Load Balancing
Fujifilm SYNAPSE

Deployment Guide
v1.2.1
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1. About this Guide

This guide details the steps required to configure a load balanced Fujifilm Synapse environment utilizing Loadbalancer.org appliances. It covers Synapse PACS, Synapse VNA, Synapse Mobility and Synapse CWM and details the configuration of the load balancers and also any Synapse server 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 for load balancing Fujifilm Synapse. The complete list of models is shown below:

<table>
<thead>
<tr>
<th>Discontinued Models</th>
<th>Current Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise R16</td>
<td>Enterprise R20</td>
</tr>
<tr>
<td>Enterprise VA R16</td>
<td>Enterprise MAX</td>
</tr>
<tr>
<td>Enterprise VA</td>
<td>Enterprise 10G</td>
</tr>
<tr>
<td>Enterprise R320</td>
<td>Enterprise 40G</td>
</tr>
<tr>
<td></td>
<td>Enterprise Ultra</td>
</tr>
<tr>
<td></td>
<td>Enterprise VA R20</td>
</tr>
<tr>
<td></td>
<td>Enterprise VA MAX</td>
</tr>
<tr>
<td></td>
<td>Enterprise AWS **</td>
</tr>
<tr>
<td></td>
<td>Enterprise AZURE **</td>
</tr>
</tbody>
</table>

* For full specifications of these models please refer to: [http://www.loadbalancer.org/products/hardware](http://www.loadbalancer.org/products/hardware)

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

3. Loadbalancer.org Software Versions Supported

- v8.3.6 and later

4. Fujifilm Synapse Software Versions Supported

- Fujifilm Synapse PACS – All versions
- Fujifilm Synapse VNA – All versions
- Fujifilm Synapse Mobility – All versions
- Fujifilm Synapse CWM – All versions
5. Load Balancing Fujifilm Synapse

For high availability and scalability, Fujifilm recommend that multiple Synapse Servers are deployed in a load balanced cluster.

### Port Requirements

The following table shows the ports used by the various Synapse systems. The load balancer must be configured to listen on the same ports.

<table>
<thead>
<tr>
<th>Port</th>
<th>Protocols</th>
<th>System</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>TCP</td>
<td>PACS</td>
<td>HTTP</td>
</tr>
<tr>
<td>104</td>
<td>TCP</td>
<td>PACS</td>
<td>DICOM</td>
</tr>
<tr>
<td>80</td>
<td>TCP</td>
<td>VNA</td>
<td>HTTP</td>
</tr>
<tr>
<td>104</td>
<td>TCP</td>
<td>VNA</td>
<td>DICOM</td>
</tr>
<tr>
<td>8080</td>
<td>TCP</td>
<td>Mobility</td>
<td>HTTP</td>
</tr>
<tr>
<td>8443</td>
<td>TCP</td>
<td>Mobility</td>
<td>HTTPS</td>
</tr>
<tr>
<td>80</td>
<td>TCP</td>
<td>CWM</td>
<td>HTTP</td>
</tr>
</tbody>
</table>

### Deployment Concept

When Fujifilm systems are deployed with the load balancer, clients connect to the Virtual Service (VIP) on the load balancer rather than connecting directly to one of the Fujifilm servers. The load balancer then distributes these connection to the load balanced servers according to the algorithm selected.

Note: The load balancer can be deployed as a single unit, although Loadbalancer.org recommends a
Virtual Service (VIP) Requirements
The following tables summarize the VIPs required for each Synapse system and how they are configured.

Synapse PACS
2 VIPs are required:

<table>
<thead>
<tr>
<th>Ref.</th>
<th>VIP Name</th>
<th>Operating Mode</th>
<th>Protocol</th>
<th>Port(s)</th>
<th>Persistence</th>
<th>Health check Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP1</td>
<td>SynapsePacsHTTP</td>
<td>Layer 7 SNAT mode</td>
<td>TCP</td>
<td>80</td>
<td>Source IP</td>
<td>Connect to Port</td>
</tr>
<tr>
<td>VIP2</td>
<td>SynapsePacsDICOM</td>
<td>Layer 4 DR mode</td>
<td>TCP</td>
<td>104</td>
<td>Source IP</td>
<td>Script – DICOM-C-ECHO</td>
</tr>
</tbody>
</table>

Synapse VNA
2 VIPs are required:

<table>
<thead>
<tr>
<th>Ref.</th>
<th>VIP Name</th>
<th>Operating Mode</th>
<th>Protocol</th>
<th>Port(s)</th>
<th>Persistence</th>
<th>Health check Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP1</td>
<td>SynapseVnaHTTP</td>
<td>Layer 7 SNAT mode</td>
<td>TCP</td>
<td>80</td>
<td>Source IP</td>
<td>Connect to Port</td>
</tr>
<tr>
<td>VIP2</td>
<td>SynapseVnaDICOM</td>
<td>Layer 4 DR mode</td>
<td>TCP</td>
<td>104</td>
<td>Source IP</td>
<td>Script – DICOM-C-ECHO</td>
</tr>
</tbody>
</table>

Synapse Mobility
1 VIP is required:

<table>
<thead>
<tr>
<th>Ref.</th>
<th>VIP Name</th>
<th>Operating Mode</th>
<th>Protocol</th>
<th>Port(s)</th>
<th>Persistence</th>
<th>Health check Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP1</td>
<td>SynapseMobility</td>
<td>Layer 7 SNAT mode</td>
<td>TCP</td>
<td>8080</td>
<td>Source IP</td>
<td>Negotiate HTTP (GET)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8443</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Synapse CWM
1 VIP is required:

<table>
<thead>
<tr>
<th>Ref.</th>
<th>VIP Name</th>
<th>Operating Mode</th>
<th>Protocol</th>
<th>Port(s)</th>
<th>Persistence</th>
<th>Health check Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP1</td>
<td>SynapseCwm</td>
<td>Layer 7 SNAT mode</td>
<td>HTTP</td>
<td>80</td>
<td>HTTP Cookie</td>
<td>Connect to Port</td>
</tr>
</tbody>
</table>

Synapse Server Configuration Requirements
As mentioned in the tables above, Layer 7 SNAT mode and Layer 4 DR mode are used when load balancing Fujifilm Synapse.
SNAT Mode
When using Layer 7 SNAT mode, no Synapse server configuration changes are required.

DR Mode
When using DR mode, the 'ARP problem' must be solved on each Synapse server for DR mode to work. For detailed steps on solving the ARP problem, please refer to section 1 in the Appendix on page 22 for more information.

6. 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
Accessing the Web User Interface (WebUI)

1. Browse to the following URL: https://192.168.2.21:9443/lbadmin/
   (replace with your IP address if it's been changed)
   * Note the port number → 9443

2. Login to the WebUI:

   **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 below:
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 1 of the appendix on page 20.

7. Load Balancing Fujifilm Synapse PACS
Appliance Configuration

Configuring VIP1 - SynapsePacsHTTP

a) Setting up the Virtual Service
1. Using the WebUI, navigate to: Cluster Configuration > Layer 7 – Virtual Service and click Add a New Virtual Service
2. Enter the following details:

   ![Virtual Service Configuration](image)

   3. Enter an appropriate label for the VIP, e.g. SynapsePacsHTTP
   4. Set the Virtual Service IP address field to the required IP address, e.g. 10.50.20.10
   5. Set the Virtual Service Ports field to 80
   6. Set Layer 7 Protocol set to TCP Mode
   7. Click Update

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

   ![Real Server Configuration](image)
3. Enter an appropriate label for the RIP, e.g. Server1
4. Set the Real Server IP Address field to the required IP address, e.g. 10.50.20.20
5. Set the Real Server Port field to 80
6. Click Update
7. Repeat the above steps to add your other server(s)

Configuring VIP2 - SynapsePacsDICOM

a) Setting up the Virtual Service (VIP)
1. Using the WebUI, navigate to: Cluster Configuration > Layer 4 – Virtual Services and click Add a new Virtual Service
2. Enter the following details:

3. Enter an appropriate label (name) for the VIP, e.g. SynapsePacsDICOM
4. Set the Virtual Service IP address field to the required IP address, e.g. 10.50.20.11
5. Set the Virtual Service Ports field to 104
6. Leave Protocol set to TCP
7. Leave the Forwarding Method to Direct Return
8. Click Update
9. Now click Modify next to the newly created Virtual Service
10. Scroll down to the Health Checks section and set the Health Check to External Script

Note: For layer 4 DR mode a star ( * ) can be specified instead of 104 to mean “all ports” if required.
11. Set Check Port to 104
12. Set External script to DICOM-C-ECHO

b) Setting up the Real Server (RIP)
1. Using the WebUI, navigate to: Cluster Configuration > Layer 4 – Real Servers and click Add a new Real Server next to the newly created VIP
2. Enter the following details:

- Enter an appropriate label (name) for the RIP, e.g. Server1
- Change the Real Server IP Address field to the required IP address, e.g. 10.50.20.21
- Click Update
- Repeat the above steps to add your other server(s)

Synapse PACS Configuration
Since VIP2 is configured using layer 4 DR (Direct Return) mode, the “ARP Problem” must be solved on each Synapse server as mentioned on page 7. For full details on how this is done, please refer to section 6 in the Appendix on page 22.

8. Load Balancing Fujifilm Synapse VNA

Appliance Configuration

Configuring VIP1 - SynapsePacsHTTP

a) Setting up the Virtual Service
1. Using the WebUI, navigate to: Cluster Configuration > Layer 7 – Virtual Service and click Add a New Virtual Service
2. Enter the following details:
3. Enter an appropriate label for the VIP, e.g. SynapseVnaHTTP
4. Set the Virtual Service IP address field to the required IP address, e.g. 10.50.20.12
5. Set the Virtual Service Ports field to 80
6. Set Layer 7 Protocol set to TCP Mode
7. Click Update

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

3. Enter an appropriate label for the RIP, e.g. Server1
4. Set the Real Server IP Address field to the required IP address, e.g. 10.50.20.22
5. Set the Real Server Port field to 80
6. Click Update
7. Repeat the above steps to add your other server(s)
Configuring VIP2 - SynapsePacsDICOM

a) Setting up the Virtual Service (VIP)
   1. Using the WebUI, navigate to: Cluster Configuration > Layer 4 – Virtual Services and click Add a new Virtual Service
   2. Enter the following details:

   ![Virtual Service Configuration](image)

   3. Enter an appropriate label (name) for the VIP, e.g. SynapseVnaDICOM
   4. Set the Virtual Service IP address field to the required IP address, e.g. 10.50.20.13
   5. Set the Virtual Service Ports field to 104

   Note: For layer 4 DR mode a star (*) can be specified instead of 104 to mean “all ports” if required.

   6. Leave Protocol set to TCP
   7. Leave the Forwarding Method to Direct Return
   8. Click Update
   9. Now click Modify next to the newly created Virtual Service
   10. Scroll down to the Health Checks section and set the Health Check to External Script
   11. Set Check Port to 104
   12. Set External script to DICOM-C-ECHO

b) Setting up the Real Server (RIP)
   1. Using the WebUI, navigate to: Cluster Configuration > Layer 4 – Real Servers and click Add a new Real Server next to the newly created VIP
2. Enter the following details:

![Image](https://via.placeholder.com/150)

3. Enter an appropriate label (name) for the RIP, e.g. **Server1**
4. Change the *Real Server IP Address* field to the required IP address, e.g. **10.50.20.23**
5. Click **Update**
6. Repeat the above steps to add your other server(s)

**Synapse VNA Configuration**
Since VIP2 is configured using layer 4 DR (Direct Return) mode, the “ARP Problem” must be solved on each Synapse server as mentioned on page 7. For full details on how this is done, please refer to section 6 in the Appendix on page 8.

**9. Load Balancing Fujifilm Synapse Mobility**

**Appliance Configuration**

**Configuring VIP1 - SynapseMobility**

a) Setting up the Virtual Service

1. Using the WebUI, navigate to: *Cluster Configuration > Layer 7 – Virtual Service* and click **Add a New Virtual Service**
2. Enter the following details:
3. Enter an appropriate label for the VIP, e.g. SynapseMobility
4. Set the Virtual Service IP address field to the required IP address, e.g. 10.50.20.14
5. Set the Virtual Service Ports field to 8080,8443
6. Set Layer 7 Protocol set to TCP Mode
7. Click Update
8. Scroll down to the Health Checks section and set the Health Check to Negotiate HTTP (GET)
9. Set Request to Send to http://syncavmob:8080/pureweb/server/login.jsp
10. Leave Response Expected blank (this will configure the load balancer to look for a 200 OK response)

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

3. Enter an appropriate label for the RIP, e.g. Server1
4. Set the Real Server IP Address field to the required IP address, e.g. 10.50.20.24
5. Leave the Real Server Port field blank
6. Click Update
7. Repeat the above steps to add your other server(s)

Synapse Mobility Configuration
As mentioned on page 2, when using Layer 7 SNAT mode no Synapse server configuration changes are required.

10. Load Balancing Fujifilm Synapse CWM

Appliance Configuration

Configuring VIP1 - SynapseCwm

a) Setting up the Virtual Service

11. Using the WebUI, navigate to: Cluster Configuration > Layer 7 – Virtual Service and click Add a New Virtual Service

12. Enter the following details:

13. Enter an appropriate label for the VIP, e.g. SynapseCwm

14. Set the Virtual Service IP address field to the required IP address, e.g. 10.50.20.15

15. Set the Virtual Service Ports field to 80

16. Set Layer 7 Protocol set to HTTP Mode

17. Click Update

b) Setting up the Real Servers

1. Using the WebUI, navigate to: Cluster Configuration > Layer 7 – Real Servers and click Add a new Real Server next to the newly created VIP

2. Enter the following details:
3. Enter an appropriate label for the RIP, e.g. **Server1**
4. Set the **Real Server IP Address** field to the required IP address, e.g. **10.50.20.25**
5. Set the **Real Server Port** field to **80**
6. Click **Update**
7. Repeat the above steps to add your other server(s)

**Synapse CWM Configuration**
As mentioned on page 7, when using Layer 7 SNAT mode no Synapse server configuration changes are required.

**11. Testing & Verification**

**Using the System Overview**
The System Overview shows a graphical view of all VIPs & RIPS (i.e. the Synapse servers) 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 Synapse servers are healthy and available to accept connections:
Client Connection Tests
Ensure that clients can connect via the load balancer to the Synapse servers. You'll probably need to create new DNS records or modify your existing DNS records, replacing the IP addresses of individual servers or the cluster with the IP address of the Virtual Service on the load balancer.

Note: For more details on testing & diagnosing load balanced services please refer to chapter 12 in the Administration Manual.

12. Technical Support
For more details about configuring the appliance and assistance with designing your deployment please don't hesitate to contact the support team using the following email address: support@loadbalancer.org.

13. Additional Documentation

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

1 - 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

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
• Click **Add new node**

• The pairing process now commences as shown below:

![CREATE A CLUSTERED PAIR](image)

• Once complete, the following will be displayed:

![HIGH AVAILABILITY CONFIGURATION - MASTER](image)

• 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.
2 – DR Mode Server Configuration

When using Layer 4 DR mode the ARP problem must be solved. This involves configuring each Synapse Server to accept traffic destined for the VIP in addition to it's own IP address, and ensuring that each server does not respond to ARP requests for the VIP address – only the load balancer should do this.

Note: The steps below are for Windows 2012 / 2016 IPv4 addresses, for other versions of Windows & IPv6 configuration steps, please refer to chapter 6 in the Administration Manual.

Step 1 of 3 : 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 of 3 : Configure the Loopback Adapter

1. Open Control Panel and click Network and Sharing Center
2. Click Change adapter settings
3. Right-click the new Loopback Adapter and select Properties
4. Un-check all items except Internet Protocol Version 4 (TCP/IPv4) as shown below:
5. For IPv4 addresses, select **Internet Protocol Version (TCP/IPv4)**, click **Properties** and configure the IP address to be the same as the address you’ve used for the Virtual Service (VIP) with a subnet mask of 255.255.255.255, e.g. 192.168.100.100/255.255.255.255 as shown below:

6. Click **OK** on TCPIIP Properties, then click **Close** on the Interface Properties to save and apply the new settings.
Step 3 of 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
```

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.

- Start Powershell or use a command window to run the appropriate netsh commands as shown in the example below:
Repeat steps 1 – 3 on all remaining Synapse Server(s).
## 16. Document Revision History

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<tr>
<th>Version</th>
<th>Date</th>
<th>Change</th>
<th>Reason for Change</th>
<th>Changed By</th>
</tr>
</thead>
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<td>1.0.0</td>
<td>17 April 2018</td>
<td>Initial version</td>
<td></td>
<td>AH</td>
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<td>1.0.1</td>
<td>6 December 2018</td>
<td>Added the new “Company Contact Information” page</td>
<td>Required updates</td>
<td>AH</td>
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<td>1.2.0</td>
<td>18 September 2019</td>
<td>Multiple updates</td>
<td>Revised load balancing design</td>
<td>RJC</td>
</tr>
<tr>
<td>1.2.1</td>
<td>17th January 2020</td>
<td>Updated the health check settings for the Synapse Mobility VIP</td>
<td>To improve the accuracy of the health check</td>
<td>RJC</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.