



# Load Balancing McKesson Radiology and McKesson Cardiology

v1.1.1

*Deployment Guide*

**NOTE:** This guide has been archived and is no longer being maintained. While the content is still valid for the particular software versions mentioned, it may refer to outdated software that has now reached end-of-life. For more information please contact [support@loadbalancer.org](mailto:support@loadbalancer.org).



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## 1. About this Guide

This guide details the steps required to configure a load balanced McKesson Radiology and McKesson Cardiology environment utilizing Loadbalancer.org appliances. It covers the configuration of the load balancers and also any McKesson Radiology and McKesson Cardiology 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 relevant Administration Manual:

- [v7 Administration Manual](#)
- [v8 Administration Manual](#)

## 2. Loadbalancer.org Appliances Supported

All our products can be used for load balancing McKesson Radiology and McKesson Cardiology. The complete list of models is shown below:

Discontinued Models	Current Models *
Enterprise R16	Enterprise R20
Enterprise VA R16	Enterprise MAX
Enterprise VA	Enterprise 10G
Enterprise R320	Enterprise 40G
	Enterprise Ultra
	Enterprise VA R20
	Enterprise VA MAX
	Enterprise AWS **
	Enterprise AZURE **
	Enterprise GCP **

\* For full specifications of these models please refer to: <http://www.loadbalancer.org/products/hardware>

\*\* Some features may not be supported, please check with Loadbalancer.org support

## 3. Loadbalancer.org Software Versions Supported

- V7.6.4 and later

## 4. McKesson Radiology and McKesson Cardiology Software Versions Supported

- McKesson Radiology, McKesson Radiology Manager, McKesson Clinical Reference Viewer, and McKesson Cardiology – all versions

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## 5. McKesson Radiology and McKesson Cardiology

Change Healthcare's suite of radiology and cardiology applications provide a comprehensive set of tools for medical imaging. The whole workflow is covered, from working with modalities and importing images to image viewing and reporting.

McKesson Radiology and McKesson Radiology Manager are a PACS solution based on well known standards such as DICOM. Features include 3D visualisations and tools, analytics and metrics tools, and a flexible deployment model.

McKesson Clinical Reference Viewer is a browser based image viewing application, giving clinicians easy access to medical imaging data through an intuitive interface.

McKesson Cardiology is an application that helps with managing cardiology imaging, data management, reporting, and more.

## 6. Load Balancing McKesson Radiology and McKesson Cardiology

Note: It's highly recommended that you have a working McKesson Radiology and McKesson Cardiology environment first before implementing the load balancer.

### Persistence (aka Server Affinity)

The virtual service for McKesson Radiology web traffic does not require session affinity at the load balancing layer.

All other virtual services require session affinity, aka persistence. When using the default layer 4 DR deployment mode described in this guide, source IP address persistence is used and different persistence timeout settings are used across the different virtual services. The specific settings are detailed in the 'Appliance Configuration' sections 11 and 12.

### Virtual Service (VIP) Requirements

To provide load balancing and HA for McKesson Radiology and McKesson Cardiology, the following VIPs are required:

- McKesson Radiology (DICOM Traffic)
- McKesson Radiology (Web Traffic)
- McKesson Radiology Manager
- McKesson Clinical Reference Viewer
- McKesson Cardiology

### Port Requirements

The following table shows the ports that are load balanced:

Port	Protocols	Use
80	TCP/HTTP	Web application traffic for all McKesson products

443	TCP/HTTPS	Encrypted web application traffic for all McKesson products
4000	TCP/DICOM	DICOM import traffic
5000	TCP/DICOM	DICOM query traffic

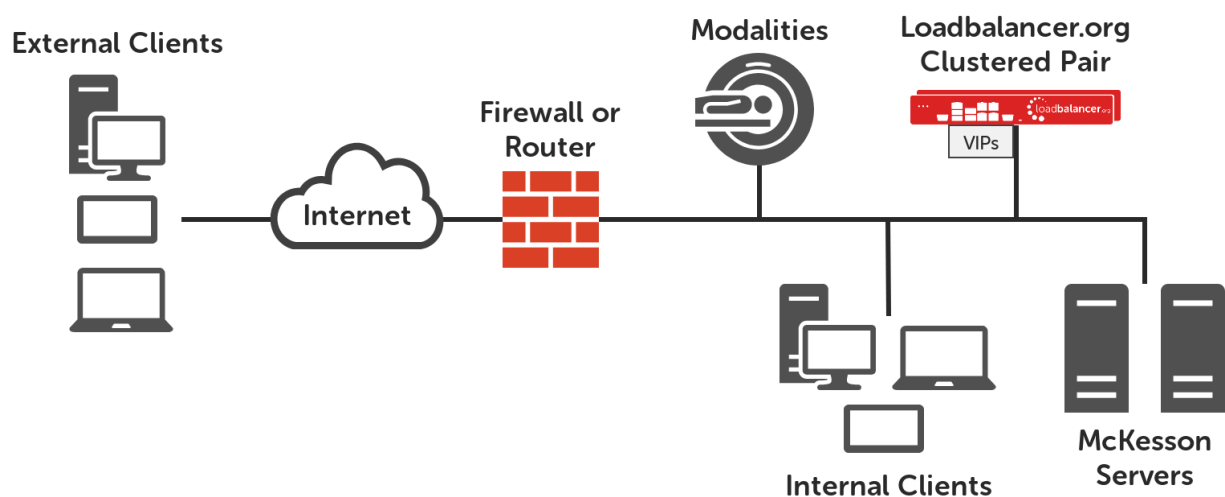
## Health Checks

Standard, built-in health checks are used for all virtual services, with one exception.

If using McKesson Radiology Web Server version 12.0, it is possible to use the same health check that is used for version 12.1, which is a built-in *Negotiate* check.

McKesson officially advise to perform an additional two health checks on version 12.0 Radiology Web Servers in order for them to be considered to be functioning fully. This is possible to achieve using an external health check script. For assistance in implementing this, please contact [solutions@loadbalancer.org](mailto:solutions@loadbalancer.org).

## 7. Deployment Concept



VIPs = Virtual IP Addresses

Note: The load balancer can be deployed as a single unit, although Loadbalancer.org recommends a clustered pair for resilience & high availability. Please refer to section 2 in the appendix on page 37 for more details on configuring a clustered pair.

## 8. Load Balancer Deployment Methods

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

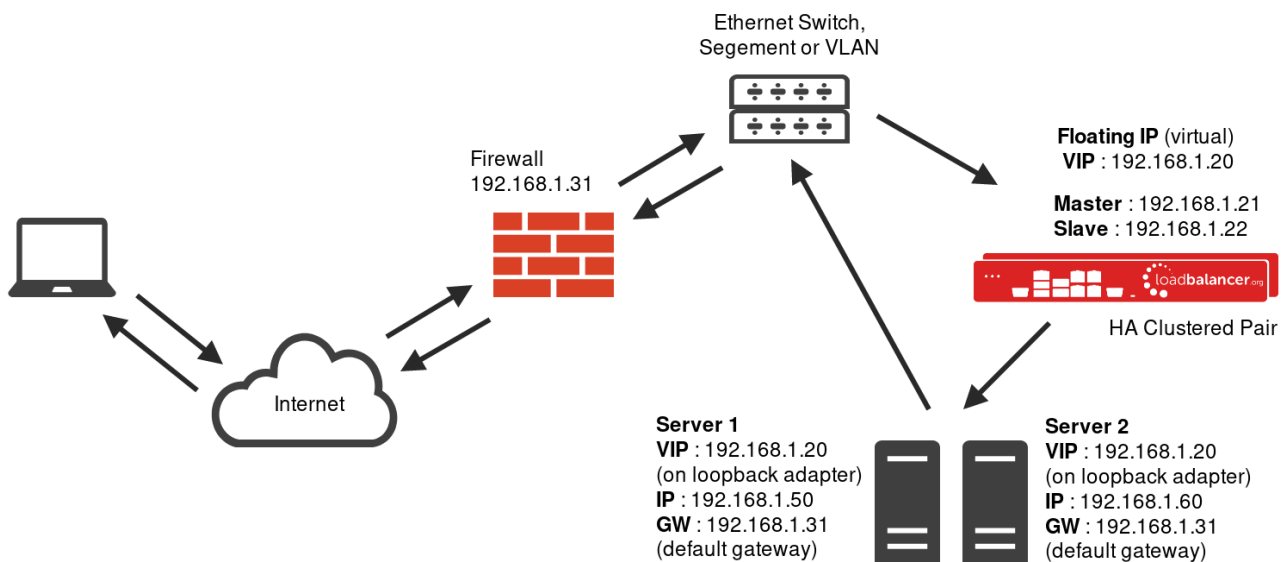
For McKesson Radiology and McKesson Cardiology, using layer 4 DR mode is recommended. It is also possible to use a combination of layer 4 NAT mode and layer 7 SNAT mode, however the performance of this set up is not as great as layer 4 DR mode. These modes are described below and are used for the configurations presented in this guide. For configuring using DR mode please refer to the section starting on page 14, and for configuring using a combination of layer 4 NAT mode and layer 7 SNAT mode refer to the section starting on page 22.



## Layer 4 DR Mode

One-arm direct routing (DR) mode is a very high performance solution that requires little change to your existing infrastructure.

Note: Kemp, Brocade, Barracuda & A10 Networks call this Direct Server Return and F5 call it N-Path.

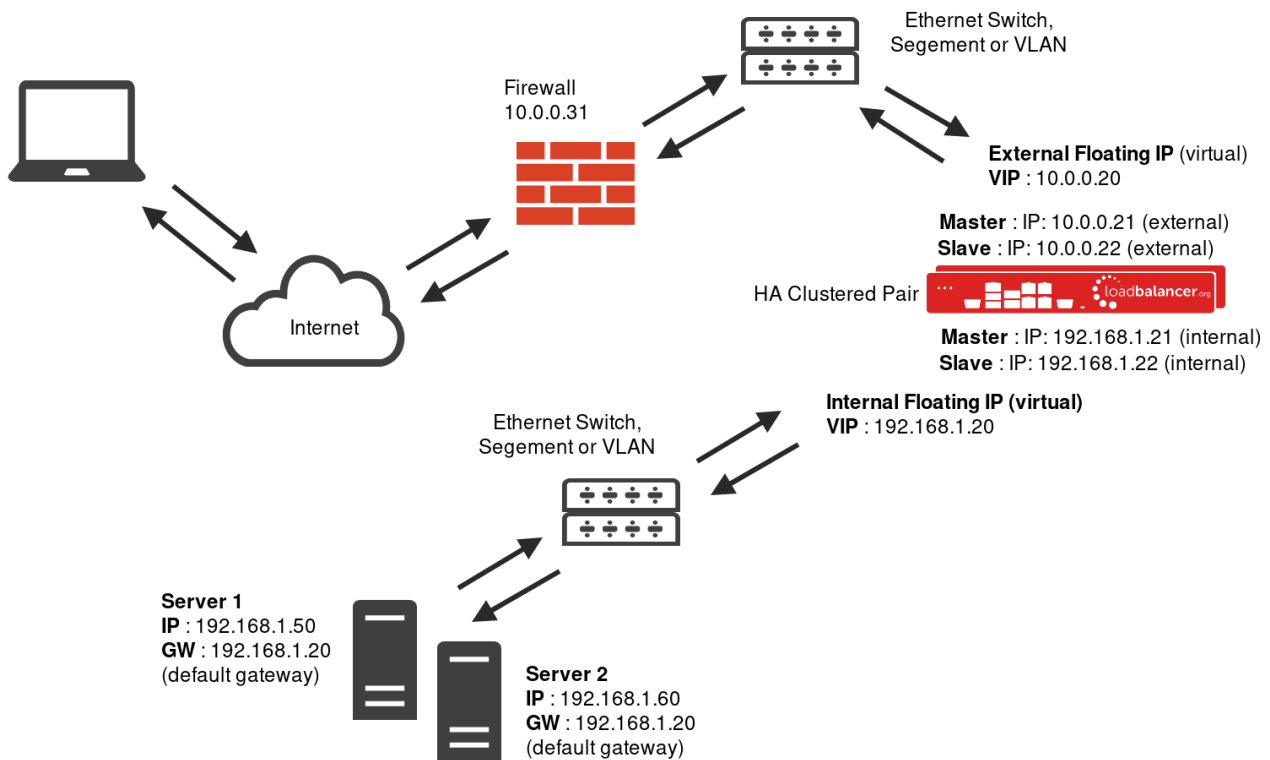


- DR mode works by changing the destination MAC address of the incoming packet to match the selected Real Server on the fly which is very fast
- When the packet reaches the Real Server it expects the Real Server to own the Virtual Services IP address (VIP). This means that you need to ensure that the Real Server (and the load balanced application) respond to both the Real Servers 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 Servers in this way is referred to as **Solving the ARP Problem**. Please refer to page [32](#) for more information
- On average, DR mode is 8 times quicker than NAT for HTTP, 50 times quicker for Terminal Services and much, much faster for streaming media or FTP
- The load balancer must have an Interface in the same subnet as the Real Servers to ensure layer 2 connectivity required for DR mode to work
- 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 in DR mode i.e. having a different RIP port than the VIP port
- DR mode is transparent, i.e. the Real Server will see the source IP address of the client

## Layer 4 NAT Mode

Layer 4 NAT mode is also a high performance solution, although not as fast as layer 4 DR mode. This is because real

server responses must flow back to the client via the load balancer rather than directly as with DR mode.



- The load balancer translates all requests from the external Virtual Service to the internal Real Servers.
- Normally eth0 is used for the internal network and eth1 is used for the external network although this is not mandatory. If the Real Servers require Internet access, Autonat should be enabled using the WebUI option: *Cluster Configuration > Layer 4 – Advanced Configuration*, the external interface should be selected.
- NAT mode can be deployed in the following ways:

**2-arm (using 2 Interfaces), 2 subnets** (as shown above) - One interface on the load balancer is connected to subnet1 and the second interface and Real Servers are connected to subnet2. The VIP is brought up in subnet1. The default gateway on the Real Servers is set to be an IP address in subnet2 on the load balancer. Clients can be located in subnet1 or any remote subnet provided they can route to the VIP.

**2-arm (using 1 Interface), 2 subnets** - same as above except that a single interface on the load balancer is allocated 2 IP addresses, one in each subnet.

**1-arm (using 1 Interface), 1 subnet** - Here, the VIP is brought up in the same subnet as the Real Servers. For clients located in remote networks the default gateway on the Real Servers must be set to be an IP address on the load balancer. For clients located on the same subnet, return traffic would normally be sent directly to the client bypassing the load balancer which would break NAT mode. To address this, the routing table on the Real Servers must be modified to force return traffic to go via the load balancer - for more details on 'One-Arm NAT Mode' refer to chapter 6 in the [Administration Manual](#).

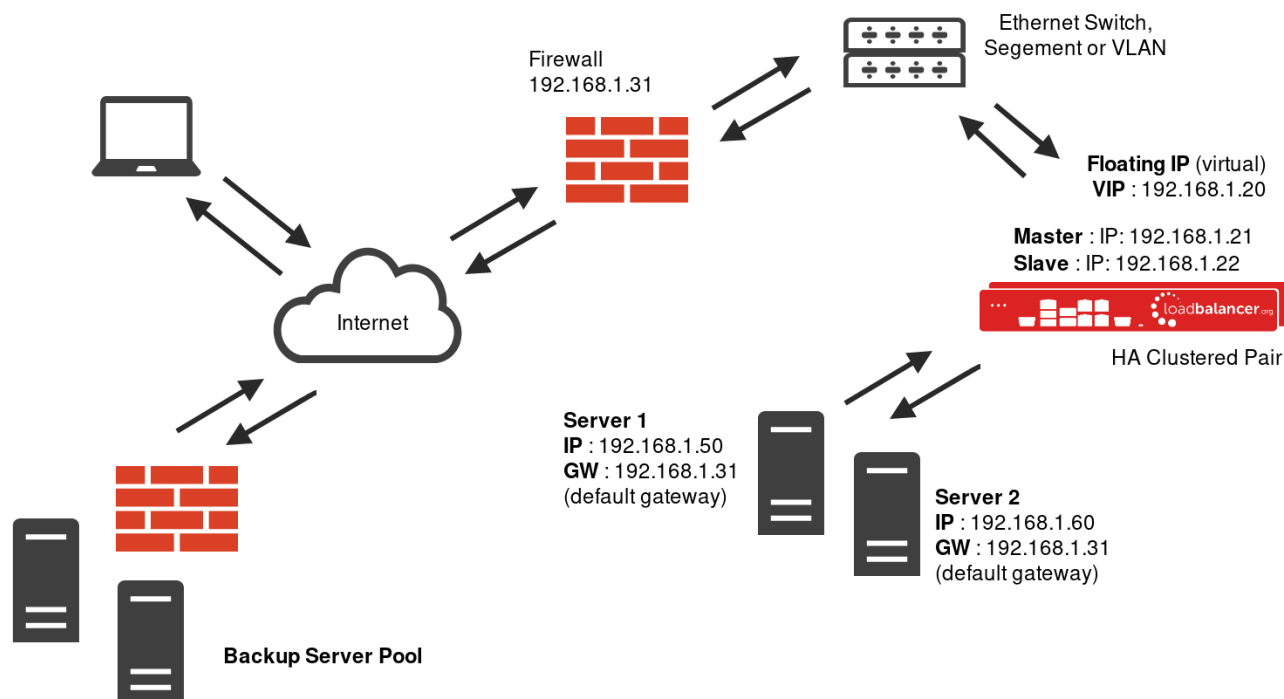
- If you want Real Servers to be accessible on their own IP address for non-load balanced services, e.g. SMTP or RDP, you will need to setup individual SNAT and DNAT firewall script rules for each Real Server or add additional VIPs for this - please refer to chapter 6 in the [Administration Manual](#).
- NAT mode is transparent, i.e. the Real Server will see the source IP address of the client.



- Port translation is possible in NAT mode, i.e. VIP:80 --> RIP:8080 is possible.

## 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 request to the chosen Real Server. As a result, Layer 7 is a slower technique than DR or NAT mode at Layer 4. 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.



This mode can be deployed in a one-arm or two-arm configuration and does not require any changes to the Real Servers. However, since the load balancer is acting as a full proxy it doesn't have the same raw throughput as the layer 4 methods.

The load balancer proxies the application traffic to the servers so that the source of all traffic becomes the load balancer.

- SNAT mode is a full proxy and therefore load balanced Real Servers do not need to be changed in any way
- Because SNAT mode is a full proxy any server in the cluster can be on any accessible subnet including across the Internet or WAN
- 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 balancers 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 clients IP address can be passed through either by enabling TProxy on the load balancer, or for HTTP, using X-forwarded-For headers. Please refer to chapter 6 in the [administration manual](#) for more details
- SNAT mode can be deployed using either a 1-arm or 2-arm configuration

## Our Recommendation

Where possible we recommend that Layer 4 Direct Routing (DR) mode is used. This mode offers the best possible

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performance since replies go directly from the Real Servers to the client, not via the load balancer. It's also relatively simple to implement. Ultimately, the final choice does depend on your specific requirements and infrastructure.

If DR mode cannot be used, for example if it is not possible to make certain changes to the real servers, or if the real servers are located in remote routed networks, then layer 4 NAT mode with layer 7 SNAT mode is recommended.

## 9. Configuring McKesson Radiology and McKesson Cardiology for Load Balancing

### Layer 4 DR Mode – Solving the ARP Problem

If using layer 4 DR mode, the 'ARP problem' must be solved on each real server for DR mode to work. For detailed steps on solving the ARP problem for Windows, please refer to section 1 of the appendix on page [32](#) for more information.

For a detailed explanation of DR mode and the nature of the ARP problem, please refer to the section that covers layer 4 DR mode on page [Z](#).

### Layer 4 NAT Mode – Changing the Real Servers' Default Gateways

If using layer 4 NAT mode, each back end real server must be configured so that the default gateway is an IP address owned by the load balancer. If using an HA pair of load balancers, this IP address should be a floating IP address so that network communication continues after a load balancer fail over.

For a detailed explanation of NAT mode, please refer to the section that covers layer 4 NAT mode on page [Z](#).

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## 10. Loadbalancer.org Appliance – the Basics

### Virtual Appliance Download & Deployment

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 and XEN and has been optimized for each Hypervisor. By default, the VA is allocated 1 CPU, 2GB of RAM and has an 8GB virtual disk. The Virtual Appliance can be downloaded [here](#).

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

Note: Please refer to the [Administration Manual](#) and the ReadMe.txt text file included in the VA download for more detailed information on deploying the VA using various Hypervisors.

### Initial Network Configuration

The IP address, subnet mask, default gateway and DNS settings can be configured in several ways as detailed below:

#### *Method 1 - Using the Network Setup Wizard at the console*

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

#### *Method 2 - Using the WebUI*

Using a browser, connect to the WebUI on the default IP address/port: **https://192.168.2.21:9443**

To set the IP address & subnet mask, use: *Local Configuration > Network Interface Configuration*

To set the default gateway, use: *Local Configuration > Routing*

To configure DNS settings, use: *Local Configuration > Hostname & DNS*

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## Accessing the Web User Interface (WebUI)

The WebUI can be accessed via HTTPS at the following URL: <https://192.168.2.21:9443/lbadmin>

\* Note the port number → **9443**

*(replace 192.168.2.21 with the IP address of your load balancer if it's been changed from the default)*

Login using the following credentials:

**Username:** loadbalancer

**Password:** loadbalancer

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

Once logged in, the WebUI will be displayed as shown on the following page:

- System Overview
- Local Configuration
- Cluster Configuration
- Maintenance
- View Configuration
- Reports
- Logs
- Support

**SYSTEM OVERVIEW** ?

2015-06-18 14:21:20 UTC

Would you like to run the Setup Wizard?

Accept

Dismiss

VIRTUAL SERVICE ⌵

IP ⌵

PORTS ⌵

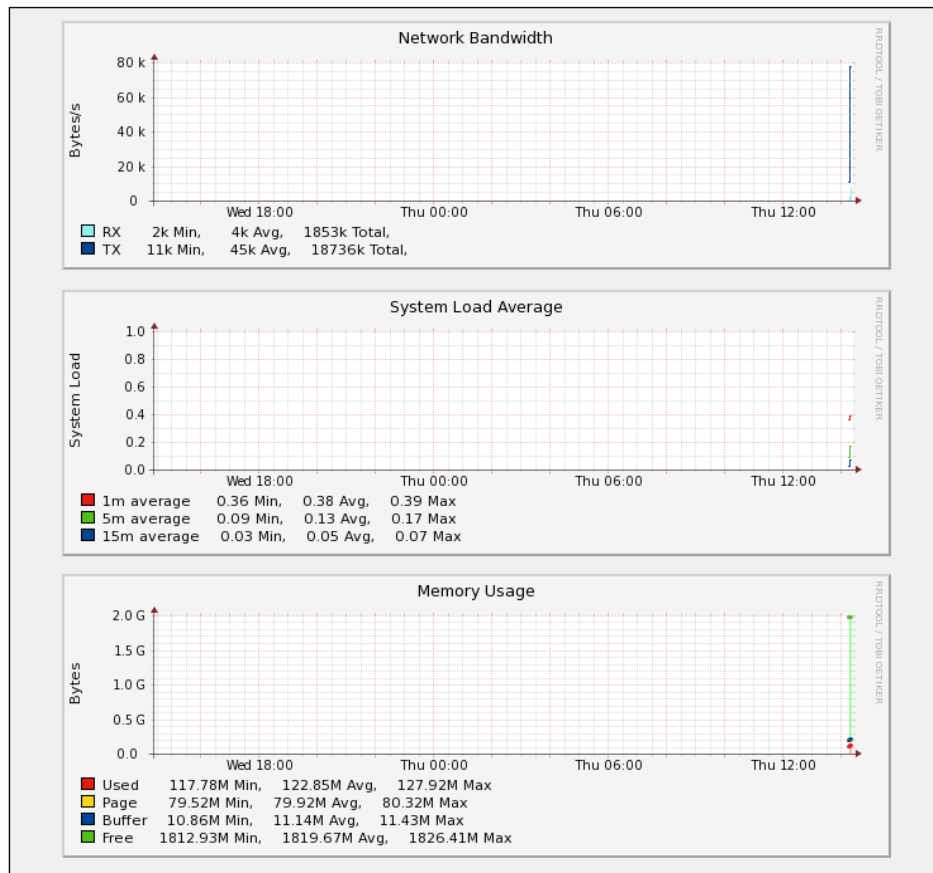
CONN'S ⌵

PROTOCOL ⌵

METHOD ⌵

MODE ⌵

No Virtual Services configured.



(shows v8.2.x)

## 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 slave unit is covered in section 2 of the appendix on page [37](#).

## 11. Appliance Configuration for McKesson Radiology and McKesson Cardiology – Using Layer 4 DR Mode

This load balancing method (layer 4 DR mode) is recommended as it offers the best possible performance.

When load balancing McKesson Radiology and McKesson Cardiology, up to five virtual services need to be configured: a virtual service for McKesson Radiology (DICOM traffic), a virtual service for McKesson Radiology (web traffic), a virtual service for McKesson Radiology Manager, a virtual service for McKesson Clinical Reference Viewer, and a virtual service for McKesson Cardiology.

### Configuring VIP 1 – McKesson Radiology (DICOM Traffic)

#### 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. **McK-Radiology\_DICOM**
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.30**
4. Set the *Ports* field to **4000,5000**
5. Leave the *Protocol* set to **TCP**
6. Leave the *Forwarding Method* set to **Direct Routing**
7. Click **Update** to create the virtual service

The screenshot shows a web form titled "LAYER 4 - ADD A NEW VIRTUAL SERVICE". The form contains the following fields and values:

Label	McK-Radiology_DICOM	?	
Virtual Service	IP Address	192.168.85.30	?
	Ports	4000,5000	?
Protocol	TCP		?
Forwarding Method	Direct Routing		?

At the bottom right of the form are two buttons: "Cancel" (red) and "Update" (green).

8. Click **Modify** next to the newly created VIP
9. Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
10. Make sure that the *Persistent* checkbox is checked
11. Set the *Persistent Timeout* value to **3600** (the units are seconds)
12. Set the *Health Checks Check Type* to **Connect to port**
13. Set the *Check Port* to **5000**
14. Click **Update**

## Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-Radiology\_Srv1**
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 real servers as required

**LAYER 4 MODIFY REAL SERVER - McK-RADIOLOGY\_DICOM / McK-RADIOLOGY-SRV1**

Label	<input type="text" value="McK-Radiology_Srv1"/>	?
Real Server IP Address	<input type="text" value="192.168.85.200"/>	?
Weight	<input type="text" value="100"/>	?
Minimum Connections	<input type="text" value="0"/>	?
Maximum Connections	<input type="text" value="0"/>	?

**Cancel** **Update**

## Configuring VIP 2 – McKesson Radiology (Web Traffic)

### 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. **McK-Radiology\_Web**
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.31**
4. Set the *Ports* field to **80**
5. Leave the *Protocol* set to **TCP**
6. Leave the *Forwarding Method* set to **Direct Routing**
7. Click **Update** to create the virtual service



LAYER 4 - ADD A NEW VIRTUAL SERVICE

Label

McK-Radiology\_Web

?

Virtual Service

IP Address

192.168.85.31

?

Ports

80

?

Protocol

TCP

?

Forwarding Method

Direct Routina

?

Cancel

Update

8. Click **Modfiy** next to the newly created VIP
9. Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
10. Make sure that the *Persistent* checkbox is not checked
11. Configure health checking depending on the version of McKesson Radiology Web Server in use:
  - If using McKesson Radiology Web Server version 12.1 and later:
    - Set *Health Checks Check Type* to **Negotiate**
    - Set the *Check Port* field to **80**
    - Leave the *Protocol* set to **HTTP**
    - Set the *Request to send* field to **/wpp/srvpacs.asp**
    - Set the *Response expected* field to **srvPACS OK**
  - If using McKesson Radiology Web Server version 12.0, it is possible to use the same health check that is used for version 12.1, which is described above.  
 McKesson officially advise to perform an additional two health checks on version 12.0 Radiology Web Servers in order for them to be considered to be functioning fully. This is possible to achieve using an external health check script. For assistance in implementing this, please contact [solutions@loadbalancer.org](mailto:solutions@loadbalancer.org)
12. Click **Update**

## Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-Radiology\_Srv1**
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 real servers as required

LAYER 4 MODIFY REAL SERVER - MCK-RADIOLOGY\_WEB / MCK-RADIOLOGY\_SRV1

Label	<input type="text" value="McK-Radiology_Srv1"/>	?
Real Server IP Address	<input type="text" value="192.168.85.200"/>	?
Weight	<input type="text" value="100"/>	?
Minimum Connections	<input type="text" value="0"/>	?
Maximum Connections	<input type="text" value="0"/>	?

Cancel

Update

## Configuring VIP 3 – McKesson Radiology Manager

### Configuring The Virtual Service (VIP)

- Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Virtual Services* and click on **Add a new Virtual Service**
- Define the *Label* for the virtual service as required, e.g. **McK-RadiologyManager**
- Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.40**
- Set the *Ports* field to **80**
- Leave the *Protocol* set to **TCP**
- Leave the *Forwarding Method* set to **Direct Routing**
- Click **Update** to create the virtual service

LAYER 4 - ADD A NEW VIRTUAL SERVICE

Label	<input type="text" value="McK-RadiologyManager"/>	?
Virtual Service	IP Address	<input type="text" value="192.168.85.40"/>
	Ports	<input type="text" value="80"/>
Protocol	<input type="text" value="TCP"/>	?
Forwarding Method	<input type="text" value="Direct Routing"/>	?

Cancel

Update

- Click **Modify** next to the newly created VIP
- Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
- Make sure that the *Persistent* checkbox is checked

11. Set the *Persistent Timeout* value to **300** (the units are seconds)
12. Set *Health Checks Check Type* to **Negotiate**
13. Set the *Check Port* field to **80**
14. Leave the *Protocol* set to **HTTP**
15. Set the *Request to send* field to **/cis/index.html**
16. Set the *Response expected* field to **OK**
17. Click **Update**

### Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-RadiologyMgr\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **192.168.85.210**
4. Click **Update**
5. Repeat these steps to add additional real servers as required

**LAYER 4 ADD A NEW REAL SERVER - McK-RADIOLOGYMANAGER**

Label	<input type="text" value="McK-RadiologyMgr_Srv1"/>	?
Real Server IP Address	<input type="text" value="192.168.85.210"/>	?
Weight	<input type="text" value="100"/>	?
Minimum Connections	<input type="text" value="0"/>	?
Maximum Connections	<input type="text" value="0"/>	?

## Configuring VIP 4 – McKesson Clinical Reference Viewer

### 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. **McK-ClinicalRefViewer**
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.50**
4. Set the *Ports* field to **80**
5. Leave the *Protocol* set to **TCP**
6. Leave the *Forwarding Method* set to **Direct Routing**
7. Click **Update** to create the virtual service

LAYER 4 - ADD A NEW VIRTUAL SERVICE

Label

McK-ClinicalRefViewer

?

Virtual Service

IP Address

192.168.85.50

?

Ports

80

?

Protocol

TCP

?

Forwarding Method

Direct Routina

?

Cancel

Update

8. Click **Modfiy** next to the newly created VIP
9. Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
10. Make sure that the *Persistent* checkbox is checked
11. Set the *Persistent Timeout* value to **300** (the units are seconds)
12. Set *Health Checks Check Type* to **Negotiate**
13. Set the *Check Port* field to **80**
14. Leave the *Protocol* set to **HTTP**
15. Set the *Request to send* field to **/McKessonEmiCRV/Ping.aspx**
16. Set the *Response expected* field to **OK**
17. Click **Update**

### Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-ClinRefVwr\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **192.168.85.220**
4. Click **Update**
5. Repeat these steps to add additional real servers as required

LAYER 4 ADD A NEW REAL SERVER - MCK-CLINICALREFVIEWER

Label

McK-ClinRefVwr\_Srv1

?

Real Server IP Address

192.168.85.220

?

Weight

100

?

Minimum Connections

0

?

Maximum Connections

0

?

Cancel

Update

## Configuring VIP 5 – McKesson Cardiology

### Configuring The Virtual Service (VIP)

- Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Virtual Services* and click on **Add a new Virtual Service**
- Define the *Label* for the virtual service as required, e.g. **McK-Cardiology**
- Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.60**
- Set the *Ports* field to **80,443**
- Leave the *Protocol* set to **TCP**
- Leave the *Forwarding Method* set to **Direct Routing**
- Click **Update** to create the virtual service

LAYER 4 - ADD A NEW VIRTUAL SERVICE

Label

McK-Cardiology

?

Virtual Service

IP Address

192.168.85.60

?

Ports

80,443

?

Protocol

TCP

?

Forwarding Method

Direct Routing

?

Cancel

Update

- Click **Modify** next to the newly created VIP
- Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
- Make sure that the *Persistent* checkbox is checked

11. Set the *Persistent Timeout* value to **14400** (the units are seconds)
12. Set *Health Checks Check Type* to **Negotiate**
13. Set the *Check Port* field to **80**
14. Leave the *Protocol* set to **HTTP**
15. Set the *Request to send* field to **I**
16. Set the *Response expected* field to **OK**

### Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-Cardiology\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **192.168.85.230**
4. Click **Update**
5. Repeat these steps to add additional real servers as required

**LAYER 4 ADD A NEW REAL SERVER - McK-CARDIOLOGY**

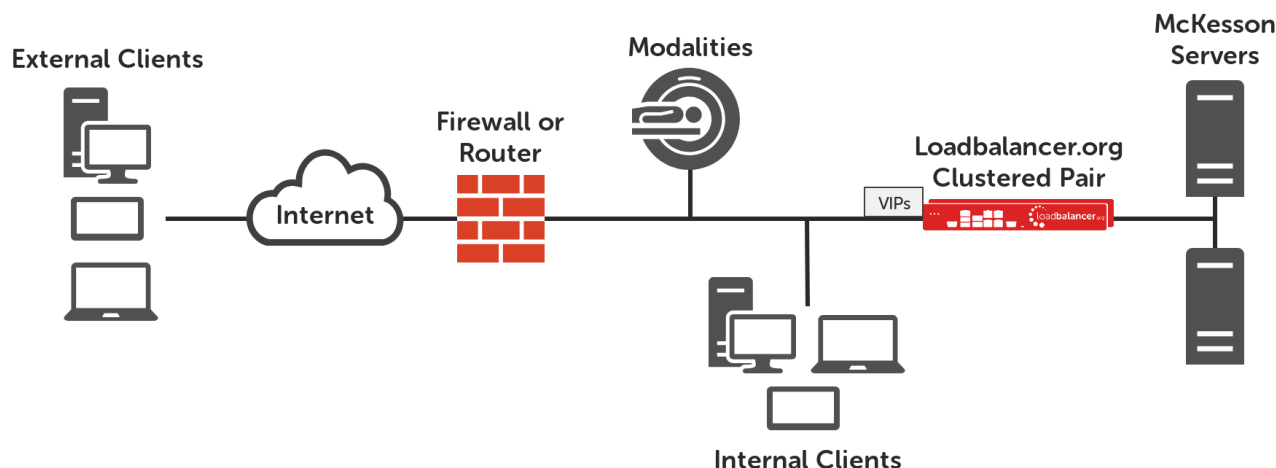
Label	<input type="text" value="McK-Cardiology_Srv1"/>	?
Real Server IP Address	<input type="text" value="192.168.85.230"/>	?
Weight	<input type="text" value="100"/>	?
Minimum Connections	<input type="text" value="0"/>	?
Maximum Connections	<input type="text" value="0"/>	?

## 12. Appliance Configuration for McKesson Radiology and McKesson Cardiology – Using Layer 4 NAT Mode and Layer 7 SNAT Mode

This is *not the recommended load balancing method*, as it does not offer the same level of performance or throughput as layer 4 DR mode. With this method, all reply traffic must go via the load balancer, which can become a bottleneck for performance.

As layer 4 NAT mode is used for load balancing the McKesson Radiology and McKesson Cardiology traffic, the real servers for these services **must** reside in a separate subnet, to which the load balancer is connected, and **must** have their default gateway set to be the load balancer. This is required for NAT mode to work.

The outline of this type of deployment is as so:



When load balancing McKesson Radiology and McKesson Cardiology, up to five virtual services need to be configured: a virtual service for McKesson Radiology (DICOM traffic), a virtual service for McKesson Radiology (web traffic), a virtual service for McKesson Radiology Manager, a virtual service for McKesson Clinical Reference Viewer, and a virtual service for McKesson Cardiology.

### Configuring VIP 1 – McKesson Radiology (DICOM Traffic)

#### 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. **McK-Radiology\_DICOM**
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.30**
4. Set the *Ports* field to **4000,5000**
5. Leave the *Protocol* set to **TCP**
6. Leave the *Forwarding Method* set to **NAT**
7. Click **Update** to create the virtual service



LAYER 4 - ADD A NEW VIRTUAL SERVICE

Label

McK-Radiology\_DICOM

?

Virtual Service

IP Address

192.168.85.30

?

Ports

4000,5000

?

Protocol

TCP

?

Forwarding Method

NAT

?

Cancel

Update

8. Click **Modify** next to the newly created VIP
9. Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
10. Make sure that the *Persistent* checkbox is checked
11. Set the *Persistent Timeout* value to **3600** (the units are seconds)
12. Set the *Health Checks Check Type* to **Connect to port**
13. Set the *Check Port* to **5000**
14. Click **Update**

### Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-Radiology\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **10.10.0.200**
4. Click **Update**
5. Repeat these steps to add additional real servers as required

LAYER 4 ADD A NEW REAL SERVER - McK-RADIOLOGY\_DICOM

Label

McK-Radiology\_Srv1

?

Real Server IP Address

10.10.0.200

?

Real Server Port

?

Weight

100

?

Minimum Connections

0

?

Maximum Connections

0

?

Cancel

Update

## Configuring VIP 2 – McKesson Radiology (Web Traffic)

### Configuring The Virtual Service (VIP)

- Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Virtual Services* and click on **Add a new Virtual Service**
- Define the *Label* for the virtual service as required, e.g. **McK-Radiology\_Web**
- Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.31**
- Set the *Ports* field to **80**
- Leave the *Protocol* set to **TCP**
- Leave the *Forwarding Method* set to **NAT**
- Click **Update** to create the virtual service

LAYER 4 - ADD A NEW VIRTUAL SERVICE

Label

McK-Radiology\_Web

?

Virtual Service

IP Address

192.168.85.31

?

Ports

80

?

Protocol

TCP

?

Forwarding Method

NAT

?

Cancel

Update

- Click **Modify** next to the newly created VIP
- Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)

10. Make sure that the *Persistent* checkbox is not checked
11. Configure health checking depending on the version of McKesson Radiology Web Server in use:
  - If using McKesson Radiology Web Server version 12.1 and later:
    - Set *Health Checks Check Type* to **Negotiate**
    - Set the *Check Port* field to **80**
    - Leave the *Protocol* set to **HTTP**
    - Set the *Request to send* field to **/wpp/srvpacs.asp**
    - Set the *Response expected* field to **srvPACS OK**
  - If using McKesson Radiology Web Server version 12.0, it is possible to use the same health check that is used for version 12.1, which is described above.  
McKesson officially advise to perform an additional two health checks on version 12.0 Radiology Web Servers in order for them to be considered to be functioning fully. This is possible to achieve using an external health check script. For assistance in implementing this, please contact [solutions@loadbalancer.org](mailto:solutions@loadbalancer.org)
12. Click **Update**

### Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-Radiology\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **10.10.0.200**
4. Click **Update**
5. Repeat these steps to add additional real servers as required

**LAYER 4 ADD A NEW REAL SERVER - MCK-RADIOLOGY\_WEB**

Label	<input type="text" value="McK-Radiology_Srv1"/>	?
Real Server IP Address	<input type="text" value="10.10.0.200"/>	?
Real Server Port	<input type="text"/>	?
Weight	<input type="text" value="100"/>	?
Minimum Connections	<input type="text" value="0"/>	?
Maximum Connections	<input type="text" value="0"/>	?

## Configuring VIP 3 – McKesson Radiology Manager

### 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. **McK-RadiologyManager**
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.40**
4. Set the *Ports* field to **80**
5. Set the *Layer 7 Protocol* to **HTTP Mode**
6. Click **Update** to create the virtual service

**LAYER 7 - ADD A NEW VIRTUAL SERVICE**

Label	McK-RadiologyManager	?	
Virtual Service	IP Address	192.168.85.40	?
	Ports	80	?
Layer 7 Protocol	HTTP Mode		?
Manual Configuration	<input type="checkbox"/>		?

**Cancel** **Update**

7. Click **Modify** next to the newly created VIP
8. Leave the *Balance Mode* set to **Weighted Least Connections** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
9. Set the *Persistence Mode* to **HTTP Cookie**
10. In the *Health Checks* section click **Advanced** to show more options
11. Set *Health Checks* to **Negotiate HTTP (GET)**
12. Set the *Check Port* field to **80**
13. Set the *Request to send* field to **/cis/index.html**
14. Set the *Response expected* field to **OK**
15. Click **Update**

### 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. **McK-RadiologyMgr\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **10.10.0.210**

4. Click **Update**
5. Repeat these steps to add additional real servers as required

**LAYER 7 ADD A NEW REAL SERVER - McK-RADIOLOGYMANAGER**

Label	McK-RadiologyMgr_Srv1	?
Real Server IP Address	10.10.0.210	?
Real Server Port		?
Re-Encrypt to Backend	<input type="checkbox"/>	?
Weight	100	?

Cancel
Update

## Configuring VIP 4 – McKesson Clinical Reference Viewer

### 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. **McK-ClinicalRefViewer**
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.50**
4. Set the *Ports* field to **80**
5. Set the *Layer 7 Protocol* to **HTTP Mode**
6. Click **Update** to create the virtual service

**LAYER 7 - ADD A NEW VIRTUAL SERVICE**

Label	McK-ClinicalRefViewer	?
Virtual Service	IP Address	192.168.85.50
	Ports	80
Layer 7 Protocol	HTTP Mode	?
Manual Configuration	<input type="checkbox"/>	?

Cancel
Update

7. Click **Modify** next to the newly created VIP
8. Leave the *Balance Mode* set to **Weighted Least Connections** (this is equivalent to what F5 call the "Observed (member)" load balancing method)

9. Set the *Persistence Mode* to **HTTP Cookie**
10. In the *Health Checks* section click **Advanced** to show more options
11. Set *Health Checks* to **Negotiate HTTP (GET)**
12. Set the *Check Port* field to **80**
13. Set the *Request to send* field to **/McKessonEmiCRV/Ping.aspx**
14. Set the *Response expected* field to **OK**
15. Click **Update**

### 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. **McK-ClinRefVwr\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **10.10.0.220**
4. Click **Update**
5. Repeat these steps to add additional real servers as required

LAYER 7 ADD A NEW REAL SERVER - McK-ClinicalRefViewer	
Label	McK-ClinRefVwr_Srv1
Real Server IP Address	10.10.0.220
Real Server Port	
Re-Encrypt to Backend	<input type="checkbox"/>
Weight	100

Cancel Update

## Configuring VIP 5 – McKesson Cardiology

### 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. **McK-Cardiology**
3. Set the *Virtual Service IP Address* field to the required IP address, e.g. **192.168.85.60**
4. Set the *Ports* field to **80,443**
5. Leave the *Protocol* set to **TCP**
6. Leave the *Forwarding Method* set to **NAT**
7. Click **Update** to create the virtual service

LAYER 4 - ADD A NEW VIRTUAL SERVICE

Label

McK-Cardiology

?

Virtual Service

IP Address

192.168.85.60

?

Ports

80,443

?

Protocol

TCP

?

Forwarding Method

NAT

?

Cancel

Update

8. Click **Modfiy** next to the newly created VIP
9. Leave the *Balance Mode* set to **Weighted Least Connection** (this is equivalent to what F5 call the "Observed (member)" load balancing method)
10. Make sure that the *Persistent* checkbox is checked
11. Set the *Persistent Timeout* value to **14400** (the units are seconds)
12. Set *Health Checks Check Type* to **Negotiate**
13. Set the *Check Port* field to **80**
14. Leave the *Protocol* set to **HTTP**
15. Set the *Request to send* field to **I**
16. Set the *Response expected* field to **OK**

### Defining The Real Servers (RIPs)

1. Using the web user interface, navigate to *Cluster Configuration > Layer 4 – Real Servers* and click on **Add a new Real Server** next to the newly created VIP
2. Define the *Label* for the real server as required, e.g. **McK-Cardiology\_Srv1**
3. Set the *Real Server IP Address* field to the required IP address, e.g. **10.10.0.230**
4. Click **Update**
5. Repeat these steps to add additional real servers as required



LAYER 4 ADD A NEW REAL SERVER - MCK-CARDIOLOGY

Label

McK-Cardiology\_Srv1

?

Real Server IP Address

10.10.0.230

?

Real Server Port

?

Weight

100

?

Minimum Connections

0

?

Maximum Connections

0

?

Cancel

Update

## Finalizing the Configuration

To apply the new settings, HAProxy must be restarted as follows:

- Using the WebUI, navigate to: *Maintenance > Restart Services* and click **Restart HAProxy**

## 13. Testing & Verification

### Using System Overview

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

SYSTEM OVERVIEW ?								2018-07-17 12:16:19 UTC
	VIRTUAL SERVICE	IP	PORTS	CONNS	PROTOCOL	METHOD	MODE	
↑	McK-RadiologyMan..	192.168.85.40	80	0	TCP	Layer 4	DR	
	REAL SERVER	IP	PORTS	WEIGHT	CONNS			
↑	McK-RadiologyMgr_S..	192.168.85.210	80	100	0	Drain	Halt	
↑	McK-RadiologyMgr_S..	192.168.85.211	80	100	0	Drain	Halt	
↑	McK-ClinicalRefV..	192.168.85.50	80	0	TCP	Layer 4	DR	
↑	McK-Cardiology	192.168.85.60	80,443	0	TCP	Layer 4	DR	
↑	McK-Radiology_DI..	192.168.85.30	4000,5000	0	TCP	Layer 4	DR	
↑	McK-Radiology_We..	192.168.85.31	80	0	TCP	Layer 4	DR	

---

## 14. 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](mailto:support@loadbalancer.org)

## 15. Further Documentation

The Administration Manual contains much more information about configuring and deploying the appliance. It's available here: <http://pdfs.loadbalancer.org/loadbalanceradministrationv8.pdf>

## 16. Conclusion

Loadbalancer.org appliances provide a very cost effective solution for highly available load balanced McKesson Radiology and McKesson Cardiology environments.

## 17. Appendix

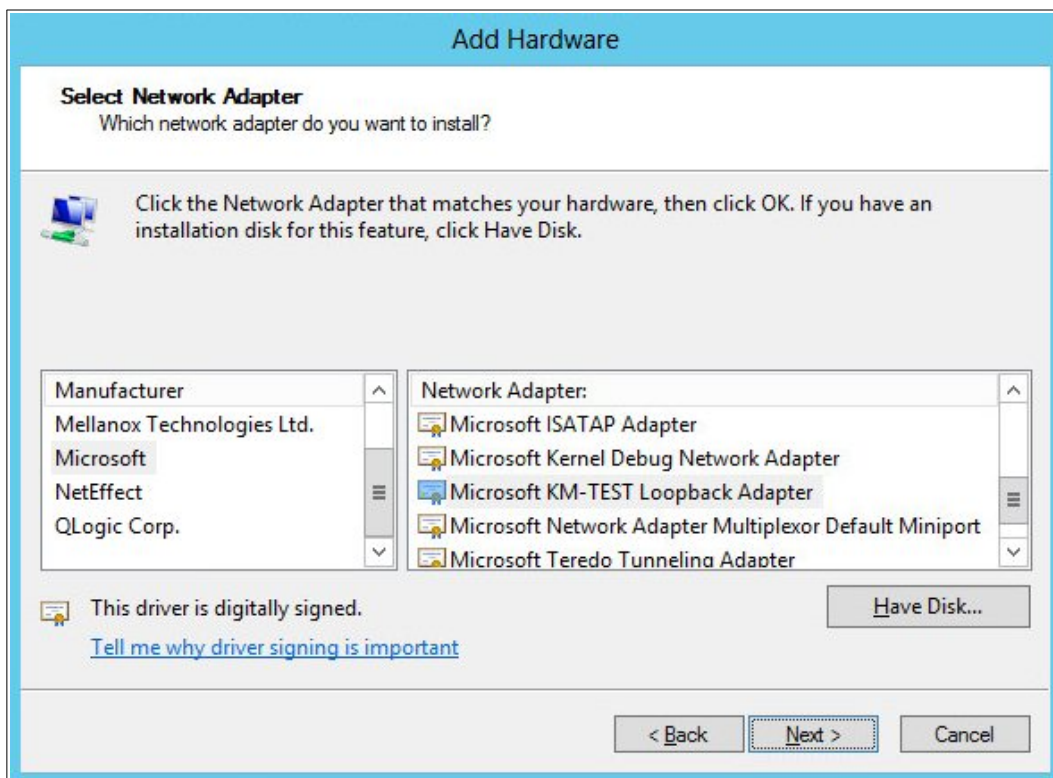
### 1 – Solving the ARP Problem

When using Layer 4 DR mode, the ARP problem must be solved. This involves configuring each Real Server to be able to receive traffic destined for the VIP, and ensuring that each Real Server does not respond to ARP requests for the VIP address – only the load balancer should do this.

The steps below are for Windows 2012/2016, for other versions of Windows please refer to chapter 6 in the [administration manual](#).

#### Step 1: Install the Microsoft Loopback Adapter

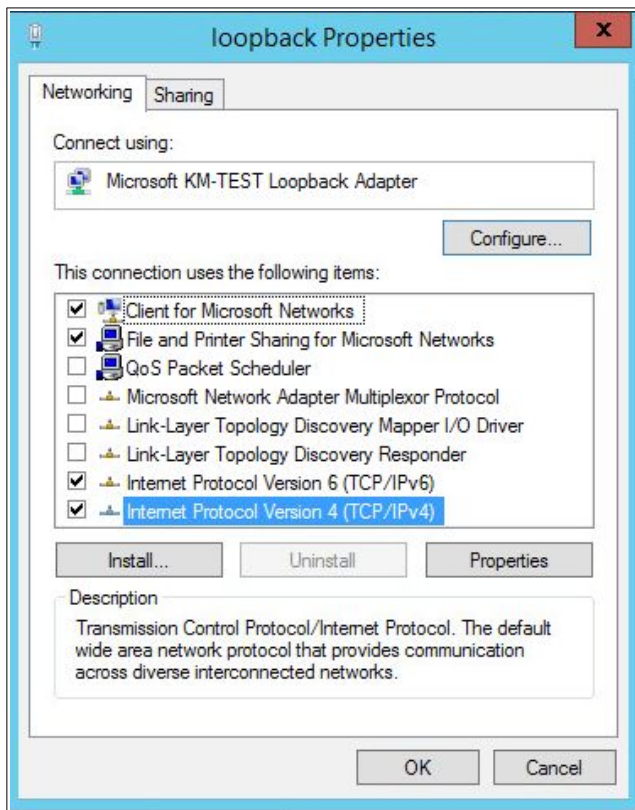
1. Click **Start**, then run **hdwwiz** to start the Hardware Installation Wizard
2. When the Wizard has started, click **Next**
3. Select **Install the hardware that I manually select from a list (Advanced)**, click **Next**
4. Select **Network adapters**, click **Next**
5. Select **Microsoft & Microsoft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



6. Click **Next** to start the installation, when complete click **Finish**

#### Step 2: 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. Un-check all items except **Internet Protocol Version 4 (TCP/IPv4)** and **Internet Protocol Version 6 (TCP/IPv6)** as shown below:

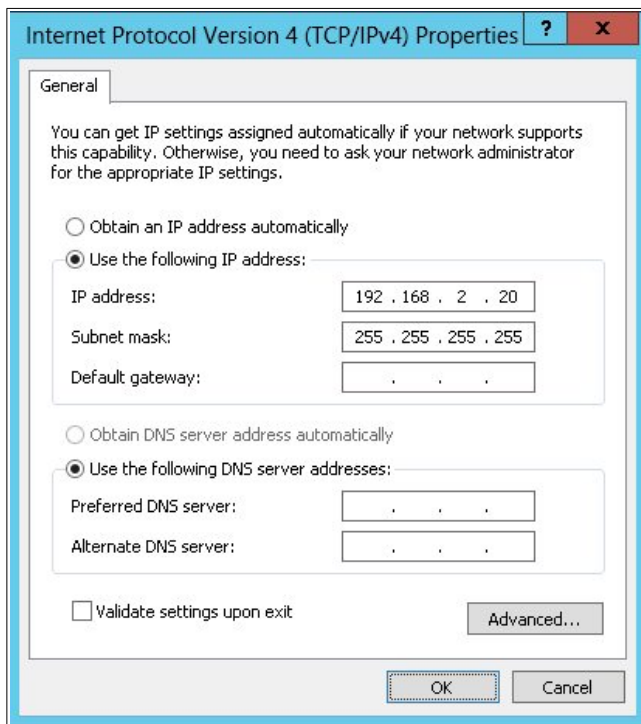


Note: Leaving both checked ensures that both IPv4 and IPv6 are supported. Select one if preferred.

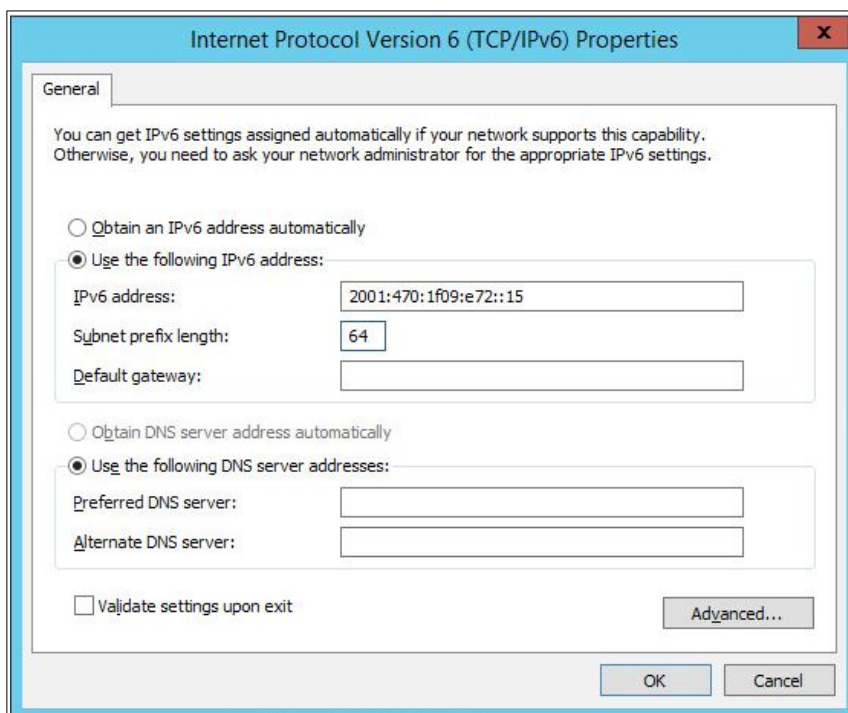
**Important:** When configuring the Loopback Adapter to solve the ARP Problem, the following options **must** also be checked (ticked):

Client for Microsoft Networks and File & Printer Sharing for Microsoft Networks

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



6. If configuring IPv6 addresses select **Internet Protocol Version (TCP/IPv6)**, click **Properties** and configure the IP address to be the same as the Virtual Service (VIP) and set the *Subnet Prefix Length* to be the same as your network setting ,e.g. 2001:470:1f09:e72::15/64 as shown below:



7. Click **OK** on TCP/IP Properties, then click **Close** on Ethernet Properties to save and apply the new settings
8. Now repeat the above process on the other Windows 2012/2016 Real Servers

---

### Step 3: Configure the strong/weak host behavior

Windows Server 2000 and Windows Server 2003 use the weak host model for sending and receiving for all IPv4 interfaces and the strong host model for sending and receiving for all IPv6 interfaces. You cannot configure this behavior. The Next Generation TCP/IP stack in Windows 2008 and later supports strong host sends and receives for both IPv4 and IPv6 by default. To ensure that Windows 2012/2016 is running in the correct mode to be able to respond to the VIP, the following commands must be run on each Real Server:

For IPv4 addresses:

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

For these commands to work, the LAN connection NIC must be named "net" and the loopback NIC must be named "loopback" as shown below. If you prefer to leave your current NIC names, then the commands above must be modified accordingly. For example, if your network adapters are named "LAN" and "LOOPBACK", the commands required would be:

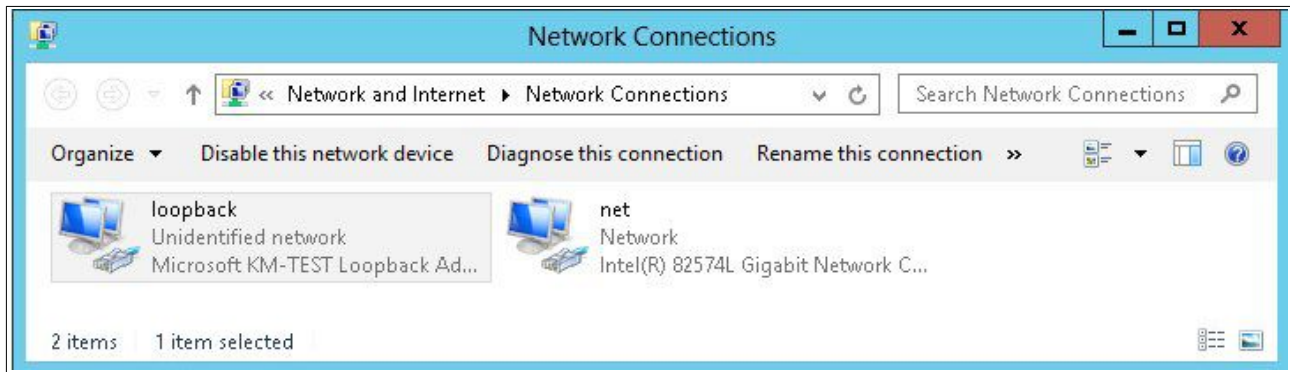
```
netsh interface ipv4 set interface "LAN" weakhostreceive=enabled
netsh interface ipv4 set interface "LOOPBACK" weakhostreceive=enabled
netsh interface ipv4 set interface "LOOPBACK" weakhostsend=enabled
```

For IPv6 addresses:

```
netsh interface ipv6 set interface "net" weakhostreceive=enabled
netsh interface ipv6 set interface "loopback" weakhostreceive=enabled
netsh interface ipv6 set interface "loopback" weakhostsend=enabled
netsh interface ipv6 set interface "loopback" dadtransmits=0
```

For these commands to work, the LAN connection NIC must be named "net" and the loopback NIC must be named "loopback" as shown below. If you prefer to leave your current NIC names, then the commands above must be modified accordingly. For example, if your network adapters are named "LAN" and "LOOPBACK", the commands required would be:

```
netsh interface ipv6 set interface "LAN" weakhostreceive=enabled
netsh interface ipv6 set interface "LOOPBACK" weakhostreceive=enabled
netsh interface ipv6 set interface "LOOPBACK" weakhostsend=enabled
netsh interface ipv6 set interface "LOOPBACK" dadtransmits=0
```



Note: The names for the NICs are case sensitive, so make sure that the name used for the interface and the name used in the commands match exactly.

1. Start Powershell or use a command window to run the appropriate netsh commands as shown in the example below:

```
Administrator: Windows PowerShell
PS C:\Users\administrator.ROBSTEST> netsh interface ipv6 set interface "net" weakhostreceive=enabled
Ok.
PS C:\Users\administrator.ROBSTEST> netsh interface ipv6 set interface "loopback" weakhostreceive=enabled
Ok.
PS C:\Users\administrator.ROBSTEST> netsh interface ipv6 set interface "loopback" weakhostsend=enabled
Ok.
PS C:\Users\administrator.ROBSTEST> netsh interface ipv6 set interface "loopback" dadtransmits=0
Ok.
PS C:\Users\administrator.ROBSTEST>
```

Note: This shows an IPv6 example, use the IPv4 commands if you're using IPv4 addresses.

2. Now repeat these 4 commands on the other Windows 2012/2016 Real Servers

Note: Solving the ARP problem for other version of Windows is similar. For full details, please refer to the [administration manual](#).



## 2 – Clustered Pair Configuration – Adding a Slave Unit

If you initially configured just the master unit and now need to add a slave - our recommended procedure, please refer to the relevant section below for more details:

Note: A number of settings are not replicated as part of the master/slave pairing process and therefore must be manually configured on the slave appliance. These are listed below:

- Hostname & DNS settings
- Network settings including IP addresses, bonding configuration and VLANs
- Routing configuration including default gateways and static routes
- Date & time settings
- Physical – Advanced Configuration settings including Internet Proxy IP address & port, Firewall table size, SMTP relay and Syslog server
- SNMP settings
- Graphing settings
- Firewall Script & Firewall Lockdown Script settings
- Software updates

Version 7:

Please refer to **Chapter 8 – Appliance Clustering for HA** in the [v7 Administration Manual](#).

Version 8:

To add a slave node – i.e. create a highly available clustered pair:

- Deploy a second appliance that will be the slave and configure initial network settings
- Using the WebUI, navigate to: *Cluster Configuration > High-Availability Configuration*
- Specify the IP address and the *loadbalancer* users password (the default is 'loadbalancer') for the slave (peer) appliance as shown above

**CREATE A CLUSTERED PAIR**

loadbalancer.org

Local IP address  
192.168.1.20


IP address of new peer  
192.168.1.21

Password for loadbalancer user on peer  
\*\*\*\*\*


Add new node

- Click **Add new node**
- The pairing process now commences as shown below:

### CREATE A CLUSTERED PAIR



192.168.120
loadbalancer.org



192.168.121
loadbalancer.org

Attempting to pair..

Local IP address

192.168.1.20

IP address of new peer

192.168.1.21


Password for loadbalancer user on peer

.....


configuring

- Once complete, the following will be displayed:

### HIGH AVAILABILITY CONFIGURATION - MASTER



192.168.120
loadbalancer.org



192.168.121
loadbalancer.org

Break Clustered Pair

- To finalize the configuration, restart heartbeat and any other services as prompted in the blue message box at the top of the screen

Note: Clicking the Restart Heartbeat button on the master appliance will also automatically restart heartbeat on the slave appliance.

Note: Please refer to chapter 9 – Appliance Clustering for HA in the [Administration Manual](#) for more detailed information on configuring HA with 2 appliances.

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## 18. Document Revision History

Version	Date	Change	Reason for Change	Changed By
1.0.0	17 July 2018	Initial version		AH
1.0.1	18 July 2018	Changed document title, and references in the document, from "McKesson Radiology And Cardiology Applications Deployment Guide" to "McKesson Radiology and McKesson Cardiology Deployment Guide"	Required updates	AH
1.0.2	6 December 2018	Added the new "Company Contact Information" page	Required updates	AH
1.1.0	7 November 2019	Styling and layout	General styling updates	AH
1.1.1	27 July 2020	New title page Updated Canadian contact details Added additional instructions for configuring layer 7 health checks	Branding update Change to Canadian contact details Changes to the appliance WebUI	AH

## About Loadbalancer.org

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



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