Deploying Oracle ZFS Storage Appliance
Virtual Storage Manager Plug-in for VMware vSphere 5.x
Deploying Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere 5.x

Introduction ................................................................. 2
Overview of System Components ................................... 3
Virtual Storage Manager Plug-in for VMware vSphere Overview ..... 4
Oracle ZFS Storage Appliance Configuration .................. 5
  Role Configuration for Virtual Storage Manager Plug-in ...... 5
Installing and Configuring the Oracle ZFS Storage Appliance
Virtual Storage Manager Plug-in for VMware vSphere .......... 9
  Plug-in Installation and Configuration ......................... 10
NFS Share Provisioning .................................................. 16
ISCSI and Fibre Channel LUN Provisioning ...................... 20
Accessing Oracle ZFS Storage Analytics ..................... 24
Conclusion .................................................................. 26
Appendix A: Benchmark Results .................................. 27
  SPC-2 Results .......................................................... 27
Appendix B: References ................................................. 27
Introduction

Data storage provisioning can be challenging in virtualized environments and, if not performed adequately, can lead to problems impacting those environments. By integrating the Oracle ZFS Storage Appliance with the VMware vSphere environment, the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere helps VMware administrators easily administer, manage and monitor data storage provisioning tasks for the VMware virtual environment. These tasks include allocating data storage, provisioning new LUNs, creating new Network File System (NFS) datastores, and presenting those datastores to the VMware environment. Working with both block and file levels, the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere permits the VMware administrator to gather and present shares and projects as well as access analytics from Oracle ZFS Storage Appliances as well as perform (LUNs and shares) resizing, creation and deletion operations from a single point of view through VMware vSphere vCenter server.

This white paper provides the best practices and considerations for deploying the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere to achieve correct configuration and reach optimal I/O performance and throughput for the VMware vSphere deployments using Oracle ZFS Storage Appliance.

The outlined storage considerations and recommendations highlight configuration and tuning options for VMware NFS protocols, disk layout recommendations, and correct design of IP network infrastructure for a VMware vSphere 5.x environment working with Oracle ZFS Storage Appliance.

Highlighted in this paper are:

- Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere overview and considerations
- Deploying Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere
- Overview of Fibre Channel, iSCSI and NFS (LUNs and datastores) configuration through Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere
- Provisioning considerations and recommendations for block and file through Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere
Overview of System Components

The following tables describe the hardware configuration, operating systems, and software releases utilized by the systems under test in this white paper.

TABLE 1. HARDWARE USED IN REFERENCE ARCHITECTURE

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>QUANTITY</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>1 cluster (2 controllers)</td>
<td>Oracle ZFS Storage ZS3-2 cluster</td>
</tr>
<tr>
<td></td>
<td></td>
<td>256 gigabytes (GB) direct random access memory (DRAM) per controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Four x 20 3-terabyte (TB) disk drivers - Oracle Storage Drive Enclosure DE2-24C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Four x 10 gigabit Ethernet (GbE) network interface cards (NICs) (per controller)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Four x 73 GB log devices</td>
</tr>
<tr>
<td>IP Network Switch</td>
<td>2</td>
<td>10 GbE network switch</td>
</tr>
<tr>
<td>(For NFS and iSCSI protocols)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibre Channel</td>
<td>2</td>
<td>8 Gigabits per second (Gbps)</td>
</tr>
<tr>
<td>Switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VMware ESXi</td>
<td>1</td>
<td>x86 system with 512 GB of memory</td>
</tr>
<tr>
<td>Hypervisor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 2. VIRTUAL MACHINE COMPONENTS USED IN REFERENCE ARCHITECTURE

<table>
<thead>
<tr>
<th>OPERATING SYSTEM</th>
<th>QUANTITY</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle Linux 6.2</td>
<td>1</td>
<td>Linux Virtual Machine</td>
</tr>
<tr>
<td>Microsoft Windows 2012</td>
<td>2</td>
<td>Windows Virtual Machine</td>
</tr>
</tbody>
</table>
TABLE 3. SOFTWARE USED IN REFERENCE ARCHITECTURE

<table>
<thead>
<tr>
<th>SOFTWARE</th>
<th>VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oracle ZFS Storage Appliance Software</td>
<td>2013.1.2.x</td>
</tr>
<tr>
<td>VMware vCenter Server</td>
<td>5.5u1</td>
</tr>
<tr>
<td>VMware ESXi hypervisor software</td>
<td>5.5u1</td>
</tr>
</tbody>
</table>

Virtual Storage Manager Plug-in for VMware vSphere Overview

Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere supports Windows 2008/R2, Windows 2012/R2 releases as well as VMware vSphere vCenter server, and VMware vSphere Client releases 5.x (including all VMware update releases such as updates 1 and 2).

NOTE: Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere requires a set of specific permissions on the Oracle ZFS Storage Appliance which are set through the Oracle ZFS Storage Appliance role tab. These permissions are listed in the plug-in configuration section.

Figure 1 presents the environment overview used for this white paper.

Figure 1. Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere – Environment Overview
Oracle ZFS Storage Appliance Configuration

The example architecture used in this white paper reflects the following configuration on the Oracle ZFS Storage Appliance:

- Oracle ZFS Storage Appliance in Active/Active mode
- Oracle ZFS Storage Appliance Software release 2013.1.2.x or greater

Note: The Oracle ZFS Storage Appliance Software releases can be downloaded from the following URL:


- Oracle ZFS Storage Appliance controllers with 256 GB of DRAM (L1ARC) cache per controller
- At least two Intel® Xeon® E5-2658 0 2.10 GHz CPUs per Oracle ZFS Storage Appliance controller
- 1x dual 10 GbE network interfaces per controller
- 1x dual 8 Gbps Fibre Channel HBA per controller
- NFS, iSCSI and Fibre Channel protocols correctly configured (on VMware and Oracle ZFS Storage Appliance)

- Two mirrored disk pools of 44 x 4 TB SAS-2 (7200 RPM capacity disk drives)
- Two 73 GB SSD devices for LogZilla working with a striped log profile

NOTE: Every Oracle Storage ZS3-2 and ZS3-4 appliance meets or exceeds these hardware requirements.

Role Configuration for Virtual Storage Manager Plug-in

In order to manage the Oracle ZFS Storage Appliance from a VMware vSphere vCenter server, Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere requires a set of specific permissions, which are set on the Oracle ZFS Storage Appliance either through the role tab in its Browser User Interface (BUI) or through the Command Line Interface (CLI). In order to create this role, a root user or other users with proper credentials are needed.

Perform the role configuration on Oracle ZFS Storage Appliance, using the instructions that follow, before installing the plug-in:

On the Oracle ZFS Storage Appliance Browser User Interface (BUI), click on Configuration, User, and then click on the plus signal next to the Roles option, as highlighted in the following screenshot of the BUI.
Deploying Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere 5.x

Figure 2. Navigating the Oracle ZFS Storage Appliance Browser User Interface (BUI) to set roles

As part of the role configuration, you must define the Properties, including Name and (role) Description, and Authorizations, which include Scope, Storage pool, Project and Share options. The roles to be set for projects and shares are: changeAccessProps, changeGeneralProps, changeSpaceProps, createProject, createShare, and destroy. These are seen in figure 3.

Figure 4 shows settings for analytics as stat: read and create, and for the worksheet in figure 5 (Worksheet option).

These figures present the correct role configuration for the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere. The presented example uses a storage pool named “performance.” Ensure that the correct role configuration has been correctly applied before installing the plug-in.

To add the role, click on the ADD button under the Authorizations option. When finished, click on ADD at bottom (on top of the Role tab).
Figure 3. Oracle ZFS Storage Appliance Browser User Interface (BUI) – role configuration and permissions
Deploying Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere 5.x

Figure 4. Oracle ZFS Storage Appliance Browser User Interface (BUI) – role configuration and permissions

Figure 5. Oracle ZFS Storage Appliance Browser User Interface (BUI) – role configuration and permissions
Once you have the role configuration correctly set, create a local user and associate it with the VSM role. To perform this configuration, click on **Configuration, Users, and Users** (plus signal next to the User option), then select **Local Only**, enter a username, full name, password, and select **VSM** as a role for this user. When finished, click on **ADD**. The following figure presents the user configuration as well as the association with the VSM role.

![User Configuration](image)

**Figure 6. Oracle ZFS Storage Appliance Browser User Interface (BUI) – role configuration and permissions**

Installing and Configuring the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere

This section presents Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere installation and configuration. In addition, this section provides an overview of the plug-in features.

NOTE: For best practices of NFS, iSCSI and Fibre Channel protocols as well as VMware virtual machine configuration with Oracle ZFS Storage Appliance, refer to the "Best Practices for Oracle ZFS Storage Appliance and VMware vSphere5.x” white paper referenced at the end of this document.
At this point, Oracle ZFS Storage Appliance has the correct role and permission for Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere, and the plug-in can be installed on VMware vSphere vCenter server.

Plug-in Installation and Configuration

Before installing the plug-in, ensure that the VMware vSphere vCenter server is correctly installed, up and running. VMware vSphere vCenter installation and configuration is out of the scope of this document; for best practices and configuration information, refer to http://www.vmware.com.

To install Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere perform the following steps:

1. Download the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere from the Oracle ZFS Storage Appliance Plug-in Download page to your console server or desktop.

2. Unzip the downloaded zip file (named something similar to Oracle_ZFSSA_VSM_x.x.x.zip where x.x.x denotes the latest version number), and then double click the setup.exe to begin the installation.

Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere does not use the VMware vSphere vCenter plug-in manager as a central repository to deploy and install the plug-in. The plug-in installation must be performed on the client side, such as a laptop, desktop or console server that is used to manage provisioning and monitor the VMware environment.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date modified</th>
<th>Type</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>ReadMe</td>
<td>10/27/2014 5:55 PM</td>
<td>HTML Document</td>
<td>6 KB</td>
</tr>
<tr>
<td>ReadMe</td>
<td>10/27/2014 5:55 PM</td>
<td>Text Document</td>
<td>12 KB</td>
</tr>
<tr>
<td>setup</td>
<td>10/27/2014 5:55 PM</td>
<td>Application</td>
<td>457 KB</td>
</tr>
<tr>
<td>VSM/VSetup</td>
<td>10/27/2014 5:55 PM</td>
<td>Windows Installer</td>
<td>1,711 KB</td>
</tr>
</tbody>
</table>

Figure 7. Oracle ZFS Storage Appliance server used to manage, provisioning – Installation files
Deploying Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere 5.x

Figure 8. Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere – Installation screen 1

Figure 9. Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere – Installation screen 2
After completing the plug-in installation, restart the VMware vSphere Client on the client side. If successfully installed, the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere icon will be available under Home, Solutions and the Applications tab on the VMware vSphere Client. As seen in the following figure, the icon is labeled "Oracle ZFS Virtual Storage Manager" -- note that references to the plug-in in this document will sometimes follow this naming convention for clarity.
At this point, the Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere has been successfully installed. The next steps show how to add an Oracle ZFS Storage Appliance to the Oracle ZFS Virtual Storage Manager (the vSphere interface name for the plug-in).

Before adding an Oracle ZFS Storage Appliance, ensure that the network interface of the appliance that will be used by the plug-in has the “Allow Administration” option checkbox enabled, as seen in the following figure. To check this option, go to the Oracle ZFS Storage Appliance Browser User Interface (BUI), click on Configuration, Network, and select the network interface.

Before adding an Oracle ZFS Storage Appliance, ensure that the network interface of the appliance that will be used by the plug-in has the “Allow Administration” option checkbox enabled, as seen in the following figure. To check this option, go to the Oracle ZFS Storage Appliance Browser User Interface (BUI), click on Configuration, Network, and select the network interface.

Properties

Name: IPMP01

Enable Interface: ✓
Allow Administration: ✓

Use these steps in the VMware vSphere Client to add an Oracle ZFS Storage Appliance:

1. On the VMware vSphere Client, go to Home, Solutions and Applications, and click on the Oracle ZFS Virtual Storage Manager icon. This will launch the plug-in. The plug-in does automatically identify the VMware vSphere vCenter server, but it does not “automatically” identify an Oracle ZFS Storage Appliance. To add an Oracle ZFS Storage Appliance you need to click on the Add button, then enter the appliance’s IP address, username, and password.
Assuming that all listed steps have been correctly followed, at this point the appliance can be managed by the Oracle ZFS Virtual Storage Manager (the name listed in the VMware interface for the plug-in). The following figure presents the appliance and the pool (performance) information to which access was granted through the permissions set for the VMware administrator.

As a best practice, grant access to an Oracle ZFS Storage Appliance’s disk pool, which should be 100 percent dedicated/allocated to the VMware environment. Remember that the user who is granted access to the Oracle ZFS Storage Appliance has deletion permission, so it is always recommended that you avoid creating others projects not related to VMware on the pool that has been presented to the Oracle ZFS Virtual Storage Manager plug-in. In this way, you can avoid data loss from accidental deletions of projects, NFS shares or LUNs.
If for some reason you added the wrong appliance, it can be deleted through the remove link seen highlighted in the following figure. Simply select the appliance you want to remove, and then click Remove.

Figure 15. Removing an appliance in the Oracle ZFS Virtual Storage Manager
Once the Oracle ZFS Storage Appliance has been successfully added to Oracle Virtual Storage Manager, you can begin the provisioning phase.

**NFS Share Provisioning**

The first step of NFS provisioning is project creation. You have two options for creating a project: either right-click on the Oracle ZFS Storage Appliance and then click on Project, or click on Provisioning on the top (right hand) of the Oracle Virtual Storage Manager screen. The following eight project information items must be configured:

**Name** – Name of the Oracle ZFS Storage Appliance project.

**Quota** – Represents a limit on the amount of disk space that can be consumed by any particular entity, and can be based on filesystem, project, user, or group.

**Reservation** – Represents a guarantee of space for a particular project or filesystem. For VMware, this can be considered as space reservation for a project level (not for file level).

**Mountpoint** – Mountpoint of the filesystem; this is the available path over NFS.

**Data compression** – Controls whether data is compressed before being written to disk. For a VMware environment, using an LJZB compression algorithm is recommended.

**Synchronous write bias** – this setting control the behavior when servicing synchronous writes. By default, the system optimizes synchronous writes for latency, which leverages the log devices to provide fast response times.

**Database record size** – Specifies a suggested block size for files in the filesystem. This property is only valid for filesystems and is designed for use with database workloads that access files in fixed-size records. The system automatically tunes block sizes according to internal algorithms optimized for typical access patterns.

NOTE: The default record size is 128 KB. The specified size must be a power of two greater than or equal to 512 and less than or equal to 1 MB. Changing the filesystem's record size affects only files created afterward; existing files and received data are unaffected. Block size is very important, should be carefully reviewed, and it is recommended to match the requirements of the applications which are running inside of the virtual machines. For block size best practices, refer to the white paper "Best Practices for Oracle ZFS Storage Appliance and VMware vSphere5.x" listed at the end of this document.

**Prevent destruction** – This property is off by default, and should be enabled. When set, the share or project cannot be destroyed. However, to destroy the share, the property must first be explicitly turned off in a separate step.

Click Next to proceed, review the configuration, and then select **Commit**. The Virtual Storage Manager project will be created and listed under the Project tab. The following two figures show the project creations screens' details.
Figure 16. Provisioning by creating a project in the Oracle ZFS Virtual Storage Manager

Figure 17. Newly created project details in the Oracle ZFS Virtual Storage Manager

To provision a share, either click on the Provision link listed near the top of the Oracle Virtual Storage Manager screen or right-click on the project (in the example, the project is VSM_TEST) listed under the Project tab. Either option redirects you to the Share Creation wizard screen, which is used for provisioning Fibre Channel or iSCSI LUNs or NFS shares. The next examples show NFS share creation, then Fibre Channel and iSCSI LUNs.
NOTE: At this point, the new VSM_TEST datastore can also be accessed from VMware vSphere.

In the Share Creation Wizard screen, enter basic information related to your filesystem, such as: name, count, user, group, and so on. In the example, VSM_SHARE is the filesystem name, the count option value is 10, and permission is set to 755. The count value of 10 requests the plug-in to create 10
VSM_SHARE filesystems with a sequential order from 1 to 10, which will be appended to the filesystem name; for example: VSM_SHARE-1, VSM_SHARE-2, VSM_SHARE-3 and so on. The following figures show values entered in the Share Creation Wizard, as well as created filesystem details, within Oracle ZFS Virtual Storage Manager.

Figure 20. Creating NFS shares with the Share Creation Wizard
At this point, the new NFS shares (VSM_SHAREs) can be mounted as VMware NFS datastores, and they are also visible on the VMware vSphere vCenter server under the Datastores and Datastore Cluster context and can be presented to VMware virtual machines or to the VMware cluster. The following figure shows details in Datastores and Datastore Clusters.

ISCSI and Fibre Channel LUN Provisioning

To simplify LUN provisioning and since iSCSI and Fibre Channel protocols are related to block devices, Oracle ZFS Virtual Storage Manager has a similar configuration tab for both protocols. The
following steps are based on iSCSI LUN provisioning; however, they can apply for Fibre Channel protocol as well because the plug-in's screens will be similar.

Steps for provisioning iSCSI or Fibre Channel LUNs are similar to those for NFS shares, except for specific configurations that are related to block devices. Before beginning the iSCSI or Fibre Channel LUN provisioning operation through Oracle ZFS Virtual Storage Manager, make sure that you have iSCSI or Fibre Channel protocols correctly configured and enabled on VMware ESXi hosts. Also ensure that the correct iSCSI or Fibre Channel storage targets/initiators have been correctly configured and accessible from the VMware ESXi hosts. Verify that you have applied the best practices and recommendations listed in the white paper "Best Practices for Oracle ZFS Storage Appliance and VMware vSphere 5.x" for both protocols.

For provisioning iSCSI LUNs through the plug-in, click Provision..., select iSCSI LUN, and click Next.

After specifying the share values, click Next. The wizard follows with a Verify the iSCSI LUN Values screen, and after reviewing the values, click Commit to create the iSCSI LUNs.

The following example will create ten 10-GB iSCSI LUNs with 128 k block presented to the VMWARE_iSCSI iSCSI target group and VMWARE_VIEW_GRP initiator group.

NOTE: The example is not using the write caching option. For more information about write caching, refer to the Oracle ZFS Storage Appliance Administration Guide.
Deploying Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere 5.x

The iSCSI LUNs have been created and are accessible under the Shares tab. At this point the iSCSI LUNs can be used by VMware as VMFS datastores, raw devices, and so on. In addition, you have the options to resize, modify, or delete each LUN.

The resize option allows you to resize the LUN. The modify option allows you to either modify the LUN configuration or resize it. As part of the modify option, you can change the LUN from thin provisioning to thick provisioning or change the iSCSI target/initiator groups, and write caching options.

Figure 24. Configuring iSCSI LUNs in Oracle ZFS Virtual Storage Manager

Figure 25. Permissible operations on the iSCSI LUNs in Oracle ZFS Virtual Storage Manager
To provision Fibre Channel LUNs, use the same steps as those just detailed for iSCSI LUNs, with the exception of choosing the Fibre Channel LUN option rather than the iSCSI LUN option on the plug-in screen, as shown in the following figure.
At this point, both Fibre Channel and iSCSI LUNs are visible through the ESXi hosts, and can be used as VMFS datastores or even Raw Device Mapping (RDM). The following figure presents all iSCSI LUNs that have been created through the plug-in.

Accessing Oracle ZFS Storage Analytics

Oracle ZFS Storage Appliance provides a powerful monitoring tool called DTrace Analytics that is essential for a virtualized environment. This tool helps VMware administrators monitor specific metrics of a virtual machine as well as identify performance problems and bottlenecks and gather data for performance analysis, load balancing, and tuning. These analytics features provide a number of drill-down options which are extremely useful for monitoring storage for virtualized environments.
VMware administrators can easily access DTrace Analytics from the Oracle ZFS Virtual Storage Manager screen through the Analytics... link seen highlighted in the following figure. When Analytics... is selected, the plug-in opens a tab in your web browser that is pointed to the Oracle ZFS Storage Appliance Analytics BUI. Due to the plug-in integration with Oracle ZFS Storage Appliance, the plug-in will automatically create worksheets (one for each protocol) such as: vSphere Fibre Channel, vSphere NFS, or vSphere Fibre Channel iSCSI. To open these worksheets, click on SAVED WORKSHEETS, and then select one of interest.

The following example presents a vSphere NFS worksheet that was automatically created by the plug-in.

![Figure 30. Confirming the action to access an NFS worksheet and trigger analytics views through the Oracle ZFS Storage Appliance](image-url)
The following figure shows the selected NFS worksheet highlighted in the Oracle ZFS Storage Appliance BUI.

![Figure 31. vSphere NFS Analytics worksheet in the Oracle ZFS Storage Appliance BUI](image)

### Conclusion

Oracle ZFS Storage Appliance Virtual Storage Manager Plug-in for VMware vSphere provides a seamless integration between VMware hypervisors and Oracle ZFS Storage Appliance. The plug-in allows VMware administrators to quickly perform critical storage provisioning tasks while gaining a better overview of NFS shares, iSCSI and Fibre Channel LUNs allocated to the VMware environment. In addition, the plug-in provides easy access to DTrace Analytics, and automatically built worksheet templates with the most appropriate metrics for monitoring particular virtualized environments.

The storage management and provisioning functionality provided by the plug-in can be extremely handy in virtualized environments. This all combines to make Oracle ZFS Storage Appliance integration with VMware vSphere hypervisors an excellent choice for your virtualized environment.
Appendix A: Benchmark Results

Refer to the following web sites for further information on testing results for the Oracle ZFS Storage Appliance.

**SPC-2 Results**


Appendix B: References

See the following resources for additional information relating to the products covered in this document.

- Oracle ZFS Storage Appliance Documentation Library, including Installation, Analytics, Customer Service, and Administration guides:

- The *Oracle ZFS Storage Appliance Administration Guide* is also available through the Oracle ZFS Storage Appliance help context.

  Oracle Support Center
  http://www.oracle.com/support

- Patches and updates downloads from My Oracle Support (MOS) (search under Oracle ZFS Storage Software Patches)

- Oracle ZFS Storage Appliance Plug-ins

- Oracle Storage Product Information

- Oracle ZFS Storage Appliance Technical White Papers and Solution Briefs, including "Best Practices for Oracle ZFS Storage Appliance and VMware vSphere5.x"

- VMware
  http://www.vmware.com