service (VIP)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 7 – Virtual Services* and click **Modify** next to the previously created DICOM VIP.
2. Click **Duplicate Service** and confirm when prompted.

3. Define the *Label* for the new virtual service as required, e.g. **QUERY**.
4. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.150**.
5. Set the *Ports* field to **105**.
6. Click **Update**.

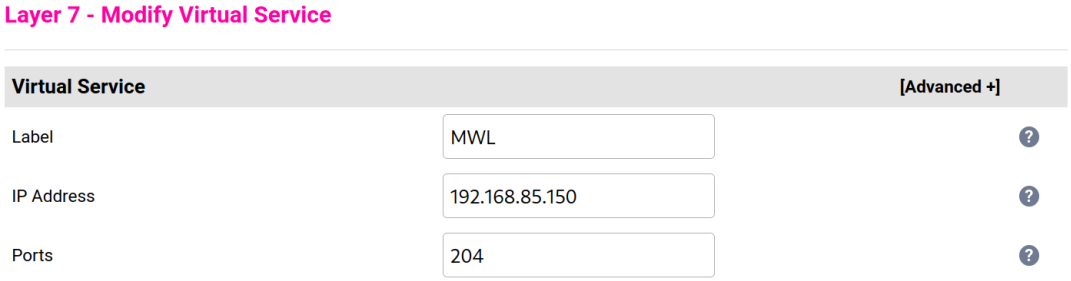


8.5. Configuring VIP 4 – MWL

8.5.1. Configuring the Virtual Service (VIP)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 7 – Virtual Services* and click **Modify** next to the previously created QUERY VIP.
2. Click **Duplicate Service** and confirm when prompted.

3. Define the *Label* for the new virtual service as required, e.g. **MWL**.
4. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.150**.
5. Set the *Ports* field to **204**.
6. Click **Update**.

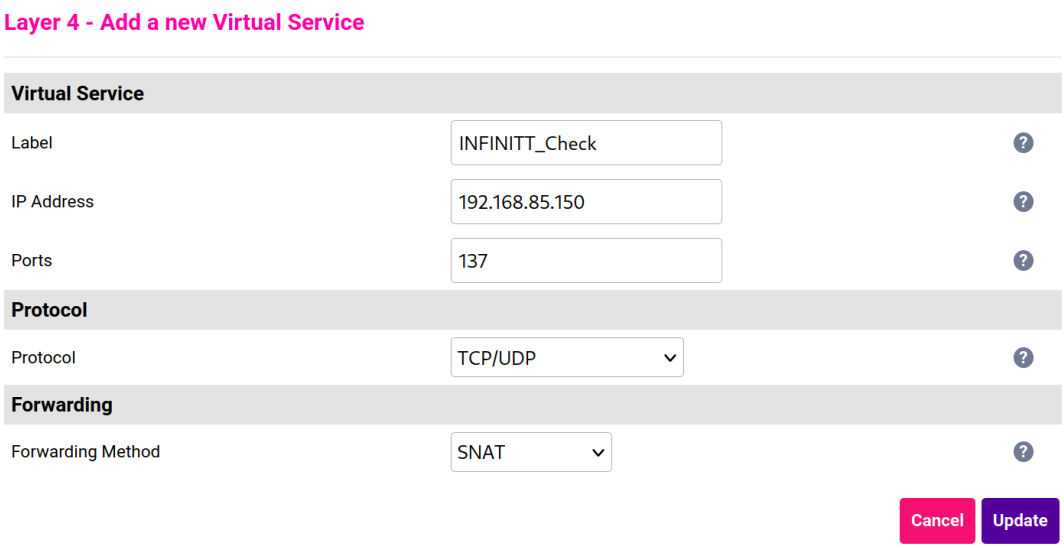


8.6. Configuring VIP 5 – INFINITT Check

8.6.1. Configuring the Virtual Service (VIP)

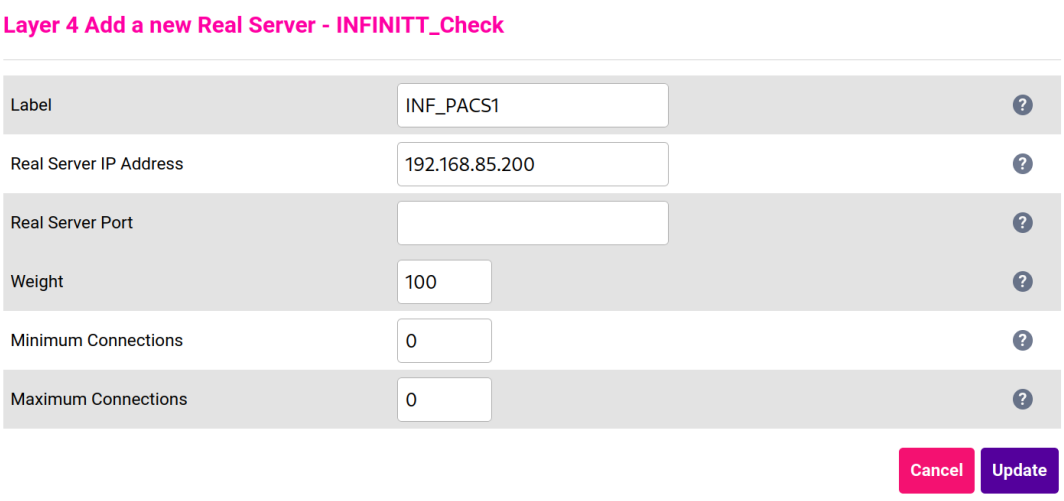
1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Virtual Services* and click on **Add a new Virtual Service**.
2. Define the *Label* for the virtual service as required, e.g. **INFINITT_Check**.
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.150**.

4. Set the *Ports* field to **137**.
5. Set the *Protocol* to **TCP/UDP**.
6. Leave the *Forwarding Method* set to **SNAT**.
7. Click **Update** to create the virtual service.



8.6.2. 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. **INF_PACS1**.
3. Set the *Real Server IP Address* field to the required IP address, e.g. **192.168.85.200**.
4. Click *Update*.
5. Repeat these steps to add additional INFINITT PACS nodes as real servers as required.



8.7. 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**.

9. Testing & Verification

> **Note** For additional guidance on diagnosing and resolving any issues you may have, please also refer to Diagnostics & Troubleshooting.

9.1. Using System Overview

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

10. 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.

11. Further Documentation

For additional information, please refer to the Administration Manual.

12. Appendix

12.1. Configuring HA - Adding a Secondary Appliance

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

> **Note** For Enterprise Azure, the HA pair should be configured first. For more information, please refer to the Azure Quick Start/Configuration Guide available in the documentation library

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

12.1.1. 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:

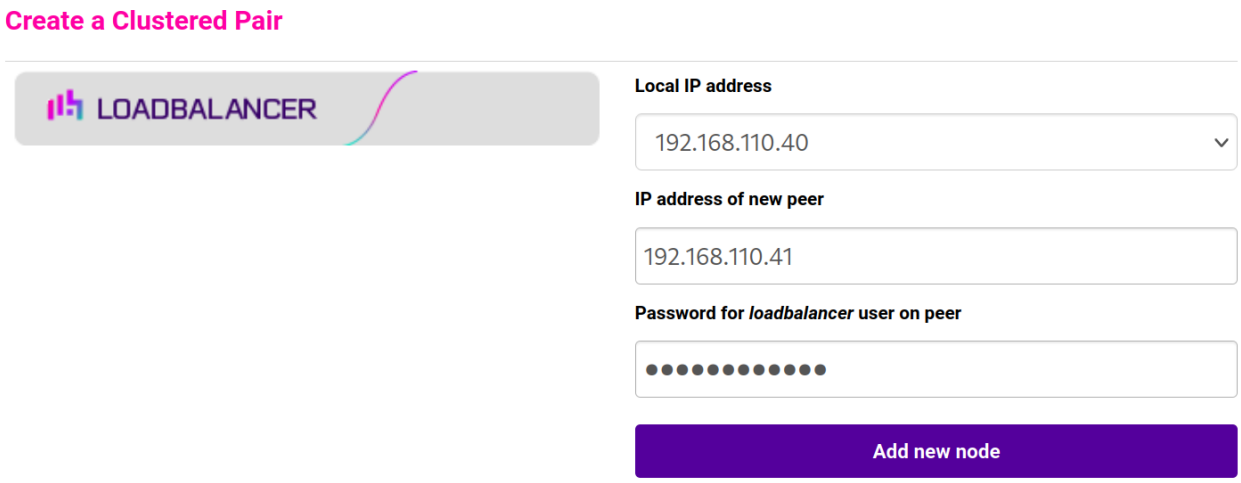
WebUI Main Menu Option	Sub Menu Option	Description
Local Configuration	Hostname & DNS	Hostname and DNS settings
Local Configuration	Network Interface Configuration	Interface IP addresses, bonding configuration and VLANs
Local Configuration	Routing	Default gateways and static routes
Local Configuration	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
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.

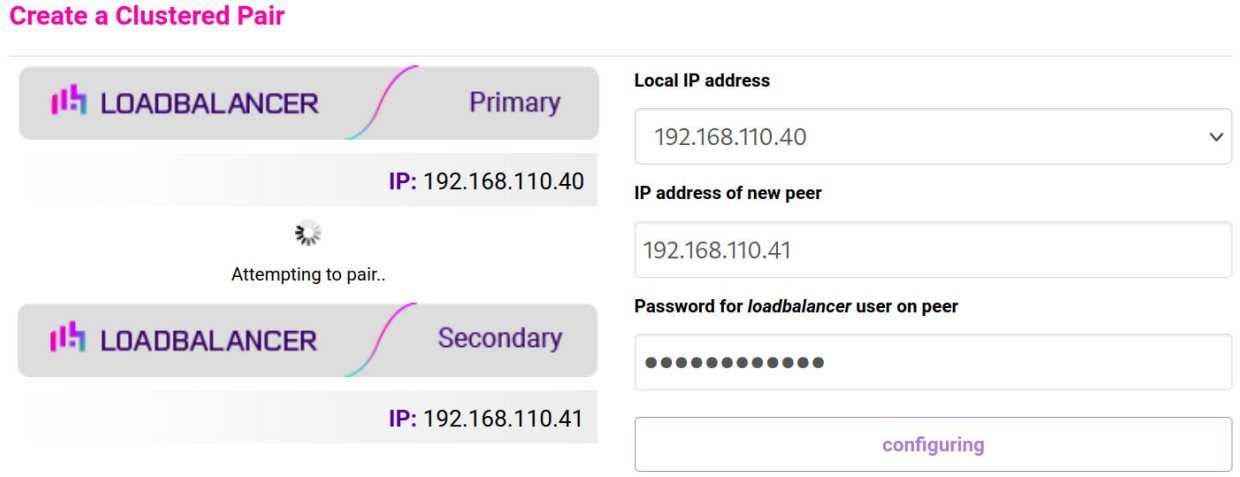
12.1.2. Configuring the HA Clustered Pair

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

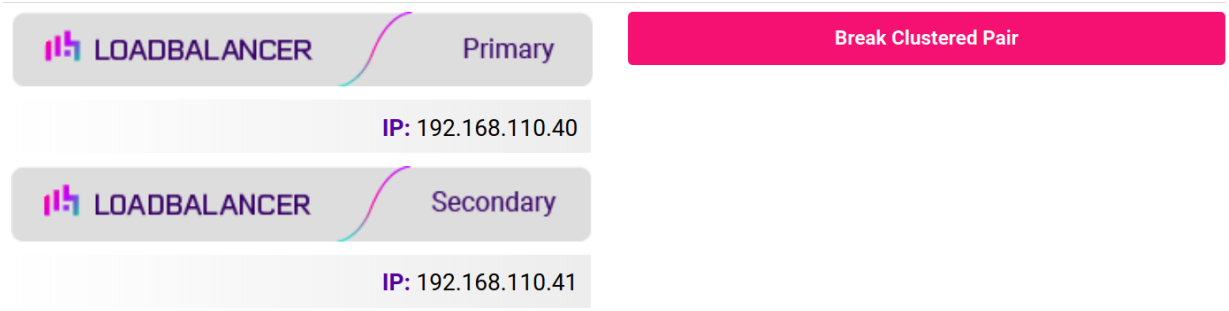
1. Deploy a second appliance that will be the Secondary and configure initial network settings.
2. Using the WebUI on the Primary appliance, navigate to: *Cluster Configuration > High-Availability Configuration*.



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



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 "Commit changes" message box at the top of the screen.

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

> **Note** For more details on configuring HA with 2 appliances, please refer to Appliance Clustering for HA.

> **Note** For details on testing and verifying HA, please refer to Clustered Pair Diagnostics.

13. Document Revision History

Version	Date	Change	Reason for Change	Changed By
1.0.0	17 December 2019	Initial version		IBG
1.0.1	1 September 2020	New title page Updated Canadian contact details	Branding update Change to Canadian contact details	AH
1.1.0	20 April 2023	Converted the document to AsciiDoc Significant updates to bring the document into line with current documentation format New document theme Modified diagram colours	Document updates required moving it to the new documentation system Branding update	AH
1.2.0	5 June 2023	Added new "INFINITT Check" virtual service Rewrote the load balancer configuration instructions to make use of the duplicate service feature Retook all screenshots	Support load balancing the latest versions of INFINITT PACS Save time during load balancer configuration by duplicating services Refresh document with new branding across all screenshots	AH

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