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1. About this Guide

This guide details the steps required to configure a load balanced Microsoft Exchange 2016 environment utilizing Loadbalancer.org appliances. It covers the configuration of the load balancers and also any Microsoft Exchange 2016 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 with Exchange 2016. 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

- V8.3.7 and later

4. Microsoft Exchange Software Versions Supported

- Microsoft Exchange 2016 – all versions
5. Exchange Server 2016

Exchange 2016 is Microsoft’s latest enterprise level messaging and collaboration server. Exchange 2016 has been designed for simplicity of scale, hardware utilization, and failure isolation. This has greatly simplified both the deployment process and the implementation of a load balancer.

6. Exchange 2016 Server Roles

In Exchange 2016 the functionality of the Exchange 2013 CAS and Mailbox server roles have been consolidated into a single role: the **Mailbox Server Role**. In addition, the **Edge Transport Role** is also included.

<table>
<thead>
<tr>
<th>Role</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mailbox Server</td>
<td>this role consolidates the Mailbox and Client Access roles from Exchange Server 2013. Compared to Exchange Server 2010 this role consolidates all of the functions of the Client Access, Mailbox, Hub Transport, and Unified Messaging server roles. The Mailbox server role in Exchange Server 2016 is the only mandatory server role, and the consolidation reinforces the recommended practice since Exchange Server 2010 to deploy Exchange as a multi-role server instead of deploying individual roles to separate servers.</td>
</tr>
<tr>
<td>Edge Transport Server</td>
<td>this role is much the same as Edge Transport in previous versions of Exchange. It’s designed to sit in perimeter networks and provide secure inbound and outbound mail flow for the organization. Edge Transport servers are not mandatory.</td>
</tr>
</tbody>
</table>

*Outlook Client Protocols*

- MAPI over HTTPS - *Outlook 2013 SP1 minimum*
- RPC over HTTPS - *aka Outlook Anywhere*

*Mail Flow*

In Exchange Server 2016, mail flow occurs through the transport pipeline. The transport pipeline is a collection of services, connections, components, and queues that work together to route all messages to the categorizer in the Transport service on an Exchange 2016 Mailbox server. For more information please refer the following Microsoft link: [https://technet.microsoft.com/en-us/library/aa996349%28v=exchg.160%29.aspx](https://technet.microsoft.com/en-us/library/aa996349%28v=exchg.160%29.aspx)

7. Load Balancing Exchange 2016

Note: It’s highly recommended that you have a working Exchange 2016 environment first before implementing the load balancer.

*Load Balancing & HA Requirements*

In Exchange Server 2016, there is a single building block that provides the client access services and the high availability architecture necessary for any enterprise messaging environment. High availability is provided by
implementing multiple Mailbox Servers, configuring a Database Availability Group (DAG) and deploying a load balancer.

Database Availability Group (DAG)
A DAG is a group of up to 16 Mailbox Servers with 100 active and passive databases. It provides automatic database-level recovery from failures that affect individual servers or databases.

Note: DAG’s utilize Microsoft Clustering Services which cannot be enabled on the same server as Microsoft Network Load Balancing (NLB). Therefore, using Microsoft NLB is not an option in this case. Using a Loadbalancer.org hardware or virtual appliance provides an ideal solution.

Persistence (aka Server Affinity)
As with Exchange 2013, Exchange 2016 does not require session affinity at the load balancing layer.

Port Requirements
The following table shows the port list that must be load balanced. Some services such as IMAP4 or POP3 may not be required in your environment.

<table>
<thead>
<tr>
<th>TCP Port</th>
<th>Role</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>MBOX</td>
<td>Inbound SMTP</td>
</tr>
<tr>
<td>110</td>
<td>MBOX</td>
<td>POP3 clients</td>
</tr>
<tr>
<td>143</td>
<td>MBOX</td>
<td>IMAP4 clients</td>
</tr>
<tr>
<td>443</td>
<td>MBOX</td>
<td>HTTPS (Outlook Web App, AutoDiscovery, Web Services, ActiveSync, MAPI over HTTP, RPC over HTTP – a.k.a. Outlook Anywhere, Offline Address Book, Exchange Administration Center)</td>
</tr>
</tbody>
</table>

Note: Outlook Web App has been renamed as Outlook on the Web in Exchange 2016

<table>
<thead>
<tr>
<th>TCP Port</th>
<th>Role</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>993</td>
<td>MBOX</td>
<td>Secure IMAP4 clients</td>
</tr>
<tr>
<td>995</td>
<td>MBOX</td>
<td>Secure POP3 clients</td>
</tr>
</tbody>
</table>

SSL Termination
We generally recommend that SSL is terminated on the Exchange servers for scalability and effective load sharing. However, if you’re load balancing Exchange using layer 7 SNAT mode, by default, the client IP address will be lost and replaced by the load balancer’s own IP and therefore audit logs will contain the load balancer’s IP address and not the clients. If this is an issue for your environment, X-Forwarded-For headers can be inserted by the load balancer which enable IIS on each Exchange server to be configured to log the client address from the XFF header as described in this Microsoft article. In this case, SSL must be terminated on the load balancer to allow the header to be inserted. Once inserted, traffic can be re-encrypted from the load balancer to the Exchange servers. For more details on configuring layer 7 SNAT mode with SSL offload, please refer to page 25.
HTTPS Namespaces & IP addresses

The following examples show 2 different approaches to HTTPS namespace configuration and the related load balancing considerations for each.

Example 1 – simple namespace configuration

<table>
<thead>
<tr>
<th>Namespace</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>mail.lbtestdom.com</td>
<td>Outlook Web App, ActiveSync, MAPI over HTTP, RPC over HTTP, Offline Address Book, Exchange Web Services</td>
</tr>
<tr>
<td>autodiscover.lbtestdom.com</td>
<td>Auto Discover</td>
</tr>
</tbody>
</table>

Notes:

- In this case a single VIP is used for all HTTPS namespaces/services
- Both DNS entries should then point at the same VIP
- This method is simple to setup, but only permits a single Exchange URL to be health checked. However, a successful full HTTPS service check on the OWA virtual directory is a good indication that the other Virtual Directories & applications are also functioning correctly

Example 2 – expanded namespace configuration

<table>
<thead>
<tr>
<th>Namespace</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>owa.lbtestdom.com</td>
<td>Outlook Web Access</td>
</tr>
<tr>
<td>outlook.lbtestdom.com</td>
<td>Outlook Anywhere</td>
</tr>
<tr>
<td>ews.lbtestdom.com</td>
<td>Exchange Web Services</td>
</tr>
<tr>
<td>autodiscover.lbtestdom.com</td>
<td>Autodiscover</td>
</tr>
<tr>
<td>activesync.lbtestdom.com</td>
<td>ActiveSync</td>
</tr>
<tr>
<td>oab.lbtestdom.com</td>
<td>Offline Address Book</td>
</tr>
</tbody>
</table>

Notes:

- In this case multiple VIPs are used – one for each HTTPS namespace/service
- Each related DNS entry should then point at the corresponding VIP
- This method is more complex to setup, but does enable more granular health checks to be configured
- This guide uses the config of example 1 above, i.e. a single IP address for all services.

Health-Checks

In this guide, the health check for HTTPS services accesses owa/healthcheck.htm on each server and checks for a '200 OK' response. A different virtual directory (e.g. ECP, EWS etc.) can be chosen if preferred or more appropriate. Note that healthcheck.htm is generated in-memory based on the component state of the protocol in question and does not physically exist on disk.
Load Balancer Deployment Concept

Exchange 2016 can be deployed in various ways, in this example two servers are used. Each server hosts the Mailbox role in a DAG configuration. This provides high availability and uses a minimum number of Exchange Servers.

Clients then connect to the Virtual Services (VIPS) on the load balancer rather than connecting directly to one of the Exchange servers. These connections are then load balanced across the Exchange servers to distribute the load according to the load balancing algorithm selected.

VIP = 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 5 in the Appendix on page 48 for more details on configuring a clustered pair.

Virtual Service (VIP) Requirements

To provide load balancing and HA for Exchange 2013, the following VIPs are required:

- HTTPS (for all HTTPS based services)
- SMTP

Optionally, additional VIPs may be required as follows:

- HTTP (for redirecting to HTTPS, please refer to section 4 in the Appendix on page 47 for more details)
- IMAP4
Load Balancer Deployment Modes

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 Exchange 2016, either layer 7 SNAT mode or layer 4 DR are normally used. These modes are described below and are used for the configurations presented in this guide.

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

- Layer 7 SNAT mode is not transparent by default, i.e. the Real Servers will not see the source IP address of the client, they will see the load 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.
- SNAT mode can be deployed using either a 1-arm or 2-arm configuration

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 section 6 in the Appendix on page 50 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

Our Recommendation
For simplicity we recommend using layer 7 SNAT mode. This mode requires no changes to the Exchange Servers and enables the Exchange Servers to be located on any route-able network.

Is SSL Offloading Required?
We generally recommend that SSL is terminated on the Exchange servers for scalability and effective load sharing. However, when using layer 7 SNAT mode, by default the client IP address is lost and is replaced by the load balancer’s own IP address. Therefore, Exchange audit logs contain the load balancer’s IP address and not the clients.

If this is an issue for your environment, X-Forwarded-For headers can be inserted by the load balancer which then enables IIS on each Exchange server to be configured to log the client address – for more information, please refer to this Microsoft article. To allow the header to be inserted, SSL must be terminated on the load balancer. Once inserted, traffic is re-encrypted from the load balancer to the Exchange Servers.

- To configure the appliance using Layer 7 SNAT mode without SSL termination, refer to page 19.
- For configuring appliance using Layer 7 SNAT mode with SSL termination, refer to page 25.

Note: System Administrators typically want to lock down a receive connector to accept SMTP connections only from a controlled set of devices such as external smart mail hosts, printers, networked photocopiers etc. However, when using layer 7 SNAT mode - which is not transparent, this is not possible. Instead, we recommend using the load balancer’s built in firewall to configure SMTP lockdown as described in section 1 of the Appendix on page 45.

Other Options:
1 - Configure a layer 4 VIP for SMTP rather than a layer 7 based VIP. Layer 4 is transparent by default so the source IP address is maintained. This is covered in section 3 of the Appendix on page 47. This requires the ARP problem to be solved – this requires loopback adapters to be installed on each Exchange Server and also modification to each servers strong / weak host model.

2 - Enable full layer 7 transparency using TProxy. This is covered in section 2 of the Appendix on page 46. This requires the load balancer to be deployed in a 2-arm configuration where the load balancer becomes the default gateway for the Exchange Servers.

8. Configuring Exchange 2016 for Load Balancing

1) External Access Domain
This can be configured using the EAC. Select servers > virtual directories and then click the spanner icon. This will open the form shown below. All Mailbox Servers should be configured with a valid external name, e.g. mail.lbtestdom.com
2) Virtual Directories
The Internal and External URL's for the various virtual directories need to be configured to suit your environment. The External URL's are automatically set to be the same as the external access domain when this is configured, but can be changed if needed. The Internal URL's must be set individually by clicking the Edit (pen) icon for each virtual directory. All settings can be configured using the EAC option: servers > virtual directories as shown below:

3) Outlook Anywhere
This is configured using the EAC. Select servers > servers and then click the edit (pen) icon next to each sever, click the Outlook Anywhere option as shown below to change the setting. The external and internal names for each server should be configured as required, e.g. mail.lbtestdom.com
4) Autodiscover

Internal

The Service Connection Point (SCP) object contains the authoritative list of Autodiscover service URLs for the forest. The Set-ClientAccessService cmdlet can be used to update the SCP object as shown in the following example:

```
Set-ClientAccessService -Identity "EXCH2016-MBOX1" -AutoDiscoverServiceInternalUri "https://autodiscover.lbtestdom.com/autodiscover/autodiscover.xml"
```

Once configured, the Test Email AutoConfiguration option available when <CTRL> right-clicking the Outlook icon in the taskbar can be used to view these settings as shown below:

Note: The minimum Outlook client for Exchange 2016 is Outlook 2010.
When Outlook is started on a client that is not domain-connected, it first tries to locate the Autodiscover service by looking up the SCP object in Active Directory. Because the client is unable to contact Active Directory, it tries to locate the Autodiscover service by using DNS. In this scenario, the client will determine the domain of the user's e-mail address, and then check DNS by using two predefined URLs. For the SMTP domain lbtestdom.com, Outlook will try the following two URLs to try to connect to the Autodiscover service:

https://lbtestdom.com/autodiscover/autodiscover.xml

https://autodiscover.lbtestdom.com/autodiscover/autodiscover.xml

Again, this can be seen using the Test Email AutoConfiguration option as shown below:
5) Certificates
The recommended approach is to use SAN certificates and specify all required namespaces. It's also possible to use wildcard certs if preferred. Certificate requests can be generated using either the graphical based Exchange Admin Center or the command based Exchange Management Shell.

The EAC can also be used to import/export certificates using the server > certificates > More option

**IMPORTANT ! !**

The same certificate and private key must be deployed on all Exchange Servers

6) Send & Receive Connectors
By default no send connectors are created when Exchange 2016 is installed. A send connector must be created manually that either sends outbound email messages to a smart host or directly to their recipient using DNS.

Five receive connectors are automatically created by default. The table below lists these connectors:

<table>
<thead>
<tr>
<th>Receive Connector</th>
<th>Role</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default &lt;server name&gt;</td>
<td>MBOX</td>
<td>Accepts connections from Mailbox servers running the Transport service and from Edge servers</td>
</tr>
<tr>
<td>Client Proxy &lt;server name&gt;</td>
<td>MBOX</td>
<td>Accepts connections from front-end servers. Typically, messages are sent to a front-end server over SMTP</td>
</tr>
<tr>
<td>Default FrontEnd &lt;server name&gt;</td>
<td>MBOX</td>
<td>Accepts connections from SMTP senders over port 25. This is the common messaging entry point into your organization</td>
</tr>
<tr>
<td>Outbound Proxy Frontend &lt;server name&gt;</td>
<td>MBOX</td>
<td>Accepts messages from a Send Connector on a back-end server, with front-end proxy enabled</td>
</tr>
<tr>
<td>Client Frontend &lt;server name&gt;</td>
<td>MBOX</td>
<td>Accepts secure connections, with Transport Layer Security (TLS) applied</td>
</tr>
</tbody>
</table>

For more information on mail connectors please refer to the following Technet article:


**Adding Connectors**
Connectors can be created using the Exchange Administration Center (EAC) or the Exchange Management Shell. Receive connectors must use a unique combination of IP address bindings, port number assignments, and remote IP address ranges from which mail is accepted. Multiple send connectors can created, this is typically done to enables multiple outbound email routes to be specified that have different costs.

The exact connector configuration depends on your specific environment and requirements.
7) DNS Configuration
Configure appropriate internal and external DNS entries for the various Internal and External URL's that have been defined in steps 1) to 4). The DNS entries should point at the HTTPS VIP on the load balancer - assuming a simple namespace design as shown below:

<table>
<thead>
<tr>
<th>DNS record</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>mail.lbtestdom.com</td>
<td>Points at the VIP used for all HTTPS based services</td>
</tr>
<tr>
<td>autodiscover.lbtestdom.com</td>
<td>Points at the VIP used for all HTTPS based services</td>
</tr>
</tbody>
</table>

Note: If multiple VIPs are defined for the various Virtual Directories, DNS should be configured accordingly.

8) Additional Exchange Server Configuration Steps (depends on Load balancing method)
The steps required depend on the load balancing mode used as described below.

SNAT Mode
When using SNAT mode, no configuration changes to the Exchange Servers are required.

DR Mode
The 'ARP problem' must be solved on each Exchange Server for DR mode to work. For detailed steps on solving the ARP problem for the various versions of Windows, Please refer to section 6 in the Appendix on page 50 for more information.

9) IIS Restart (** Important **)
Once all Exchange configuration is complete restart IIS on each server (or reboot the server) to ensure all changes are applied. This can be done using the following command in a command or Powershell Window:

iisreset /restart

9. 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.
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 5 of the Appendix on page 48.
10. Appliance Configuration – Using Layer 7 SNAT Mode (without SSL Offload)

**Load Balancer Deployment Overview**

The diagram below illustrates how the load balancer is configured and deployed.

![Diagram](image)

**Notes:**

- **Layer 7 is not transparent by default.** This means that the client source IP address is lost and is replaced by the IP address of the load balancer. All Exchange audit logs will show the IP address of the load balancer, not the clients. If this is an issue, please refer to the configuration option on page 25 where X-Forwarded-For headers are used to record the client IP address in the Exchange server’s IIS logs.

- **System Administrators typically want to lock down a receive connector to accept SMTP connections only from a controlled set of devices such as external smart mail hosts, printers, networked photocopiers etc. However, when using layer 7 SNAT mode - which is not transparent, this is not possible. Instead, we recommend using the load balancer’s built in firewall to configure SMTP lockdown as described in section 1 of the Appendix on page 45.

**Other Options:**

1. **Configure a layer 4 VIP for SMTP rather than a layer 7 based VIP.** Layer 4 is transparent by default so the source IP address is maintained. This is covered in section 3 of the Appendix on page 47. This requires the ARP problem to be solved – this requires loopback adapters to be installed on each Exchange Server and also modification to each servers strong / weak host model.

2. **Enable full layer 7 transparency using TProxy.** This is covered in section 2 of the Appendix on page 46. This requires the load balancer to be deployed in a 2-arm configuration where the load balancer becomes the default gateway for the Exchange Servers.
Load Balancer Configuration

Configure VIP1 – Mailbox Server Role HTTPS Services

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:

   ![VIP Configuration Screen](image)

   - Enter an appropriate label for the VIP, e.g. **MBOX-HTTPS**
   - Set the **Virtual Service IP address** field to the required IP address, e.g. **192.168.30.10**
   - Set the **Virtual Service Ports** field to **443**
   - Set **Layer 7 Protocol** set to **TCP Mode**
   - Click **Update**
   - Now click **Modify** next to the newly created VIP
   - Set **Balance mode** to **Weighted Round Robin**

   **Note:** Microsoft recommends that 'Round Robin' rather than 'Least Connection' should be used to help prevent over loading servers when they are brought online. This could occur if Least Connection was selected, since the load balancer would try to balance the number of connections across all real servers and therefore send all new requests to the new server. The trade off here is that using Round Robin will mean that server load may remain unbalanced for some time after bringing a new server into the active pool.

10. Scroll down to the **Persistence** section and set **Persistence Mode** to **None**
11. In the **Health Checks** section set **Health Checks** to **Negotiate HTTPS (GET)**
12. Set **Request to send** to **owa/healthcheck.htm**
Note: As mentioned earlier, any other Exchange virtual directory (e.g. ECP, EWS etc.) can be used if preferred or more appropriate. All have an associated healthcheck.htm that can be used in the same way. Note that healthcheck.htm is generated in-memory based on the component state of the protocol in question and does not physically exist on disk.

13. Leave Response expected blank, this will configure the load balancer to look for a '200 OK' response
14. Scroll down to the Other section and click [Advanced]
15. Enable (check) the Timeout checkbox and set both Client Timeout & Real Server Timeout to 30m (i.e. 30 minutes)
16. 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. MBOX1
   4. Change the Real Server IP Address field to the required IP address, e.g. 192.168.30.20
   5. Change the Real Server Port field to 443
   6. Click Update
   7. Repeat the above steps to add your other Mailbox Server(s)

c) Configure HTTP to HTTPS OWA Redirect

If required, the load balancer can be configured to automatically redirect users who attempt to connect to http://<URL-to-access-OWA> to https://<URL-to-access-OWA>. For details on configuring this, please refer to section 4 of the Appendix on page 47.

Configure VIP2 – Mailbox Server Role IMAP4/POP3 Services

a) Setting up the Virtual Service
Note: These steps show IMAP4 settings, for POP3 change the port numbers from 143 & 993 to 110 & 995.

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. **MBOX-IMAP4**
    4. Set the **Virtual Service IP address** field to the required IP address, e.g. **192.168.30.10**
    5. Set the **Virtual Service Ports** field to **143,993**
    6. Set **Layer 7 Protocol** to **TCP Mode**
    7. Click **Update**
    8. Now click **Modify** next to the newly created VIP
    9. Set **Balance mode** to **Weighted Round Robin**

Note: Microsoft recommends that 'Round Robin' rather than 'Least Connection' should be used to help prevent over loading servers when they are brought online. This could occur if Least Connection was selected, since the load balancer would try to balance the number of connections across all real servers and therefore send all new requests to the new server. The trade off here is that using Round Robin will mean that server load may remain unbalanced for some time after bringing a new server into the active pool.

10. Scroll down to the **Persistence** section and set **Persistence Mode** to **None**
11. Scroll down to the **Other** section and click **[Advanced]**
12. Enable (check) the **Timeout** checkbox and set both **Client Timeout & Real Server Timeout** to **30m** (i.e. 30 minutes)
13. 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. **MBOX1**

   4. Change the **Real Server IP Address** field to the required IP address, e.g. **192.168.30.20**

   5. Leave the **Real Server Port** field blank

   6. Click **Update**

   7. Repeat the above steps to add your other Mailbox Server(s)

**Configure VIP3 – Mailbox Server Role SMTP Services**

**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. MBOX-SMTP
4. Set the Virtual Service IP address field to the required IP address, e.g. 192.168.30.10
5. Set the Virtual Service Ports field to 25
6. Set Layer 7 Protocol to TCP Mode
7. Click Update
8. Now click Modify next to the newly created VIP
9. Scroll down to the Persistence section and set Persistence Mode to None
10. Scroll down to the Other section and click [Advanced]
11. Enable (check) the Timeout checkbox and set both Client Timeout & Real Server Timeout to 30m (i.e. 30 minutes)
12. 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. MBOX1
4. Change the Real Server IP Address field to the required IP address, e.g. 192.168.30.20
5. Change the Real Server Port field to 25
6. Click Update
7. Repeat the above steps to add your other Mailbox Server(s)

Configuring Firewall Rules To Lockdown SMTP
Because layer 7 is not transparent by default, it’s not possible to filter inbound SMTP connections by IP address at the receive connector. Our recommended way to address this is to use the load balancer’s built-in firewall to control which hosts can connect to the SMTP VIP on port 25. Please refer to section 1 in the Appendix on page 45 for details of how to configure this.

Additional Settings If Using Kerberos Authentication
If you’re using Kerberos to authenticate your Exchange users and these users are members of a large number of AD security groups and/or have a large SID history, Kerberos tickets may become so large that they no longer fit in the
standard 16K HAProxy response buffer. For Windows 2012 and later, the default MaxTokenSize is set to 48K. In addition, there is a new KDC policy setting that can be enabled to log an event in the system event log if a Kerberos ticket is larger than a certain size (the default setting is 12K). If you determine that tickets in your environment are larger than 16K, the default response buffer size on the load balancer must be increased.

To increase the Request buffer size:

1. Go to Cluster Configuration > Layer 7 – Advanced Configuration
2. Set the Request buffer length to the required value, e.g. **51200** (i.e. 50K)

**Finalizing The Configuration**

To apply the new layer 7 configuration, HAProxy must be restarted using the WebUI option: Maintenance > Restart Services and clicking **Restart HAProxy**

**Exchange Server Configuration Steps**

No additional configuration is required when SSL is terminated on the Exchange Servers.

**11. Appliance Configuration – Using Layer 7 SNAT Mode (with SSL Offload)**

**Load Balancer Deployment Overview**

The diagram below illustrates how the load balancer is configured and deployed. The key difference to the previous configuration is that SSL is terminated on the load balancer.

**Notes:**

- Layer 7 is not transparent by default. This means that the client source IP address is lost and is replaced by the IP address of the load balancer. To allow the client IP address to be passed to the Exchange Servers, SSL is terminated on the load balancer which enables X-forwarded-For headers to be inserted. The Exchange servers can then be configured so that this address is included in the IIS logs as described in [this Microsoft article](https://support.microsoft.com).
System Administrators typically want to lock down a receive connector to accept SMTP connections only from a controlled set of devices such as external smart mail hosts, printers, networked photocopiers etc. However, when using layer 7 SNAT mode - which is not transparent, this is not possible. Instead, we recommend using the load balancer's built in firewall to configure SMTP lockdown as described in section 1 of the Appendix on page 45.

Other Options:

1 - Configure a layer 4 VIP for SMTP rather than a layer 7 based VIP. Layer 4 is transparent by default so the source IP address is maintained. This is covered in section 3 of the Appendix on page 47. This requires the ARP problem to be solved – this requires loopback adapters to be installed on each Exchange Server and also modification to each servers strong / weak host model.

2 - Enable full layer 7 transparency using TProxy. This is covered in section 2 of the Appendix on page 46. This requires the load balancer to be deployed in a 2-arm configuration where the load balancer becomes the default gateway for the Exchange Servers.

Load Balancer Configuration

Configure VIP1 – Mailbox Server Role HTTPS Services

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. MBOX-HTTPS
4. Set the Virtual Service IP address field to the required IP address, e.g. 192.168.30.10
5. Set the Virtual Service Ports field to 80
6. Set Layer 7 Protocol set to HTTP Mode
7. Click Update
8. Now click Modify next to the newly created VIP
9. Set Balance mode to Weighted Round Robin

Note: Microsoft recommends that 'Round Robin' rather than 'Least Connection' should be used to help prevent over loading servers when they are brought online. This could occur if Least Connection was selected, since the load balancer would try to balance the number of connections across all real severs and therefore send all new requests to the new server. The trade off here is that using Round Robin will mean that server load may remain unbalanced for some time after bringing a new server into the active pool.

10. Scroll down to the Persistence section and set Persistence Mode to None
11. In the Health Checks section set Health Checks to Negotiate HTTPS (GET)
12. Set Request to send to owa/healthcheck.htm

Note: As mentioned earlier, any other Exchange virtual directory (e.g. ECP, EWS etc.) can be used if preferred or more appropriate. All have an associated healthcheck.htm that can be used in the same way. Note that healthcheck.htm is generated in-memory based on the component state of the protocol in question and does not physically exist on disk.

13. Leave Response expected blank, this will configure the load balancer to look for a '200 OK' response
14. Scroll down to the Other section and click [Advanced]
15. Enable (check) the Timeout checkbox and set both Client Timeout & Real Server Timeout to 30m (i.e. 30 minutes)
16. Ensure that Set X-forwarded-For Header is enabled (checked)
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. **MBOX1**

4. Change the **Real Server IP Address** field to the required IP address, e.g. **192.168.30.20**

5. Change the **Real Server Port** field to **443**

6. Enable (check) the **Re-Encrypt to Backend** checkbox

7. Click **Update**

8. Repeat the above steps to add your other Mailbox Server(s)

c) Export Your SSL Certificate

When you export your certificate from Exchange, make sure that you include the private key.

d) Upload Your SSL Certificate to The Load Balancer

**To upload a Certificate:**

1. Using the WebUI, navigate to: **Cluster Configuration > SSL Certificates**

2. Click **Add a new SSL Certificate** & select **Upload prepared PEM/PFX file**

3. Enter a suitable **Label** (name) for the certificate, e.g. **ExchangeCert**

4. Browse to and select the certificate file to upload (PEM or PFX format)

5. Enter the password, if applicable

6. Click **Upload Certificate**, if successful, a message similar to the following will be displayed:
e) Configure SSL Termination

To configure an SSL VIP:

for v8.3.3 and later:

1. Using the WebUI, navigate to: Cluster Configuration > SSL Termination and click Add a new Virtual Service

![Virtual Service Configuration Interface]

2. Enter a suitable Label (name) for the VIP, e.g. MBOX-SSL
3. Set Associated Virtual Service to the appropriate VIP, e.g. MBOX-HTTP
4. Select the SSL Certificate uploaded previously
5. Click Update

for v8.3.2 and earlier:

1. Enter the following details:

![Virtual Service Configuration Interface (v8.3.2)]

2. Enter the required Label (name) for the Virtual Service, e.g. MBOX-SSL
3. Select the certificate uploaded previously in the SSL Certificate drop-down
4. Set the Virtual Service IP address to be the same as the VIP created previously, e.g. 192.168.30.10
5. Set the Virtual Service Port field to 443
6. Set the Backend Virtual Service IP address to be the same as the VIP created previously, e.g. 192.168.30.10
7. Set the Backend Virtual Service Port field to 80
8. The other settings can be left at their default values
9. Click Update

f) Configure HTTP to HTTPS OWA Redirect

If required, the load balancer can be configured to automatically redirect users who attempt to connect to http://<URL-to-access-OWA> to https://<URL-to-access-OWA>. For details on configuring this, please refer to section 4 of the Appendix on page 47.

Configure VIP2 – Mailbox Server Role IMAP4/POP3 Services

a) Setting up the Virtual Service

Note: These steps show IMAP4 settings, for POP3 change the port numbers from 143 & 993 to 110 & 995.

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. MBOX-IMAP4
4. Set the Virtual Service IP address field to the required IP address, e.g. 192.168.30.10
5. Set the Virtual Service Ports field to 143,993
6. Set Layer 7 Protocol to TCP Mode
7. Click Update
8. Now click Modify next to the newly created VIP
9. Set Balance mode to **Weighted Round Robin**

Note: Microsoft recommends that 'Round Robin' rather than 'Least Connection' should be used to help prevent over loading servers when they are brought online. This could occur if Least Connection was selected, since the load balancer would try to balance the number of connections across all real servers and therefore send all new requests to the new server. The trade off here is that using Round Robin will mean that server load may remain unbalanced for some time after bringing a new server into the active pool.

10. Scroll down to the **Persistence** section and set **Persistence Mode** to **None**
11. Scroll down to the **Other** section and click **[Advanced]**
12. Enable (check) the **Timeout** checkbox and set both **Client Timeout & Real Server Timeout** to **30m** (i.e. 30 minutes)
13. 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. **MBOX1**
4. Change the **Real Server IP Address** field to the required IP address, e.g. **192.168.30.20**
5. Leave the **Real Server Port** field blank
6. Click **Update**
7. Repeat the above steps to add your other Mailbox Server(s)

Configure VIP3 – Mailbox Server Role SMTP Services

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. **MBOX-SMTP**
4. Set the Virtual Service IP address field to the required IP address, e.g. **192.168.30.10**
5. Set the Virtual Service Ports field to **25**
6. Set Layer 7 Protocol to **TCP Mode**
7. Click **Update**
8. Now click **Modify** next to the newly created VIP
9. Scroll down to the Persistence section and set Persistence Mode to **None**
10. Scroll down to the **Other** section and click **[Advanced]**
11. Enable (check) the Timeout checkbox and set both Client Timeout & Real Server Timeout to **30m** (i.e. 30 minutes)
12. 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 RSP, e.g. **MBOX1**
4. Change the Real Server IP Address field to the required IP address, e.g. 192.168.30.20
5. Change the Real Server Port field to 25
6. Click Update
7. Repeat the above steps to add your other Mailbox Server(s)

Configuring Firewall Rules To Lockdown SMTP

Because layer 7 is not transparent by default, it’s not possible to filter inbound SMTP connections by IP address at the receive connector. Our recommended way to address this is to use the load balancer’s built-in firewall to control which hosts can connect to the SMTP VIP on port 25. Please refer to section 1 of the Appendix on page 45 for details of how to configure this.

Additional Settings If Using Kerberos Authentication

If you're using Kerberos to authenticate your Exchange users and these users are members of a large number of AD security groups and/or have a large SID history, Kerberos tickets may become so large that they no longer fit in the standard 16K HAProxy response buffer. For Windows 2012 and later, the default MaxTokenSize is set to 48K. In addition, there is a new KDC policy setting that can be enabled to log an event in the system event log if a Kerberos ticket is larger than a certain size (the default setting is 12k). If you determine that tickets in your environment are larger than 16K, the default response buffer size on the load balancer must be increased.

To increase the Request buffer size:

1. Go to Cluster Configuration > Layer 7 – Advanced Configuration
2. Set the Request buffer length to the required value, e.g. 51200 (i.e. 50K)

Finalizing The Configuration

To apply the new layer 7 configuration, HAProxy must be restarted using the WebUI option: Maintenance > Restart Services and clicking Restart HAProxy.

Exchange Server Configuration Steps

Configure IIS Logging To Capture XFF Header IP Addresses

Please refer to this Microsoft article for configuration steps.

12. Appliance Configuration – Using Layer 4 DR Mode

Load Balancer Deployment Overview

The diagram below illustrates how the load balancer is configured and deployed.
Notes:

- Layer 4 DR mode is transparent by default. This means that the client source IP address is maintained through to the Exchange Servers & the audit logs.

- When using DR mode, System Administrators are able to lock down the receive connector to accept SMTP connections only from a controlled set of devices such as external smart mail hosts, printers, networked photocopiers etc. As mentioned earlier, this is because DR mode is transparent, so source IP addresses are preserved through the load balancer to the Exchange Servers.

Load Balancer Configuration

Configure VIP1 – Mailbox Server Role HTTPS Services

a) Setting up the Virtual Service

1. Using the WebUI, navigate to: Cluster Configuration > Layer 4 – Virtual Service and click Add a New Virtual Service

2. Enter the following details:
3. Enter an appropriate label for the VIP, e.g. **MBOX-HTTPS**
4. Set the **Virtual Service IP address** field to the required IP address, e.g. **192.168.30.10**
5. Set the **Virtual Service Ports** field to **443**
6. Leave **Protocol** set to **TCP**
7. Leave **Forwarding Method** set to **Direct Routing**
8. Click **Update**
9. Now click **Modify** next to the newly created VIP
10. Set **Balance mode** to **Weighted Round Robin**

Note: Microsoft recommends that 'Round Robin' rather than 'Least Connection' should be used to help prevent over loading servers when they are brought online. This could occur if Least Connection was selected, since the load balancer would try to balance the number of connections across all real servers and therefore send all new requests to the new server. The trade off here is that using Round Robin will mean that server load may remain unbalanced for some time after bringing a new server into the active pool.

11. Un-check the **Persistence** option
12. Set **Check Type** to **Negotiate**
13. Set **Protocol** to **HTTPS**
14. Set **Request to send** to **owa/healthcheck.htm**

Note: As mentioned earlier, any other Exchange virtual directory (e.g. ECP, EWS etc.) can be used if preferred or more appropriate. All have an associated healthcheck.htm that can be used in the same way. Note that healthcheck.htm is generated in-memory based on the component state of the protocol in question and does not physically exist on disk.
15. Set Response expected to **200 OK**
16. Click **Update**

b) Setting up the Real Servers

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:

   ![Real Server Configuration](image)

   3. Enter an appropriate label for the RIP, e.g. **MBOX1**
   4. Change the **Real Server IP Address** field to the required IP address, e.g. **192.168.30.20**
   5. Click **Update**
   6. Repeat the above steps to add your other Mailbox Server(s)

c) Configure HTTP to HTTPS OWA Redirect

If required, the load balancer can be configured to automatically redirect users who attempt to connect to `http://<URL-to-access-OWA>` to `https://<URL-to-access-OWA>`. For details on configuring this, please refer to section 4 of the Appendix on page 47.

Configure VIP2 – Mailbox Server Role IMAP4/POP3 Services

a) Setting up the Virtual Service

   **Note:** These steps show IMAP4 settings, for POP3 change the port numbers from 143 & 993 to 110 & 995.

1. Using the WebUI, navigate to: **Cluster Configuration > Layer 4 – Virtual Service** and click **Add a New Virtual Service**
2. Enter the following details:
3. Enter an appropriate label for the VIP, e.g. MBOX-IMAP4
4. Set the Virtual Service IP address field to the required IP address, e.g. 192.168.30.10
5. Set the Virtual Service Ports field to 143,993
6. Leave Protocol set to TCP
7. Leave Forwarding Method set to Direct Routing
8. Click Update
9. Now click Modify next to the newly created VIP
10. Set Balance mode to Weighted Round Robin

Note: Microsoft recommends that 'Round Robin' rather than 'Least Connection' should be used to help prevent over loading servers when they are brought online. This could occur if Least Connection was selected, since the load balancer would try to balance the number of connections across all real servers and therefore send all new requests to the new server. The trade off here is that using Round Robin will mean that server load may remain unbalanced for some time after bringing a new server into the active pool.

11. Un-check the Persistence option
12. Click Update

b) Setting up the Real Servers
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:
3. Enter an appropriate label for the RIP, e.g. **MBOX1**
4. Change the *Real Server IP Address* field to the required IP address, e.g. **192.168.30.20**
5. Click **Update**
6. Repeat the above steps to add your other Mailbox Server(s)

**Configure VIP3 – Mailbox Server Role SMTP Services**

a) Setting up the Virtual Service

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

3. Enter an appropriate label for the VIP, e.g. **MBOX-SMTP**
4. Set the *Virtual Service IP address* field to the required IP address, e.g. **192.168.30.10**
5. Set the *Virtual Service Ports* field to **25**
6. Leave *Protocol* set to **TCP**
7. Leave Forwarding Method set to **Direct Routing**
8. Click **Update**
9. Now click **Modify** next to the newly created VIP
10. Un-check the **Persistence** option
11. Click **Update**

**b) Setting up the Real Servers**

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:

   ![Real Server Configuration](image)

   - Enter an appropriate label for the RIP, e.g. **MBOX1**
   - Change the **Real Server IP Address** field to the required IP address, e.g. **192.168.30.20**
   - Click **Update**
   - Repeat the above steps to add your other Mailbox Server(s)

**Exchange Server Configuration Steps**

When using layer 4 DR mode, as mentioned earlier on page 16, the “ARP Problem” must be solved on each Exchange server. For full details of the steps required to do this, please refer section 6 in the Appendix on page 50.

**13. Testing & Verification**

**Useful Exchange 2016 & Other Microsoft Tools**

**Testing Server Health-checks Using Set-ServerComponentState**

The Exchange Management shell cmdlet Set-ServerComponentState can be used to verify that the load balancer is correctly health-checking the Exchange servers. In this guide, the health-check verifies that the owa virtual directory can be accessed.

To verify that the health-check is working correctly, the following command can be used:
Set-ServerComponentState <SERVER> -Component OwaProxy -Requester Maintenance -State Inactive

Where <SERVER> is the hostname of the Exchange Server

Once run, the server specified should be marked down (shown red) in the System Overview of the loadbalancer’s WebUI

To bring it back online, use the following command:

Set-ServerComponentState <SERVER> -Component OwaProxy -Requester Maintenance -State Active

Where <SERVER> is the hostname of the Exchange Server

Once run, the server specified should be marked up (shown green) in the System Overview of the loadbalancer’s WebUI

Exchange Management Shell:

Testing Mailflow

The Test-Mailflow cmdlet can be used to diagnose whether mail can be successfully sent and delivered.

To send a test probe message to the administrators email address, use the following command:

Test-Mailflow -TargetEmailAddress administrator@lbtestdom.com

Exchange Management Shell:
If everything is working correctly, a new message will appear in the test user's mailbox:

![Screenshot of SMTP test result]

**Testing SMTP Mail Flow Using Telnet**

SMTP can be tested using telnet to connect to port 25, then by issuing various commands to simulate an email being sent. Using System Overview in the WebUI, each Mailbox Server server can be tested by 'Halting' all others then running through the tests.

To connect to port 25 of a server using Telnet, use the following command:

```
telnet <IP Address> 25
```

The following screenshot shows an example of using telnet to verify SMTP operation:
If everything is working correctly, a new message will appear in the test users mailbox:

To do the same test via the load balancer, connect to the VIP rather than directly to each server, e.g.:

```
telnet mail.lbtestdom.com 25
```

Microsoft Exchange Testing Tool

The Remote Connectivity Analyzer tool available at [https://testconnectivity.microsoft.com/](https://testconnectivity.microsoft.com/) is a useful Web-based Microsoft tool designed to help IT Administrators troubleshoot connectivity issues with their Exchange Server deployments. The tool simulates several client logon and mail flow scenarios. When a test fails, many of the errors have troubleshooting tips to assist the IT Administrator in correcting the problem.
Useful Appliance based Tools & Features

Using System Overview

The System Overview can be viewed in the WebUI. It shows a graphical view of all VIPs & RIPs (i.e. the Exchange 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 both Mailbox Servers are healthy and available to accept connections:

The example below shows that rip2 has been put in halt mode:

Layer 4 Status Report

The Layer 4 Status report gives a summary of layer 4 configuration and running stats as shown below. This can be accessed in the WebUI using the option: Reports > Layer 4 Status.
Layer 7 Statistics Report

The Layer 7 Statistics report gives a summary of all layer 7 configuration and running stats as shown below. This can be accessed in the WebUI using the option: Reports > Layer 7 Status.

### HAPProxy

#### Statistics Report for pid 8727

<table>
<thead>
<tr>
<th>General process information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pid:</strong> 8727 (process 41,haproxy = 4)</td>
</tr>
<tr>
<td><strong>uptime:</strong> 6h:43m:35s</td>
</tr>
<tr>
<td><strong>system total mem:</strong> 166806 MB</td>
</tr>
<tr>
<td><strong>cputime:</strong> 12:21:31</td>
</tr>
<tr>
<td><strong>running:</strong> 4MB</td>
</tr>
<tr>
<td><strong>swap:</strong> 217MB, free = 185MB</td>
</tr>
</tbody>
</table>

<table>
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<tr>
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<th>active UP</th>
<th>active DOWN</th>
<th>going down</th>
<th>active or backup DOWN</th>
<th>backup UP</th>
<th>backup DOWN</th>
<th>going up</th>
<th>active or backup DOWN for maintenance (NAINF)</th>
<th>Display option:</th>
<th>External resources:</th>
</tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>Online manual</td>
<td></td>
</tr>
</tbody>
</table>

#### Appliance Logs

Logs are available for both layer 4 and layer 7 services and can be very useful when trying to diagnose issues. Layer 4 logs are active by default and can be accessed using the WebUI option: Logs > Layer 4.

Layer 7 logging is not enabled by default (because its extremely verbose) and can be enabled using the WebUI option: Cluster Configuration > Layer 7 – Advanced Configuration > Logging, and then viewed using the WebUI option: Logs > Layer 7.

### 14. Technical Support

If you have any questions regarding the appliance or would like assistance designing your deployment, please don’t hesitate to contact our support team: support@loadbalancer.org.

### 15. Further Documentation


### 16. Conclusion

Loadbalancer.org appliances provide a very cost effective solution for highly available load balanced Exchange 2016 environments.
17. Appendix

1 - Configuring Firewall Rules to Lockdown SMTP

Because layer 7 is not transparent by default, it's not possible to filter inbound SMTP connections by IP address at the receive connector. Our recommended way to address this is to use the load balancer’s built-in firewall to control which hosts can connect to the SMTP VIP on port 25. The examples below show how the rules are constructed:

Example 1 - limit inbound SMTP connections to a specific smart host:

VIP1="192.168.30.10"
SRC1="192.168.30.50"
iptables -A INPUT -p tcp --src $SRC1 --dst $VIP1 --destination-port 25 -j ACCEPT
iptables -A INPUT -p tcp --dport 25 -j DROP

These rules will only allow SMTP traffic from the host 192.168.30.50 to reach the 192.168.30.10 VIP.

Example 2 - limit inbound SMTP connections to a range of smart hosts:

VIP1="192.168.30.10"
SRC1="192.168.30.50-192.168.30.60"
iptables -A INPUT -p tcp -m iprange --src-range $SRC1 --destination $VIP1 --destination-port 25 -j ACCEPT
iptables -A INPUT -p tcp --dport 25 -j DROP

These rules will only allow SMTP traffic from hosts in the range 192.168.30.50 through 192.168.30.60 to reach the 192.168.30.10 VIP.

To add firewall rules:

1. Using the WebUI, navigate to: Maintenance > Firewall Script
2. Scroll down to the the bottom of the script, add a descriptive comment for the rules, then copy & paste the appropriate example rules as shown in the example below:
3. Insert a comment using the ' # ' symbol, e.g. # Lockdown SMTP inbound connections
4. Ensure that the IP addresses specified for VIP1 and SRC1 are configured for your environment
5. Click Update

2 – Enabling Layer 7 Transparency using TProxy
As mentioned previously, Layer 7 SNAT mode is not transparent by default. If a fully transparent configuration is required, TProxy can be used. The main points to note are that two subnets must be used and the default gateway on the Exchange Servers must be set to be the load balancer.

Key points to note:
- The Exchange Servers must be on a different subnet to the VIP – this can be achieved by using two network adapters, or by creating VLANs on a single adapter
- The default gateway on the Exchange Servers must be configured to be an IP address on the load balancer. For a clustered pair of load balancers, an additional floating IP should be used for this purpose allow failover to the slave
- TProxy must be enabled using the WebUI option: Cluster Configuration > Layer 7 – Advanced Configuration
and set **Transparent Proxy** to 'On' and click **Update**

Note: If the load balancer has been deployed in Layer 4 DR mode, this is transparent by default so no additional steps are required. This section only applies when Layer 7 SNAT mode was initially used and transparency is now required.

3 – Using a Layer 4 Virtual Service for SMTP

Layer 7 Virtual Services are not transparent by default which can be an issue for the HT role. One option in this case is to use a Layer 4 DR mode VIP. For more details about Layer 4 DR mode please refer to page 10.

Note: If the load balancer has been deployed in Layer 4 DR mode, this is transparent by default so no additional steps are required. This section only applies when Layer 7 SNAT mode was initially used and transparency is now required.

**Layer 4 DR Mode - Solving the ARP Problem:**

Layer 4 DR mode works by changing the MAC address of the inbound packets to match the Real Server selected by the load balancing algorithm. To enable DR mode to operate:

- Each Real Server must be configured to accept packets destined for both the VIP address and the Real Servers IP address (RIP). This is because in DR mode the destination address of load balanced packets is the VIP address, whilst for other traffic such as health-checks, administration traffic etc. it’s the Real Server’s own IP address (the RIP). The service/process (e.g. IIS) must respond to both addresses.
- Each Real Server must be configured so that it does not respond to ARP requests for the VIP address – only the load balancer should do this.

Configuring the Real Servers in this way is referred to as ‘**Solving the ARP problem**’. The steps required depend on the particular version of Windows being used. For detailed steps on solving the ARP problem for Windows 2012/2016 Please refer to section 6 of the Appendix on page 50.

4 – Configuring an HTTP to HTTPS redirect for OWA

An additional layer 7 VIP is required that listens on HTTP port 80 on the same IP address. The VIP is then configured to redirect connections to HTTPS port 443.

E.g. `http://mail.robtest.com/owa` should be redirected to `https://mail.robtest.com/owa`

1) Create another Layer 7 VIP with the following settings:

- **Label**: HTTP-redirect
• Virtual Service IP Address: <same as the VIP that's listening on port 443>
• Virtual Service Ports: 80
• Layer 7 Protocol: HTTP Mode
• Persistence Mode: None
• Force to HTTPS: Yes

Note: This additional VIP will be shown purple/green to indicate that it's being used for HTTP to HTTPS redirection.

2) Apply the new settings – to apply the new settings, HAProxy must be restarted:

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

5 – 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

Click Add new node

The pairing process now commences as shown below:

Once complete, the following will be displayed:
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.

6 – 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:

![Loopback Properties](image)

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

5. If configuring 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, eg. 192.168.30.10/255.255.255.255 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 address you’ve used for 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:

```bash
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:

```bash
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:

```bash
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:

```bash
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.

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

```
PS C:\Users\administrator.MOBTEST> netsh interface ip6 set interface "net" weaknessreceive-enabled
OK.
PS C:\Users\administrator.MOBTEST> netsh interface ip6 set interface "loopback" weaknessreceive-enabled
OK.
PS C:\Users\administrator.MOBTEST> netsh interface ip6 set interface "loopback" weaknesssend-enabled
OK.
PS C:\Users\administrator.MOBTEST> netsh interface ip6 set interface "loopback" dsttransmit-0
OK.
PS C:\Users\administrator.MOBTEST>
```

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

**Step 4: Check / Update the Network Adapter Priority Order (Windows 2016 Only)**

To ensure that the newly added loopback adapter has no effect on which interface Windows attempts to use, it's important that the loopback adapter has the lowest priority. In Windows Server 2016, you can use the interface metric to configure the order of network interfaces. As mentioned [here](#), the interface metric can be viewed and configured using either PowerShell or via the Windows GUI.

To check the current interface metric for all adapters using PowerShell:

1. Open a PowerShell command window and run the following command:
Get-NetIPinterface

Output similar to the following will be displayed:

![Windows PowerShell output for Get-NetIPInterface]

(the interface metric is displayed in the 5\textsuperscript{th} column)

2. In the above example, the ‘loopback’ and ‘net’ adapters have the same interface metric (25). To ensure that there is no possibility of issues occurring, the loopback adapter should be modified so that it has a higher interface metric, and is therefore a lower priority (see below).

To configure the loopback adapter’s interface metric using the Windows GUI:

1. Open the Properties of the loopback adapter, select the required IP version (if IPv4 and IPv6 are needed, repeat these steps for both), click Properties, then click Advanced.

2. Uncheck the Automatic Metric checkbox, then enter a suitable value to ensure that the loopback adapter has the highest value, e.g. 500 as shown below.

![Interface Metric configuration in Windows GUI]

3. Click OK, OK and Close to apply the new settings.

Repeat steps 1 – 4 on all remaining Exchange Server(s).
18. Document Revision History

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<td>1.3.0</td>
<td>6th August 2019</td>
<td>Styling and layout</td>
<td>General styling updates</td>
<td>RJC</td>
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