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1. About this Guide

This guide details the steps required to configure a highly available IBM Cloud Object Storage Accessor node environment utilizing Loadbalancer.org appliances. It covers the configuration of the load balancers and also any Accessor node configuration changes that are required.

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 IBM Cloud Object Storage. For full specifications of available models please refer to https://www.loadbalancer.org/products. Some features may not be supported in all cloud platforms due to platform specific limitations, please check with Loadbalancer.org support for further details.

3. Loadbalancer.org Software Versions Supported

- V8.4.1 and later

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

4. IBM Cloud Object Storage Software Versions Supported

- IBM Cloud Object Storage – all versions

5. Load Balancing IBM Cloud Object Storage Accessor Nodes

The IBM COS system is a breakthrough cloud platform that helps solve petabyte and beyond storage challenges for enterprises worldwide. It uses an innovative and cost-effective approach for storing large volumes of unstructured data while still ensuring scalability, security, availability, reliability, manageability, and flexibility.

- Scalability offers a single storage system and namespace versus an ever-increasing number of limited-capacity storage silos
- Security features include a wide range of capabilities designed to help meet security requirements
- Availability and reliability characteristics of the system are configurable to best suit different use cases and requirements
- Manageability helps enable storage administrators to handle large storage capacity
- Flexibility of a software-defined storage solution that does not require specific or proprietary hardware

For high availability and scalability, IBM recommend that a load balancer is used to distribute client connections to the IBM Accessor node clusters. Load balancers monitor and perform health checks on a node to ensure traffic is routed correctly to healthy nodes. Without the use of a load balancer, an offline or failed node would still receive traffic, causing failures.

A variety of load balancing methods are currently supported by IBM COS Accessor nodes, dependent on customer infrastructure, including layer 4, layer 7, and geo GSLB / location affinity.
Application Prerequisites

Network Time Protocol (NTP) configuration is required for proper operations of an IBM COS system. Time must be synchronized not only among the IBM COS nodes but also across all connecting clients. Typically, the IBM COS manager node synchronizes with an external time source, and all other nodes synchronize with the manager node. It is therefore advised to configure the NTP settings on the load balancer which can be found via the WebUI under Local Configuration > System Date & Time.

Port Requirements

The following table shows the ports used by the IBM Accessor nodes. The load balancer must be configured to listen on the same ports.

<table>
<thead>
<tr>
<th>Port</th>
<th>Protocols</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>80/8080</td>
<td>TCP/HTTP</td>
<td>HTTP &amp; Object Interfaces to Vaults</td>
</tr>
<tr>
<td>443</td>
<td>TCP/HTTPS</td>
<td>HTTPS for dsNet Auth/Registry Data</td>
</tr>
</tbody>
</table>

Deployment Concept

When the IBM Accessor nodes 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 Accessor nodes.

HTTP and HTTPS (SSL Pass-through) load balancing
HTTP and HTTPs (SSL Termination) load balancing

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

Virtual Service (VIP) Requirements
To provide load balancing for IBM COS Accessor nodes the following VIP is required:

- VIP 1: Accessor Cluster

Deployment Mode
As mentioned above, the VIP can be configured using either Layer 4 or Layer 7, depending on the architecture of the network. In this case we recommend using Layer 7 as no network changes are required and SSL termination can be implemented. This mode offers high performance and implementation flexibility, however as Layer 7 is a reverse proxy the client source IP address is not visible at the real server: instead, the IP address of the load balancer is visible at the real server. In order to retain the client source IP address, the load balancer inserts an X-Forwarded-For header into the load balanced traffic, which the IBM Accessor nodes can log for troubleshooting issues while seeing the true source IP address of connecting clients.
6. Loadbalancer.org Appliance – the Basics

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

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

**Note**
Please refer to **The Virtual Appliance - Hypervisor Deployment** and the ReadMe.txt text file included in the VA download for more detailed information on deploying the VA using various Hypervisors.

**Note**
For the VA, 4 NICs are included but only eth0 is connected by default at power up. If the other NICs are required, these should be connected using the network configuration screen within the Hypervisor.

**Initial Network Configuration**
After boot up, follow the instructions on the console to configure the IP address, subnet mask, default gateway, DNS and other network settings.

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

**Accessing the WebUI**
The WebUI is accessed using a web browser. By default, user authentication is based on local Apache .htaccess files. User administration tasks such as adding users and changing passwords can be performed using the WebUI menu option: **Maintenance > Passwords**.

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

**Note**
If required, users can also be authenticated against LDAP, LDAPS, Active Directory or Radius. For more information please refer to **External Authentication**.

1. Using a browser, access the WebUI using the following URL:


2. Log in to the WebUI:

   **Username**: loadbalancer
   **Password**: <configured-during-network-setup-wizard>
Note To change the password, use the WebUI menu option: Maintenance > Passwords.

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

![WebUI screenshot](image.png)

**Note** The WebUI for the VA is shown, the hardware and cloud appliances are very similar. The yellow licensing related message is platform & model dependent.

3. You’ll be asked if you want to run the Setup Wizard. If you click Accept the Layer 7 Virtual Service configuration wizard will start. If you want to configure the appliance manually, simple click Dismiss.

**Main Menu Options**

**System Overview** - Displays a graphical summary of all VIPs, RIPs and key appliance statistics
Local Configuration - Configure local host settings such as IP address, DNS, system time etc.
Cluster Configuration - Configure load balanced services such as VIPs & RPs
Maintenance - Perform maintenance tasks such as service restarts and taking backups
View Configuration - Display the saved appliance configuration settings
Reports - View various appliance reports & graphs
Logs - View various appliance logs
Support - Create a support download, contact the support team & access useful links
Live Chat - Start a live chat session with one of our Support Engineers

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

7. Appliance & IBM Accessor Node Configuration

Appliance Configuration
Configuring VIP1 – Accessor Cluster using SSL Pass-through
a) Setting up the Virtual Service (VIP)
   1. Using the WebUI, navigate to Cluster Configuration > Layer 7 – Virtual Services and click Add a new Virtual Service.
   2. Enter the following details:

   ![Layer 7 - Add a new Virtual Service](image)

   3. Enter an appropriate label (name) for the VIP, e.g. Accessor Cluster.
   4. Set the Virtual Service IP address field to the required IP address, e.g. 192.168.0.200.
   5. Set the Virtual Service Ports field to 443.
   6. Leave Protocol set to TCP.
   7. Click Update.
   8. Click Modify next to the newly created VIP.
9. Set Persistence Mode to None.
10. Set Health Checks to Connect to Port.
11. Click Update.

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

<table>
<thead>
<tr>
<th>Label</th>
<th>Accessor node 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Server IP Address</td>
<td>192.168.0.41</td>
</tr>
<tr>
<td>Real Server Port</td>
<td></td>
</tr>
<tr>
<td>Re-Encrypt to Backend</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>100</td>
</tr>
</tbody>
</table>

   3. Enter an appropriate label (name) for the RIP, e.g. Accessor node 1.
   4. Set the Real Server IP Address field to the IP address of the Accessor node 1.
   5. Click Update.
   6. Repeat these steps to add additional Accessor nodes as real servers as required.

Configuring VIP1 – Accessor Cluster using SSL Termination
a) Setting up the Virtual Service (VIP)
   1. Using the WebUI, navigate to Cluster Configuration > Layer 7 – 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. Accessor_Cluster.

4. Set the Virtual Service IP address field to the required IP address, e.g. 192.168.0.150.

5. Set the Virtual Service Ports field to 80 or 8080.

6. Leave Protocol set to HTTP.

7. Click Update.

8. Click Modify next to the newly created VIP.

9. Set Persistence Mode to None.

10. Set Health Checks to Connect to Port.

11. Click Update.

**Note**

When configuring a layer 7 HTTP mode virtual service the X-Forward-For header is automatically enabled within the Other > Advanced > Set X-Forward-For header to assist in retaining the visibility of the client source IP at the real server.

b) Setting up the Real Servers (RIPs)

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

2. Enter the following details:
3. Enter an appropriate label (name) for the RIP, e.g. **Accessor node 1**.

4. Set the *Real Server IP Address* field to the IP address of the Accessor node 1.

5. Click **Update**.

6. Repeat these steps to add additional Accessor nodes as real servers as required.

**Finalizing the Configuration**

To apply the new settings, HAProxy must be reloaded. This can be done using the button in the blue box at the top of the screen or by using the **Restart Services** menu option:

1. Using the WebUI, navigate to: **Maintenance > Restart Services**.

2. Click **Reload HAProxy**.

**8. Additional Configuration Options & Settings**

**SSL Termination**

SSL termination can be handled in the following ways:

1. On the Real Servers - aka **SSL Pass-through**.

2. On the load balancer – aka **SSL Offloading** *(recommend for IBM COS Accessor Nodes)*.

3. On the load balancer with re-encryption to the backend servers – aka **SSL Bridging**.

In the case of IBM COS Accessor Nodes, it is recommended that SSL be terminated on the load balancer *(SSL offloading)* with **Force to HTTPS** enabled.
SSL termination on the load balancer can be very CPU intensive.

By default, a self-signed certificate is used for the new SSL VIP. Certificates can be requested on the load balancer or uploaded as described in the section below. The default self-signed certificate can be regenerated if needed using the WebUI menu option: SSL Certificate and clicking the Regenerate Default Self Signed Certificate button.

The backend for the SSL VIP can be either a Layer 7 SNAT mode VIP or a Layer 4 NAT or SNAT mode VIP. Layer 4 DR mode cannot be used since stunnel acts as a proxy, and the Accessor node servers see requests with a source IP address of the VIP. However, since the Accessor node servers believe that they own the VIP (due to the loopback adapter configured to handle to ARP problem) they are unable to reply to stunnel.

SSL Termination on the load balancer - SSL Offloading

![SSL Termination Diagram](image)

In this case, an SSL VIP utilizing stunnel is configured on the appliance and an SSL certificate is uploaded and associated to the Virtual Service. Data is encrypted from the client to the load balancer, but is un-encrypted from the load balancer to the backend servers as shown above.

Certificates
If you already have an SSL certificate in either PFX or PEM file format, this can be uploaded to the Load balancer using the certificate upload option as explained below in Uploading Certificates. Alternatively, you can create a Certificate Signing Request (CSR) on the load balancer and send this to your CA to create a new certificate. For more information please refer to Generating a CSR on the Load Balancer.

Uploading Certificates
If you already have a certificate in either PEM or PFX format, this can be uploaded 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. *Cert1*.

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:

   ![](image)

   **Note**
   It's important to backup all of your certificates. This can be done via the WebUI from *Maintenance > Backup & Restore > Download SSL Certificates*.

### Configuring SSL Termination on the Load Balancer

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

2. Set **Associated Virtual Service** to the Accessor Cluster VIP, e.g. *Accessor_Cluster*. This will automatically fill in the label as the VIP name with SSL inserted in front of the VIP name e.g. *SSL-Accessor_Cluster*.
The Associated Virtual Service drop-down is populated with all single port, standard (i.e. non-manual) Layer 7 VIPs available on the load balancer. Using a Layer 7 VIP for the backend is the recommended method although as mentioned earlier, Layer 4 NAT mode and layer 4 SNAT mode VIPs can also be used if required. To forward traffic from the SSL VIP to these type of VIPs, you’ll need to set Associated Virtual Service to Custom, then configure the IP address & port of the required VIP.

3. Leave Virtual Service Port set to 443.
5. Select the required certificate from the SSL Certificate drop-down.
6. Click Update.

Once configured, HTTP traffic will be load balanced by the Layer 7 SNAT mode VIP and HTTPS traffic will be terminated by the SSL VIP, then passed on to the Layer 7 SNAT mode VIP as unencrypted HTTP for load balancing.

Finalizing the Configuration
To apply the new settings, HAProxy and STunnel must both be reloaded. This can be done using the buttons in the blue box at the top of the screen or by using the Restart Services menu option:

1. Using the WebUI, navigate to: Maintenance > Restart Services.
2. Click Reload HAProxy.
3. Click Reload STunnel.

9. Testing & Verification

Note For additional general guidance please also refer to Testing Load Balanced Services.

Using System Overview

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

10. Technical Support

For more details about configuring the appliance and assistance with designing your deployment please don’t hesitate to contact the support team using the following email address: support@loadbalancer.org.
11. Further Documentation


12. Conclusion

Loadbalancer.org appliances provide a very cost effective solution for highly available load balanced IBM Cloud Object Storage environments.
Configuring GSLB / Location Affinity

Conceptual Overview
For multi-site IBM COS deployments, it is possible to use the load balancer’s global server load balancing (GSLB) functionality to provide both high availability and location affinity across multiple sites.

- Clients across multiple sites use the same fully qualified domain name to access the Accessor nodes.
- **Under normal operation**: clients are directed to their local site’s cluster of Accessor nodes.
- **In the event of a local service failure**: clients are automatically directed to a functioning cluster of Accessor nodes at another site. This would happen if the local site’s Accessor node cluster and/or load balancers were offline and unavailable.

For the sake of simplicity, the diagram presented below shows a two site setup. The principle can be extended to encompass as many sites as desired.

**Explanation:**

- **Start**: A client tries to access the IBM COS Accessor node cluster. To do this, the client uses the service’s fully qualified domain name, in this example *gslb.domain.tld*

- The client sends a DNS query for *gslb.domain.tld* to its local DNS server.
The DNS server has the domain gslb.domain.tld delegated to the load balancers.

The DNS server sends a delegated DNS query for gslb.domain.tld to one of the load balancers.

The load balancer that received the delegated DNS query replies to the DNS server. The load balancer answers with the IP address of the VIP (Accessor node cluster) that is local to the DNS server making the query, and hence local to the original client.

An example: if the delegated query from the DNS server originated from the 10.0.0.0/24 subnet then the VIP in that subnet is served up. Likewise, if the delegated query originated from the 172.16.0.0/24 subnet then the VIP in that subnet is served up. As such, clients are always directed to their local, on-site Accessor node instance, provided that the local instance is online and available.

The DNS server sends the delegated DNS answer to the client.

Finish: The client connects to gslb.domain.tld by using the local VIP address.

In the event that the cluster of Accessor nodes and/or load balancers at one site should completely fail then local clients will be directed to the cluster of Accessor nodes at the other site and the service will continue to be available.

Note

This style of multi-site failover is possible because the load balancers' GSLB functionality continuously health checks the service at each site. When the service at a site is observed to be unavailable then that site's IP address is no longer served when responding to DNS queries.

DNS Server Prerequisites

Important Location affinity (ensuring clients 'stick' to their local site) requires a unique DNS server at each site.

For this setup to work and provide location affinity, a unique DNS server is required at each site, like the example deployment shown at the beginning of this section.

If multiple sites share a common DNS server then clients cannot be directed to their local, on-site Accessor node cluster.

Example: Consider a two data centre deployment with a shared, common DNS server located at DC 1. From the perspective of a load balancer in this scenario, every delegated DNS request would be seen to come from the single, shared DNS server at DC 1. Specifically, the requests would all come from the DNS server’s IP address, which would fall within DC 1's subnet.
A load balancer would have no way to distinguish between delegated requests for DC 1’s clients and delegated requests for DC 2’s clients. All delegated requests would originate from within DC 1’s subnet, therefore all traffic would be directed to DC 1’s Accessor node cluster.

To resolve such a situation, a DNS server would need to be deployed at DC 2. The load balancers could then easily tell which site a given delegated DNS query has come from and, therefore, which site the client should be directed to.

If having unique DNS servers per-site and splitting up sites using a topology configuration is not possible then clients will bounce between different VIPs (and hence bounce between sites) in a round-robin fashion. If this behaviour is acceptable then it can theoretically be used without significant issue.

Handling Multiple Subdomains, Including Wildcard Subdomains

Scenario

Some DNS configurations will make use of various DNS subdomains, for example:

- `ibmcos-<region/location>.domain.tld` (e.g. `ibmcos-region1.domain.tld`)

Some scenarios also require the use of wildcard DNS entries, for example to cover bucket specific subdomains like `app-instance-f57ac0.ibmcos-region1.domain.tld`. 
Solution
Configuring DNS delegation can be complex. As such, the supported solution is to:

- Delegate a single subdomain to the load balancer, e.g. gslb.
- Use CNAME records to point everything else at the delegated subdomain

For example, the subdomain gslb.domain.tld would be delegated and everything else would point to it. This would look like so:

<table>
<thead>
<tr>
<th>Subdomain</th>
<th>DNS Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>gslb.</td>
<td>Delegate to the load balancer</td>
</tr>
<tr>
<td>ibmcos-&lt;region&gt;.</td>
<td>CNAME to gslb.domain.tld</td>
</tr>
<tr>
<td>*.ibmcos-&lt;region&gt;.</td>
<td>CNAME to gslb.domain.tld</td>
</tr>
<tr>
<td>ibmcos-admin-console.</td>
<td>CNAME to gslb.domain.tld</td>
</tr>
</tbody>
</table>

This approach simplifies DNS entry configuration, particularly when wildcard entries are involved.

Appliance Configuration
The GSLB service should be configured on the primary load balancer appliance at each site.

Note that the GSLB configuration must be identical across all sites: inconsistent configurations will lead to unexpected behaviour.

Configuration takes place in the WebUI under Cluster Configuration > GSLB Configuration:

**GSLB Configuration**

<table>
<thead>
<tr>
<th>Global Names</th>
<th>Members</th>
<th>Pools</th>
<th>Topologies</th>
<th>New Global Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 1 – Configuring the Global Name

1. Using the WebUI on the primary appliance for the first site, navigate to Cluster Configuration > GSLB Configuration.
2. Select the Global Names tab.
3. Click the New Global Name button.
4. Define a friendly Name for the new hostname, which can just be the subdomain itself, e.g. gslb.domain.tld

**Note**

If only working with a single subdomain then it’s perfectly acceptable to directly delegate the specific subdomain in question, e.g. ibmcos-region1.domian.tld, rather than delegating a generic subdomain like gslb.domain.tld.

5. Define the Hostname of what will be the delegated subdomain, e.g. gslb.domain.tld
6. Click **Submit**.

---

**Step 2 – Configure the Members**

Each *member* can be thought of as a single site.

1. Select the **Members** tab.
2. Click the **New Member** button.
3. Enter a friendly *Name* for the member, e.g. **DC1**.
4. Specify an *IP* address for the member: in this context, this should be the VIP address of the site’s Accessor node cluster, e.g. **10.0.0.2**.
5. Ignore the example value in the *Monitor IP* field.
6. Click **Submit**.
7. Repeat these steps to add additional sites as members as required.
Step 3 – Configure the Pool

A pool must be created to link together a global name with the members that should serve traffic for that global name.

Continuing with the example presented in this section, both sites have a functional Accessor node cluster ready for use. A pool would therefore be created linking the global name `gslb.domain.tld` with members (sites) DC1 and DC2, both of which should serve Accessor traffic.

1. Select the **Pools** tab.
2. Click the **New Pool** button.
3. Enter a friendly **Name** for the pool, e.g. `accessor-sites`.
4. Set the **Monitor** to **HTTP**.
5. Set **Monitor Use SSL** to **Yes**.
6. Set **Monitor Hostname** to a hostname that should respond if the Accessor cluster is online and healthy, e.g. `ibmcos-region1.domain.tld`.
7. Set **Monitor URL Path** to `/`.
8. Set **Monitor Port** to **443**.
9. Set **Monitor Expected Codes** to **200**.
10. Set **LB Method** to **twrr**.
11. From the **Global Names** list box, select the global name in question, e.g. `gslb.domain.tld`.
12. In the **Members** section, drag the appropriate members (sites) from the **Available Members** box into the **Members In Use** box.
13. Click **Submit**.
Step 4 – Configure the Topology

Topology configuration is used to map subnets to sites. This gives the solution its location awareness, allowing clients to be directed to their local Accessor node cluster instead of being bounced between every site which has been defined.

1. Select the Topologies tab.
2. Click the New Topology button.
3. Enter a friendly Name for the topology, e.g. DC1.
4. In the IP/CIDR text box, define the subnet(s) that covers the site in question, e.g. 10.0.0.0/24.

This can be a comma separated list of subnets and hosts, e.g. 10.0.0.0/24, 192.168.2.0/24, 192.168.17.57. The key is that the site’s DNS server and its Accessor node VIP fall within the union of all subnets and hosts defined for the site. This is what allows DNS queries originating from the site to be matched up with that site’s local VIP: the local VIP is then served as a DNS response for clients at that site.
5. Click Submit.

6. Repeat these steps to add additional topology configurations as required.

Step 5 – Finalising the Configuration
To apply the new settings, the GSLB service must be restarted as follows:

1. Using the WebUI, navigate to: Maintenance > Restart Services and click Restart GSLB.

Optional: Defining a Default Site for External Traffic (Handling DNS Requests from Unpredictable Source Addresses)
It is plausible that a Accessor node GSLB deployment may be required to answer DNS queries sourced from outside of the subnets defined in the topology configuration.

Consider a client on the public internet requesting a resource from the Accessor node cluster. The DNS query associated with the request may be sourced from a previously unseen, unpredictable public IP address. DNS queries from IP addresses that do not fall within the predefined network topology/subnets will be answered with DNS records pointing to any of the defined sites in a round-robin fashion.

An alternative is to define a default site. All DNS queries from outside the predefined network topology will be answered with the same DNS record: a record pointing to the default site.

To configure this, add the widest possible subnet of 0.0.0.0/0 to the topology configuration of the site which is to be the 'default'. Any DNS query whose source IP address does not fall within one of the other, smaller subnets will be picked up by this new "catch all" subnet.

Following on from the previous example, setting data centre 1 to be the 'default' site would look like so:
Once the GSLB service has been configured on the primary load balancer at every site, the DNS server at each site must then be configured for GSLB.

The DNS server at each site must be configured to delegate DNS requests for the subdomain in question to the load balancers; the load balancers' GSLB services will serve the appropriate IP addresses to the DNS servers. Using the example presented throughout this section, the DNS server at each site would be configured with a delegation for the domain `gslb.domain.tld`. The domain would be delegated to every load balancer across every site, which provides multi-site redundancy.

Steps walking through creating a DNS delegation on a Microsoft DNS server in the context of setting up GSLB on our appliance can be found in the appendix, in the section **Microsoft DNS Server Configuration**.

### Microsoft DNS Server Configuration

Once the GSLB service has been fully configured on the primary load balancer at every site, as described in the previous sections, the DNS server at each site must be configured for GSLB.

The DNS server at each site must be configured to delegate DNS requests for the subdomain in question to the load balancers; the load balancers' GSLB services will serve the appropriate IP addresses to the DNS servers. Using the example presented throughout this document, the DNS server at each site would be configured with a delegation for the domain `gslb.domain.tld`. The domain would be delegated to every load balancer across every site, which provides multi-site redundancy.

The exact steps for creating a DNS delegation vary between different DNS servers. Presented below are steps that walk through creating a DNS delegation on a Microsoft DNS server in the context of setting up GSLB on our appliance.

### Microsoft DNS Server

Delegating a subdomain in Microsoft DNS Manager is a short process.

1. Open **DNS Manager** and create A records for every load balancer at every site, using `Action > New Host` (e.g. `dc1-lbprimary.domain.tld`, `dc1-lbsecondary.domain.tld`, `dc2-lbprimary.domain.tld`, and...
Provided that the load balancer part of the GSLB configuration has been completed and is working, the **New Delegation** wizard should now be used to delegate the subdomain to the load balancers. The delegation will use the new FQDNs for the load balancers, as defined in the previous step. The delegation wizard is located at **Action > New Delegation**.
3. Test the delegation to make sure it is working as expected.

From the Windows command line, the `nslookup` program can be used to send test DNS queries to the DNS server. The DNS server is located at IP address 10.0.0.50 in the example presented here.

For the first test, use the `-norecurse` option to instruct the DNS server not to query another server for the answer. A successful test would see the DNS server respond and indicate that the subdomain in question is served by another server(s), giving the other server’s details, like so:

```
C:\Users\me>nslookup -norecurse gslb.domain.tld 10.0.0.50
Server: UnKnown
Address: 10.0.0.50
Name:   gslb.domain.tld
Served by:
- dc1-lbprimary.domain.tld    10.0.0.100
  gslb.domain.tld
- dc1-lbsecondary.domain.tld  10.0.0.101
  gslb.domain.tld
- dc2-lbprimary.domain.tld    172.16.0.100
  gslb.domain.tld
- dc2-lbsecondary.domain.tld  172.16.0.101
  gslb.domain.tld
```

For the second test, execute the same command without the `-norecurse` option. This should see the DNS server fetch the answer from the load balancer and then serve up the ‘fetched’ answer in its response. A successful test would see the server reply with the IP address of one of the online sites/services, like so:

```
C:\Users\me>nslookup gslb.domain.tld 10.0.0.50
Server: UnKnown
Address: 10.0.0.50
Non-authoritative answer:
Name:   gslb.domain.tld
Address: 10.0.0.2
```
Alternative Load Balancing Method for Read-Intensive Deployments (Direct Routing)

Direct routing, also known as direct server return or DSR, is a method of load balancing. With direct routing, reply traffic flows directly from the back end servers to the clients. In this way, the load balancer is completely bypassed on the return journey for a given connection, thus removing the load balancer as a potential bottleneck for traffic on the return path.

This alternative method of load balancing can benefit read-intensive deployments which feature a large reply traffic to request traffic ratio. For example, consider the scenario where a typical client request is 10 kB in size while a typical reply is 10 GB in size (perhaps file retrieval or video streaming). Direct routing benefits such scenarios: the much larger volume of reply traffic bypasses the load balancer and is not limited by the load balancer’s network throughput. The reply traffic is instead limited by the total available network bandwidth between the servers and the clients, which is limited only by the underlying infrastructure.

Caveats

There are caveats for using the direct routing load balancing method which should be considered:

- The load balancers must be on the same network segment / switching fabric as the Accessor nodes (due to the fact that this load balancing method works by rewriting MAC addresses, i.e. operates at layer 2 of the OSI model).

- Each Accessor node must own the VIP address so that they can all accept and reply to the load balanced traffic. This address should be assigned to a loopback network adaptor.
• Each Accessor node must be configured to not reply to ARP requests for the VIP address or advertise that they own the address.

For guidance on configuring the Accessor nodes for direct routing, in the context of the caveats described above, please consult with the IBM COS team or Support.

Appliance Configuration for IBM COS Accessor Nodes – Using Layer 4 DR Mode (Direct Routing)

Configuring VIP 1 – Accessor Cluster

Configuring the Virtual Service (VIP)

1. Using the web user interface, navigate to Cluster Configuration > Layer 4 – Virtual Services and click on Add a new Virtual Service.
2. Define the Label for the virtual service as required, e.g. Accessor Cluster.
3. Set the Virtual Service IP Address field to the required IP address, e.g. 192.168.0.167.
4. Set the Ports field to 80.
5. Leave the Protocol set to TCP.
7. Click Update to create the virtual service.
8. Click Modify next to the newly created VIP.
9. Ensure that the Persistence Enable checkbox is unchecked.
10. Set the Health Checks Check Type to Connect to port.
11. Set the Check Port to 80.
12. Click Update.

Defining the Real Servers (RIPs)

1. Using the web user interface, navigate to Cluster Configuration > Layer 4 – Real Servers and click on Add a new Real Server next to the newly created VIP.
2. Define the Label for the real server as required, e.g. accessor-node1.
3. Set the Real Server IP Address field to the required IP address, e.g. 192.168.0.41.
4. Click Update.
5. Repeat these steps to add additional Accessor nodes as real servers as required.

Configuring HA - Adding a Secondary Appliance

Our recommended configuration is to use a clustered HA pair of load balancers to provide a highly available and resilient load balancing solution.

We recommend that the Primary appliance should be configured first, then the Secondary should be added. Once the Primary and Secondary are paired, all load balanced services configured on the Primary are automatically replicated to the Secondary over the network using SSH/SCP.
For Enterprise Azure, the HA pair should be configured first. In Azure, when creating a VIP using an HA pair, 2 private IPs must be specified – one for the VIP when it’s active on the Primary and one for the VIP when it’s active on the Secondary. Configuring the HA pair first, enables both IPs to be specified when the VIP is created.

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

A number of settings are not replicated as part of the Primary/Secondary pairing process and therefore must be manually configured on the Secondary appliance. These are listed by WebUI menu option in the table below:

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

To add a Secondary node - i.e. create a highly available clustered pair:

1. Deploy a second appliance that will be the Secondary and configure initial network settings.
2. Using the WebUI on the Primary appliance, navigate to: Cluster Configuration > High-Availability Configuration.
3. Specify the IP address and the *loadbalancer* user’s password for the Secondary (peer) appliance as shown above.

4. Click *Add new node*.

5. The pairing process now commences as shown below:

6. Once complete, the following will be displayed on the Primary appliance:

7. To finalize the configuration, restart heartbeat and any other services as prompted in the blue message box at the top of the screen.
Clicking the **Restart Heartbeat** button on the Primary appliance will also automatically restart heartbeat on the Secondary appliance.

For more details on configuring HA with 2 appliances, please refer to [Appliance Clustering for HA](#).
## 14. Document Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Change</th>
<th>Reason for Change</th>
<th>Changed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0.0</td>
<td>19 March 2020</td>
<td>Initial version</td>
<td></td>
<td>IBG</td>
</tr>
<tr>
<td>1.0.1</td>
<td>2 September 2020</td>
<td>New title page</td>
<td>Branding update</td>
<td>AH</td>
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<tr>
<td></td>
<td></td>
<td>Updated Canadian contact details</td>
<td>Change to Canadian contact details</td>
<td></td>
</tr>
<tr>
<td>1.1.0</td>
<td>1 November 2021</td>
<td>Converted the document to AsciiDoc</td>
<td>Move to new documentation system</td>
<td>AH, RJC, ZAC</td>
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<tr>
<td>1.2.0</td>
<td>6 April 2022</td>
<td>Updated GSLB set up instructions to use GUI-driven GSLB configuration</td>
<td>GSLB updates across all documentation</td>
<td>AH</td>
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<tr>
<td></td>
<td></td>
<td>Updated DNS server configuration instructions</td>
<td>Changed to use new, consistent common component</td>
<td></td>
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<tr>
<td>1.2.1</td>
<td>22 April 2022</td>
<td>Updated SSL related content to reflect latest software version</td>
<td>New software release</td>
<td>RJC</td>
</tr>
</tbody>
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