



# **Snapshots and Clones with Oracle on Windows**

## **Implementation Guide**

Overview of the steps and considerations for creating and deploying snapshots and clones with Oracle Database running on Microsoft Windows platform.



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# 1. Introduction

Snapshots and clones can have many uses ranging from performance scaling to workload isolation to deployment simplicity to data security. This makes snapshots and clones one of the most powerful tools on modern enterprise storage platforms. The following is a guide that walks the reader through snapshot and clone creation and deployment as well as covers some of the common considerations used for decision making. The guide should be an overview of the steps, in order, that should be taken. This guide does not replace the best practices guide or the array's user guides which should be used as companion documents.

## 1.1. Terminology

Before we get into the steps, let's clarify terminology.

- **Snapshots.** Point in time markers saved on the storage array. These markers allow an administrator to revert a LUN, or group of LUNs, back to the state of the data at the time of the marker.
- **Clone.** A new LUN, or set of LUNs, created to contain data with a state as of a point in time (a snapshot).
- **Thin clones** are merely pointers to the existing LUN or LUNs whereby changes to the data are held in the newly created clone LUNs but all of the original, non-changed, data is still stored in the source LUN.
- **Thick clones** are fully hydrated LUN or LUNs whereby the array will make an exact copy of the LUN into new LUNs and these new LUNs will act independently. Once a thick clone is created it cannot be remapped to another snapshot (point-in-time marker).
- **Remap.** The ability to change the source point-in-time marker (snapshot) for a thin clone.
- **Rollback.** Ability to revert the state of the LUN or LUNs back to a previous point in time marker (snapshot).

## 1.2. FSP: Flash Storage Platform

Violin Memory's Flash Storage Platform (FSP) is the combination of custom-for-flash hardware and custom-for-flash software delivering both cost effective and performance based storage solutions. Concerto OS7 is the software layer of the FSP that delivers a full suite of data services including protection, efficiency, continuity, migration and scaling. These features can also be combined for increased value and security. For example, an application consistent snapshot can reside on mirrored LUNs or the source LUNs can also be replicated to remote sites, etc.

Also included in the FSP are host based agents and tools which allow for advanced application consistent snapshots as well as other features. These tools and agents include:

- **SDM.** The SAN Disk Manager (SDM) is the foundation configuration tool which allows an administrator to connect the host to the FSP, configure Fibre channel or iSCSI connectivity, review snapshots, manage the other host agents and much more.
- **Snapshot Agent for Oracle Database.** The snapshot process is initiated and owned by the FSP. This agent receives communication from the FSP during a snapshot and coordinates with the Oracle Database to place the database into backup mode for the duration of the snapshot, delivering an application consistent snapshot. This agent also allows for configuration of any scripts that may need to be ran before and/or after the snapshot.

## 2. Preparing the Source

The snapshot and clone process journey starts with the source host. In this section we will review the considerations and pre-snapshot steps that should be taken before creating and scheduling snapshots.

### 2.1. Considerations

Snapshots can be used for many purposes so considerations can cover a large amount of ground. The following are a few things to keep in mind when designing the architecture of the primary host.

#### 2.1.1. Volume mapping

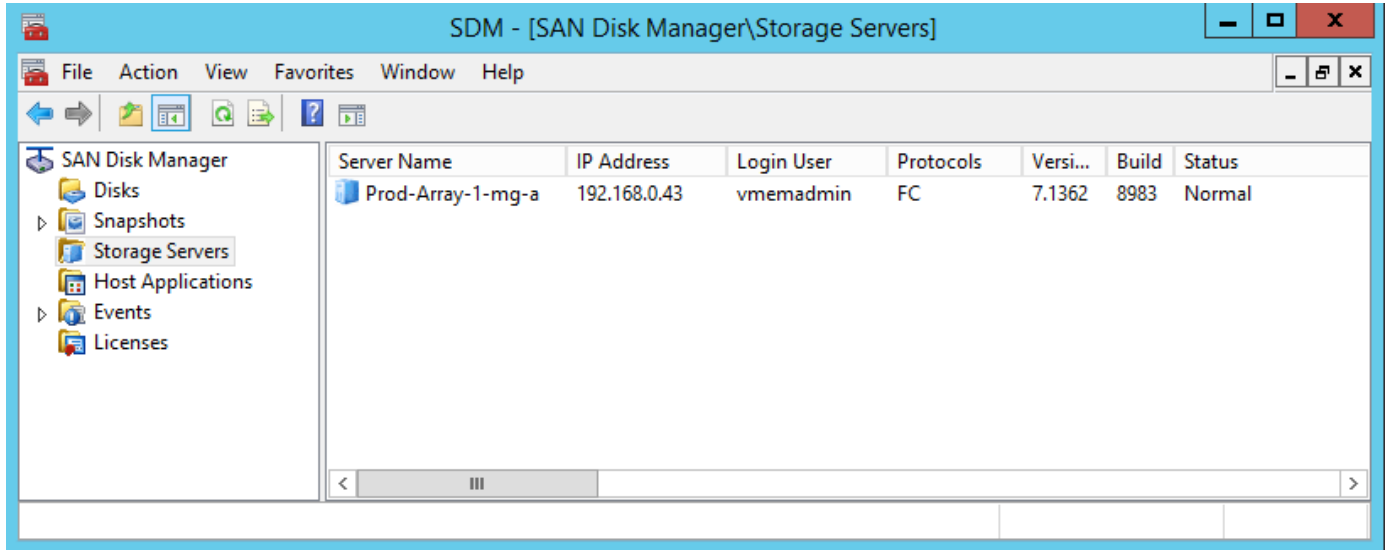
If the intent of the snapshot and cloning process is to mount a clone on a separate host then it simplifies the process if the appropriate volume drive letters and mount points are available on destination host. This allows Windows to mount the new LUNs without volume label conflict that would require administrators to execute scripts and add complexity to the process.

#### 2.1.2. LUN based snapshots

Concerto OS7 is a LUN-based snapshot technology. This means that while the array can, for application consistent snapshots, coordinate with the Oracle Database to put the database into backup mode during the brief snapshot process for the entire LUN or LUN group. Clones will therefore be of the entire LUN or LUN group, not specific volumes or files on the LUN. So, if the intent of the architecture is to have the ability to only clone (or restore) one database, then multiple databases should not be resident on the same LUN as the cloned LUN will contain all volumes and files (databases). Similarly, the administrator must decide whether to include Oracle binaries on the same LUN(s) as the Oracle Database files, causing these to be snapped together. In some installations, it is preferable to place these on separate LUNs, allowing for infrequent or manual snaps of the binaries that do not change frequently and may not be desired to clone or replicate along with the database files.

### 2.2. Install SDM and Configure Storage Connectivity

The SAN Disk Manager (SDM) is the management tool that allows for a wide variety of tasks to be accomplished on the host server. With it an administrator can create LUNs, set up connections to storage, review agent events, review existing snapshots and much more. This is a required piece of software to be installed on any host that will be the source of snapshots, as this tool is configured the connection to the FSP, configures the Fibre Channel or iSCSI connectivity settings, and manages the host agents after install.



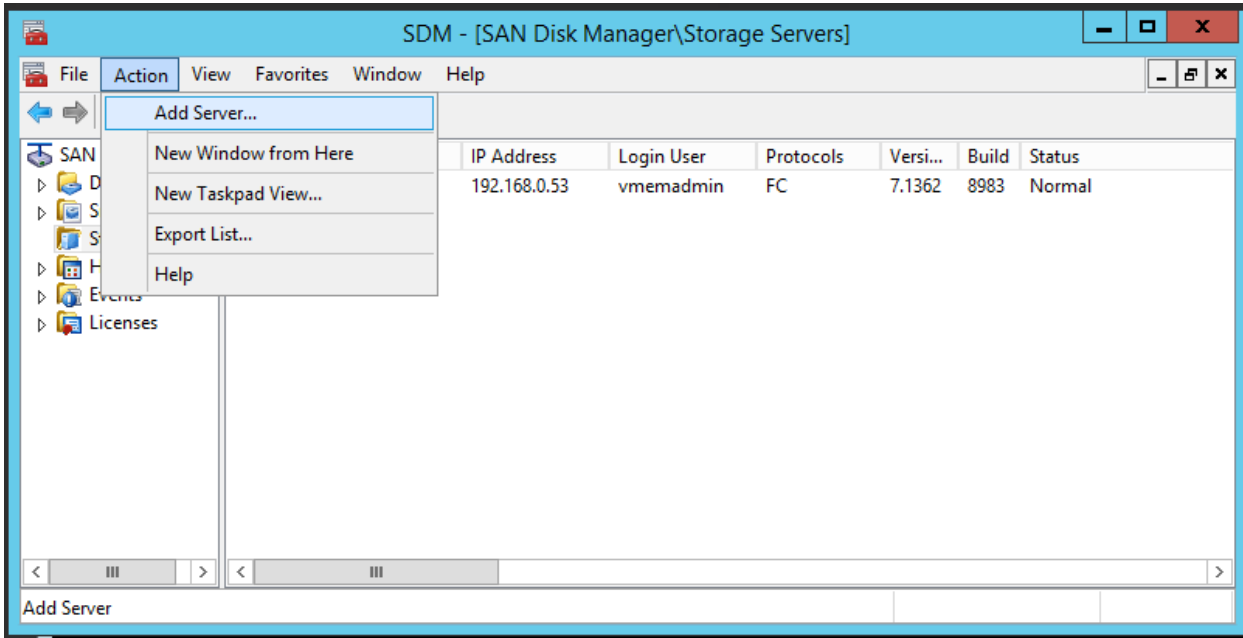
### 2.2.1. Install the SDM

Windows Explorer view of the install executable for the SDM tool required for snapshots:

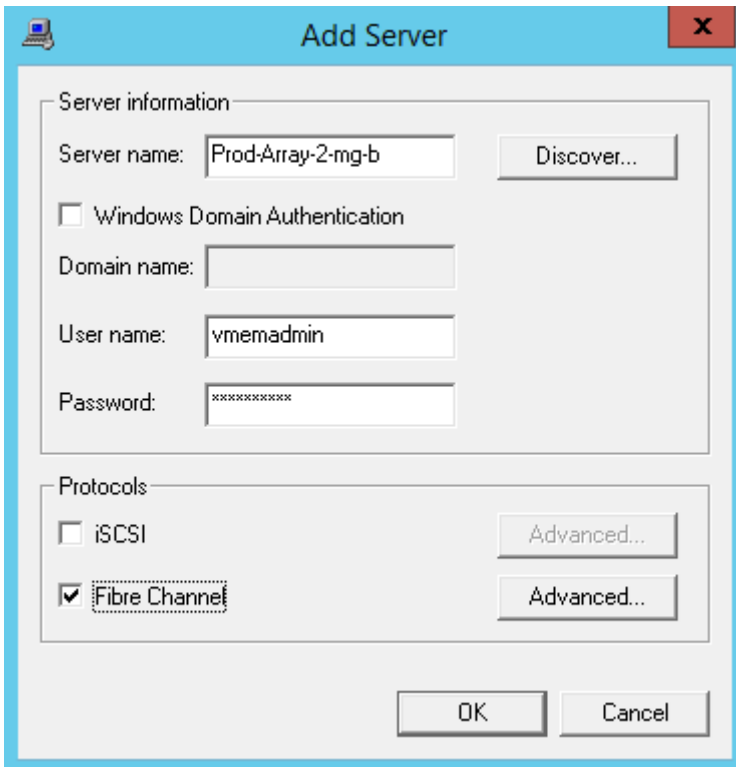
SDM-Windows-2.51-735-violin-x64 1/24/2015 8:58 AM Application

### 2.2.2. Connect the SDM to the storage tier

Be sure to highlight the "Storage Server" node in the navigation pane on the left. Then click Action | Add Server from the drop down menu.



In the Add Server wizard, enter the IP address or DNS name of the FSP, along with the credentials established for managing the FSP itself. Then click iSCSI or Fibre Channel as appropriate, and click on the corresponding Advanced button to add the initiator configurations. The dialog box will inform the user if the login credentials are not accepted.



### 2.2.3. Verify the SDM configuration in Symphony

Within Symphony where the Server is managed, click on the Manage tab, then the SAN Clients subtab. Locate the Windows host just registered and confirm it contains the login name specified in the previous step as part of the client name field. This is required for proper functioning of the agents later. If the client was previously added from within Symphony and does not show the login name in this field, you must delete the client registration and perform it as described in the previous step. Note that a SAN client may not be deleted while any LUN(s) are assigned to it, so unassign the LUN(s) before attempting to delete the client.

The screenshot shows the Violin Symphony Manage interface. The 'SAN CLIENTS' tab is selected, displaying a table of registered clients. The table columns are: SAN Client, Controller, IP Address, Client Type, LUNs, LUN #, LUN Access, FC Enabled, and iSCSI Enabled. The 'WIN-ORA[vmemadmin]' client is highlighted, showing its associated LUNs and access permissions.

SAN Client	Controller	IP Address	Client Type	LUNs	LUN #	LUN Access	FC Enabled	iSCSI Enabled
				Spike-Dedup-4	7	Read/Write (Shared)		
				Spike-Dedup-5	8	Read/Write (Shared)		
VDI-1	Prod-Array-2-mg-a	192.168.0.26	VMWare	VDI-Dedup-1	0	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
				VDI-Thick-1	1	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
VDI-2	Prod-Array-2-mg-a	192.168.0.27	VMWare	VDI-Dedup-1	0	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
				VDI-Thick-1	1	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
WIN-ORA[vmemadmin]	Prod-Array-2-mg-a	192.168.0.28	Winnt4	Win-Oracle-Data	0	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
				Win-Oracle-Redo-Logs	1	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
				Win-Oracle-Trans-Logs	2	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
XenServer-1	Prod-Array-2-mg-a	192.168.0.25	Linux	Xen-Server-Dedup	0	Read/Write (Shared)	<input checked="" type="checkbox"/>	<input type="checkbox"/>

## 2.3. Install Agents

The Windows file system agent may also be installed on the host system for snapping a generic individual drive, e.g. Oracle binaries location. The VSS agent allows communication with the VSS service on Windows to achieve a consistent shadow copy of the volume. Install the agents in the following order. Ensure that you have the correct version of each agent.

*Windows Explorer view of the install executables for the agents required for generic drive snapshots:*

Snapshot_Agent_FileSystem_Windows-5.00-735	1/24/2015 8:57 AM	Application
SnapshotAgent-VSS-Windows-5.10-735-generic	1/24/2015 8:56 AM	Application

### 2.3.1. Install the Oracle Agent

*Windows Explorer view of the install executables for the agent required for Oracle Database snapshots:*

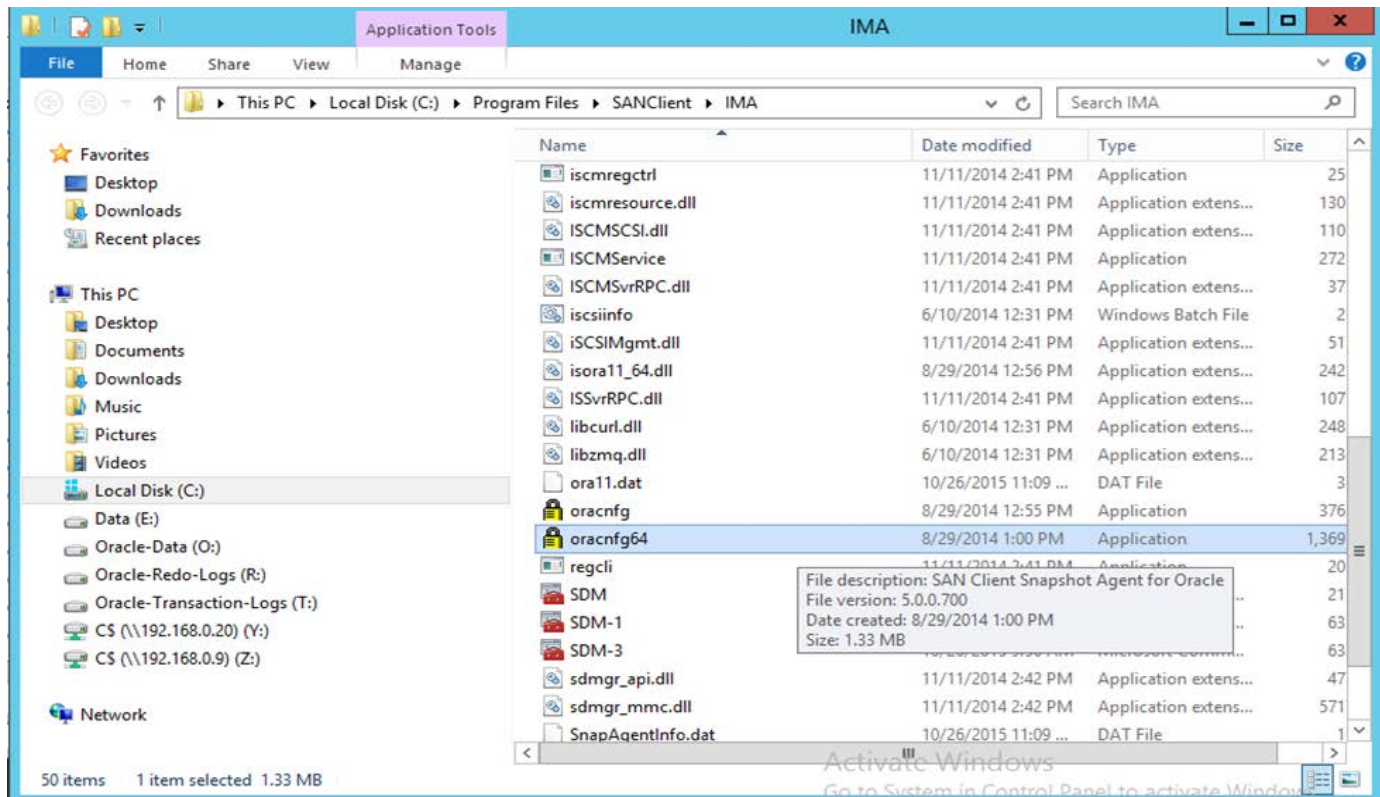
SnapshotAgent-Oracle-Windows-5.00-536-generic.exe	11/25/2014 3:11 PM	Application
---	--------------------	-------------



The Oracle agent is the process that coordinates with the Oracle Database to place the database into backup mode during a snapshot. This is all that is required for an application consistent snapshot of Oracle, as, while in backup mode, the database records both the before and after image of every changed block in the redo logs. This constitutes enough information for the database to correct any fractured blocks recorded in the snapshot. An administrator can review the logs of the Oracle Database instance (known as the instance's *alert log*) and see the database going into and out of backup mode. Launch this executable and follow the installation steps.

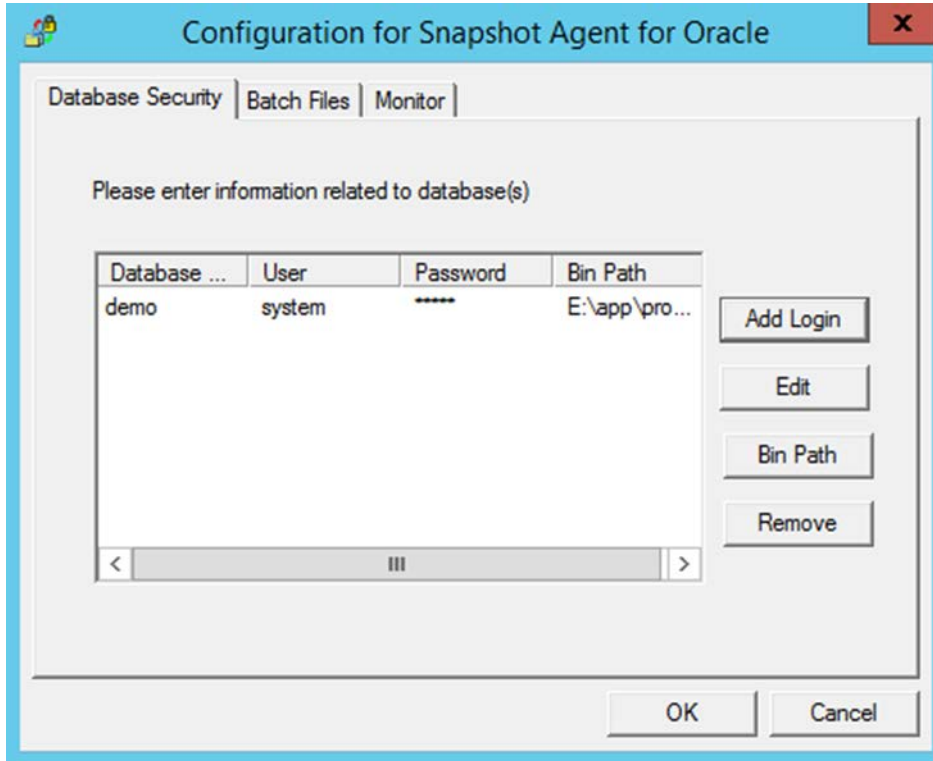
### 2.3.1.1. Open and Configure the Oracle Agent

The Oracle agent's program name is "Configuration for Snapshot Agent for Oracle". Searching for the program on the Windows desktop you can use "Agent" or "Snapshot" to bring up any of the agents, or locate the file manually as shown:



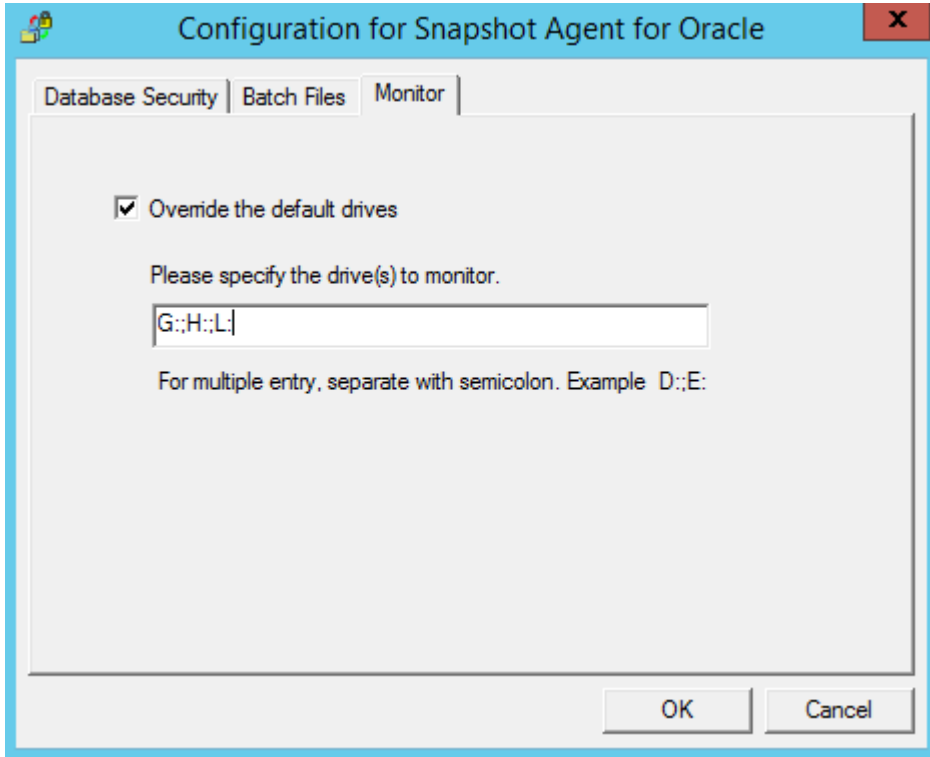
### 2.3.1.2. Choose the appropriate Oracle Database and supply credentials

On the Database Security tab, click the Add Login button to specify the desired Oracle Database and Oracle Home path, and configure the appropriate credentials.



### 2.3.1.3. Input the volumes to be snapshotted

In the Monitor tab, add the volumes that cover all of the database data and log files. This is a semicolon delimited list of drive letters including their colons.



### 2.3.2. Install the File System Agent

The File System agent is required for coordination with the file system when only volumes are being snapshotted. This is not required for application consistent Oracle Database snapshots. Therefore, no additional configuration is required for database snapshots. Installing this agent is optional for application consistent snapshots but is recommended, as it is common for hosts to also require volume-based snapshots.

### 2.3.3. Install the VSS Agent

The Snapshot Agent for VSS is required for all installs to coordinate with the VSS agent. No additional configuration is required for database snapshots or file system snapshots as this is a coordination agent. The database or volume configurations for database or file system snapshots, items such as scripts to run or database credentials, are configured in the Oracle agent or FileSystem agent.

## 3. Creating and Scheduling Snapshots

Moving from the database host to Symphony, now it is time to create the actual snapshot resources, policies and schedules. It is important to note that once initial configurations are set on the host, all management and monitoring should be done on the FSP via Symphony. Concerto OS7, the array software, is the overall owner of the snapshot execution and initiates coordination with the host side agents. Symphony is the management console tool that allows for configuration and monitoring of the Concerto OS7 software.

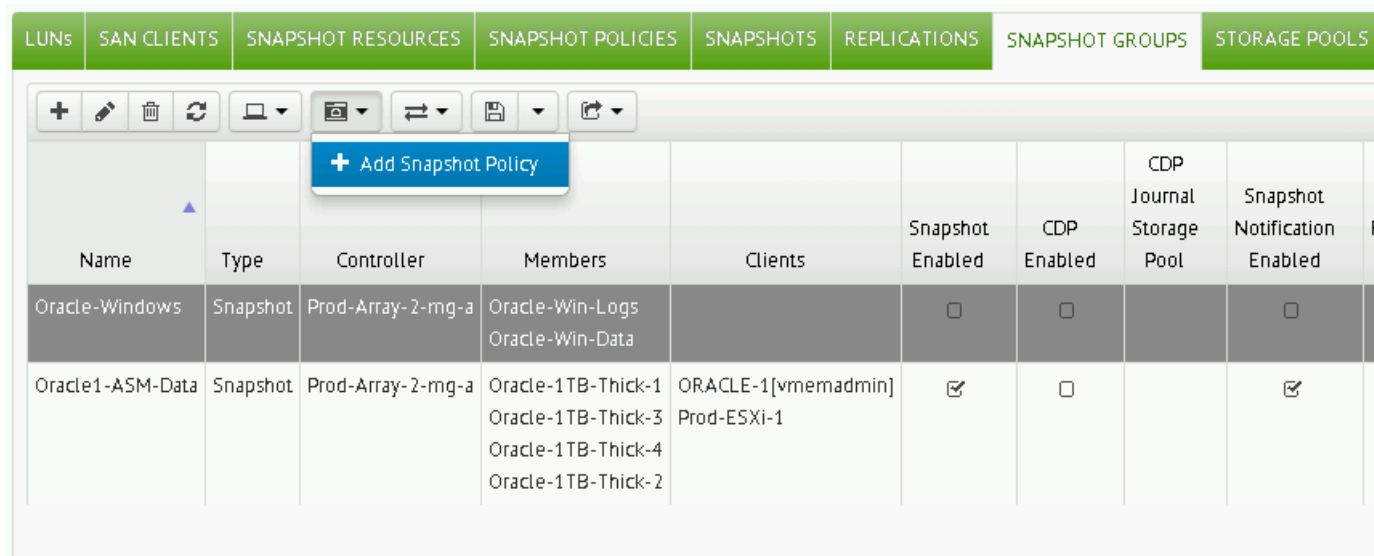
### 3.1. Snapshot Resource Area (SRA) Considerations

Snapshots track the application changes by saving both the new and old blocks. The older versions of the blocks are saved into a Snapshot Resource Area (SRA) that allows an administrator to allocate specific amounts of space for this function based upon their system’s requirements for data security and availability. The SRA can auto grow and shrink and has many different retention policy options.

If any or all of the LUNs in a snapshot group will have unique retention or sizing requirements then the SRA per LUN should be set up individually. This is done via the SNAPSHOT RESOURCES tab in Symphony. If, however, the LUNs can have the same sizing and retention policies then a batch process can be utilized for the SRA creation via the SNAPSHOT GROUP tab in Symphony. It is most common, and easier, to use the SNAPSHOT GROUPS tab’s wizard to create the SRA in a batch for all the LUNs at the same time. It is a best practice to utilize a few common policies over the snapshot use cases instead of unique policies for each, unless separate policies are required by the particular implementation.


### 3.2. Snapshot Group

With the wizard in the SNAPSHOT GROUPS tab, all of the snapshot resources, policies and scheduling can be created.



Name	Type	Controller	Members	Clients	Snapshot Enabled	CDP Enabled	CDP Journal Storage Pool	Snapshot Notification Enabled
Oracle-Windows	Snapshot	Prod-Array-2-mg-a	Oracle-Win-Logs Oracle-Win-Data		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
Oracle1-ASM-Data	Snapshot	Prod-Array-2-mg-a	Oracle-1TB-Thick-1 Oracle-1TB-Thick-3 Oracle-1TB-Thick-4 Oracle-1TB-Thick-2	ORACLE-1[vmemadmin] Prod-ESXi-1	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>

#### 3.2.1. Add Snapshot Group

The first step is to create a new Snapshot Group. In the SNAPSHOT GROUPS tab, click on the plus sign icon  and choose an appropriate name. This is also where you will choose all of the LUNs to include in the group and the controller to coordinate the snapshot process.

**CREATE SNAPSHOT GROUP**


Name:  \*

Controller:

Member LUNs:

Show available LUNs

### 3.2.2. Create Snapshot Policy for the Snapshot Group

Next, start the wizard by clicking on the camera icon  and choosing Create Snapshot Policy. This wizard will take you through the steps required to set up the resource area (SRA), retention policy and scheduling. Click Start on the first page of the wizard to move to the next step.

**CREATE SNAPSHOT POLICY**

**Snapshot Resource** needs to be created before **Snapshot Policy** can be created.

LUN: Oracle-Win-Logs, Oracle-Win-Data

Step 1: Add Snapshot Resource

Step 2: Add Snapshot Policy

Click the **Start** button to create **Snapshot Resource** followed by **Snapshot Policy**.



### 3.2.2.1. Create Snapshot Resource form

In this form you will configure several items. Fill out the Storage Policy, Resource Policy and Advanced tabs. Do not fill out the Reclamation Policy tab yet. Click on the Resource Policy tab after defining the storage policy on the first tab.

**CREATE SNAPSHOT RESOURCE**

Storage Policy    Resource Policy    Advanced    Reclamation Policy

LUN: Oracle-Win-Logs, Oracle-Win-Data

Storage Pool:  \*

Allocated Size:  GiB \*

Available Size: 23240 GiB (Storage Pool Size 40960 GiB)

Threshold:  % \*

Expand Automatically:  ON

Increment Size:  % \*

Max Size:  GiB

### 3.2.2.2. Snapshot Resource Policy

On this tab, you define how snapshots are kept and their priority. The options are as follows:

Preserve all snapshots: grow the SRA as needed and potentially stall writes to the LUN(s) if the SRA is full and cannot grow

Preserve recent snapshots: selecting this will cause a new dialog to pop asking how many snapshots to preserve. These will be kept in rolling fashion, with the SRA growing as needed to accommodate this number of snaps.

Maintain writes: grow the SRA as needed until it cannot grow anymore, then purge snapshots, starting with the oldest, to free space to keep from stalling incoming writes to LUN(s)

The screenshot shows a dialog box titled "CREATE SNAPSHOT RESOURCE" with four tabs: "Storage Policy", "Resource Policy", "Advanced", and "Reclamation Policy". The "Resource Policy" tab is selected. It contains three radio button options for "Resource Policy": "Preserve All Snapshots", "Preserve Recent Snapshots", and "Always Maintain Write Operations". The "Always Maintain Write Operations" option is selected. Below these options is a toggle switch for "Enable Snapshot Notification" which is currently set to "ON". At the bottom right of the dialog are "Cancel" and "Create" buttons.

### 3.2.2.3. Create Snapshot Policy form

In this form, fill out the Schedule, Notification and Retention tabs. Skip the other two tabs.

When setting up the schedule, make sure to leave time before the first snapshot is taken to finish up any other configurations that may need to be done.

Note that the application consistent or “notification” process requires communicating with the host-side agent to snap each configured database. If there is more than one database being snapshotted, this could add to the length of time the whole snapshot process takes. Note also that the setting specified on this tab is stored as a default for this snapshot policy. Manual snapshots may override this, and snapshots collected via the Schedule mechanism may choose to employ application notification for every snapshot or once every N snapshots, depending on business needs.

As shown here, administrators may be very specific in the snapshot retention policy.

**CREATE SNAPSHOT POLICY**

Schedule
Notification
Replication
Retention
CDP

Keep:  All Snapshots  
 Most Recent Snapshots  
 Snapshots based on following Rules

All for past:   \*

Hourly from the past:   days, closest to  min \*

Daily from the past:   days, closest to  hour \*

Weekly from the past:   weeks, closest to  \*

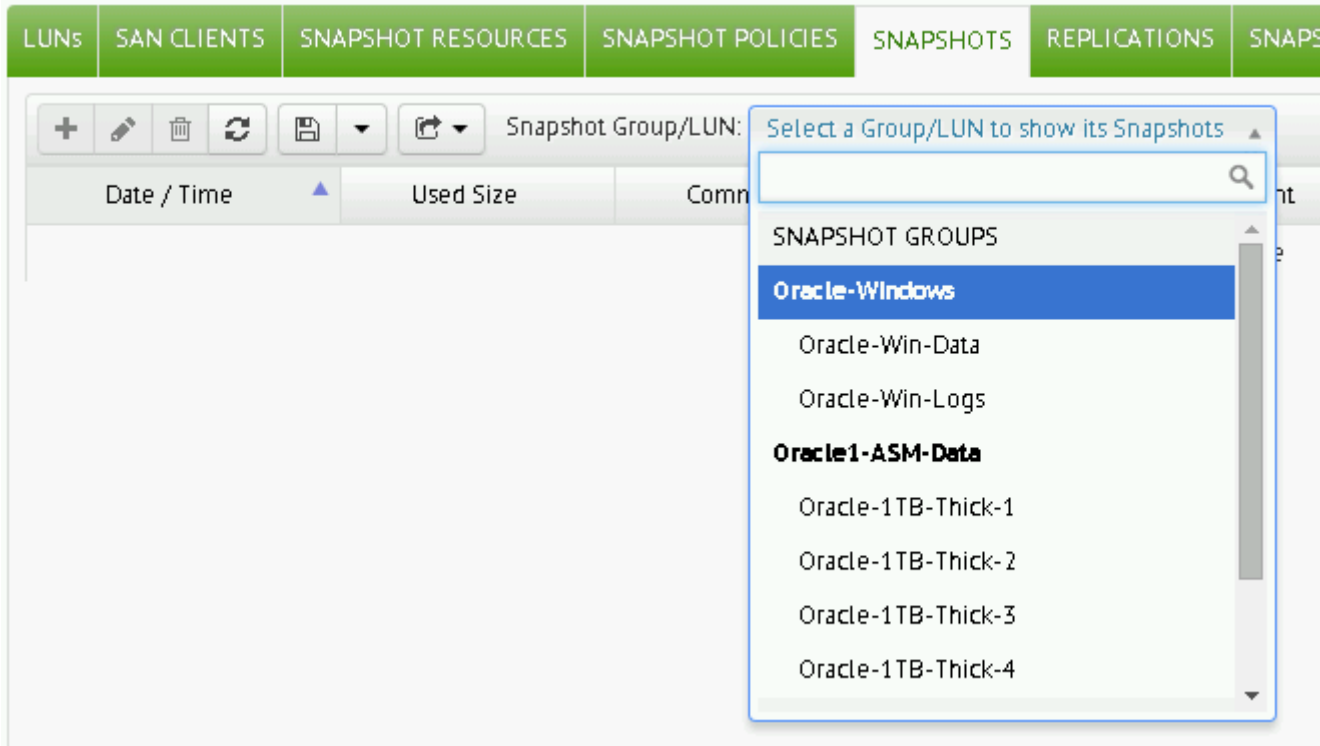
Monthly from the past:   months, closest to  day \*


Cancel
Create

### 3.3. Test Snapshots

The process of creating and scheduling snapshots is now done. You can review the snapshots as they are created by the system by going to the SNAPSHOTS tab in Symphony. Use the “Snapshot Group/LUN” drop down to review the existing snapshots for individual LUNs or snapshot groups.





Click the plus sign  to create a new snapshot manually, and specify that application notification be included.

**CREATE SNAPSHOT**

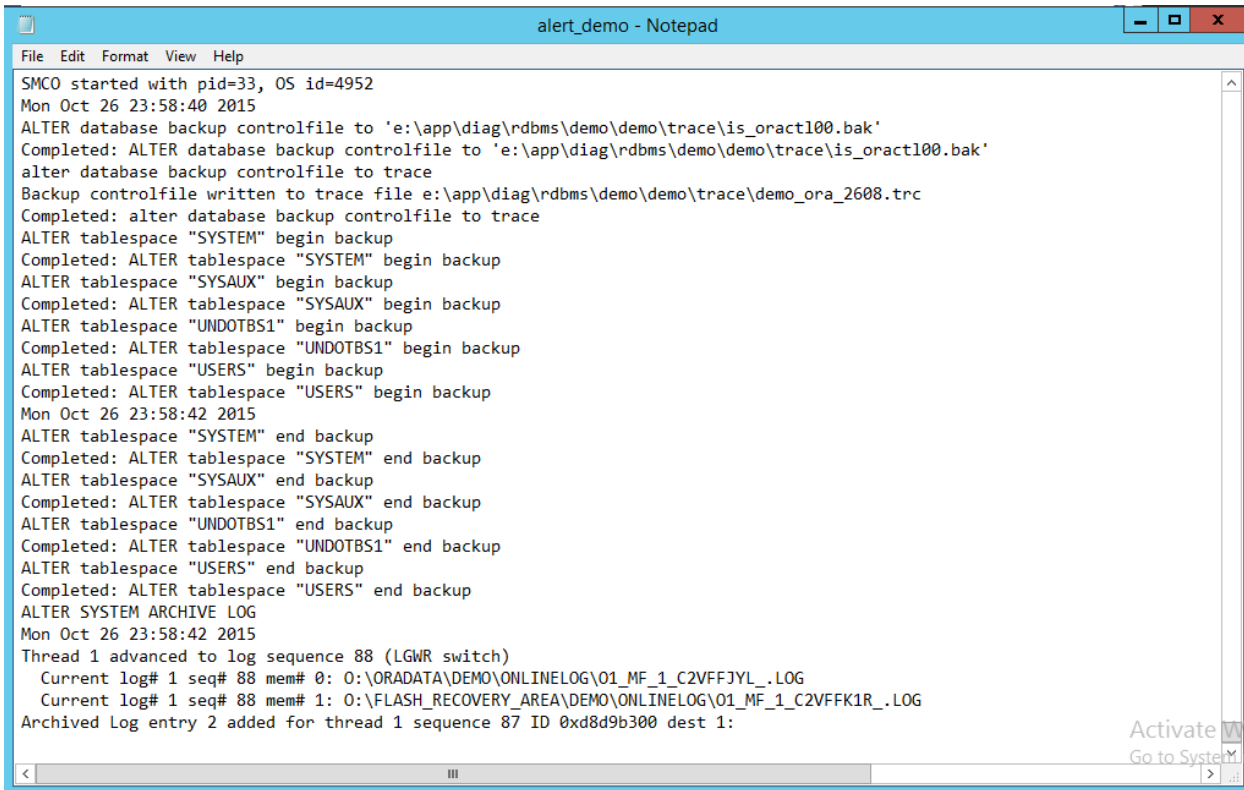
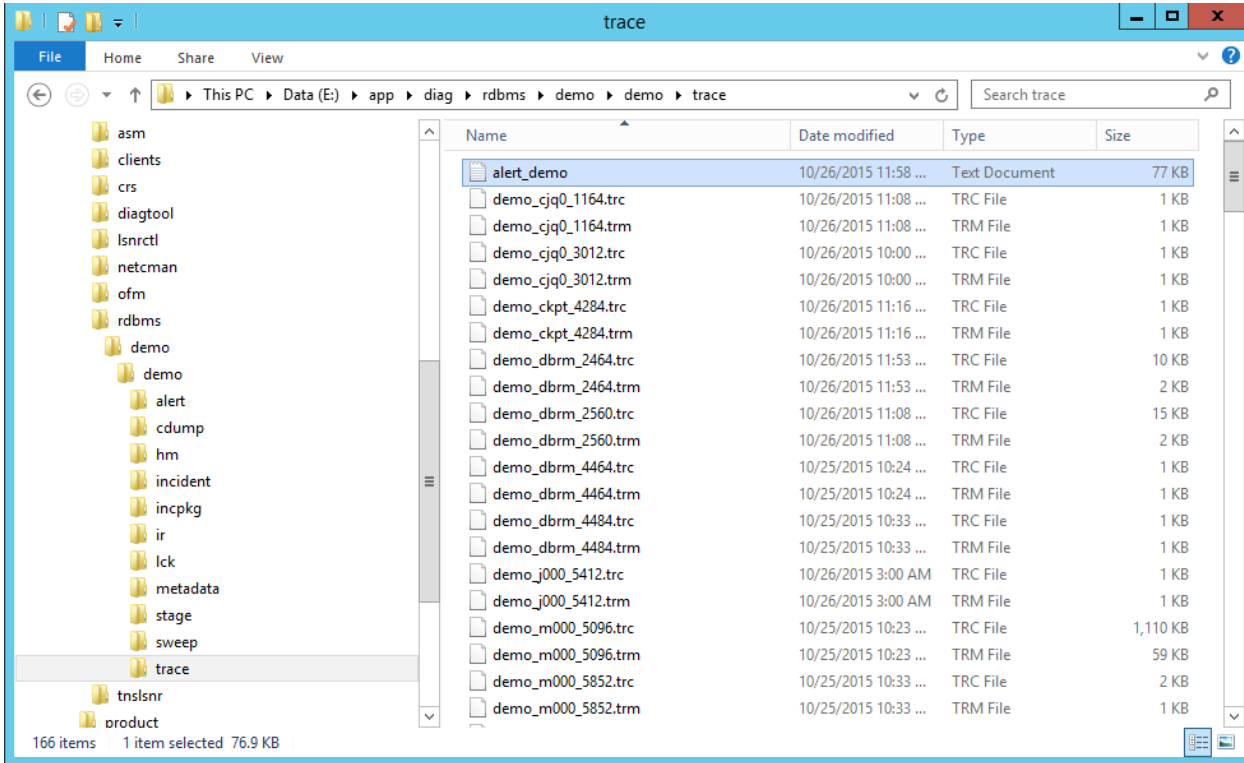
Snapshot Group: Oracle-Windows

Comment:

Priority:

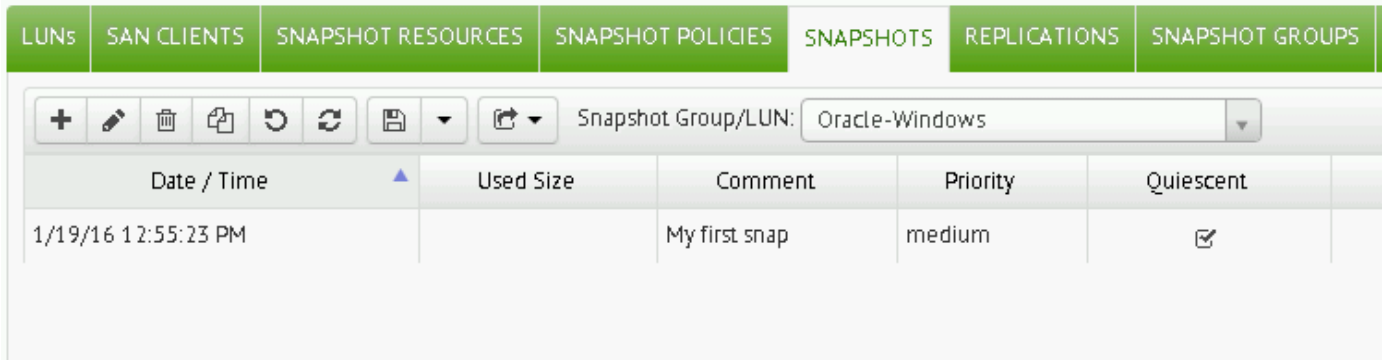
Enable Snapshot Notification:  ON

On the Windows host, locate the database instance alert log for the database previously configured with the Oracle agent configuration utility, and view the log contents immediately after the snapshot process completes and Symphony lists your new snapshot in its inventory.



In the resulting grid, the Quiescent column indicates which snapshots are application consistent (checked) or crash consistent


(not checked).

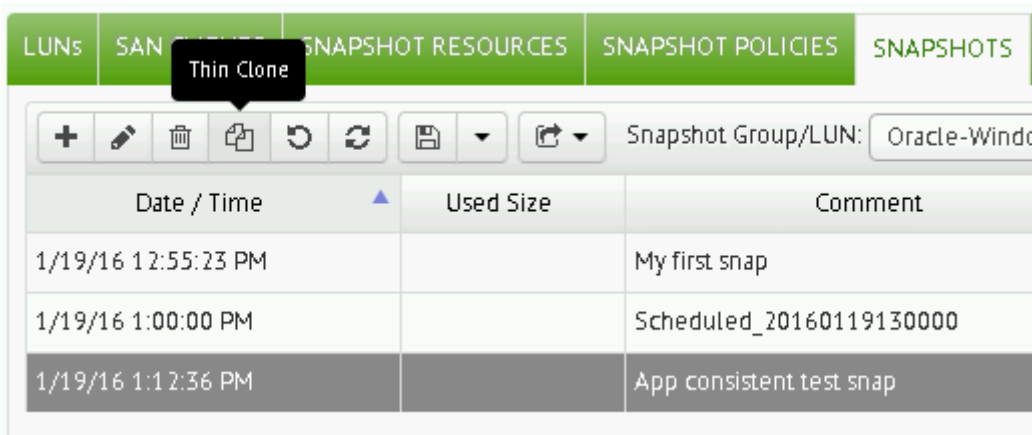


## 4. Create Clones

Now that snapshots are being taken, you can choose to turn one LUN or snapshot group into a thick or thin clone and mount it back to the same host or a different host.

### 4.1. Choose Snapshot Source

Choose one of the LUNs or snapshot groups in the “Snapshot Group/LUN” drop down. Choose a row item that matches your requirements. Then click the “Thin Clone” button  from the task bar.



## 4.2. Choose Clone Type

The default is a thin clone, which does not require any additional space initially. To create a fully hydrated thick clone as of the time of the selected snapshot, use the Instant Copy button on the bottom of the Thin Clone Snapshot form. This will start a background process that will copy data into the destination LUNs, resulting in a full separate copy of the source LUNs while allowing you to start using the LUNs immediately.

The screenshot shows a web-based form titled "THIN CLONE SNAPSHOT". The form has two tabs: "Snapshot" (selected) and "Storage Policy". The "Snapshot" tab contains the following fields and controls:

- Group: Oracle-Windows
- Snapshot At: 1/19/16 2:00:00 PM - Scheduled\_20160119140000 \*
- Storage Pool: A Storage-Pool \*
- Allocated Size: 5 GiB \*
- Thin Clone Name Format: {n}\_{t} ? \*
- Thin Clone Names: Oracle-Win-Logs\_20160119140000 Oracle-Win-Data\_20160119140000
- Instant Copy: OFF

At the bottom right of the form, there are two buttons: "Cancel" and "Clone".


Within seconds, the thin clones show as online.

LUNs	SAN CLIENTS	SNAPSHOT RESOURCES	SNAPSHOT POLICIES	SNAPSHOTS	REPLICATIONS	SNAPSHOT GROUPS	STORAGE POOLS	PHYS
LUN	LUN Type	Controller	Storage Pool	Snapshot Group	Tags	Status	Total Size	Allocated Size
Oracle-1TB-Thick-5-oradata	Thick	Prod-Array-2-mg-a	Storage-Pool			Online	1000 GiB	1000 GiB
Oracle-1TB-Thick-5-oradata_20151214115754	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			Online	1000 GiB	5 GiB
Oracle-1TB-Thick-5-oradata_20151222112507	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			Online	1000 GiB	5 GiB
Oracle-1TB-Thick-6-fra	Thick	Prod-Array-2-mg-a	Storage-Pool			Online	1000 GiB	1000 GiB
Oracle-500G-Thick-1	Thick	Prod-Array-2-mg-a	Storage-Pool			Online	500 GiB	500 GiB
Oracle-500G-Thick-2	Thick	Prod-Array-2-mg-a	Storage-Pool			Online	500 GiB	500 GiB
Oracle-500G-Thick-3	Thick	Prod-Array-2-mg-a	Storage-Pool			Online	500 GiB	500 GiB
Oracle-500G-Thick-4	Thick	Prod-Array-2-mg-a	Storage-Pool			Online	500 GiB	500 GiB
Oracle-Win-Data	Thick	Prod-Array-2-mg-a	Storage-Pool	Oracle-Windows		Online	1 TiB	1 TiB
Oracle-Win-Data_20160119140000	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			Online	1 TiB	5 GiB
Oracle-Win-Logs	Thick	Prod-Array-2-mg-a	Storage-Pool	Oracle-Windows		Online	100 GiB	100 GiB
Oracle-Win-Logs_20160119140000	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			Online	100 GiB	5 GiB

### 4.3. Assign Clone to Host

Choose which host to assign the thin clone. This can be the same host as the source database or an entirely new host server.

Start by navigating to the LUN tab in Symphony. Then highlight one of the new LUNs created by the thin clone process and click

the computer button  in the task bar. Then choose "Assign to SAN Client"

LUNs	SAN CLIENTS	SNAPSHOT RESOURCES	SNAPSHOT POLICIES	SNAPSHOTS	REPLICATIONS	SNAPSHOT GROUPS	STORAGE POOLS	PHYS																																																																																																																					
<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> <span>+</span> <span>✎</span> <span>🗑</span> <span>🔍</span> <span>🔄</span> <span>📄</span> <span>📁</span> <span>🖨</span> <span>🌐</span> <span>📷</span> <span>↔</span> <span>💾</span> <span>🔄</span> <span>🔗</span> </div> <div style="border: 1px solid #ccc; padding: 5px;"> <span>➤ Assign to SAN Client</span> </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>LUN</th> <th>LUN Type</th> <th>Controller</th> <th>Storage Pool</th> <th>Snapshot Group</th> <th>Tags</th> <th>Status</th> <th>Total Size</th> <th>Allocated Size</th> </tr> </thead> <tbody> <tr> <td>Oracle-1TB-Thick-5-oradata</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>1000 GiB</td> <td>1000 GiB</td> </tr> <tr> <td>Oracle-1TB-Thick-5-oradata_20151214115754</td> <td>Thin Clone</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>1000 GiB</td> <td>5 GiB</td> </tr> <tr> <td>Oracle-1TB-Thick-5-oradata_20151222112507</td> <td>Thin Clone</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>1000 GiB</td> <td>5 GiB</td> </tr> <tr> <td>Oracle-1TB-Thick-6-fra</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>1000 GiB</td> <td>1000 GiB</td> </tr> <tr> <td>Oracle-500G-Thick-1</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>500 GiB</td> <td>500 GiB</td> </tr> <tr> <td>Oracle-500G-Thick-2</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>500 GiB</td> <td>500 GiB</td> </tr> <tr> <td>Oracle-500G-Thick-3</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>500 GiB</td> <td>500 GiB</td> </tr> <tr> <td>Oracle-500G-Thick-4</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>500 GiB</td> <td>500 GiB</td> </tr> <tr style="background-color: #f2f2f2;"> <td>Oracle-Win-Data</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td>Oracle-Windows</td> <td></td> <td>✔ Online</td> <td>1 TiB</td> <td>1 TiB</td> </tr> <tr> <td>Oracle-Win-Data_20160119140000</td> <td>Thin Clone</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>1 TiB</td> <td>5 GiB</td> </tr> <tr> <td>Oracle-Win-Logs</td> <td>Thick</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td>Oracle-Windows</td> <td></td> <td>✔ Online</td> <td>100 GiB</td> <td>100 GiB</td> </tr> <tr> <td>Oracle-Win-Logs_20160119140000</td> <td>Thin Clone</td> <td>Prod-Array-2-mg-a</td> <td>Storage-Pool</td> <td></td> <td></td> <td>✔ Online</td> <td>100 GiB</td> <td>5 GiB</td> </tr> </tbody> </table>									LUN	LUN Type	Controller	Storage Pool	Snapshot Group	Tags	Status	Total Size	Allocated Size	Oracle-1TB-Thick-5-oradata	Thick	Prod-Array-2-mg-a	Storage-Pool			✔ Online	1000 GiB	1000 GiB	Oracle-1TB-Thick-5-oradata_20151214115754	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			✔ Online	1000 GiB	5 GiB	Oracle-1TB-Thick-5-oradata_20151222112507	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			✔ Online	1000 GiB	5 GiB	Oracle-1TB-Thick-6-fra	Thick	Prod-Array-2-mg-a	Storage-Pool			✔ Online	1000 GiB	1000 GiB	Oracle-500G-Thick-1	Thick	Prod-Array-2-mg-a	Storage-Pool			✔ Online	500 GiB	500 GiB	Oracle-500G-Thick-2	Thick	Prod-Array-2-mg-a	Storage-Pool			✔ Online	500 GiB	500 GiB	Oracle-500G-Thick-3	Thick	Prod-Array-2-mg-a	Storage-Pool			✔ Online	500 GiB	500 GiB	Oracle-500G-Thick-4	Thick	Prod-Array-2-mg-a	Storage-Pool			✔ Online	500 GiB	500 GiB	Oracle-Win-Data	Thick	Prod-Array-2-mg-a	Storage-Pool	Oracle-Windows		✔ Online	1 TiB	1 TiB	Oracle-Win-Data_20160119140000	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			✔ Online	1 TiB	5 GiB	Oracle-Win-Logs	Thick	Prod-Array-2-mg-a	Storage-Pool	Oracle-Windows		✔ Online	100 GiB	100 GiB	Oracle-Win-Logs_20160119140000	Thin Clone	Prod-Array-2-mg-a	Storage-Pool			✔ Online	100 GiB	5 GiB
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In the ASSIGN LUNS form, select all of the LUNs in the snapshot group on the left and the desired host on the right and click the Assign button at the bottom.

### ASSIGN LUNS

Select LUNs to Assign

Select All  Deselect All

Oracle-Win-	Search	Search		
LUN	LUN #	Type	Gro	
<input type="checkbox"/> Oracle-Win-Data		Thick	Oracle-W	
<input checked="" type="checkbox"/> Oracle-Win-Data_20160119140000	auto	Thin Clone		
<input type="checkbox"/> Oracle-Win-Logs		Thick	Oracle-W	
<input checked="" type="checkbox"/> Oracle-Win-Logs_20160119140000	auto	Thin Clone		

Showing 1 to 4 of 4 entries (filtered from 29 total entries)

Assign to SAN Clients

Select All  Deselect All

Client	Allowed
<input type="checkbox"/> ACCESS-5[vmemadmin]	✔
<input type="checkbox"/> LD-Appliance	✔
<input type="checkbox"/> ORACLE-1[vmemadmin]	✔
<input type="checkbox"/> Prod-ESXI-1	✔
<input checked="" type="checkbox"/> WindowsOracleServ	✔

Showing 1 to 5 of 5 entries

Available LUN #: 0-255

Access: Read/Write (Shared)

All Targets: ON

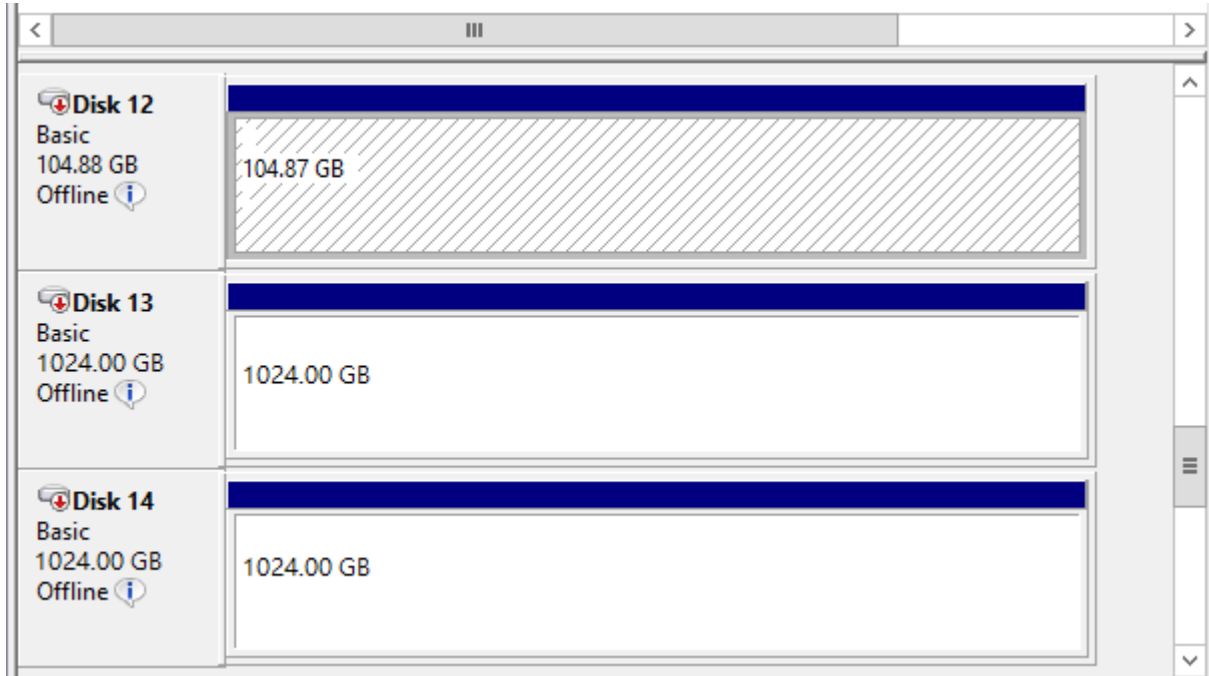
Cancel
Assign

## 5. Mounting Clones to a Windows Host

Moving back to the destination host for the clone, this section covers how to configure the newly assigned LUN or LUNs.

### 5.1. Prepare Volumes

If the new clone is being assigned to a new host for the first time, then Windows will have no mapping of the LUN IDs to their drive letters. Online the volumes and assign the drives letters desired. If the Windows instance has seen the LUNs before, then it will already have a mapping. Depending on the Windows version, it can also auto-assign the next available drive letters. Make sure that the drive letters end up mapped appropriately or a script is launched to handle the online and drive letter mapping.



## 6. Attaching Cloned Databases to Oracle

Now that the drive letters have been assigned, you are ready to attach the database to Oracle. Create a new initialization parameter file for the cloned database, and specify the new drive letters just created as storage locations for datafiles and redo logs as appropriate.

Start the database, and it will perform instance recovery (in the case of a crash-consistent snapshot) or will fail to open, saying it requires media recovery or that the backup be ended (in the case of the application-consistent snapshot). Issue either of the following commands via SQL\*Plus or your favorite administrative tool:

```
SQL> startup
ORACLE instance started.

Total System Global Area 2622255104 bytes
Fixed Size                 2256112 bytes
Variable Size             1761608464 bytes
Database Buffers          838860800 bytes
Redo Buffers              19529728 bytes
Database mounted.
ORA-10873: file 1 needs to be either taken out of backup mode or media recovered
ORA-01110: data file 1: 'G:\ORADATA\DEMO\DATAFILES\SYSTEM.264.880440951'
```

```
SQL> recover database;
Media recovery complete.
SQL> alter database open;
```





Database altered.

```
SQL> exit
```

or

```
SQL> startup
```

ORACLE instance started.

Total System Global Area 2622255104 bytes

Fixed Size 2256112 bytes

Variable Size 1761608464 bytes

Database Buffers 838860800 bytes

Redo Buffers 19529728 bytes

Database mounted.

ORA-10873: file 1 needs to be either taken out of backup mode or media recovered

ORA-01110: data file 1: 'G:\ORADATA\DEMO\DATAFILES\SYSTEM.264.880440951'

```
SQL> alter database end backup;
```

Database altered.

```
SQL> alter database open;
```

Database altered.

```
SQL> exit
```

## 7. Remap a Cloned Database

It is possible to change the state of the data inside of a thin clone to another point-in-time (snapshot). This is called remapping. The most common uses for this would be to either revert a change that was made (remap to a former snapshot) or to advance the thin clone to a more recent data set (remap to a newer snapshot).

### 7.1. Prepare the Database and Volumes


Similar to application consistent snapshots versus crash consistent snapshots, in order to ensure that there is no data corruption when making changes at the LUN or snapshot level, it is a best practice to offline the database and the volumes on the host.

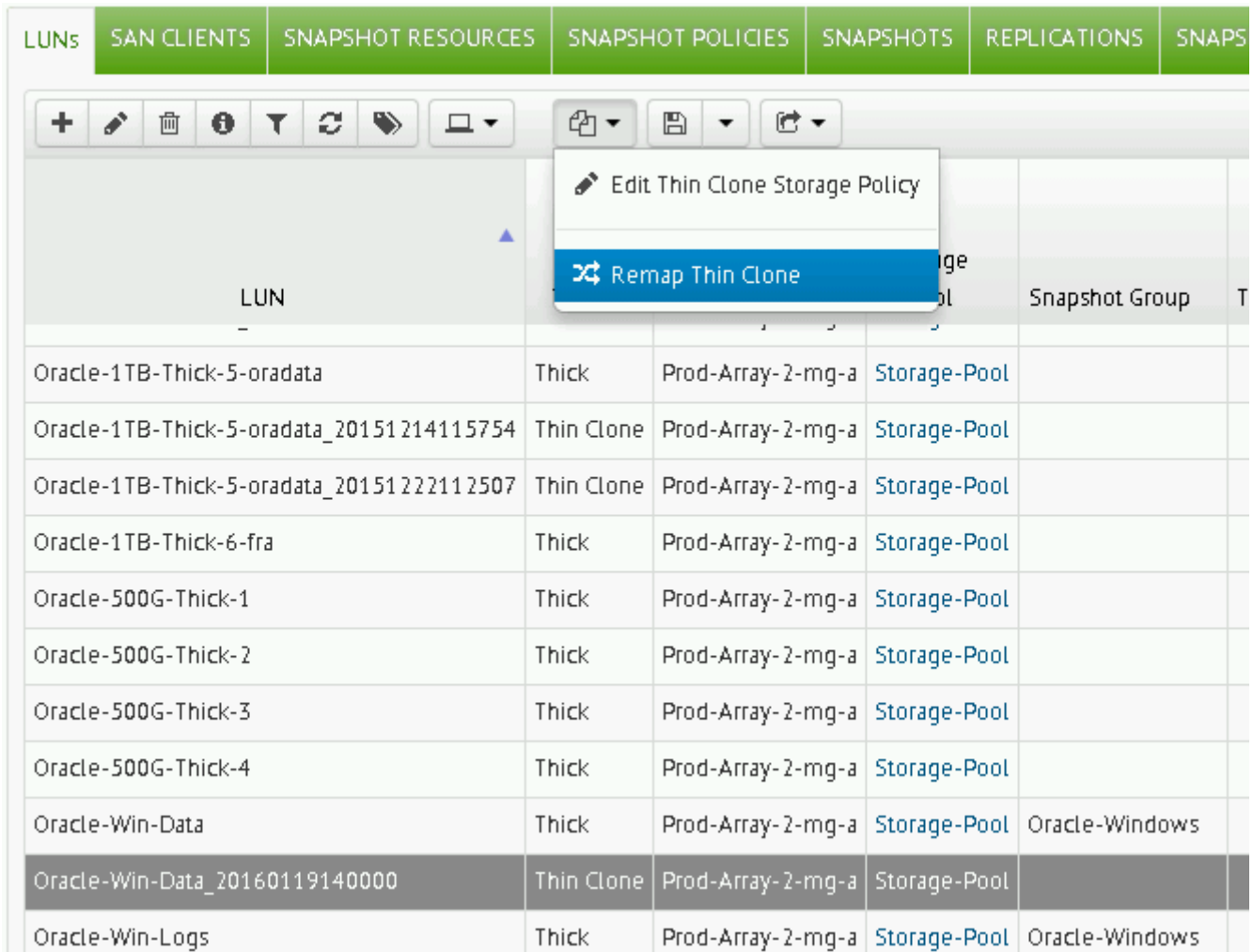
This makes sure that nothing is in flight or in memory when the change is made.

### 7.2. Remap the Clone

Important note: Prior to remapping the contents of any clone to a different snapshot of the source LUN(s), unmount the drive from any client side applications. Failing to stop the application or unmount the LUN on the client side will have undefined consequences.



In Symphony, on the LUNs tab, select one of the LUNs associated with the snapshot group. This will change the tool bar and introduce the clone button . Click on it and select the “Remap Thin Clone” option.



LUN	Policy	Array	Storage Pool	Snapshot Group	T
Oracle-1TB-Thick-5-oradata	Thick	Prod-Array-2-mg-a	Storage-Pool		
Oracle-1TB-Thick-5-oradata_20151214115754	Thin Clone	Prod-Array-2-mg-a	Storage-Pool		
Oracle-1TB-Thick-5-oradata_20151222112507	Thin Clone	Prod-Array-2-mg-a	Storage-Pool		
Oracle-1TB-Thick-6-fra	Thick	Prod-Array-2-mg-a	Storage-Pool		
Oracle-500G-Thick-1	Thick	Prod-Array-2-mg-a	Storage-Pool		
Oracle-500G-Thick-2	Thick	Prod-Array-2-mg-a	Storage-Pool		
Oracle-500G-Thick-3	Thick	Prod-Array-2-mg-a	Storage-Pool		
Oracle-500G-Thick-4	Thick	Prod-Array-2-mg-a	Storage-Pool		
Oracle-Win-Data	Thick	Prod-Array-2-mg-a	Storage-Pool	Oracle-Windows	
Oracle-Win-Data_20160119140000	Thin Clone	Prod-Array-2-mg-a	Storage-Pool		
Oracle-Win-Logs	Thick	Prod-Array-2-mg-a	Storage-Pool	Oracle-Windows	

Choose the desired new snapshot in the “Snapshot At:” drop down, and click on Remap at the bottom.

**REMAP THIN CLONE**

Current Thin Clone At: 1/19/16 2:00:00 PM

Remap for:  Snapshot Group  LUN

Group: Oracle-Windows

Snapshot At:  \*

Thin Clone Name Format:  ? \*

Thin Clone Names:

### 7.3. Online the Volumes and Database

Now that the source LUNs have been remapped to a new point-in-time (snapshot) you can now online the volumes with Disk Manager and repeat the process to start the cloned database as of this snapshot.

Note: Sometimes Windows will mark the modified LUNs as read-only. If this happens, use the diskpart utility to clear the readonly parameter of the volumes.

```

Administrator: Command Prompt - diskpart
DISKPART> list volume

  Volume ###  Ltr  Label              Fs          Type          Size      Status       Info
  -----
  Volume 0     C           NTFS            Partition    232 GB      Healthy      Boot
  Volume 1     D           NTFS            Partition    232 GB      Healthy      System
  Volume 2     G  SQL_Snap_Da  NTFS            Partition    106 GB      Healthy
  Volume 3     H  SQL_Snap_Da  NTFS            Partition    106 GB      Healthy
  Volume 4     L  SQL_Snap_Lo  NTFS            Partition     56 GB      Healthy
  Volume 5     O  DiskSpd-2    NTFS            Partition    395 GB      Healthy
  Volume 6     P  DiskSpd-3    NTFS            Partition    395 GB      Healthy
  Volume 7     R  Arv          NTFS            Partition   1023 GB      Healthy
  Volume 8     S  Arv          NTFS            Partition   1023 GB      Healthy
  Volume 9     T  Arv          NTFS            Partition   1023 GB      Healthy
  Volume 10    U  Arv          NTFS            Partition   1023 GB      Healthy
  Volume 11    Q  DiskSpd-4    NTFS            Partition    395 GB      Healthy
  Volume 12    X  SQL_Snap_Da  NTFS            Partition    106 GB      Healthy      Hidden
  Volume 13    Y  SQL_Snap_Da  NTFS            Partition    106 GB      Healthy      Hidden
  Volume 14    Z  SQL_Snap_Lo  NTFS            Partition     56 GB      Healthy      Hidden
  Volume 15    N  DiskSpd-1    NTFS            Partition    395 GB      Healthy

DISKPART> select volume 12
Volume 12 is the selected volume.

DISKPART> attribute volume clear readonly
Volume attributes cleared successfully.

```