



# HP Matrix Operating Environment and HP Storage Provisioning Manager support for port groups

Storage controller port load balancing using SPM

## Table of contents

Introduction .....	2
Background .....	2
Overview.....	2
Port Groups .....	2
Least Used Port policy .....	3
Port Group selection script .....	3
Controller Port White List (3PAR StoreServ Only).....	3
Defining Port Groups .....	4
Identifying network topology .....	4
Port Group definition file examples .....	5
Manually Selecting Port Groups.....	6
Identify controller ports in need of load balancing.....	7
Identify logical servers and volumes .....	8
Activities prior to re-zoning .....	9
Perform rezoning using the script .....	10
Final actions .....	11
Additional Information Using Port Groups in SPM .....	11
Controlling port group behavior within SPM.....	11
Adding array controller ports when using Port Groups and White List.....	12
Upgrading SPM to 2.2.2 or later .....	12
Summary.....	13
For More Information .....	13

## Introduction

With the release of the 7.2 Update 2 hotfix patch CMSOEPK-72X.3A14 (available in November 2013), HP Matrix Operating Environment (Matrix OE) and HP Storage Provisioning Manager (SPM version 2.2.2) support fine-grained control over controller port usage on SAN storage solutions. Using a new concept called *port groups*, administrators have tight control over which servers access which volumes through what set of controller ports. In addition, administrators have the capability of migrating volume access to new controller ports if it is determined that the load needs to be [re]balanced. This paper describes the process of creating and using port groups. In addition, this paper will discuss three related new features:

- Least Used Port selection (automatic selection of port group)
- Port group selection script (manual selection of port group via a CLI script)
- Controller port 'white list' (administrator-defined list of HP 3PAR StoreServ controller ports available to SPM)

## Background

Since the 7.0 release, Matrix OE (including Matrix infrastructure orchestration) supports fully automating the process of creating volumes, presenting volumes to servers, and zoning access to storage. Matrix does this by allowing the administrator to define storage requirements within Matrix IO service templates. These requirements are then passed down to SPM to be fulfilled. SPM in turn uses the appropriate management interface for HP 3PAR StoreServ, P6000/EVA, or B-Series SAN switches to automatically create new volumes, present them to servers as LUNs, and to create the needed SAN zoning. Prior to this 7.2 Update 2 enhancement, SPM presented all created LUNs through all storage controller ports and zoned the server (initiator) WWNs to all storage controller ports on the appropriate fabric, allowing all servers to see all controller ports.

This behavior of automatically presenting and zoning to all of the controller ports raises the following concerns:

- It can make controller ports look like they are oversubscribed.  
This is especially concerning for HP 3PAR StoreServ storage, which sets limits on how many servers can access each controller port. The best practice to avoid this issue is to zone one server WWN to one or two controller ports, limiting visibility. Each server can then be zoned to different sets of controller ports, balancing the load. (The limits, and the best practices to avoid these limits, are discussed in detail within the whitepaper Best practices for HP 3PAR StoreServ Storage with the HP Matrix Operating Environment and SAN configurations.)
- It does not allow the administrator to control the distribution of I/O load across controller ports.  
Without controlling load balancing via zoning, it is highly likely that some controller ports may be overused, while others remain unused or more lightly used.
- It does not allow Matrix/SPM to use a subset of the storage solution controller ports.  
Some environments may involve a storage solution intended to be used by Matrix/SPM in addition to other purposes, with the desire to segregate I/O traffic across different ports.

These concerns can be addressed with the new port groups and white list capabilities of SPM.

## Overview

This section provides an overview of the various features discussed in this document. Later sections discuss goals such as automated and manual load balancing, and using subsets of storage controller ports for automated operations.

## Port Groups

When using SPM with BNA (B-Series or Brocade Network Advisor) to automate zoning\*\*, port groups allow the storage administrator to preconfigure groups of controller ports that will always be zoned together when zoning to server WWNs. Using port groups is optional. The current behavior described above will be used if port groups are not used. Port groups only need to be defined once, and will be used from that point forward. A port group is limited to the set of controller ports from a single storage array on a single fabric/network. A port group can contain anywhere from one controller port, to all of the controller ports for an array on a given network. Port groups with only one controller port will provide one server WWN to one controller port (one-to-one) zoning. Port groups that contain all of the controller ports on a given fabric provide the

same behavior as not using port groups. Since port groups define zoning, each port group must contain controller ports from the same fabric. See the [Defining Port Groups](#) section for details of how to define port groups.

\*\* Port groups are not needed and should not be used if doing manual zoning. When doing manual zoning, the administrator already has complete control over controller port access.

## Least Used Port policy

When port groups are defined, SPM will automatically use port groups for zoning based on a 'least used port' policy. SPM will identify which controller port is used by the least number of services\*, and select the port group that contains that port. This allows users to automatically take advantage of the port group based zoning without doing any additional work. Matrix does not directly provide a way to define which port groups to use when defining storage for fulfillment through SPM. Because of this, all storage created after port groups are defined will initially be zoned using the least used port policy. If you desire, this can be manually changed later using a port group selection script (e.g., to fine-tune the load balancing across controller ports).

\* When using the least used port policy, actual disk I/O is not taken into consideration when determining which port to use. Because of this, ports automatically selected by SPM may actually be the most heavily used. This can be manually rebalanced using the port group selection script described below.

## Port Group selection script

When using port groups, you allow SPM to automatically select which port groups to use based on a least used port policy. If the storage administrator needs to load balance, or to direct the disk I/O for specific servers to specific storage controller ports, they will need to manually select the port groups. A PowerShell script is supplied to help the administrator do this. The script takes the server WWN to be rezoned and the name of the new port group to be used for zoning. It then performs the following actions

1. Delete the zone containing the server WWN and the original controller port(s)
2. Create a new zone containing the server WWN and the new controller port(s)

Note that using this script may temporarily take one or more LUNs offline, possibly causing server issues (e.g., if the boot or data disks become unavailable). This can be avoided with proper configuration and processes. See the section [Manually Selecting Port Groups](#), which describes using this port group selection script (including the means of identifying which ports are overloaded and which servers are currently using those ports).

## Controller Port White List (3PAR StoreServ Only)

The 3PAR configuration file `<SPM install location>/state/3par_storage/Configuration.xml` can now include a section describing array ports that may be used by SPM. This allows administrators to specify a subset of storage controller target ports available on a 3PAR StoreServ storage system for use by SPM/Matrix. This optional section is called "ArrayPortWhiteLists". If a white list is not present in the configuration file for a particular HP 3PAR StoreServ storage system, SPM behaves as it did in SPM 2.2.0, using all storage system controller ports. If a white list is present in the configuration file for a particular HP 3PAR StoreServ storage system, SPM will only make use of the target ports listed in the white list. Please see the *HP Storage Provisioning Manager (SPM) User Guide* for more information.

### Example HP 3PAR StoreServ Configuration File

An example configuration file containing a white list is illustrated below. Note that array names within the white list are the array names of arrays as visible in the SPM user interface (case sensitive), not the fully qualified domain name of the storage system.

```
<?xml version="1.0" ?>
  <Configuration xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" Version="2.2"
xmlns="urn:TPDStoragePlugin">
  <OSPersonaMaps>
    <OSPersonaMap VersionMinimum=" " VersionMaximum="3.1.2.219">
      <OSPersona OS="Windows" Persona="Generic-1" />
      ...
      <Various persona mappings>
      ...
    </OSPersonaMap>
  </OSPersonaMaps>
```

```

<ArrayPortWhiteLists>
  <ArrayPortWhiteList ArrayName="Array1">
    <Port WWN="20:01:00:E5:00:00:AA:01" />
    <Port WWN="20:02:00:E5:00:00:AA:01" />
    <Port WWN="21:01:00:E5:00:00:AA:01" />
    <Port WWN="21:02:00:E5:00:00:AA:01" />
  </ArrayPortWhiteList>
</ArrayPortWhiteLists>
</Configuration>

```

## Defining Port Groups

Defining port groups is a matter of creating an appropriate `Configuration.xml` file within the directory, `<SPM install location>\state\storageArrayBridge`. Examples of port group `Configuration.xml` files can be seen in the section, [Port Group definition file examples](#).

Two key factors determine what should be in this file:

1. The FC (Fibre Channel) network topology. The steps to determine this topology can be found below in the section, [Identifying network topology](#) below.
2. Any local administrative policies governing controller port usage

Note that these policies may include considerations such as:

- If zoning must be one-to-one, one-to-two, or higher zoning. (server WWN to controller port(s) )  
(The whitepaper, *Best practices for HP 3PAR StoreServ Storage with the HP Matrix Operating Environment and SAN configurations*, discusses this in more detail.)
- If some controller ports need to be dedicated for certain types of servers

Within a given fabric/network, these policies will determine how the controller ports are grouped into port groups.

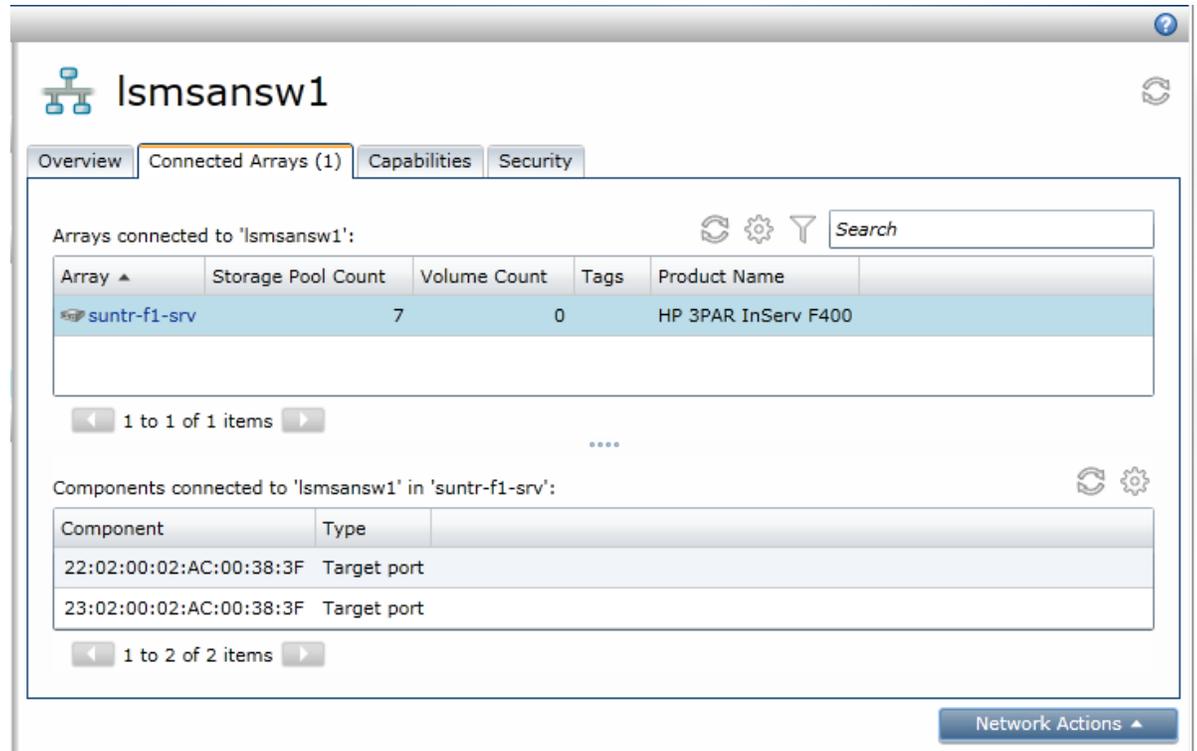
When this `Configuration.xml` file is defined and copied into the previously specified directory, SPM will start using port groups for zoning on all new SPM service creations and activations. Initially, it will automatically select port groups based on the least used port policy. Administrators can then manually override these selections by using the provided port group selection script, *Rezone.ps1*. See the [Manually Selecting Port Groups](#) section.

## Identifying network topology

Since zoning takes place within a fabric/network, and port groups determine zoning, all controller ports within a given port group must be from the same network. (It doesn't make sense to zone for a controller port that is on a different switch.) SPM can be used to determine which controller ports are visible on which networks. The steps to do this are:

1. Log into the SPM user interface and select **Network** in the navigation pane on the left.
2. For each network in the list, click on its link to bring up the network details.
3. Within the network details, click on the **Connected Arrays** tab to show the list of arrays that are connected to this network.
4. For each Array in the "Array connected to..." table, click on its line (but not its name/link). This will bring up the list of controller ports from the array that is connected to this network.

**Figure 1.** An example of the network and controller port information in SPM.



In the example in **Figure 1**, there are two controller ports from the “suntr-f1-srv” 3PAR StoreServ on this particular network (“lsmansw1”). In this smaller case, the only two configuration options available are:

1. Create one port group with both controller ports
  2. Create two port groups with one controller port each
- (Examples of both configurations can be found in the [Port Group definition file examples](#) section.)

This identification should be done for each of the networks defined within SPM.

## Port Group definition file examples

### Example configured for one-to-one zoning

The following is an example of a Configuration.xml file that defines four port groups for the HP 3PAR StoreServ “matrix-3par”. Each port group contains one controller port, which will result in one-to-one zoning. Note that there are two (redundant) networks, with two port groups defined for each network. (The storage array has four controller ports total, two on each network.)

```
<?xml version="1.0"?>
<StorageArrayBridgeConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema" Version="2.2"
xmlns="urn:StorageArrayBridgeConfiguration">
  <ArrayPortGroupLists>
    <ArrayPortGroupList ArrayName="suntr-f1-srv">
      <PortGroup GroupName="SANA_Group1">
        <Port WWN="22:01:00:02:AC:00:38:3F" />
      </PortGroup>
      <PortGroup GroupName="SANA_Group2">
        <Port WWN="23:01:00:02:AC:00:38:3F" />
      </PortGroup>
      <PortGroup GroupName="SANB_Group1">
        <Port WWN="22:02:00:02:AC:00:38:3F" />
      </PortGroup>
      <PortGroup GroupName="SANB_Group2">
        <Port WWN="23:02:00:02:AC:00:38:3F" />
      </PortGroup>
    </ArrayPortGroupList>
  </ArrayPortGroupLists>
</StorageArrayBridgeConfiguration>
```

### Example showing all controller ports in same port group

The following is an example of a `Configuration.xml` file that defines two port groups for the HP 3PAR StoreServ “matrix-3par”. Each port group contains two controller ports, which will result in one-to-two zoning. Note that there are two (redundant) networks, with one port group defined for each network. (Note that because there is only one port group defined for each network, and all of the controller ports for each network are included within that one port group, this provides the exact same behavior as not using port groups.)

```
<?xml version="1.0"?>
<StorageArrayBridgeConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema" Version="2.2"
xmlns="urn:StorageArrayBridgeConfiguration">
  <ArrayPortGroupLists>
    <ArrayPortGroupList ArrayName="suntr-fl-srv">
      <PortGroup GroupName="SANA_Group">
        <Port WWN="22:01:00:02:AC:00:38:3F" />
        <Port WWN="23:01:00:02:AC:00:38:3F" />
      </PortGroup>
      <PortGroup GroupName="SANB_Group">
        <Port WWN="22:02:00:02:AC:00:38:3F" />
        <Port WWN="23:02:00:02:AC:00:38:3F" />
      </PortGroup>
    </ArrayPortGroupList>
  </ArrayPortGroupLists>
</StorageArrayBridgeConfiguration>
```

### Example showing port group configuration with two arrays

The following example is not from the same array as the previous two examples. It is used to show an example of a more complex `Configuration.xml` file, with the definitions for multiple arrays within the same file.

```
<?xml version="1.0"?>
<StorageArrayBridgeConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema" Version="2.2"
xmlns="urn:StorageArrayBridgeConfiguration">
  <ArrayPortGroupLists>
    <ArrayPortGroupList ArrayName="Array1">
      <PortGroup GroupName="Group1">
        <Port WWN="22:01:00:02:AC:00:38:3F" />
        <Port WWN="23:01:00:02:AC:00:38:3F" />
      </PortGroup>
      <PortGroup GroupName="Group2">
        <Port WWN="22:02:00:02:AC:00:38:3F" />
        <Port WWN="23:02:00:02:AC:00:38:3F" />
      </PortGroup>
    </ArrayPortGroupList>
    <ArrayPortGroupList ArrayName="Array2">
      <PortGroup GroupName="Group3">
        <Port WWN="22:02:00:02:AC:00:37:3E" />
        <Port WWN="23:02:00:02:AC:00:37:3E" />
        <Port WWN="22:01:00:02:AC:00:37:3E" />
        <Port WWN="23:01:00:02:AC:00:37:3E" />
      </PortGroup>
      <PortGroup GroupName="Group4">
        <Port WWN="24:02:00:02:AC:00:37:3E" />
        <Port WWN="21:02:00:02:AC:00:37:3E" />
        <Port WWN="24:01:00:02:AC:00:37:3E" />
        <Port WWN="21:01:00:02:AC:00:37:3E" />
      </PortGroup>
    </ArrayPortGroupList>
  </ArrayPortGroupLists>
</StorageArrayBridgeConfiguration>
```

## Manually Selecting Port Groups

As previously noted, controller ports will be selected automatically using the least used port policy by SPM, or manually by the storage administrator via a PowerShell script. The script adjusts the existing SAN zoning, removing access via one set of ports and providing access through a different set of ports (essentially moving the access). This section discusses the general steps needed to identify which server WWNs to move, the precautions that need to be taken, and finally how to rezone to the new port groups. These steps will involve coordination between administrators overseeing servers using

storage on the storage system and administrators overseeing the storage system itself. The steps to be performed are indicated here, without distinction regarding who should perform which step.

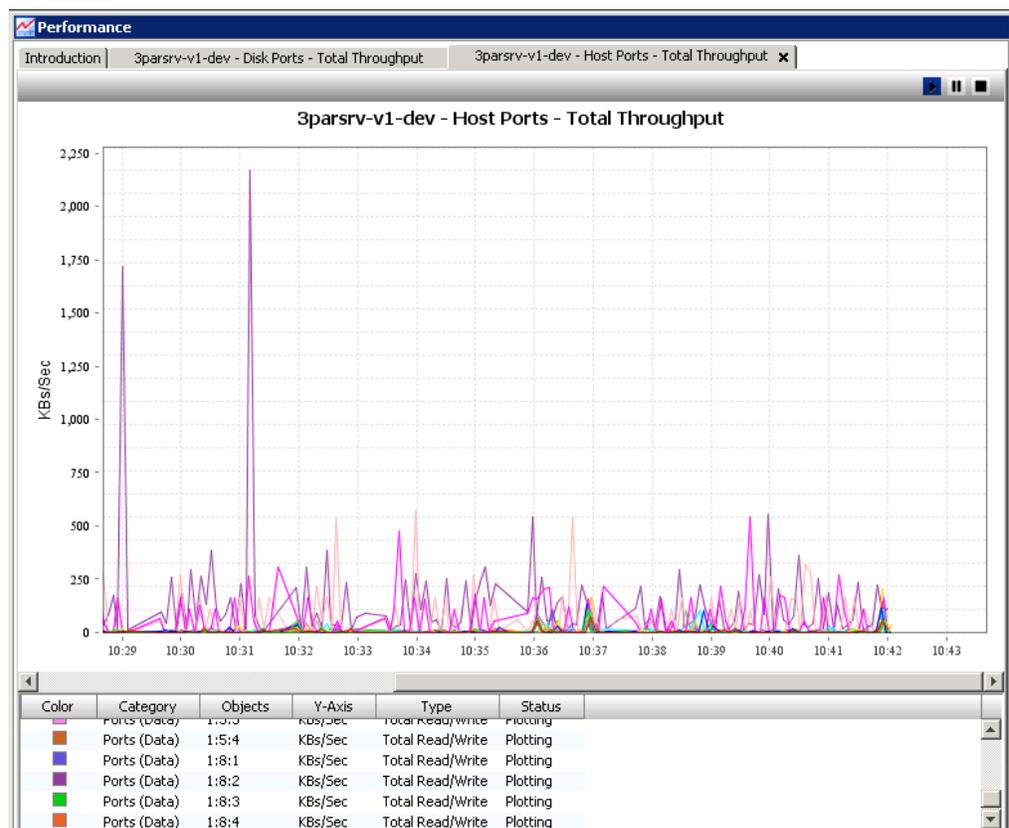
1. Identify controller ports in need of load balancing (using storage system management tools)
2. Identify servers (initiator WWNs) that need to be moved to new controller ports
  - a. Identify list of server WWNs that need rezoning to new controller ports (use storage management console to build the initiator list)
  - b. Determine which Matrix services/logical servers ‘own’ these initiator WWNs and if the volumes accessed via those initiators are redundant or not (use the Matrix OE visualization logical server summary page)
3. Based on above information, determine pre-zoning actions. This includes identifying if servers need to be taken down, and if VMs need to be moved to new hosts.
4. Perform the rezoning to the new controller ports (Use the provided PowerShell script to perform the rezoning operations.)
5. Final actions (This includes starting servers back up and moving VMs back that may have been moved.)

The steps are covered in further detail below.

## Identify controller ports in need of load balancing

Determining if load balancing is needed is beyond the scope of this paper. However, there are multiple criteria that can be used to determine which controller ports need offloading. It can be based on the number of hosts currently connected to each controller port, where the goal is to keep this number level across all controller ports. Another option is to use actual I/O traffic through each controller port. Often, the storage solution will provide tools to monitor this information. The screenshot in Figure 2 shows the monitoring of disk I/O traffic across the controller ports for HP 3PAR StoreServ.

**Figure 2.** HP 3PAR StoreServ Management Console showing total throughput over time for each controller port.



Regardless of the criteria used, two things need to be identified:

1. What controller ports are overloaded and need servers moved off of them
2. What controller ports are underutilized and can have servers migrated to them

## Identify logical servers and volumes

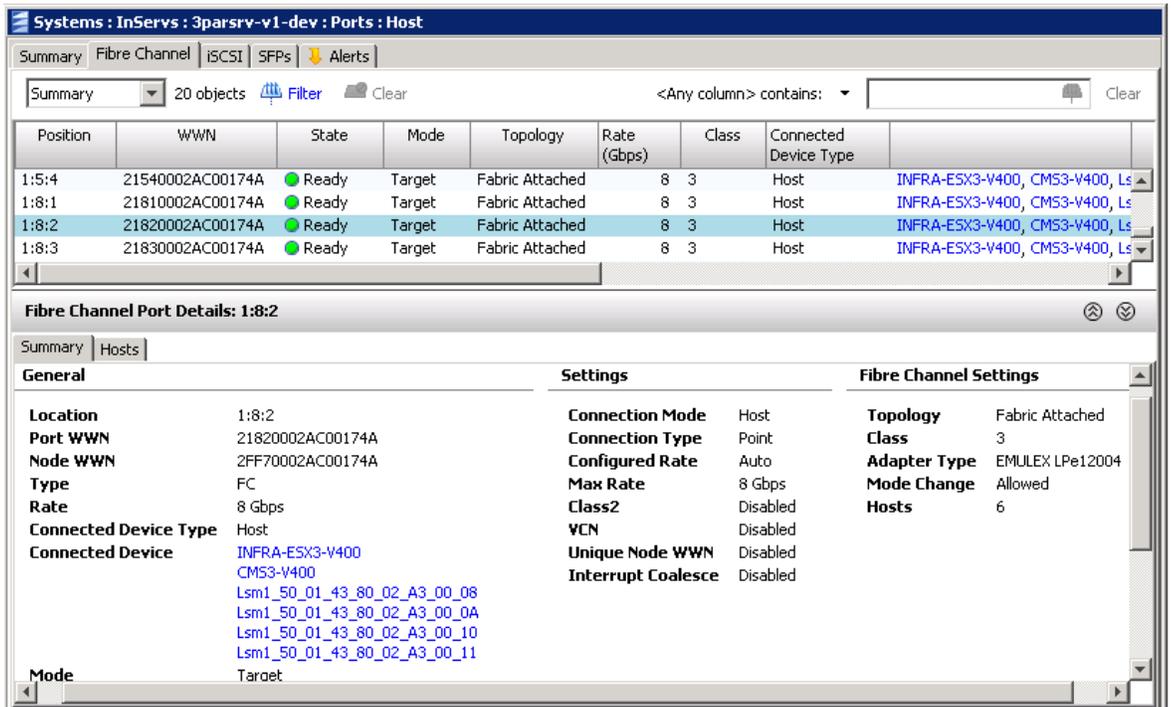
Once the set of controller ports that need to be off loaded is known, the next step is to identify which logical servers are currently using these controller ports. Doing this is a two-step process:

1. Identify which server (initiator) WWNs are accessing these controller ports.
2. Map these server WWNs back to the logical servers that 'own' them.

### Identify server WWNs using controller ports

The server WWNs that are currently connected to a given controller port can be found by using the array's management console. For each controller port that needs to be offloaded, the controller port details show the list of hosts currently connected. The actual server WWNs can then be found by looking at the individual host definitions.

**Figure 3.** Screenshot showing port 1:8:2 is currently connected to six hosts. These six host definitions contain the server WWNs which may be suitable to move other controller ports that have less load.

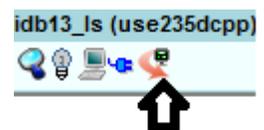


### Identify the logical servers that own these server WWNs

Once a list of server WWNs has been collected as previously described, they will need to be mapped back to the logical servers that own them. The reasons to do this are:

- It makes sense to migrate an entire server to new controller ports, although this is not required.
- Knowing if the volumes accessed through those WWNs are redundant will help in creating an action plan

Identifying the logical server(s) that own these WWNs can be done in several different ways depending on how many logical servers are in the environment. If there are a small number of logical servers, this mapping can be done within the HP Matrix OE visualization screen. Each logical server entry contains an icon that brings up a logical server summary page when clicked. (See image on right.)



The summary page contains the list of the storage pool entries used by the logical server. Within each storage pool entry description, there is a list of server ports containing the server WWNs use by the logical server, along with the volumes accessed using those server WWNs. For each logical server owning WWNs which will be moving to new controller ports, identify if the volumes are redundant or not.

If the list of logical servers is too large to easily use the mechanism described above, there is the ability to output the logical server definitions into a single XML formatted text file. This file can then be searched within a text editor to find the server

WWNs and the owning logical servers. The logical servers can be output to XML using the `lsmutil` command on the CMS (Central Management Server). The command is:

```
C:\> lsmutil -list -ls -xml -file ls_list_out.xml
```

The above command will generate a file named `ls_list_out.xml`. Search and editing tools can be used to find the server WWNs and identify the owning logical servers. The generated XML file contains Sever WWN structures such as the following:

```
<LsaWWN>
  <id>303</id>
  <value>50:01:43:80:02:60:00:09</value>
  <nodeValue>50:01:43:80:02:60:00:0B</nodeValue>
  <oldValue>50:01:43:80:02:60:00:09</oldValue>
  <allocatedValue>50:01:43:80:02:60:00:09</allocatedValue>
  <owner>111</owner>
  <wwnNumber>1</wwnNumber>
  <state>4</state>
  <type>0</type>
  <timeRequested>0</timeRequested>
  <physicalPort>0</physicalPort>
  <inProfile>false</inProfile>
  <inProfileOrder>777</inProfileOrder>
  <connectionType>UNKNOWN</connectionType>
</LsaWWN>
```

The 'value' field (within the LsaWWN object) is the server WWN. The 'owner' field is the internal ID of the logical server that owns this server WWN. Search for the logical server that owns this WWN by searching for that ID. The result will be a LsaLogicalServer object with that ID, similar to the following:

```
<LsaLogicalServer>
  <id>111</id>
  <name>pg_sample_ls_1</name>
  <description></description>
  ...
```

Whatever procedure is used, the result is a list of logical servers that need to be migrated to new controller ports, and information on whether or not the volumes being accessed are redundant. Note that a redundant volume can be identified by its two paths. (It will have both a primary and secondary path.) Depending on the method used above, this will show up visually in the GUI or as multiple LsaSanVolumePath objects under the volume within the generated XML file.

## Activities prior to re-zoning

With the list of logical servers in hand, it is time to create a plan to do the actual rezoning.

**Note: The rezoning operations can take disks offline for a period of time, causing issues with boot and data volume access.**

Previously, it was determined if the impacted volumes use redundant paths (multi-path). In this context, redundant paths identify the volume as being accessible using two different initiator WWNs from the same server. Having multiple paths allows one path to be used for volume access while the other path is being rezoned to new controller ports. Storage access will automatically failover as needed to use the live path during this process. When rezoning the second path, volume access will failover to the newly zoned first path. This allows rezoning to take place on a running server, making it the easiest solution. Note that all of the steps outlined in the section [Perform rezoning using the script](#) should be followed for one path before starting the rezoning of the second path.

If any of the volumes are not redundant, or if it can't be determined that they are redundant, then it is necessary to deactivate (shutdown) the server before rezoning. Arrangements must be made to avoid interrupting the services that depend on that path. For example, migrate the VM guests providing the affected services to other hypervisors, or arrange for a service interval in which the services that depend on the path can be halted, the Rezone script run, and the services can be restarted.

## Perform rezoning using the script

After all preparations have been completed, and the list of server (initiator) WWNs and new port groups have been determined, it is time to do the actual rezoning. `Rezone.ps1` is the supplied PowerShell script used to do this rezoning operation. When run, this script will:

1. Find all SPM storage services using the specified initiator.
2. Remove the initiator WWN requirements matching the specified initiator WWN and any port group requirements from those services.
3. Reactivate the services.  
This will remove the SPM created zones that are no longer being used by the initiator WWN\*.
4. Re-apply the initiator WWN requirements.
5. Add port group requirements for the port group specified.
6. Reactivate the services a second time.

This will create zones for the initiator WWNs that have no existing zones\*.

\*SPM will not remove zones that were created outside of SPM. When creating zones, SPM will use existing zones that meet the initiator WWN requirements, even if not created by SPM.

**Note:** Using the Rezone script on SPM services that were upgraded from a previous version requires special handling. Please see the section [Upgrading SPM to 2.2.2 or later](#) for more information.

The Rezone script takes the following parameters.

-Port <port#>	TCP port number used to communicate with SPM. Default is 8000.
-Login <login name>	if omitted, prompts for a username
-Password <password>	if omitted, prompts for a password
-UseHttp	Web protocol. Allowed values are http and https. Default is https
-InitiatorWWN <wwn>	Initiator (Server) WWN to be rezoned. This must be provided.
-PortGroup <group name>	Name of new port group to be used. If none is provided, SPM chooses the 'least used' port group.
-ArrayName <array name>	Optional name of array for which target ports should be rezoned

The port group and array name arguments are optional. If no port group is specified, SPM will use the least-used port algorithm to choose a new port group. If no array name is specified, SPM will act on all services that reference the specified initiator. If an array name is specified SPM will limit its actions to those services that present volumes on the specified array to the specified initiator.

Limitations:

- The Rezone script must run on the CMS where SPM is installed.
- While the Rezone script is running, no operations should be performed on any service referencing the initiator provided to the script.
- The Rezone script should not be started when operations on any service referencing the initiator provided to the script are in progress. This can be determined by reviewing the current jobs within the SPM job table.
- The PowerShell script execution policy may need to be modified to allow the script to be run.

Note that if there is already an existing zone connecting the initiator to the target ports on the array, SPM will re-use that zone. If there is no existing zone, SPM will create a new zone containing the initiator and all ports on the array that are on the same fabric as the initiator (and in the white list, if one is defined for HP 3PAR StoreServ). Please see the *HP Storage Provisioning Manager (SPM) User Guide* for more information.

**Note:** If the Rezone script fails for some reason, such as if services were previously upgraded and never re-activated, the affected services need to be repaired before the Rezone script can be run again. This should be done using Matrix OE storage pool entries. The suggested steps to do this are:

1. Find and modify the SPE that contains the broken services (volumes).
2. Uncheck the **Mask** checkbox for the broken volume(s\*).

3. Save the SPE. (This will cause SPM to un-present the volume(s) from the host(s).)
4. When the operation is completed, modify the SPE again.
5. Check the **Mask** checkbox for the previously unmasked volume(s\*).
6. Save the SPE. (This will cause SPM to re-present the volume(s) to the host(s).)

When all activations within SPM are complete, the Rezone script can be rerun on the initiator WWN and all of its services.

\* Many volumes/services can be operated on at the same time using these steps, saving time. Simply uncheck the **Mask** checkbox for all affected volumes before saving the SPE. SPM will perform an un-present operation for each volume.

### Example of running Rezone.ps1

Figure 4 shows an example of using the Rezone PowerShell script. The definition for the port group being zoned, “SANB\_Group2”, can be found in the port group definition examples earlier in this document.

Figure 4. Output from a typical running of the Rezone.ps1 script.

```
PS C:\scripts> .\Rezone -InitiatorWWN 50:01:43:80:02:56:00:04 -PortGroup SANB_Group2
Host name (blank for localhost):
Login: Administrator
Password: *****
[11/12/2013 10:45:23] =====Starting Rezone Initiator=====
[11/12/2013 10:45:23] Connecting to SPM instance https://lsmcms09:8000/ArcadiaService
[11/12/2013 10:45:26] Found 1 services to rezone.
[11/12/2013 10:45:26] Attempting to rezone services.
[11/12/2013 10:45:26] =====Removing Initiator WWN Requirements From Services=====
[11/12/2013 10:45:26] *****
[11/12/2013 10:45:26] Service: lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1 <363256c7-9d1a-4126-be5b-e97c594a598f>
[11/12/2013 10:45:26] Updating requirements for service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'.
[11/12/2013 10:45:26] Reactivating service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'
[11/12/2013 10:45:26] Validating service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'
[11/12/2013 10:45:49] Successfully validated activation of service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'
[11/12/2013 10:45:49] Reactivated service lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1 without initiator wwn require
ment.
[11/12/2013 10:45:49] =====Reactivating Services With New Port Groups=====
[11/12/2013 10:45:49] *****
[11/12/2013 10:45:49] Service: lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1 <363256c7-9d1a-4126-be5b-e97c594a598f>
[11/12/2013 10:45:49] Updating requirements for service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'.
[11/12/2013 10:45:49] Reactivating service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'
[11/12/2013 10:45:50] Validating service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'
[11/12/2013 10:46:08] Successfully validated activation of service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1'
[11/12/2013 10:46:08] Reactivated service 'lsm-request-64468-libra_vcdg_PoolEntry_66-vol 1' after restoring initiator W
WN and adding port group requirement.
[11/12/2013 10:46:09] =====Completed Reactivate Services=====
PS C:\scripts>
```

## Final actions

When all rezoning operations for the impacted servers are complete, the last action is to return the servers back to their original state. If the volumes were redundant, and the rezoning done to the live servers, then there is no additional action. Otherwise, servers will need to be restarted. If they are VM hosts, then all VM guests originally moved off of these servers should be moved back.

## Additional Information Using Port Groups in SPM

This section discusses additional topics specific to using port groups and the controller port white list from within SPM.

**Note:** These capabilities are not available through Matrix, but can impact storage provisioned through Matrix.

## Controlling port group behavior within SPM

Port group behavior can be controlled within SPM using the port group configuration file and by using Fibre Channel port group requirements within SPM services. If port groups are configured for an array, when creating an SPM service using a volume on that array, SPM will zone each initiator to the ports in one port group. If a service request includes a port group requirement within its initiator endpoint requirement and there is a port group defined with the same name for the array, SPM will use the ports in the group with the name specified by the requirement. If a service request does not include a port group requirement within an initiator endpoint requirement or if there is such a requirement but the specified port group name does not match the name of any port group on the array, SPM will use the port group containing a target port that is used by the least number of SPM storage services. If a number of ports are used by the least number of SPM storage services, SPM will choose one at random. Ports that are not mentioned in the port group file are treated as if they are in a port group containing only that port. Arrays not mentioned in the port group file are treated as if all ports on the array are in a single group. These default groups are not named, and cannot be specified in a port group requirement. Please see the *HP Storage Provisioning Manager (SPM) User Guide* for more information.

## Adding array controller ports when using Port Groups and White List

When adding ports to a storage system for which a white list is configured (i.e. HP 3PAR StoreServ), if any new ports are to be used by SPM and Matrix, they must be added to the white list, and the storage system must be resynchronized in SPM. If no white list is configured for that storage system, the storage system must be resynchronized in order for SPM to discover and use the new ports.

If port groups are configured for a storage system to which new ports are being added, SPM will treat the newly added ports as each being in their own port group. If this is not the desired configuration, the port group configuration file must be edited, and the new ports must be added to port groups as desired within the file. After editing the file, services that use port groups that have changed may become nonconformant. To make them conformant again, these services should be reactivated in SPM.

If port groups are not configured for a storage system to which new ports are being added, SPM will add the new ports to the default port group containing all ports on the storage system. As above, active services that use that port group may become nonconformant, and if so they should be reactivated. In this case, any service using a volume on the storage system to which new ports have been added may require reactivation.

## Upgrading SPM to 2.2.2 or later

Previous versions of SPM did not support port groups. Active services will be conformant after an upgrade to versions of SPM that do support port groups. Configuring port groups after upgrading to SPM 2.2.2 or later will not make active services nonconformant. If it is required that active services be reconfigured to use a new port group, use the Rezone script.

Previous versions of SPM did not support white lists for HP 3PAR StoreServ. Active services should be conformant after an upgrade to versions of SPM that do support white lists. Creating a white list after upgrading to SPM 2.2.2 or later should make active services using array ports that are not white listed nonconformant. If an in-use port was mistakenly omitted from the white list, edit the white list to add the port. If it was intentional to no longer use an in-use port (removing service access via that port), the following two steps will make these services conformant again:

1. un-present the volume from the host (in SPM, remove the host requirement from the services and reactivate),
2. re-present the volume to the host. (in SPM, replace the host requirement and reactivate)

If these nonconformant services were created using Matrix IO or via a Matrix OE storage pool entry, it is suggested that the above operations be performed using Matrix OE. The steps to do this are:

1. Find and modify the SPE that contains the nonconformant service (volume).
2. Uncheck the **Mask** checkbox for the nonconformant volume(s\*).
3. Save the SPE. (This will cause SPM to un-present the volume(s) from the host(s\*).
4. When the operation is completed, modify the SPE again.
5. Check the **Mask** checkbox for the previously unmasked volume(s\*).
6. Save the SPE. (This will cause SPM to re-present the volume(s) to the host(s\*).

\* Many volumes/services can be operated on at the same time using these steps, saving time. Simply uncheck the **Mask** checkbox for all nonconformant volumes before saving the SPE. SPM will perform an un-present operation for each volume.

Note that performing these steps may require that servers be shut down if they do not have redundant connections to the storage system. These operations affect all servers that are sharing the nonconformant volumes.

**Note:** If the manual Rezone script is to be used on services activated using SPM 2.2.0 or earlier, it is necessary to reactivate the services before using the Rezone script. You can determine if an existing SPM service was activated before or after the upgrade by comparing the Modified date of the service to the date when the upgrade to SPM 2.2.2 or later version was performed. If a service was reactivated since the upgrade (perhaps to bring it back into conformance after creating a white list as described above), it is not necessary to repeat the reactivation. To perform the reactivation in SPM prior to manual Rezoning, choose **Configure Requirements** from the right-click menu item on that service, or from the "Storage Service Actions" menu, and accept the defaults that are provided in the Provision Storage Service Wizard.

## Upgrading and adding ports

If a site is upgrading and adding ports simultaneously, it is recommended to upgrade SPM first, configure any white list or port group configuration files to account for the new ports, then add the new ports to the storage system and resynchronize the storage system in SPM. If performed in this order, the extra WWNs in the configuration files will be ignored while the ports do not exist, and then the configuration will be correct when SPM discovers the newly-added ports.

## Summary

Using the new port group feature (available in SPM version 2.2.2 and later) gives administrators the ability to control zoning like never before. When automating zoning through SPM, administrators can now control which controller ports are zoned together with an initiator WWN (versus the default of zoning to all ports on a fabric/network). A white list can be defined for HP 3PAR StoreServ indicating a subset of controller ports to be used (versus all discovered ports). These capabilities provide a solution to the concerns with zoning all controller ports to an initiator, including:

- It can make controller ports look like they are oversubscribed.  
This is especially concerning for HP 3PAR StoreServ storage, which sets limits on how many servers can access each controller port. The best practice to avoid this issue is to zone one server WWN to one or two controller ports, limiting visibility. Each server can then be zoned to different sets of controller ports, balancing the load. (The limits, and the best practices to avoid these limits, are discussed in detail within the whitepaper Best practices for HP 3PAR StoreServ Storage with the HP Matrix Operating Environment and SAN configurations.)
- It does not allow the administrator to control the distribution of I/O load across controller ports  
Without controlling load balancing via zoning, it is highly likely that some controller ports may be overused, while others remain unused or more lightly used.
- It does not allow Matrix/SPM to use a subset of the storage solution controller ports  
Some environments may involve a storage solution intended to be used by Matrix/SPM in addition to other purposes, with the desire to segregate I/O traffic across different ports.

## For More Information

Please see the following website(s) and document(s) for more information

- HP 3PAR StoreServ Solutions  
<http://hp.com/go/storage>  
<http://hp.com/go/3parstoreserv>
- Enabling Storage Automation in HP CloudSystem Matrix  
<http://hp.com/go/matrix>  
<http://hp.com/go/matrixondemandstorage>
- Matrix Operating Environment documentation website  
<http://hp.com/go/matrixoe/docs>
  - Whitepaper: *Faster storage provisioning in the HP Matrix Operating Environment: use of the HP Storage Provisioning Manager storage catalog with controlled storage operations*
  - Whitepaper: *Best practices for HP 3AR StoreServ Storage with the HP Matrix Operating Environment and SAN configuration*
  - *HP Storage Provisioning Manager (SPM) User Guide*

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