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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.

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

3. Software Versions Supported

3.1. Loadbalancer.org Appliance
- V8.6.1 and later

Note: The screenshots used throughout this document aim to track the latest Loadbalancer.org software version. If using an older software version, note that the screenshots presented here may not match the 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:

<table>
<thead>
<tr>
<th>Port</th>
<th>Protocols</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>TCP/HTTP</td>
<td>Web Portal Access</td>
</tr>
<tr>
<td>104</td>
<td>TCP/DICOM</td>
<td>DICOM Communication</td>
</tr>
<tr>
<td>105</td>
<td>TCP/DICOM</td>
<td>DICOM Query Communication</td>
</tr>
<tr>
<td>137</td>
<td>UDP/NetBIOS</td>
<td>NetBIOS Name Service for Health Checking</td>
</tr>
<tr>
<td>204</td>
<td>TCP</td>
<td>Modality Worklist Communication</td>
</tr>
</tbody>
</table>

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
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 Server and other network settings.
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.

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

A number of compatibility issues have been found with various versions of Microsoft Internet Explorer and Edge. The WebUI has been tested and verified using both Chrome & Firefox.

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


   You'll receive a warning about the WebUI's 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.

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

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

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

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

**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
7.4. Appliance Software Update

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

Determining the Current Software Version

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

Checking for Updates using Online Update

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 v8.9.0 is the current release. No updates are available

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

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

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

   Information: Update completed successfully.

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

Using Offline Update

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

   ![Upload and Install Button]

   - **Archive:** Choose File [No file chosen]
   - **Checksum:** Choose File [No file chosen]

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

**7.5. Ports Used by the Appliance**

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

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Port</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP</td>
<td>22</td>
<td>SSH</td>
</tr>
<tr>
<td>TCP &amp; UDP</td>
<td>53</td>
<td>DNS</td>
</tr>
<tr>
<td>TCP &amp; UDP</td>
<td>123</td>
<td>NTP</td>
</tr>
<tr>
<td>TCP &amp; UDP</td>
<td>161</td>
<td>SNMP</td>
</tr>
<tr>
<td>UDP</td>
<td>6694</td>
<td>Heartbeat between Primary &amp; Secondary appliances in HA mode</td>
</tr>
<tr>
<td>TCP</td>
<td>7778</td>
<td>HAPproxy persistence table replication</td>
</tr>
<tr>
<td>TCP</td>
<td>9080</td>
<td>WebUI - HTTP (disabled by default)</td>
</tr>
<tr>
<td>TCP</td>
<td>9081</td>
<td>Nginx fallback page</td>
</tr>
<tr>
<td>TCP</td>
<td>9443</td>
<td>WebUI - HTTPS</td>
</tr>
</tbody>
</table>
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

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.

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.

![Health Checks Configuration](image)

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.

![Real Server Configuration](image)

8.3. Configuring VIP 2 – DICOM

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.

9. Click Update.

8.4. Configuring VIP 3 – QUERY

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 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

**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

**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.

**Layer 4 - Add a new Virtual Service**

---

**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.

**Layer 4 Add a new Real Server - INFINTT_Check**

---

**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**

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

**Note**

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

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

**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:

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

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

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

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