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1. About this Guide

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

- V8.3.8 and later

4. Pharos Blueprint Software Versions Supported

- Pharos Blueprint Enterprise v5.3 & Later

5. Pharos Blueprint

Pharos Blueprint gives you critical insights into your print environment and workflows, empowering you to successfully manage print and its related costs. Blueprint is a single system with the flexibility to work with a mix and match of equipment manufacturers and device models. Blueprint makes it easy to manage your entire print environment. Blueprint delivers secure printing and significant cost savings and waste reduction. It provides the information you need to optimize your equipment fleet, improve employee printing habits, and take meaningful action today and throughout the future.

6. Load Balancing Pharos Blueprint

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

Load Balancing & HA Requirements

2 or more Collector servers are configured to create a load balanced pool. Clients then connect to this pool via Virtual Services (VIPs).
Port Requirements
The following tables show the ports that are load balanced:

<table>
<thead>
<tr>
<th>Port</th>
<th>Protocols</th>
<th>Use</th>
</tr>
</thead>
</table>
| 808  | TCP       | • Server to Server Communications (Analyst to Collector, Collector to Collector)  
• Administrator to Server Communications  
• 808 is used by the Administrator to the TaskMaster. It is encrypted. Anything the Administrator tool wants is pulled by TaskMaster service and given to Administrator over 808 |
| 8080 | TCP       | • Server to Server Communications (Analyst to Collector, Collector to Collector)  
• Administrator to Server Communications  
• 8080 is how Collectors upload their transaction info and provide status update/health check info to the Analyst, and how the Analyst updates its own health check  
• Client to Server Communication (View waiting print jobs) |
| 9001 | TCP       | • Used for inter-server communications between the Pharos Systems Secure Release Service and the MobilePrint Worker service |
| 445  | TCP       | • Microsoft Print/SMB Services |

Pharos Blueprint Deployment Concept

VIP = Virtual IP Addresses
Virtual Service (VIP) Requirements
To provide load balancing and HA for Pharos Blueprint, 4 VIPs are used. Three VIPs for the Pharos Blueprint services, and a fourth for the underlying Microsoft print services.

Supported Load Balancer Deployment Methods
For Pharos Blueprint, both layer 4 DR mode and layer 7 SNAT mode can be used, although for maximum throughput the preferred method is Layer 4 DR Mode (Direct Routing, aka DSR / Direct Server Return). This is a very high performance solution that requires little change to your existing infrastructure. It is necessary to solve “the ARP problem” on the Collector Servers. This is a straightforward process, and is detailed on page 21 in the appendix.

Where it's not feasible to use layer 4 DR mode, layer 7 SNAT mode should be used. Whilst this mode does not have the raw throughput of layer 4 methods, it still enables high performance load balancing and requires no changes to the Collector Servers.

Each Mode is described below.

Layer 4 DR Mode
One-arm direct routing (DR) mode is a very high performance solution that requires little change to your existing infrastructure.

- DR mode works by changing the destination MAC address of the incoming packet to match the selected Real Server on the fly which is very fast
- When the packet reaches the Real Server it expects the Real Server to own the Virtual Services IP address (VIP). This means that you need to ensure that the Real Server (and the load balanced application) respond to both the Real Servers own IP address and the VIP
- The Real Server should not respond to ARP requests for the VIP. Only the load balancer should do this. Configuring the Real Servers in this way is referred to as Solving the ARP Problem. Please refer to page 21 for more information
- On average, DR mode is 8 times quicker than NAT for HTTP, 50 times quicker for Terminal Services and much,
much faster for streaming media or FTP

- The load balancer must have an Interface in the same subnet as the Real Servers to ensure layer 2 connectivity required for DR mode to work
- The VIP can be brought up on the same subnet as the Real Servers, or on a different subnet provided that the load balancer has an interface in that subnet
- Port translation is not possible in DR mode i.e. having a different RIP port than the VIP port
- DR mode is transparent, i.e. the Real Server will see the source IP address of the client

Layer 7 SNAT Mode

Layer 7 SNAT mode uses a proxy (HAProxy) at the application layer. Inbound requests are terminated on the load balancer, and HAPerxy generates a new request to the chosen Real Server. As a result, Layer 7 is a slower technique than DR or NAT mode at Layer 4. Layer 7 is typically chosen when either enhanced options such as SSL termination, cookie based persistence, URL rewriting, header insertion/deletion etc. are required, or when the network topology prohibits the use of the layer 4 methods.

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

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

- SNAT mode is a full proxy and therefore load balanced Real Servers do not need to be changed in any way
- Because SNAT mode is a full proxy any server in the cluster can be on any accessible subnet including across
the Internet or WAN

- SNAT mode is not transparent by default, i.e. the Real Servers will not see the source IP address of the client, they will see the load balancers own IP address by default, or any other local appliance IP address if preferred (e.g. the VIP address), this can be configured per layer 7 VIP. If required, the clients IP address can be passed through either by enabling TProxy on the load balancer, or for HTTP, using X-forwarded-For headers. Please refer to chapter 6 in the Administration Manual for more details.

- SNAT mode can be deployed using either a 1-arm or 2-arm configuration

7. 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 as detailed below:

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.

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

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:
HA Clustered Pair Configuration
Loadbalancer.org recommend that load balancer appliances are deployed in pairs for high availability. In this guide a single unit is deployed first, adding a secondary slave unit is covered in section 2 of the appendix on page 25.

8. Load Balancing Pharos Blueprint – Using Layer 4 DR Mode

**STEP 1 – Prepare the Pharos Blueprint Servers for Load Balancing**

**A) Prerequisites**
For a load balanced Pharos Blueprint environment, each Collector Server must comply with the following requirements:

- Be a member of a Microsoft Windows Domain
- Have the **Print and Document Service** role / **Print Server** service installed
- Have all required printers installed and shared – the share names and permissions must be the same across all servers
- Have Pharos Blueprint installed

**B) Solve The ARP Problem On Each Server**
When using layer 4 DR mode, the “ARP problem” must be solved on each Collector server for DR mode to work. For detailed steps on solving the ARP problem for Windows, please refer to section 1 of the appendix on page 21 for more information.

For a detailed explanation of DR mode and the nature of the ARP problem, please refer to the section that covers layer 4 DR mode on page 6.

**C) Enable Print Server Load Balancing**
To enable the load balanced Collector Servers to be accessed via a shared name (blueprintservice is the example used in this guide), the following steps must be completed:

**Windows 2019**
Host entries must be added to the local hosts file on each Collector Server. For example, if you have 2 Collector Servers: 192.168.81.11 and 192.168.81.12, add the following entries to the hosts files:

**On the 192.168.81.11 server**
192.168.81.11 blueprintservice
192.168.81.11 blueprintservice.yourdomain.com
On the 192.168.81.12 server
192.168.81.12 blueprintservice
192.168.81.12 blueprintservice.yourdomain.com

where blueprintservice is the DNS name clients use to access the load balanced Collector Servers.

Windows 2012 & 2016
Configure the following Registry entries:

Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa
Value: DisableLoopbackCheck
Type: REG_DWORD
Data: 1

Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\lanmanserver\parameters
Value: DisableStrictNameChecking
Type: REG_DWORD
Data: 1

Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\lanmanserver\parameters
Value: OptionalNames
Type: REG_MULTI_SZ
Data: blueprintservice

Note: In the example presented here, blueprintservice is the name that will be used to access the load balanced Collector Servers via the VIPs created on the load balancer. This can be set to any appropriate name. Whatever name is used, it must resolve to the IP address used for the VIPs.

D) Configure Name Resolution
To enable clients to connect via the load balancer, DNS name resolution must be configured. Create a DNS Host (A) record for the printer share name (blueprintservice in this example) that points at the IP address used for the VIPs (192.168.81.10 in this example).
In addition, NetBIOS over TCP/IP should be disabled on all interfaces on each Collector Server as shown below:

E) Reboot Each Server
To apply all settings, reboot each Collector Server.

STEP 2 – Configure the VIPs & RIPv

VIP1 – Port 808

Define the VIP

1. Using the web user interface, navigate to Cluster Configuration > Layer 4 – Virtual Services and click **Add a new Virtual Service**
2. Define the **Label** (i.e. the name) for the virtual service as required, e.g. **PharosBP-808**
3. Set the **Virtual Service IP Address** field to the required IP address, e.g. **192.168.81.10**
4. Set **Ports** to **808**
5. Leave **Protocol** set to **TCP**
6. Leave **Forwarding Method** set to **Direct Routing**
7. Click **Update**
8. Now click **Modify** next to the newly created VIP
9. Scroll down to the **Persistence** section and uncheck the **Enable** checkbox
10. Click **Update**

**Define 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** (i.e. the name) for the Real Server as required, e.g. **Collector1**
3. Set the **Real Server IP Address** field to the required IP address, e.g. **192.168.81.11**
4. Click Update
5. Repeat these steps to add additional Collector Servers as required

VIP2 – Port 8080
- Click Modify next to the PharosBP-808 VIP just created, then click Duplicate Service
- Change the VIP label to an appropriate name, e.g. PharosBP-8080
- Change the VIP Ports to 8080
- Leave all other settings the same
- Click Update to save the new VIP

VIP3 – Port 9001
- Again, duplicate the PharosBP-808 VIP
- Change the VIP label to an appropriate name, e.g. PharosBP-9001
- Change the VIP Ports to 9001
- Leave all other settings the same
- Click Update to save the new VIP

VIP4 – Port 445
- Again, duplicate the PharosBP-808 VIP
- Change the VIP label to an appropriate name, e.g. PharosBP-445
- Change the VIP Ports to 445
- Leave all other settings the same
- Click Update to save the new VIP


STEP 1 – Prepare the Pharos Blueprint Servers for Load Balancing

A) Prerequisites
For a load balanced Pharos Blueprint environment, each Collector Server must comply with the following requirements:
- Be a member of a Microsoft Windows Domain
- Have the Print and Document Service role / Print Server service installed
- Have all required printers installed and shared – the share names and permissions must be the same across all servers
Have Pharos Blueprint installed

B) Enable Print Server Load Balancing
To enable the load balanced Collector Servers to be accessed via a shared name (blueprintservice is the example used in this guide), the following steps must be completed:

**Windows 2019**
Host entries must be added to the local hosts file on each Collector Server. For example, if you have 2 Collector Servers: 192.168.81.11 and 192.168.81.12, add the following entries to the hosts files:

**On the 192.168.81.11 server**
192.168.81.11 blueprintservice
192.168.81.11 blueprintservice.yourdomain.com

**On the 192.168.81.12 server**
192.168.81.12 blueprintservice
192.168.81.12 blueprintservice.yourdomain.com

where blueprintservice is the DNS name clients use to access the load balanced Collector Servers.

**Windows 2012 & 2016**
Configure the following Registry entries:

**Key:** HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa
**Value:** DisableLoopbackCheck
**Type:** REG_DWORD
**Data:** 1

**Key:** HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\lanmanserver\parameters
**Value:** DisableStrictNameChecking
**Type:** REG_DWORD
**Data:** 1

**Key:** HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\lanmanserver\parameters
**Value:** OptionalNames
**Type:** REG_MULTI_SZ
**Data:** blueprintservice
Note: In the example presented here, `blueprintservice` is the name that will be used to access the load balanced Collector Servers via the VIPs created on the load balancer. This can be set to any appropriate name. Whatever name is used, it must resolve to the IP address used for the VIPs.

C) Configure Name Resolution
To enable clients to connect via the load balancer, DNS name resolution must be configured. Create a DNS Host (A) record for the printer share name (`blueprintservice` in this example) that points at the IP address used for the VIPs (192.168.81.10 in this example).

In addition, NetBIOS over TCP/IP should be disabled on all interfaces on each Collector Server as shown below:

D) Reboot Each Server
To apply all settings, reboot each Collector Server.

STEP 2 – Configure the VIPs & RIPv

VIP1 – Port 808
Define the VIP

1. Using the web user interface, navigate to Cluster Configuration > Layer 7 – Virtual Services and click **Add a new Virtual Service**

   - **Label** (i.e. the name) for the virtual service as required, e.g. **PharosBP-808**
   - Set the **Virtual Service IP Address** field to the required IP address, e.g. **192.168.81.10**
   - Set **Ports** to **808**
   - Change **Layer 7 Protocol** to **TCP Mode**
   - Click **Update**
   - Now click **Modify** next to the newly created VIP
   - Scroll down to the **Persistence** section and change **Persistence Mode** to **None**
   - Click **Update**

Define the Real Servers (RIPs)

1. Using the web user interface, navigate to Cluster Configuration > Layer 7 – Real Servers and click on **Add a new Real Server** next to the newly created VIP

   - **Label** (i.e. the name) for the Real Server as required, e.g. **Collector1**

2. Define the **Label** (i.e. the name) for the Real Server as required, e.g. **Collector1**
3. Set the **Real Server IP Address** field to the required IP address, e.g. 192.168.81.11
4. Leave **Real Server Port** blank
5. Click **Update**
6. Repeat these steps to add additional Collector Servers as required

**VIP2 – Port 8080**
- Click **Modify** next to the PharosBP-808 VIP just created, then click **Duplicate Service**
- Change the VIP **label** to an appropriate name, e.g. **PharosBP-8080**
- Change the VIP **Ports** to 8080
- Leave all other settings the same
- Click **Update** to save the new VIP

**VIP3 – Port 9001**
- Again, duplicate the PharosBP-808 VIP
- Change the VIP **label** to an appropriate name, e.g. **PharosBP-9001**
- Change the VIP **Ports** to 9001
- Leave all other settings the same
- Click **Update** to save the new VIP

**VIP4 – Port 445**
- Again, duplicate the PharosBP-808 VIP
- Change the VIP **label** to an appropriate name, e.g. **PharosBP-445**
- Change the VIP **Ports** to 445
- Leave all other settings the same
- Click **Update** to save the new VIP

**Finalize Settings – Reload HAProxy**
To apply settings and activate the new VIPs, click the **Reload** button in the blue box at the top of the screen.

**10. Testing & Verification**

**Testing the Load Balanced Servers**
The load balanced servers can be tested either by browsing to the chosen DNS name, in this guide **blueprintservice**.

e.g.
\blueprintservice
\blueprintservice.yourdomain.com

The shared printers that have been configured on the Collector Servers should be visible. Open/connect to the shared printers.

**Using System Overview**

The System Overview can be viewed in the WebUI. It shows a graphical view of all VIPs & RIPs (i.e. the Pharos Blueprint servers) and shows the state/health of each server as well as the state of the each cluster as a whole.

The example below shows that all Real Servers are healthy and available to accept connections.

![System Overview](image)

*Note:* This example shows layer 7 VIPs. A layer 4 configuration will look very similar.

If a particular server fails its health check, that server will be displayed red rather than green.
11. 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.

12. Further Documentation
The Administration Manual contains much more information about configuring and deploying the appliance. It's available here: https://www.loadbalancer.org/products

13. Conclusion
Loadbalancer.org appliances provide a very cost effective solution for highly available load balanced Pharos Blueprint environments.
14. Appendix

1 - Solving the ARP Problem

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

The steps below are for Windows 2012/2016/2019.

**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

![Add Hardware dialog box](image)

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.

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

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

5. If configuring IPv4 addresses select **Internet Protocol Version (TCP/IPv4)**, click **Properties** and configure the IP address to be the same as the Virtual Service (VIP) with a subnet mask of 255.255.255.255, e.g. 192.168.2.20/255.255.255.255 as shown below:
6. If configuring IPv6 addresses select Internet Protocol Version (TCP/IPv6), click Properties and configure the IP address to be the same as the Virtual Service (VIP) and set the Subnet Prefix Length to be the same as your network setting, e.g. 2001:470:1f09:e72::15/64 as shown below:

7. Click OK on TCP/IP Properties, then click Close on Ethernet Properties to save and apply the new settings.

8. Now repeat the above process on the other Real Servers.
Step 3: Configure the strong/weak host behavior

To configure the correct strong/weak host behavior for Windows 2012/2016/2019, 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.

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

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

2. Now repeat these 4 commands on the other Real Servers

2 – Clustered Pair Configuration – Adding a Slave Unit
If you initially configured just the master unit and now need to add a slave – our recommended procedure, please refer to the relevant section below for more details:

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

   • Hostname & DNS settings
   • Network settings including IP addresses, bonding configuration and VLANs
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

![Create a Clustered Pair](image)

- 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:

![Create a Clustered Pair](image)

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

![High Availability Configuration - Master](image)

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.
## 15. Document Revision History

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<thead>
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<th>Version</th>
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<th>Change</th>
<th>Reason for Change</th>
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<tr>
<td>1.0.0</td>
<td>3rd March 2021</td>
<td>Initial version</td>
<td></td>
<td>RJC</td>
</tr>
<tr>
<td>1.0.1</td>
<td>25th March 2021</td>
<td>Added section &quot;Loadbalancer.org Appliance – the Basics&quot;</td>
<td>Not included in the initial version</td>
<td>RJC</td>
</tr>
</tbody>
</table>
About Loadbalancer.org

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

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