Load Balancing Qumulo Hybrid File System

v1.0.2

Deployment Guide
1. About this Guide

This guide details the steps required to configure a load balanced Qumulo Hybrid File System environment utilizing Loadbalancer.org appliances. It covers the configuration of the load balancers and also any Qumulo configuration changes that are required to enable load balancing.

For more information about initial appliance deployment, network configuration and using the Web User Interface (WebUI), please also refer to the Administration Manual.

2. Loadbalancer.org Appliances Supported

All our products can be used for load balancing Qumulo Hybrid File System. 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>
<tr>
<td></td>
<td>Enterprise GCP **</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

- V8.4.1 or later

4. Qumulo Hybrid File System Versions Supported

- V3.0.0 or later
5. Qumulo Hybrid File System

Qumulo’s advanced hybrid file software allows you to symmetrically scale capacity and performance. Work in real-time, without the need for tree walks. Qumulo offers the most efficient file system in the industry, with the best raw-to-useable capacity that leverages 100 percent of useable storage.

Qumulo's file system is built for the hybrid cloud, providing a single file solution whether your data is in the cloud or on-prem or scaling across both. Users can burst compute in AWS or GCP and shift primary workloads to the cloud without application changes.

6. Load Balancing Qumulo Hybrid File System

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

Load Balancing & HA Requirements

The function of the load balancer is to ensure that connections to a Qumulo Hybrid file System cluster are distributed across healthy Qumulo nodes. This is done to provide a highly available and scalable service. To provide HA for the load balancer, Loadbalancer.org recommends that 2 appliances are deployed as an HA clustered pair.

Load Balancer Configuration

Load balancing a Qumulo deployment requires no Virtual Services (VIPS). Instead, both load balancers are configured as smart DNS name servers for the FQDN of the Qumulo cluster address in question (qumulo.company.com in this guide). The is achieved using the load balancer's built-in GSLB service and by using DNS delegation.

Connection Distribution

The GSLB service uses weighted round-robin load balancing to distribute inbound client connections across the healthy Qumulo nodes. The weights for the nodes can be set as required depending on relative node performance.

Health Checks

Each Qumulo node is regularly health-checked by each load balancer and this information is used when providing the smart DNS response to inbound DNS queries.

Note: For more details on configuring DNS delegation please refer to page 9.

7. Deployment Concept

The diagram below illustrates how the load balancer is deployed.
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 1 in the appendix on page 13 for more details on configuring an HA clustered pair.

Explanation:

1. The client sends a DNS query for the service FQDN, e.g. `qumulo.company.com` to the local DNS server
2. The local DNS server has the sub domain delegated to both load balancers (both load balancers are configured as name servers for the sub domain)
3. One of the load balancers receives the delegated DNS query
4. The load balancer selects a healthy Qumulo node based on the GSLB health checks and the round robin algorithm used
5. The load balancer returns the IP address of the selected Qumulo node to the DNS server
6. The DNS server returns the IP address of the selected Qumulo node to the client
7. The client connects directly to the Qumulo node

8. Loadbalancer.org Appliance – the Basics

Virtual Appliance Download & Deployment
A fully featured, fully supported 30 day trial is available if you are conducting a PoC (Proof of Concept) deployment. The VA is currently available for VMware, Virtual Box, Hyper-V, KVM and XEN and has been optimized for each Hypervisor. By default, the VA is allocated 1 CPU, 2GB of RAM and has an 8GB virtual disk. The Virtual Appliance can be downloaded [here](#).

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

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

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

**Method 1 – Using the Network Setup Wizard at the console**
After boot up, follow the instructions on the console to configure the IP address, subnet mask, default gateway and DNS settings.

**Method 2 – Using the WebUI**
Using a browser, connect to the WebUI on the default IP address/port: https://192.168.2.21:9443
To set the IP address & subnet mask, use: `Local Configuration > Network Interface Configuration`
To set the default gateway, use: `Local Configuration > Routing`
To configure DNS settings, use: `Local Configuration > Hostname & DNS`

**Accessing the Web User Interface (WebUI)**
The WebUI can be accessed via HTTPS at the following URL: https://192.168.2.21:9443/lbadmin

* Note the port number → 9443

(replace 192.168.2.21 with the IP address of your load balancer if it’s been changed from the default)
Login using the following credentials:

**Username:** loadbalancer  
**Password:** loadbalancer

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

Once logged in, the WebUI will be displayed as shown below:
9. Appliance Configuration for Qumulo Hybrid File System

**Step 1 – Configure the HA Pair**
If you intend to deploy 2 load balancers in order to configure an HA clustered pair (our recommended configuration) then the HA pair should be configured first before the GSLB configuration takes place. This simplifies the process since GSLB settings will then be automatically replicated to the paired appliance. This helps ensure that both appliances are correctly configured and ready for sub domain delegation (please refer to page 9).

Once the HA pair is configured, the remaining configuration should take place on the master unit, the slave unit will then be kept in sync automatically. For details on configuring an HA pair, please refer to section 1 in the appendix on page 13.

**Step 2 – Configure GSLB**
Using the WebUI of the master appliance, navigate to **Cluster Configuration > GSLB Configuration** and select **Polaris Config** from the drop-down list.

If GSLB has never been configured, the default example configuration will be displayed in the text box.

The example below relates to the 4-node example presented in section 7. This can be copied and pasted to replace the default example and can be used as a basis for creating a deployment-specific configuration.

The elements highlighted in **bold** should be customised to reflect the Qumulo deployment in question. Stanzas should be added or removed as needed under the “members” section to reflect your deployment.

Be sure to click the **Update** button when finished to write the configuration to disk.

---

Note: Indentation is important and must be preserved, otherwise the underlying Polaris GSLB service will throw an error.

```yaml
globalnames:
  qumulo.company.com:
    pool: qumulo-nodes
    ttl: 5

pools:
  qumulo-nodes:
    monitor: tcp
    monitor_params:
      port: 443
      timeout: 2
      interval: 5
      retries: 2
    lb_method: wrr
    fallback: any
    members:
    - ip: 10.0.0.11
      name: qumulo-node1
      weight: 1
    - ip: 10.0.0.12
      name: qumulo-node2
      weight: 1
    - ip: 10.0.0.13
```
Step 3 – Apply the GSLB Configuration

If updating an existing GSLB configuration then simply click the **Reload GSLB** button when prompted.

If setting up the GSLB service for the first time, the service **must** undergo a full **restart** (rather than a reload) for the configuration to be applied. To do this, using the WebUI, navigate to **Maintenance > Restart Services** and click the **Restart GSLB** button. For an HA pair, this procedure to restart the service (rather than reload) **must** also be carried out on the slave appliance.

For any subsequent configuration updates, the GSLB service only needs to be reloaded using the service reload link presented at the top of the WebUI on the master appliance after changes have been made.

Step 4 – Verify the GSLB Configuration

The GSLB configuration should be tested to ensure it’s working as expected and that both master and slave appliances are able to correctly respond to DNS queries for the sub domain. This must be operating correctly when configuring the DNS delegation in the following section.

From a Windows command prompt, the `nslookup` command can be used to send test DNS queries to the load balancers. The master load balancer is located at IP address 10.0.0.1 in the example presented here.

For the test, use the `-norecurse` option to instruct the load balancer **not** to attempt to query another server for the answer. A successful test would see the load balancer respond with the IP address of one of the online Qumulo nodes as shown below:

```
C:\Users\me>nslookup -norecurse qumulo.company.com 10.0.0.1
Server:  Unknown
Address:  10.0.0.1

Name:    qumulo.company.com
Address:  10.0.0.11
```

This test should be repeated using the IP address of the slave unit to ensure that the slave is also able to return the IP address of one of the online Qumulo nodes.

10. DNS Server Configuration for Qumulo Hybrid File System

Once the load balancer’s GSLB service has been fully configured and tested as described in the previous section, the local DNS server must also be configured for GSLB.

The DNS server must be configured to delegate DNS requests for the subdomain in question to the load balancers; the load balancer's GSLB services will then serve the IP address of the selected Qumulo node to the DNS server. Using the

---

Note: The GSLB configuration presented above does not include any Qumulo floating IP addresses. To aid a graceful failover, these addresses can also be added to the GSLB configuration.
example presented throughout this document, the DNS server must be configured with a delegation for the sub domain qumulo.company.com. The sub domain must be delegated to both load balancers if using an HA pair.

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 the load balancer.

**Microsoft DNS Server**

Delegating a subdomain using Microsoft DNS Manager is a straight forward process:

1. Open DNS Manager and create A records for each load balancer using the menu option: Action > New Host (e.g. lbmaster.company.com, IP 10.0.0.1 and lbslave.company.com, IP 10.0.0.2 for an HA pair of load balancers)

2. Provided that the load balancer's GSLB configuration has been completed and tested as described in section 9 on page 8, the New Delegation wizard can now be used to delegate the chosen subdomain (in this guide qumulo.company.com) to the load balancers. The delegation wizard can be started using the menu option: Action > New Delegation.

   Now add each load balancer as a name server for the sub domain as shown below:
11. Testing & Verification
Since the load balancers have no Virtual Services, there is no graphical overview of ‘healthy’ services to check and verify on the System Overview page of the WebUI. Instead, the GSLB configuration should be checked, ensuring that the client is able to resolve the FQDN of the Qumulo deployment via delegation and connect to a healthy Qumulo node.

Verify the DNS Delegation
From a Windows command prompt, the `nslookup` command 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 this 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 other name servers, giving the other server’s details as shown in the example below:

```
C:\Users\me>nslookup -norecurse qumulo.company.com 10.0.0.50
Server:  UnKnown
Address:  10.0.0.50
Name:    qumulo.company.com
Served by:
- lbmaster.company.com
  10.0.0.1
  qumulo.company.com
- lbslave.company.com
  10.0.0.2
  qumulo.company.com
```

Verify the Full DNS Request & Response
Now execute the same command without the `-norecurse` option. This should see the DNS server fetch the answer from one of the load balancers 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 Qumulo nodes as shown in the example below:

```
C:\Users\me>nslookup qumulo.company.com 10.0.0.50
Server:  UnKnown
Address:  10.0.0.50
Non-authoritative answer:
Name:    qumulo.company.com
Address:  10.0.0.11
```

Accessing the Service
A successful test will see the test connection passed directly from the test client to one of the online Qumulo nodes.

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

14. Conclusion
Loadbalancer.org appliances provide a very cost effective solution for highly available load balanced Qumulo Hybrid File System environments.
15. Appendix

1 – Clustered Pair Configuration
To configure an HA pair, follow the steps below:

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

- Using the WebUI of the appliance to be the master, 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.
### 16. 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>23 April 2020</td>
<td>First draft</td>
<td></td>
<td>RJC</td>
</tr>
<tr>
<td>1.0.1</td>
<td>29 April 2020</td>
<td>Various minor updates</td>
<td>Improved readability</td>
<td>RJC</td>
</tr>
<tr>
<td>1.0.2</td>
<td>3 September 2020</td>
<td>New title page</td>
<td>Branding update</td>
<td>AH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Updated Canadian contact</td>
<td>Change to Canadian contact details</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>details</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
About Loadbalancer.org

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