High Availability for Desktop Virtualization

How to provide a comprehensive, end-to-end high-availability strategy for desktop virtualization.
Contents

Introduction ......................................................................................................................... 3
Local Availability .................................................................................................................. 3
Operating System Delivery ................................................................................................. 4
  TFTP ................................................................................................................................. 4
  BootStrap .......................................................................................................................... 7
Provisioning Services High-Availability ............................................................................... 8
Desktop Delivery ................................................................................................................. 9
  Load Balancing .................................................................................................................. 9
Farm Configuration ............................................................................................................. 10
Application Delivery .......................................................................................................... 11
  Load Balancing .................................................................................................................. 12
Virtual Desktop Configuration ............................................................................................. 13
Remote Access ................................................................................................................... 14
Section Summary ............................................................................................................... 15
Global Availability .............................................................................................................. 15
  Global Server Load Balancing .......................................................................................... 15
Site Roaming ........................................................................................................................ 19
Disaster Recovery .............................................................................................................. 21
Summary .............................................................................................................................. 22
Revision History ................................................................................................................ 23
Introduction

Providing high-availability to a XenDesktop environment provides the level of assurance organizations need when moving towards a desktop virtualization solution. Because the desktop operating environment is no longer on the endpoint, but is instead within the data center, a failure of one component has the potential to impact hundreds or thousands of users. This is a risk with any desktop virtualization solution. Because of this fact, XenDesktop is built around fault tolerant components that can be further enhanced with Citrix NetScaler to provide disaster recovery and business continuity.

This Implementation Guide shows how to provide high-availability, disaster recovery and business continuity to a XenDesktop environment. The document is divided into the following sections:

- Local Availability: Configure the XenDesktop components in a highly-available configuration
- Global Availability: Configure the XenDesktop architecture to provide the best delivery for users, regardless of location
- Disaster Recovery/Business Continuity: Provide XenDesktop users with a fallback solution in the event of a major outage.

Section 1: Local Availability

In many enterprise-level XenDesktop implementations, the architecture typically incorporates redundancy, as shown in the following diagram:

![XenDesktop Architecture Diagram]

Although the core XenDesktop infrastructure contains redundancy, there are portions where components are only used in the event of a failure of the primary (dotted lines). For example, redundant Web Interface servers are recommended, but there must be a way for connections to be
routed to the secondary in the event of a failure of the primary. Also, there must be redundant TFTP servers used to deliver the initial bootstrap file.

The Local Availability section of this document focuses on how to enable the high-availability features of XenDesktop as well as utilize NetScaler to provide greater levels of availability through the use of smart monitors and intelligent load balancing. Once configured, redundant-backup links are removed as NetScaler directs requests appropriately, as shown in the following diagram:

The configuration steps that follow, focus on:

- Operating System Delivery
- Desktop Delivery
- Application Delivery

**Operating System Delivery**

Delivering the operating system to the desktop requires proper high-availability configuration of the following items:

- TFTP
- Bootstrap
- Provisioning services

**TFTP**

The operating system delivery is based on Provisioning services streaming. When a desktop receives a DHCP response with option 66 (TFTP server name) set, the virtual desktop contacts the TFTP server for boot instructions. DHCP only allows a single address in option 66. Using the following instructions creates a virtual address that is load balanced across many different TFTP servers.
<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot](description) | **Connect to the NetScaler by entering the NetScaler’s IP Address (NSIP) in the web browser:**
http://172.17.1.23

- Log into the Configuration system with the ID and Password
In order to load balance TFTP services, the servers hosting the service must first be defined by doing the following:
- Select the **Load Balancing -> Servers** in the left-hand menu item.
- Select **Add** from the bottom menu bar

| ![Screenshot](create-server) | **In the **Create Server** window, enter in the following information for the first Provisioning services server:**
- Server Name: **PVS1**
- IP Address: **172.16.0.54**
- Select **Create**
- For the second Provisioning services server, enter in the following:
  - Server Name: **PVS2**
  - IP Address: **172.16.0.55**
  - Select **Create**
- Select **Close**

| ![Screenshot](create-service-group) | **A new service group must be created for the services to be load balanced. The service group creation process is as follows:**
- Select **Service Group** from the left hand column
- Select **Add**

| ![Screenshot](create-service-group2) | **In the **Create Service Group** window, do the following**
- Enter in a name for the group: **ServiceGroup_TFTP**
- Select the correct Protocol: **Any**
- Change the Specify Members to **Server Based**
- Select the TFTP servers created earlier
- Enter in the correct port: * (the * means any port)
- Select **Add**

| ![Screenshot](create-service-group3) | - Select the **Monitors** tab
- Select the following monitor: **Ping**
- Select **Add**
**TFTP**

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Advanced tab](image1.png) | - Select the Advanced tab  
- Enable the Use Source IP in the settings section  
- Select OK  
When the TFTP service receives a request, the TFTP service makes a new connection to the endpoint. By selecting "Use Source IP", NetScaler passes the TFTP service the endpoints source IP instead of the NetScaler IP. |
| ![Virtual Servers](image2.png) | The final part for configuring the load balancing solution for TFTP is to bind the Service Group to a vServer. This is done by the following:  
- Select Virtual Servers in the left column  
- Select Add in the bottom menu |
| ![Create Virtual Server](image3.png) | In the Create Virtual Server (Load Balancing) screen, do the following:  
- Enter in a valid name: VS_TFTP  
- Select the Protocol: Any  
- Enter in the virtual IP Address: 172.16.0.74  
- Enter in a valid port: * (means any port)  
- Select Service Group tab  
- Select and mark Active: ServiceGroup_TFTP |
| ![Methods and Persistence](image4.png) | - Select Methods and Persistence tab  
- Select Source IP in the Persistence section  
- Select Create |
On the DHCP server, the **Boot Server Host Name** (Option 66) must use the Virtual IP assigned to the virtual load balancing server: **172.16.0.74**

When DHCP clients request their IP information, DHCP uses the 172.16.0.74 address. The client requests TFTP services from the virtual address. NetScaler, upon receiving the request, forwards the request to the appropriate TFTP server.

### BootStrap

The TFTP service delivers the bootstrap file to the client. The bootstrap file (ARDBP32.BIN) is used by the client to make an initial connection to the Provisioning services farm. The Provisioning services farm compares the client’s MAC address to the farm database. When the lookup is complete, a Provisioning services server and vDisk image are identified. This information is used by the client to boot the operating system. The bootstrap file can include multiple addresses (up to 4) and is configured as shown:

#### Bootstrap

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot](image1.png) | - Connect to the Provisioning services server and launch the console.  
- Select Farm – Sites – SiteName – Servers – ServerName  
- Select Action – Configure Bootstrap |
| ![Screenshot](image2.png) | In the **Configure Bootstrap** window, enter in the following:  
- Select Add  
- Add the IP address for the other servers that are hosting the bootstrap file.  
- Once the IP Address is entered, select **OK**  
- Repeat for the other servers hosting the bootstrap file (maximum of 4) |
Provisioning Services High-Availability

Once the TFTP and Bootstrap are configured for high-availability, endpoints are assured an initial connection to a Provisioning services server. However, once the connection is established, there is the potential that the Provisioning services server becomes unavailable. This can be overcome with the integrated high-availability option, which is configured as follows:

**Provisioning Services High-Availability**

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Screenshot" /></td>
<td>Select the other servers hosting the Bootstrap file and repeat the previous two steps to configure that server’s bootstrap file.</td>
</tr>
</tbody>
</table>

1. **Provisioning Services High-Availability**

   **Screenshot**
   ![Screenshot](image2)
   **Description**
   Within the Provisioning Services console, do the following:
   - Select *Farm – Stores – StoreName*
   - Right click on the store and select *Properties*

   **Screenshot**
   ![Screenshot](image3)
   **Description**
   Within the *Store Properties* window, do the following:
   - Select the Provisioning services servers that are part of the highly available group
   - Select *OK*
**Provisioning Services High-Availability**

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot](image1) | - With the store still selected in the left column, select the appropriate image in the right-side of the console.  
- Right-click the image and select **Properties** |
| ![Screenshot](image2) | In the vDisk properties window, do the following:  
- Select **Edit File Properties**  
- Select **Options**  
- Enable **High Availability (HA)**  
- Select **OK**  
If the Provisioning services server fails, the targets receiving the stream tries to reacquire the stream from another server. Because the vDisk image is in a disk store served by multiple servers, the stream automatically fails over to another available server. |

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**Desktop Delivery**

Utilizing redundant Web Interface servers requires users to remember multiple addresses or dictates the need for a load balancing solution. Intelligent load balancing with NetScaler prevents users from being directed to servers with inactive services. Before NetScaler directs a user request to a Web Interface server, NetScaler uses the built-in monitors to validate the services are functioning properly. The configuration is as follows:

**Load Balancing**

NetScaler is used to improve detection of potential problems with the initial access components of XenDesktop. By utilizing NetScaler’s XenDesktop load balancing wizards, the XenDesktop Web Interface and desktop controllers are monitored. The results of the monitors are subsequently used to make load balancing decisions for new user requests. The configuration of the NetScaler is as follows:
XenDesktop Load Balancing

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot 1](image1.png) | Within the NetScaler console
- Select Load Balancing – Load Balancing wizard for Citrix XenDesktop |
| ![Screenshot 2](image2.png) | In the Load Balancing Wizard for Citrix XenDesktop, do the following for the Load Balance WI servers portion
- Select Next
- Enter in the virtual IP address: 172.16.0.70
- Verify the Port is correct: 80
- Verify the Protocol is correct: HTTP
- Add the Web Interface servers IP address
  - 172.16.0.51
  - 172.16.0.53
- Verify the Site Path is correct: /Citrix/DesktopWeb/site/default.aspx
- Select Next |
| ![Screenshot 3](image3.png) | In the Load Balancing Wizard for Citrix XenDesktop, do the following for the Load Balance DDC servers portion
- Enter in the virtual IP address: 172.16.0.71
- Verify the Port is correct: 80
- Verify the Protocol is correct: HTTP
- Add the Web Interface servers IP address
  - 172.16.0.50
  - 172.16.0.52
- Select Next
- Select Finish |

Farm Configuration

Now that there are virtual IP addresses created corresponding to the load balanced pool, those virtual addresses are used within the Web Interface configuration for the XenDesktop farm.

<table>
<thead>
<tr>
<th>XenDesktop Farm Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Screenshot 4" /></td>
<td></td>
</tr>
</tbody>
</table>
Application Delivery

Following the same path as the desktop delivery section, the application delivery requires redundant Web Interface servers to ensure availability. Intelligent load balancing with NetScaler prevents users from being directed to servers with inactive services or requiring users to remember multiple addresses, thus providing a more seamless user experience. Before NetScaler directs a user request to a Web Interface server, NetScaler uses the built-in monitors to validate the services are functioning properly. The configuration is as follows:
Load Balancing

NetScaler is used to improve detection of potential problems with the initial access components of XenApp. By utilizing NetScaler’s XenApp load balancing wizards, the XenApp Web Interface and XML brokers are monitored. The results of the monitors are subsequently used to make load balancing decisions for new user requests. The configuration of the NetScaler is as follows:

<table>
<thead>
<tr>
<th>XenApp Load Balancing</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot](image1.png) | Within the NetScaler console  
• Select Load Balancing – Load Balancing wizard for Citrix XenApp |
| ![Screenshot](image2.png) | In the Load Balancing Wizard for Citrix XenApp, do the following for the Load Balance WI servers portion  
• Select Next  
• Enter in the virtual IP address: 172.16.0.72  
• Verify the Port is correct: 80  
• Verify the Protocol is correct: HTTP  
• Add the Web Interface servers IP address  
  ○ 172.16.0.57  
  ○ 172.16.0.59  
• Verify the Site Path is correct: /Citrix/XenApp/site/default.aspx  
• Select Next |
| ![Screenshot](image3.png) | In the Load Balancing Wizard for Citrix XenApp, do the following for the Load Balance XML Broker servers portion  
• Enter in the virtual IP address: 172.16.0.73  
• Verify the Port is correct: 80  
• Verify the Protocol is correct: HTTP  
• Add the Web Interface servers IP address  
  ○ 172.16.0.56  
  ○ 172.16.0.58  
• Verify Application Name is correct  
• Select Next  
• Select Finish |

Farm Configuration

Now that there are virtual IP addresses created corresponding to the load balanced pool, those virtual addresses are used within the Web Interface configuration for the XenApp farm.
XenApp Farm Configuration

**Screenshot**

Within the Citrix Access Management console

- Select Citrix Resources – Configuration Tools – Web Interface
- Select the appropriate resource
- Select Manage Server Farms

**Description**

- Highlight the appropriate server farm and select Edit
- Remove the static address and replace with the virtual address for the DDC created on NetScaler: 172.16.0.73.
- Select OK
- Select OK

Virtual Desktop Configuration

Once connected to a virtual desktop, application enumeration requests should be directed to the virtual IP address for the XenApp Web Interface servers. If Citrix Receiver is incorporated into the virtual desktop image, then a new Receiver configuration is required that points to the correct IP address.
Remote Access

In many situations, users originate from an external location, thus requiring them to have secure remote access to the internal network. Using of Access Gateway, integrated on the NetScaler, provides a highly available single site as follows:

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot 1](image1) | **Within the NetScaler console**
- Select **Access Gateway – Virtual Server**
- Select the appropriate virtual server in the right window
- Select **Open** |
| ![Screenshot 2](image2) | - Select the **Policies** tab
- Select the appropriate policy
- Select **Modify Policy** |
| ![Screenshot 3](image3) | - Select **Modify** next to the **Request Profile** dropdown |
Within the Configure Access Gateway Session Profile screen
- Select the Published Applications tab
- Update the Web Interface Address with the virtual load balanced IP address for the XenDesktop Web Interface server: 172.16.0.70
- Select OK
- Select OK
- Select OK

Section Summary

At this point, all components within the site are configured for high availability. The same processes should be conducted at the remaining sites. Once this is complete, each site should be tested for availability and fault tolerance before continuing onto the global availability.

Global Availability

With the potential a user accessing the environment from any location and across multiple data centers, there is a need to provide the user with the correct access point. The first part of this process is to get the user to an entry point without requiring multiple addresses or workflows. Secondly, users must be directed to the data center that contains their resources in order to provide the best user experience. The configuration of global availability is discussed in the following sections:

- Global Server Load Balancing
- Site roaming

Global Server Load Balancing

The global server load balancing configuration allows a user to enter in a single fully-qualified domain name and have that address direct them to an available site. This configuration is done with NetScaler deployed within each data center as the following figure shows.
The configuration is as follows:

**Global Server Load Balancing Configuration (XenDesktop)**

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot 1](image1.png) | Within the **NetScaler** console  
  - Select **GSLB – GSLB Wizard for Citrix XenDesktop**  
  - Select **Next** on the opening screen |
| ![Screenshot 2](image2.png) | Within the **Specify GSLB domain** screen  
  - Enter a valid fully qualified domain name. This is the address users will enter within their browser.  
  - Select **Next** |
| ![Screenshot 3](image3.png) | Within the **Configure GSLB Sites** screen  
  - Select **Add Local Site** |
| ![Screenshot 4](image4.png) |  
  - Enter in the Site IP address (NetScaler MIP)  
  - Enter in a Site Name  
  - Select the Access Gateway virtual server  
  - Enter in the Web Interface virtual IP address and port: 172.16.0.70:80  
  - Enter in the Web Interface Site path: /Citrix/DesktopWebExternal/site/default.aspx  
  - Enter in the Desktop Delivery Controller Server virtual address and port: 172.16.0.71:80  
  - Select **Create** |
Global Server Load Balancing Configuration (XenDesktop)

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Remote Site Configuration](image) | - Select Remote Sites  
- Enter in the Site IP Address: 172.16.0.26  
- Enter in the Site Name: 172.16.0.26_site  
- Enter the Access Gateway Server and Port: 172.16.0.29 port 443  
- Enter the Web Interface Server and Port: 172.16.0.80 port 80  
- Enter the Desktop Delivery Controller Server and Port: 172.16.0.81 port 80  
- Select Create |

Repeat this process on the NetScaler devices located within the DMZ for the remaining sites.

At this point in the configuration, NetScaler is providing global server load balancing based on the availability of the XenDesktop controller and Web Interface server at the site. If XenDesktop is being used in conjunction with XenApp, then the following should be done to the global server load balancing configuration.

Global Server Load Balancing Configuration (XenApp)

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![NetScaler Console](image) | Within the NetScaler console  
- Select Load Balancing – Monitors  
- Select Add |

The first monitor scans the local site’s XenApp Web Interface site. It is configured as follows:  
- Name: XA_172.16.0.72_80_gslbmn  
- Type: Citrix-Web-Interface  
- Destination IP: 172.16.0.72  
- Destination Port: 80
Global Server Load Balancing Configuration (XenApp)

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot](image1) | • Select the **Special Parameters** tab  
• Configure the Site Path: \Citrix\XenApp\site\default.aspx  
• Select Create |
| ![Screenshot](image2) | The second monitor scans the remote site’s XenApp Web Interface site. It is configured as follows:  
• Name: XA_172.16.0.82_80_gslbmn  
• Type: Citrix-Web-Interface  
• Destination IP: 172.16.0.82  
• Destination Port: 80  
• Select the **Special Parameters** tab  
• Configure the Site Path: \Citrix\XenApp\site\default.aspx  
• Select Create |
| ![Screenshot](image3) | The third monitor scans the local site’s XenApp XML Broker service. It is configured as follows:  
• Name: XA_172.16.0.73_80_gslbmn  
• Type: Citrix-XML-Service  
• Destination IP: 172.16.0.73  
• Destination Port: 80  
• Select the **Special Parameters** tab  
• Configure the Application Name: **Notepad**  
• Select Create |
| ![Screenshot](image4) | The fourth monitor scans the remote site’s XenApp XML Broker service. It is configured as follows:  
• Name: XA_172.16.0.83_80_gslbmn  
• Type: Citrix-XML-Service  
• Destination IP: 172.16.0.83  
• Destination Port: 80  
• Select the **Special Parameters** tab  
• Configure the Application Name: **Notepad**  
• Select Create |
| ![Screenshot](image5) | • Select **GSLB – Services**  
• Select the local site’s service and select **Open** |
Global Server Load Balancing Configuration (XenApp)

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Monitor Tab](image1.png) | • Select the **Monitors** tab  
  • Select the two XenApp monitors for the local site and select **Add**  
  • Select **OK**  
  This process assigns the two XenApp monitors to the local site’s service. In order for the local site to be considered available, the following must be active:  
  1. Access Gateway  
  2. XenDesktop Web Interface site  
  3. XenDesktop Controller  
  4. XenApp Web Interface site  
  5. XenApp XML Broker |
| ![Remove Site Service](image2.png) | • Select the remove site’s service and select **Open** |
| ![Monitor Tab](image3.png) | • Select the **Monitors** tab  
  • Select the two XenApp monitors for the remote site and select **Add**  
  • Select **OK**  
  Repeat this process for the remote site(s). |

Site Roaming

The global server load balancing configuration allows users to use a single address and gain access to the environment. There are situations where NetScaler directs a user to one data center but the user’s virtual desktop is running in another data center, along with their profile and data. The following diagram shows what could happen if site roaming is not utilized.
As can be seen, the user accesses a virtual desktop in one data center. The virtual desktop must then traverse the WAN link to access the user data, resulting in a poor user experience. In these situations, it is advisable to utilize the site roaming feature of Web Interface, which redirects a user’s virtual desktop request to an appropriate site as shown in the following diagram.

As can be seen, virtual desktop to user data communication stays local, thus improving the user experience. The site roaming feature is configured as follows:

<table>
<thead>
<tr>
<th>Site Roaming Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screenshot</strong></td>
<td>On a domain controller, access the <strong>Active Directory Users and Computers</strong> utility</td>
</tr>
<tr>
<td></td>
<td>- Create a Group for each data center site</td>
</tr>
<tr>
<td></td>
<td>- Provide a valid and descriptive name</td>
</tr>
<tr>
<td></td>
<td>- Populate the group with the appropriate users</td>
</tr>
<tr>
<td></td>
<td>The Active Directory group links a set of users with a particular data center, thus defining the user’s preferred, or “Home”, data center.</td>
</tr>
</tbody>
</table>
Site Roaming Configuration

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot](image1.png) | On a Web Interface server  
- Navigate to: `C:\inetpub\wwwroot\Citrix\siteName\conf`  
- Open the file: `WebInterface.conf`  
- Find the line that starts with `Farm1`  
- Add a new line to define the XenDesktop farm in the second site:  
  `Farm2=172.16.0.81,Name=XenDesktop Site 2, etc,etc`  
  **Note:** the `Farm1` line can be copied and pasted to simplify configuration. Simply change the prefix `Farm(n)`, address and name. |
| ![Screenshot](image2.png) | Add the following new line:  
  `Farm1Groups=domain\group_name`
  `Farm2Groups=domain\group_name`  
  **Note:** Each farm should have a corresponding group entry and each `FarmNGroup` can contain multiple Active Directory groups. |
| ![Screenshot](image3.png) | Disaster Recovery  
The final step to provide a high-availability solution is to incorporate disaster recovery. The global server load balancing configuration with NetScaler directs users to sites with availability of components, but if that site is not able to support a disaster recovery scenario or the user is not allowed virtual desktops from the site, a failover farm can be configured and used. The configuration is as follows: |

Site Failover Configuration

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Screenshot](image4.png) | Within the `WebInterface.conf` file add the following new line:  
  `RecoveryFarm1=address, name, etc`  
  If the Web Interface is unable to identify a resource for the user based on the Site Roaming configuration, the user will be directed to resources within the Recovery Farm configuration. |
Summary

A robust high-availability solution is incorporated within the XenDesktop infrastructure. However, the base high-availability options often leave resources unused until failure occurs. Incorporating the intelligent load balancing solution of NetScaler allows for a greater level of availability.

For implementations requiring a global disaster recovery option, a desktop virtualization solution must be capable of

- Always providing a user with a desktop
- Linking the user’s desktop location with the data location
- Provide a process to supply a desktop in the event of a data center failure

Without this level of availability, users will be left without a desktop and without a way to do their job.
Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Change Description</th>
<th>Updated By</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Document released</td>
<td>Daniel Feller – Lead Architect</td>
<td>October 26, 2009</td>
</tr>
</tbody>
</table>

About Citrix

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