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IBM Geographically Dispersed Resiliency for IBM Power Systems

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IBM Geographically Dispersed Resiliency for IBM Power Systems

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Note: Before using this information and the product it supports, read the information in “Notices” on page vii.

First Edition (March 2017)

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Contents

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Preface

This IBM® Redbooks® publication introduces and provides a broad understanding of the new IBM Geographically Dispersed Resiliency for IBM Power Systems™ solution.

The IBM Geographically Dispersed Resiliency for Power Systems solution is a set of software components that together provide a disaster recovery (DR) mechanism for virtual machines (VMs) running on an IBM POWER7® processor-based server or later. This document describes various components, subsystems, and tasks that are associated with the IBM Geographically Dispersed Resiliency for Power Systems solution.

This book is targeted at technical professionals (consultants, technical support staff, IT Architects, and IT Specialists) that are responsible for providing high availability (HA) and DR solutions and support on IBM Power Systems servers.

Updates: Since the released of the first IBM Geographically Dispersed Resiliency for Power Systems V1.1.0, a new SP1 has been released which delivers the following capabilities and support changes to the offering.

Note: This is a replacement offering for the Geographically Dispersed Resiliency (5799-DRP) PRPQ. Implementation services for Geographically Dispersed Resiliency are strongly recommended. Contact GDR@us.ibm.com for further information on the services available.

Geographically Dispersed Resiliency for Power Systems V1.1.0 SP1 offers support for:

- IBM i as a guest operating system, adding to the current support for IBM AIX and Linux
- IBM DS8000 Global Mirror
- IBM SAN Volume Controller/IBM Storwize Metro and Global Mirror
- EMC SRDF synchronous replication
- Boot device selection for IBM POWER8 technology-based systems

Geographically Dispersed Resiliency for Power Systems V1.1.0 SP1 includes new capabilities to help you achieve your disaster recovery objectives:

- Support for both synchronous and asynchronous replication of data through the IBM SAN Volume Controller
- Support for both synchronous and asynchronous replication of data through the Storwize family
- Support for asynchronous replication of data through the DS8000 family
- Support for synchronous replication of data through EMC storage by using Symmetrix Remote Data Facility (SRDF)
- Support for IBM i guest virtual machines
- On POWER8 technology-based systems, support for multiple boot disks to allow selection of the appropriate boot device to use in recovery

Note: At the time this publication was written, the residency team developed the content utilizing IBM Geographically Dispersed Resiliency for Power Systems V1.1.0.

For more information, refer to the IBM Geographically Dispersed Resiliency for Power Systems website at the following link:

https://www.ibm.com/us-en/marketplace/disaster-recovery-for-power

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1

High availability and disaster recovery overview

The following topics are described in this chapter:

- General high availability and disaster recovery overview
- Introduction to IBM Geographically Dispersed Resiliency for Power Systems

1.1 General high availability and disaster recovery overview

This section discusses high availability and disaster recovery topics from a high-level overview. Before providing details, the terminology that is used throughout this publication is defined. These definitions might not match the information that you find on the Internet because sometimes different meanings exist for the same phrase.

- Availability

  Ability of a service component to perform its required function at a stated instant or over a stated period. It is usually expressed as the availability ratio, for example, the proportion of time that the service is available for use by the customers within the agreed service hours.

- Continuous availability (CA)

  Attribute of a system to deliver nondisruptive service to the user 365 days a year, 24 hours a day (assuming no planned or unplanned outages exist). Figure 1-1 shows this relationship.

  > **Note:** In most cases when people talk about high availability (HA), they mean continuous availability.

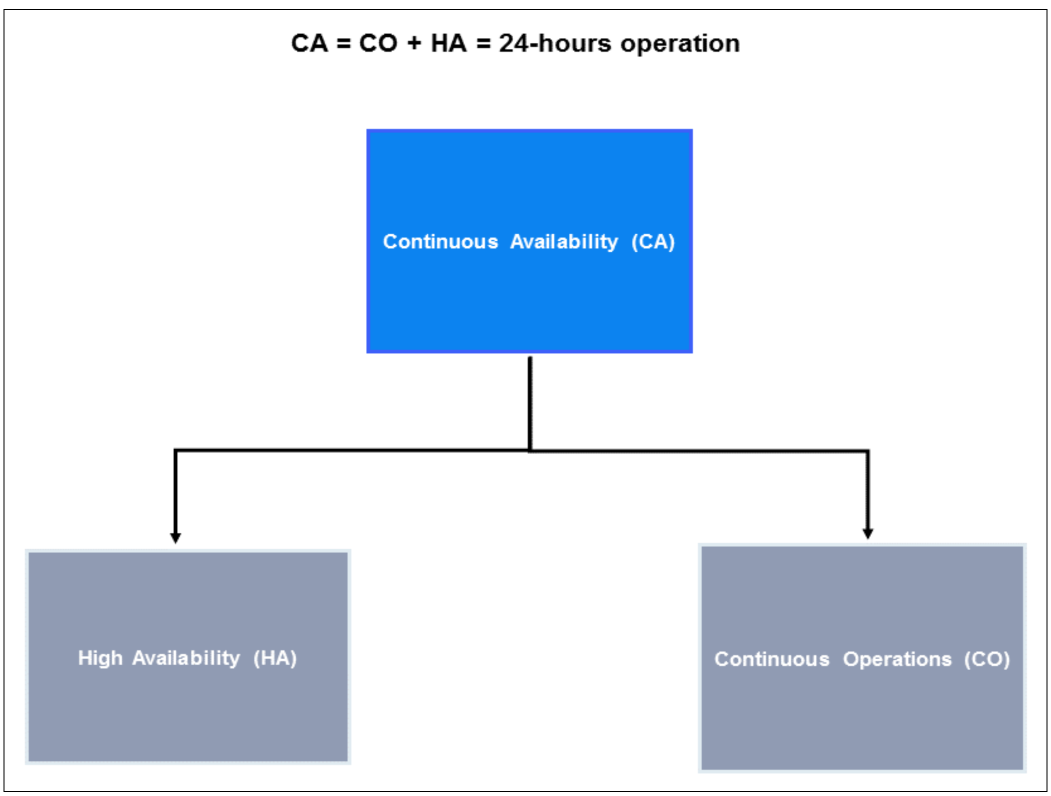


Figure 1-1 CA, HA, CO relationship

- Continuous operations (CO)

  Ability of a system to continuously operate and mask planned outages from users. It uses redundant hardware and software components (often clustering) along with nondisruptive maintenance and change management procedures.

- High availability (HA)

  Ability of a system to provide access to applications regardless of local failures, whether these failures are in the business processes, in the physical facilities, or in the IT hardware or software. The aim is to mask *unplanned outages* from users.

- Disaster recovery (DR)

  Ability to continue processing with minimal loss of integrity of a data center at a different site if a disaster destroys the primary site or otherwise renders it inoperable. With a DR solution, processing resumes at a different site and on different hardware.

- Recovery time objective (RTO)

  The total time that you can allow for your systems to be offline. How long can you afford to be without your systems?

- Recovery point objective (RPO)

  The point at which data is restored to if there is a disaster. When it is recovered, how much data can you afford to re-create?

- Business recovery objective (BRO)

  The desired time within which business processes should be recovered, along with the minimum staff, assets, and services required within this time.

- Network recovery objective (NRO)

  How long can you afford to take to switch over the network?

1.1.1 General concepts

From a service perspective, two concepts exist:

Active/passive The service is running on one system at a time, and one or more backup systems are able to take over the service.

Active/active The same service is running at the same time in multiple systems.

An active/active solution requires that the application is aware of the redundant components; an active/passive solution is exempt from this requirement.

From an operating system or system perspective, two concepts also exist:

- Internal-managed
- External-managed

Figure 1-2 illustrates these two concepts. Detailed differences are described in the following sections.

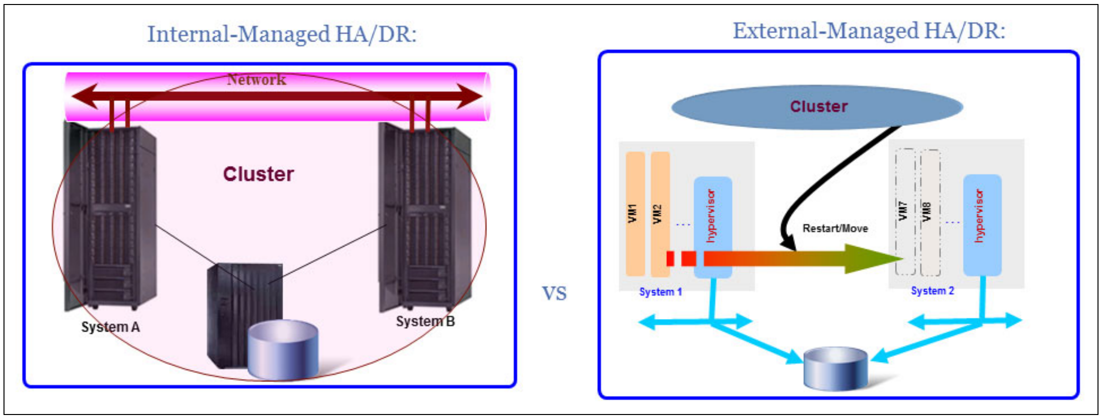


Figure 1-2 Internal and external managed HA, and DR

Internal-managed

In an internal-managed environment, the operating system has information that it is part of a cluster. In most cases. HA components are installed. These check whether the cluster partners, hardware, and software components are reachable or available.

Highlights of this environment include these items:

- Has hot standby topology.
- Is based on multiple operating systems.
- Rolling migration is possible.
- Supports active/passive and active/active architecture within the cluster.

External-managed

In an external-managed environment, the operating system has no information of whether it is part of a cluster.

Highlights of this environment include these items:

- Has Cold standby topology.
- Is based on a single operating system.
- Supports only active/passive architecture within the cluster.
- Offers reduced license costs.

1.1.2 High availability and continuous availability

As mentioned in the previous sections, in most cases when the discussion is about high availability (HA), it means continuous availability. This applies to all references of HA in this section.

Measuring availability

In many cases, people like to measure the availability in percentage (%) numbers. You might find comments that are related to the *three nines* or *four nines* of high availability. Although those sound great, what do they really mean? Table 1-1 shows what these percentage values mean in hours or minutes.

Table 1-1 Availability measuring

	Availability %	Downtime/year	Downtime/month	Downtime/week
One nine	90	36.5 days	72 hours	16.8 hours
Two nines	99	3.65 days	7.2 hours	1.68 hours
Three nines	99.9	8.76 hours	43.2 hours	10.1 hours
Four nines	99.99	52.56 min.	4.32 min.	1.01 min.
Five nines	99.999	5.26 min.	25.9 sec.	6.05 sec.
Six nines	99.9999	6.05 sec.	2.59 sec.	0.605 sec.

The real question is this: Do these percentage numbers help for high availability planning at all? Here is a fictional situation in which a customer has the following guidelines:

1. It is acceptable if the system goes offline for 1 hour every day.
2. If the system is down for 8 hours continuously, the company will be bankrupt.

What does this mean in terms of the annual availability percentages?

For guideline 1 In the worst case scenario, you might have up to 365 hours of outage but happy customers because you have an annual availability percentage of 95.833 %.

For guideline 2 In this case, if you have a single outage extending to and beyond 8 hours, then the customer is bank, even though the annual availability percentage is 99.909 %.

The two important items to consider when planning for HA and DR solutions include the recovery time objective (RTO) and the recovery point objective (RPO).

RPO means how much data is allowed to be lost without a major business impact. Or how far can you go back to get consistent data.

Figure 1-3 illustrates the three major RTO components:

Outage How long until the outage is recognized?

Failover How long until fallover to the backup system occurs?

Restart How long until the service is restarted on the same or different hardware?

Depending on the selected solution and the used application, these items have different values.

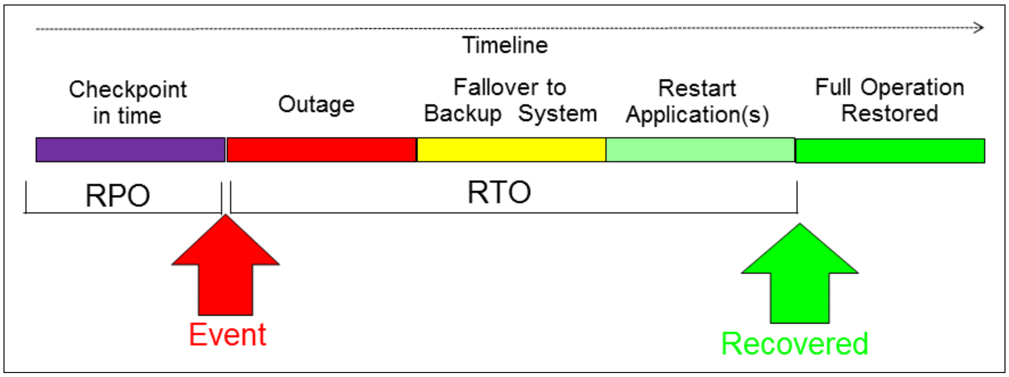


Figure 1-3 RPO, RTO content for high availability

Other considerations for high availability

Several additional required items must be considered when planning for a highly available environment as shown in Figure 1-4.

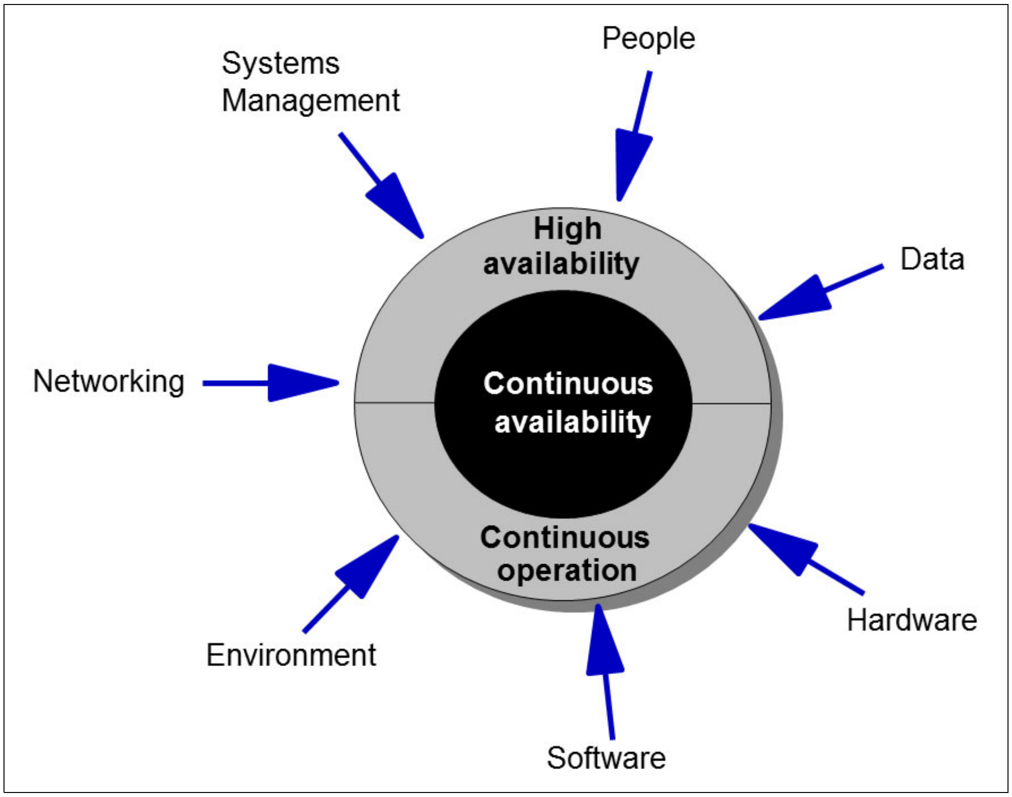


Figure 1-4 Other considerations for continuous availability

The following list includes, but is not limited to the items represented in Figure 1-4:

- People

  The knowledge and experience of the system administrators managing the environment is important to the stability and usability of the availability solution.

- Data

  An important aspect is that critical data should redundant (RAID 1, 5, or 6) and backups should exist.

- Hardware

  The hardware must be able to handle the expected workload because a slow responding system is as bad as a non-existing one.

- Software

  The software (application) should have the ability to automatically recover after a system crash.

- Environment

  The location of your data center is important and it should not be too close to the coastline or river due to the high risk of flooding. Additionally electrical power support should be redundant.

- Networking

  Also important is to configure an internal redundant network that is combined with a redundant Internet connection.

- Systems management

  Here an especially good change management control is important. You also need to have organized incident and problem management.

1.1.3 Disaster recovery

This section discusses some components of disaster recovery from an IT perspective.

> **Recovery plan:** DR is a small component of the overall business recovery plan.

The main purpose of disaster recovery is to have a defined, and possibly automated, procedure for the recovery from a major business impact such as an outage of the whole data center as the result of an earthquake, flooding, and storm.

From a risk assessment perspective, you have the same challenges as described in “Measuring availability” on page 5.

Recovery time objective (RTO) and recovery point objective (RPO) for disaster recovery are normally different from the RPO and RTO values for availability.

> **Note:** RPO means how much data can be lost without suffering a major impact to the business. Or how far back you have to go to get consistent data. The RPO for disaster recovery typically is greater than RPO for availability. The worse case is usually the time between the disaster and when the last successful backup was completed.

Figure 1-5 is the RTO summary of the four major components as follows:

Outage How long until the outage is recognized.

Prepare to repair How long until a decision is made whether a disaster recovery situation should be declared.

Note: Declaring a disaster is often a management decision.

Repair, fallover How long until fallover to the backup system occurs. Or how long until the original system is repaired or reinstalled.

Minimum service How long until full service is available on the same or different hardware.

Depending on the selected solution and the application that are used, these items have different values.

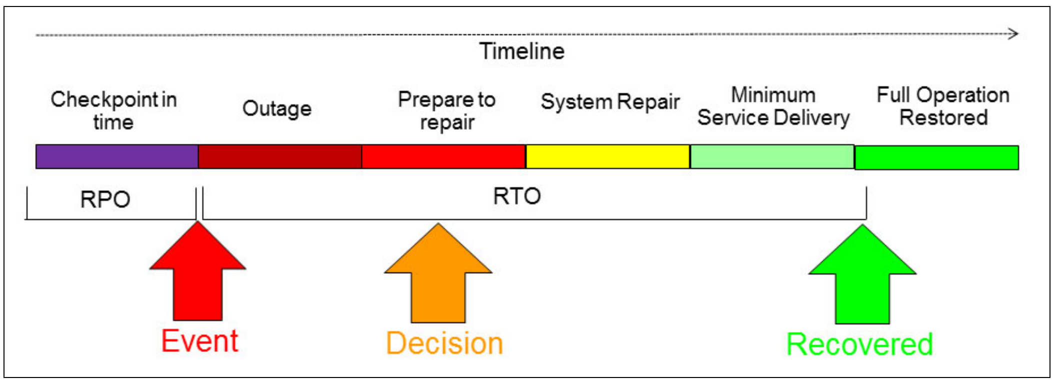


Figure 1-5 RPO, RTO content for disaster recovery

As for availability, a disaster recovery solution should also address the items that are described under “Other considerations for high availability” on page 7.

1.2 Introduction to IBM Geographically Dispersed Resiliency for Power Systems

This section introduces IBM Geographically Dispersed Resiliency for Power Systems. Announced in October 2016, IBM Geographically Dispersed Resiliency for Power Systems is an IBM disaster recovery solution. IBM Geographically Dispersed Resiliency for Power Systems provides a simplified and easy-to-deploy disaster recovery solution across two sites for virtual machines running on POWER7 or IBM POWER8®.

IBM Geographically Dispersed Resiliency for Power Systems is similar to VMware Site Recovery Manager (SRM) and IBM z® Systems GDPS® solutions, and is part of the GDPS offering family of disaster recovery solutions. Users who are familiar with GDPS notice references to similar components in IBM Geographically Dispersed Resiliency for Power Systems. Although these components might seem familiar, IBM Geographically Dispersed Resiliency for Power Systems is a new product for Power Systems hardware and does not share any of the same code. IBM Geographically Dispersed Resiliency for Power Systems focuses on the logical partition virtual machine (LPAR (VM)) restart solution for disaster recovery.

IBM Geographically Dispersed Resiliency for Power Systems offers the following benefits:

- Simplified disaster recovery management
- Cost saving as a result of eliminating the need for hardware and software resources on backup site
- Reduced license costs
- Reduced administrative costs
- Ease of deployment because no high availability clustering is required
- Ability to test the disaster recovery environment without effecting the production environment

IBM Geographically Dispersed Resiliency for Power Systems uses VM restart technology to restart VMs on a backup site if there is a disaster or planned system maintenance by the administrator. All of this is controlled by a single management system separate from the production systems.

Replication is performed at the storage layer, and presently only Dell EMC SRDF is supported, but other storage-level technologies, such as SAN Volume Controller, IBM Systerm Storage DS8000, and Hitachi, are planned for upcoming releases.

Note: Support storage level replication is necessary only to ensure data consistency across sites. This is not possible with host-based replication such as GLVM.

VMs are defined as hosts in IBM Geographically Dispersed Resiliency for Power Systems and paired across the two sites. Each site must have the resources available to run the host if there is a planned or unplanned move.

The main difference between IBM Geographically Dispersed Resiliency for Power Systems and a traditional DR environment such as PowerHA is that IBM Geographically Dispersed Resiliency for Power Systems does not require resources (VM or LPARs) to be running on the backup site for failover. The benefit of the IBM Geographically Dispersed Resiliency for Power Systems configuration is that it reduces licensing costs and administration requirements.

IBM Geographically Dispersed Resiliency for Power Systems is managed by a single control system LPAR called *KSYS*, which stands for *c(K)troller system LPAR*. The management system (KSYS) allows the administrator to perform move operations and DR tests. KSYS handles all the complexity of the communicating with the different components of the IBM Geographically Dispersed Resiliency for Power Systems environment to perform the necessary tasks.

1.2.1 Features of IBM Geographically Dispersed Resiliency for Power Systems

IBM Geographically Dispersed Resiliency for Power Systems provides the following features to assist with DR in a traditional two-site configuration:

- Support for POWER7 and POWER8 systems hardware.
- AIX and Linux guest virtual machine support.
- Enterprise pool support: flexible capacity management.
- Daily validation: Early detection of a faulty configuration or other issues.
- Storage replication: Currently Dell EMC SRDF (VMAX).
- Customization framework: Plug-in scripts to perform custom checks daily, and custom process events as they occur.
- Easy to deploy: Fewer than 10 steps of deployment enables simplified DR.

The IBM Geographically Dispersed Resiliency for Power Systems solution consists of several necessary components (Figure 1-6) that work together to provide a highly available (HA) environment for systems across two sites.

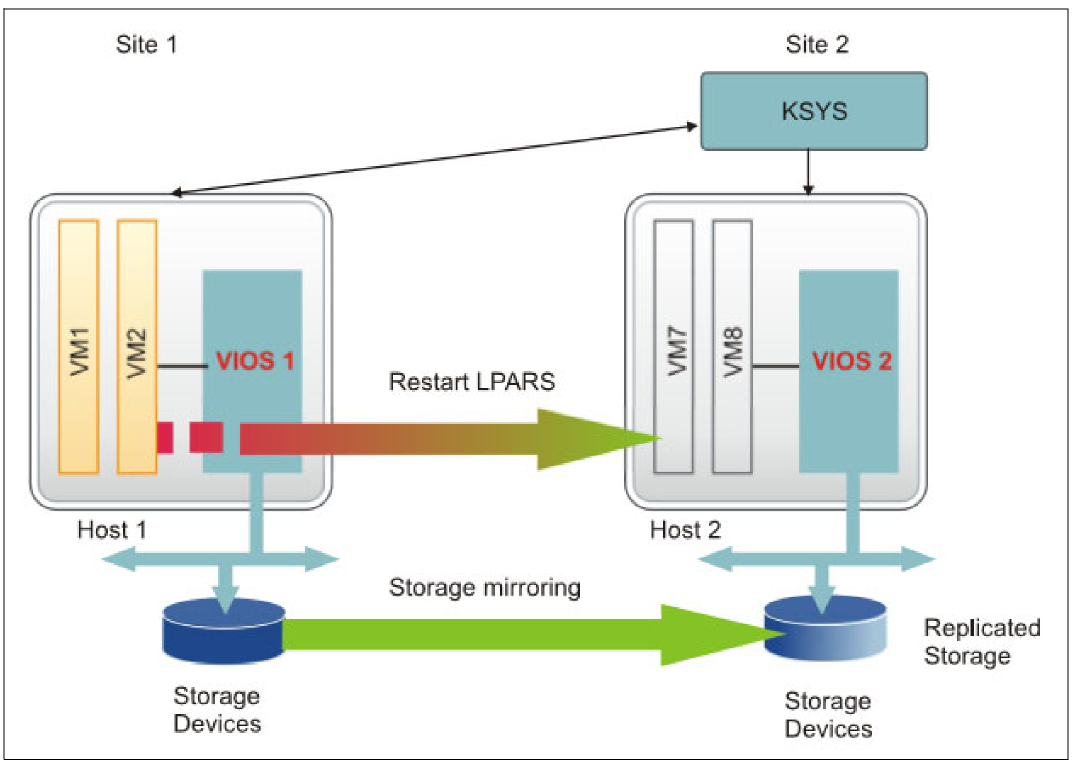


Figure 1-6 Components of IBM Geographically Dispersed Resiliency for Power Systems

Figure 1-6 on page 11 illustrates the following components of IBM Geographically Dispersed Resiliency for Power Systems:

- KSYS
- Site
- Host
- Storage
- Dell EMC Storage agent
- Virtual I/O Server (VIOS)
- Hardware Management Console (HMC)

KSYS

KSYS is the main subsystem and it provides the single point of control for IBM Geographically Dispersed Resiliency for Power Systems. The KSYS controller runs on an AIX LPAR, and should be separate from your primary DR site to avoid an outage if there is a site failure. With this initial release of IBM Geographically Dispersed Resiliency for Power Systems, the KSYS has no redundancy ability so it must be protected from a site failure. IBM intends to deliver enhancements to the releases of IBM Geographically Dispersed Resiliency for Power Systems, which allow for KSYS to run across both sites to provide redundancy.

Tips:

- The KSYS system should be configured on an LPAR that shares the minimum configuration with the sites, and isolated from being effected by a site-based failure.
- The KSYS LPAR should be hosted on the backup site to protect it from a site failure.

Figure 1-7 shows how KSYS interacts with other components. KSYS constantly monitors the physical components of a production site through the HMC and storage controller. Additionally, KSYS collects system information through the HMC for Hosts, VIOS, and storage.

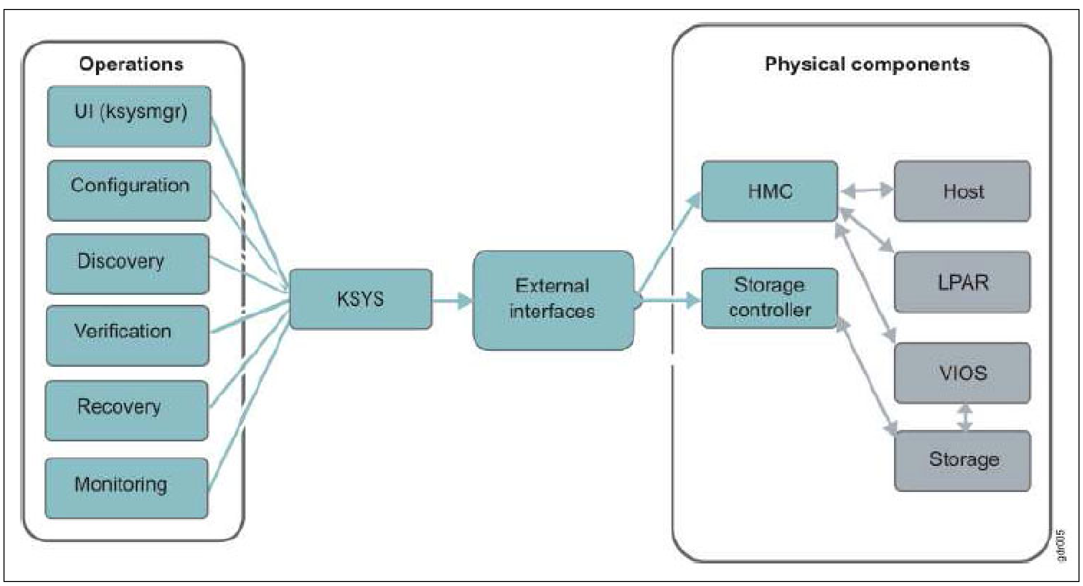


Figure 1-7 KSYS interaction with IBM Geographically Dispersed Resiliency for Power Systems and components

If a site failure or problem occurs, the administrator is notified to take the appropriate action, such as recovering to the other site.

Note: Unlike PowerHA, automatic site failover does not happen in IBM Geographically Dispersed Resiliency for Power Systems. When a problem is identified, IBM Geographically Dispersed Resiliency for Power Systems notifies the administrator through KSYS. At all times, the control belongs to the administrator to determine whether a site failover is necessary. Site failovers can be quickly performed from the KSYS manager's command interface.

Site

Similar to a traditional cluster, the site plays a role as primary or standby. One of the main benefits of IBM Geographically Dispersed Resiliency for Power Systems is that there is no need for duplication of software on the standby site. This results in a less costly, and easier to manage environment.

Host

The host is a system that is managed by IBM Geographically Dispersed Resiliency for Power Systems. Host systems must be defined in the IBM Geographically Dispersed Resiliency for Power Systems host pair. This consists of the host systems on the primary site and the host systems on the backup site. These systems are paired to allow for disaster recovery or site maintenance if there is a site failure. Figure 1-8 shows a typical host-pair configuration.

Each host must have adequate resources to run the other host systems if there is a site failure. These resources include CPU, memory, storage, and Virtual I/O Server (VIOS) required resources to host VMs.

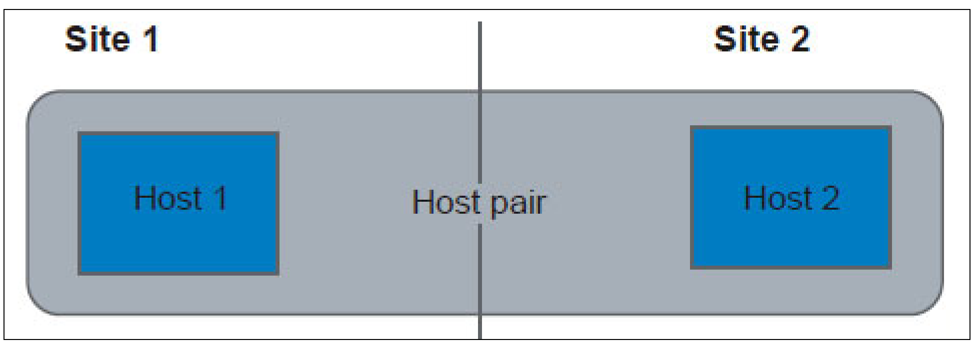


Figure 1-8 Host pair

Note: More than one host pair can be defined in IBM Geographically Dispersed Resiliency for Power Systems but they must be configured as a pair in a 1:1 relationship across the two sites. More hosts that are defined in one site than the other is not supported.

Storage

IBM Geographically Dispersed Resiliency for Power Systems requires storage-based replication and currently supports Dell EMC Storage Symmetrix Remote Data Facility (SRDF) replication. Storage needs to be defined in IBM Geographically Dispersed Resiliency for Power Systems as a 1:1 disk-based group. Disks across sites should typically be of the same size in the disk group. Disk grouping is important to ensure data consistency between disks, and allows for time-constrained snapshots.

Figure 1-9 shows the IBM Geographically Dispersed Resiliency for Power Systems storage replication.

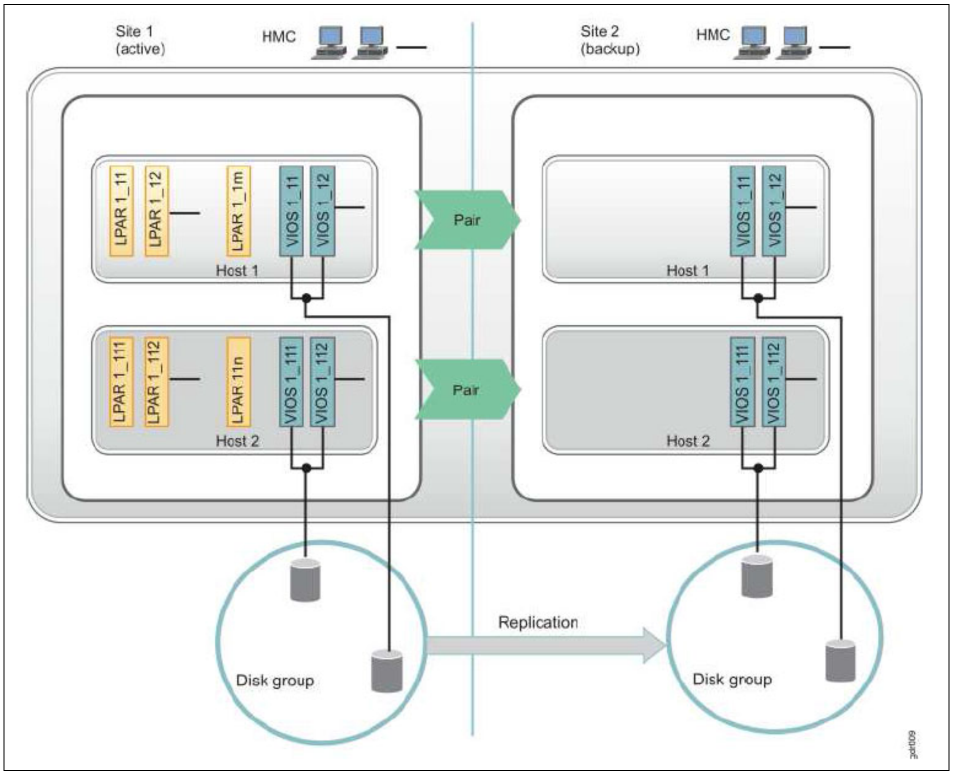


Figure 1-9 IBM Geographically Dispersed Resiliency for Power Systems storage replication

To configure and use the storage, a storage subsystem must be added to the KSYS configuration. In this way, KSYS can interact with the storage subsystem. If you have a storage controller, then KSYS is able to communicate with it, through the storage agent, to perform storage operations with the disks.

The storage subsystem uses the following components for configuration and recovery operations:

- Storage controller

  This is a node that contains the software to manage the interaction between the disks and the hosts that are connected to the storage.

- Disk group

  Indicates a group of disks within a site.

- Consistency group

  Indicates a group of storage devices from multiple storage arrays use to maintain the consistency of data. For more information about consistency groups, see “Consistency group” on page 32.

- Disk pair

  Indicates the set of disks or disk groups that are paired across the sites for high availability and disaster recovery.

Dell EMC Storage agent

To use Dell EMC Storage SRDF replication, configure the Dell EMC Storage agent (SYMAPI) server. IBM Geographically Dispersed Resiliency for Power Systems uses the Dell EMC command-line interface (SYMCLI), and SYMAPI server that runs on the solution enabler server node as shown in Figure 1-10.

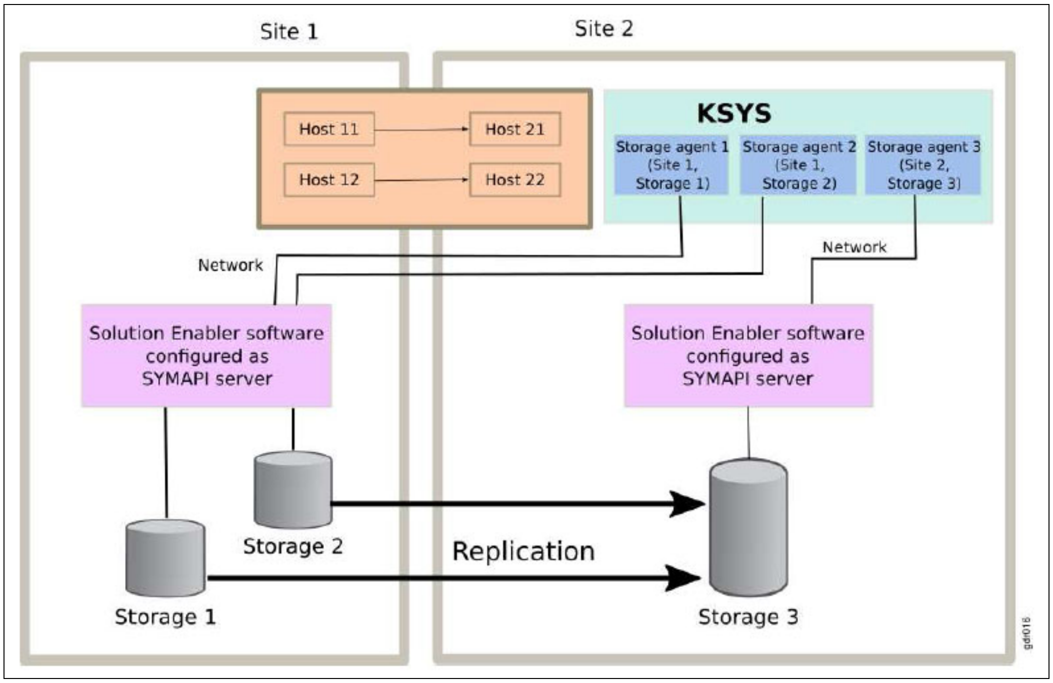


Figure 1-10 IBM Geographically Dispersed Resiliency for Power Systems with Dell EMC Storage enabler SYMAPI server

IBM Geographically Dispersed Resiliency for Power Systems relies on replication of the storage data by using the SRDF/Asynchronous (SRDF/A) mode. The SRDF/A replication mode provides a dependent write-consistent, point-in-time image on the secondary devices that slightly lags from the primary devices. During the SRDF/A session, the data is transferred to the remote Symmetrix systems in cycles or delta sets.

Virtual I/O Server (VIOS)

IBM Geographically Dispersed Resiliency for Power Systems requires that each VM is managed by VIOS. KSYS communicates with VIOS through the HMC as part of the validation and configuration processes. Information such as disks provisioned to the clients from VIOS is looked at. Checks are also made during the validation process to ensure that the backup site can run the client partitions on the main site.

When a site move is requested for a site failure or DR test, KSYS communicates with the VIOS to restart the client partitions.

Hardware Management Console (HMC)

The KSYS controller system must be able to communicate with the HMC to manage the systems. KSYS collects information from the HMC about the managed hosts such as details if those can run on the standby site with VIOS resources, and LPARs information details which can be managed by IBM Geographically Dispersed Resiliency for Power Systems such as processor, memory, and worldwide port names (WWPNs).

The HMC provides the Representational State Transfer (REST) application program interfaces (APIs) to KSYS to perform the following functions:

- Checks system capability for each operation.
- Collects information about the host state, LPAR state, VIOS state, and the IP addresses of the host.
- VIOS and LPAR that KSYS can use for subsequent monitoring.
- Provides the disk mapping information to the VIOS in the backup site.
- Validates the backup site by checking whether the destination hosts can perform remote restart operation.
- Provides appropriate return codes to KSYS so that KSYS can perform the required recovery actions.
- Cleans up disk mapping information in VIOS when the mapping information is no longer required.
- Cleans up the data and workload-related information from the primary site and saves the data in the KSYS data store.

Tip: Have a dual HMC configuration to ensure that the HMC is always available for IBM Geographically Dispersed Resiliency for Power Systems. KSYS uses the other HMC if one is unavailable.

1.2.2 Differences between IBM Geographically Dispersed Resiliency for Power Systems and PowerHA

Figure 1-11 shows the differences between IBM Geographically Dispersed Resiliency for Power Systems and PowerHA.

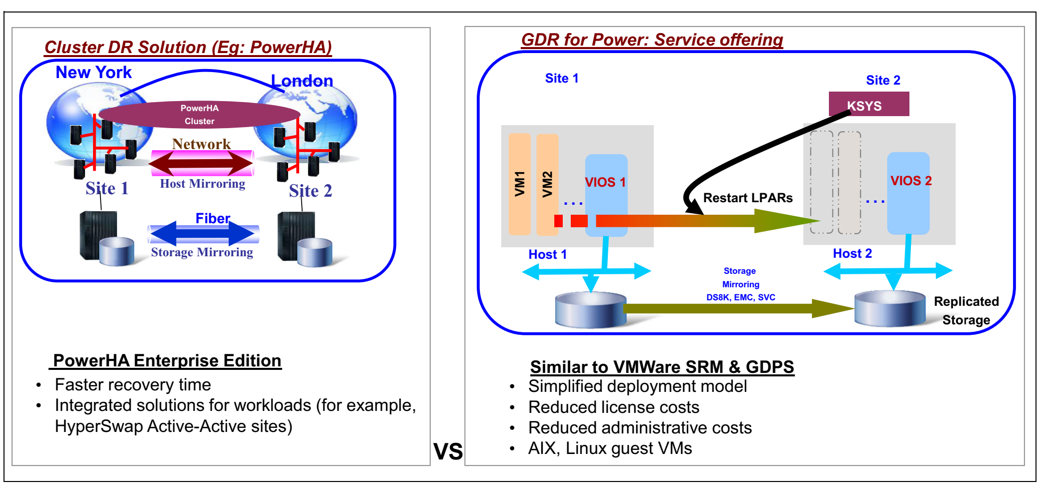


Figure 1-11 PowerHA versus IBM Geographically Dispersed Resiliency for Power Systems

Which solution should be used

IBM Geographically Dispersed Resiliency for Power Systems is not a replacement for PowerHA. Which you choose to deploy depends on your environment. Typically PowerHA is used for critical systems where an automated or quick recovery is required. PowerHA can achieve this because a standby site is already running a cluster LPAR. If a problem occurs on site one, you can quickly fail the resource group over to site two by using fast disk takeover, and have the application seamlessly transferred to the other node.

IBM Geographically Dispersed Resiliency for Power Systems offers the advantage of not having to configure, maintain, and pay for licensing costs of needing a duplicate system running on the standby site to take over if there is a problem. However, the cost of this advantage is that failover can take a little more time because you need to move the VM configuration over to the adjacent site and restart the LPARs. This is also performed manually because it is not possible (not the wish of an administrator) to have multiple LPARs move automatically to another site without manual intervention by the system administrator to decide when and if moving the resource is necessary.

One significant benefit of IBM Geographically Dispersed Resiliency for Power Systems is that you can manage multiple LPARs compared to PowerHA, which is limited by the cluster configuration, and number of clusters. For example, if you want to protect 30 LPARs, you are looking at many clusters, which are difficult to configure and manage. With IBM Geographically Dispersed Resiliency for Power Systems, you have a single solution that can cope with many LPARs (tens through hundreds of LPARs) because all you are doing is moving them, and restarting on the other site, if there is a site failure, by using VM restart technology.

You can implement an IBM Geographically Dispersed Resiliency for Power Systems solution for your DR needs with existing IBM PowerHA SystemMirror® clusters because IBM Geographically Dispersed Resiliency for Power Systems is not aware of what is running on a VM it is protecting. Some caveats exist regarding this; they are explained in Chapter 2, “Planning for IBM Geographically Dispersed Resiliency” on page 19.

Table 1-2 shows the differences between a PowerHA and IBM Geographically Dispersed Resiliency for Power Systems solution. As mentioned, IBM Geographically Dispersed Resiliency for Power Systems is not a replacement for PowerHA and the suitability for both depends on the environment for which they are providing a DR solution. Both can run, side by side.

Table 1-2 PowerHA versus IBM Geographically Dispersed Resiliency for Power Systems

Category	PowerHA	IBM Geographically Dispersed Resiliency for Power Systems
Suitability	Critical systems: Needing rapid recovery	Fewer time critical systems that can afford a longer recovery time and manual intervention
Supported LPARs	Limited to number of clusters	Unlimited (can support many)
Recovery time	Quick: Attempts local recovery, and if necessary failover to other site	Slower: Needs to restart VMs on standby site
Automatic failover?	Yes (but option for manual)	No (manual only)
Client support	AIX only (other versions available for iSeries, and Linux)	Single solution for AIX and Linux (all distributions)

Category	PowerHA	IBM Geographically Dispersed Resiliency for Power Systems
Local cluster	Yes	No (support for sites only)
Extended cluster (sites)	Yes	Yes
Customization framework	Yes through automatic sync/verify and scripts	Yes, plug-in script to do daily checks, and custom script support
Deployment	Involved: Needs both cluster nodes to be configured and support hosting the applications	Easy deployment: Requires only primary site to be configured
Licensing cost	Requires licensing for software to run concurrently on both cluster nodes	Reduced cost because only one instance of VM running at any one time (no need to install on backup site)

The IBM Geographically Dispersed Resiliency for Power Systems solution is better placed to provide a DR solution for the majority of other systems in an environment where DR is required. It is especially suitable for systems that can currently have a manual DR recovery in place. With IBM Geographically Dispersed Resiliency for Power Systems, you have to move, and restart the VMs on the other site, so this can mean a longer recovery time because you must wait for all the VMs to restart. For more information about recovery times, see 1.1.2, "High availability and continuous availability" on page 5.

The other factor to consider is that IBM Geographically Dispersed Resiliency for Power Systems does not provide an automatic DR solution. Any issue that requires site failover (for example a power failure of the production site) requires the system administrator to initiate a DR failover by using KSYS.

1.2.3 Further information

For more information, see the following websites:

- IBM Geographically Dispersed Resiliency
- IBM Geographically Dispersed Resiliency for Power Systems social forum

2

Planning for IBM Geographically Dispersed Resiliency

In order to plan for IBM Geographically Dispersed Resiliency for Power Systems, you look at your current infrastructure and determine which systems are best to deploy IBM Geographically Dispersed Resiliency for Power Systems on to perform disaster recovery (DR) protection. As advised in 1.2.2, "Differences between IBM Geographically Dispersed Resiliency for Power Systems and PowerHA" on page 16, it depends on the role of your systems as to which solution is best for you.

IBM Geographically Dispersed Resiliency for Power Systems can coexist with your existing DR solutions (for example, PowerHA) with a few exceptions. You should be aware of the limitations of managing PowerHA systems from within IBM Geographically Dispersed Resiliency for Power Systems. Both hardware and software planning is required before deployment to ensure that you meet the requirements.

The following topics are described in this chapter:

- Software requirements
- Configuration requirements

2.1 Software requirements

Table 2-1 shows the software requirements for IBM Geographically Dispersed Resiliency for Power Systems.

Table 2-1 IBM Geographically Dispersed Resiliency for Power Systems software component requirements

Components	Required software
KSYS controller	AIX 7.2 TL1 SP1. Latest OpenSSL is required.
Hardware Management Console (HMC)	HMC Version 8 Release 8.6.0 or later.
Virtual I/O Server (VIOS)	VIOS 2.2.5.00 or later.
Logical partition (LPAR)	Each host must have one of the following operating systems: ▶ AIX 6.1 or later ▶ IBM PowerLinux™ (Red Hat, SUSE, or Ubuntu distributions)

Note: You must install OpenSSL version 1.0.1.516, or later for the AIX operating system. You can download OpenSSL from this website.

The latest version of OpenSSL is also included in the AIX base media.

2.2 Configuration requirements

IBM Geographically Dispersed Resiliency for Power Systems supports a two-site cluster. There is no limit to the distance between the sites because the storage replication is managed at the storage layer. In IBM Geographically Dispersed Resiliency for Power Systems, you have an active site and a backup site. The active site hosts all the LPARs (also referred to as VMs). The backup site is available to host the LPARs in the event of a DR operation (planned or unplanned by the system administrator). When planning, it is important to understand that the backup site must be capable of hosting all LPARs that are managed by IBM Geographically Dispersed Resiliency for Power Systems in the active site. To achieve this task, all VIOS resources must be available when required on the backup site. In addition, you need to ensure that the backup site has available resources that are either assigned or available by way of the enterprise pool to be able to host the LPARs.

Figure 2-1 shows the IBM Geographically Dispersed Resiliency for Power Systems configuration overview.

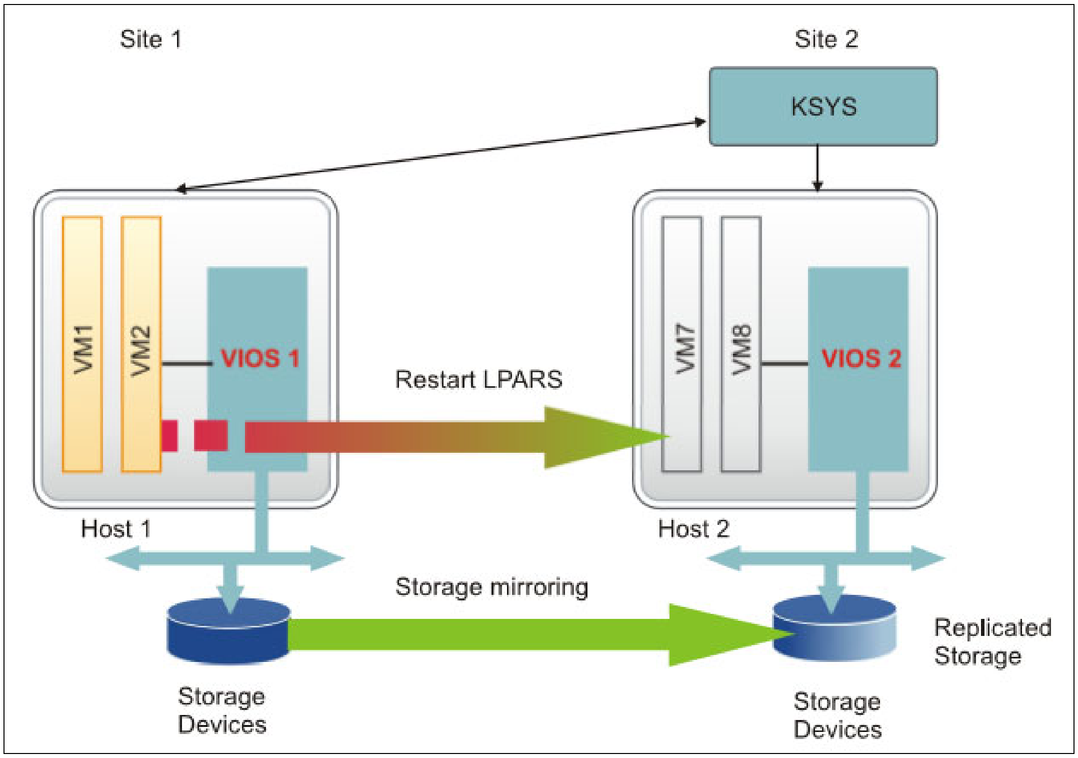


Figure 2-1 IBM Geographically Dispersed Resiliency configuration overview

It is advisable when deploying such a configuration to perform regular DR testing to make sure that the backup site can run all the systems without a problem. One of the benefits of IBM Geographically Dispersed Resiliency for Power Systems is the ability for live DR testing without affecting the production site. You can achieve this situation by providing the ability to isolate the network between both sites, and start the hosts independently on the backup site without affecting the primary site.

2.2.1 Key requirements

The following section describes the requirements for the solution.

KSYS requirements

IBM Geographically Dispersed Resiliency for Power Systems deployment requires the configuration of one KSYS controller LPAR. This KSYS controller LPAR is critical to the operation of IBM Geographically Dispersed Resiliency for Power Systems, so you must ensure that it is not affected by an outage on the primary production site. Thus, a mandatory requirement is that KSYS be configured on the standby site to ensure availability if there is a total site failure of the production site.

The KSYS controller must be able to communicate with the HMC and the storage controller from both sites to manage the cluster.

KSYS hardware requirements

The KSYS LPAR must have at least one core CPU and 8 GB of memory. These requirements can be higher if you have a large environment of more than 100 LPARs in the data center.

Virtual machines requirements

The virtual machines (VMs) setup for DR must be on IBM POWER7 or later hardware. IBM Geographically Dispersed Resiliency for Power Systems can manage systems on IBM AIX 6.1 or higher, and PowerLinux (Red Hat, SUSE, and Ubuntu distributions).

IBM Geographically Dispersed Resiliency for Power Systems is not aware of what is running on a VM. When you fail over the resources, you are shutting down the VMs on one site, and restarting them on the new site (the standby or backup site). The VM images are replicated as part of the storage replication. In some cases, if the software relies on unique hardware identifiers, then an action might be needed to ensure that the systems can start on the backup site. IBM PowerHA 7.x or later (CAA) is an example of where you might need to make some changes to ensure that the repository disk comes online on the backup site.

Tip: IBM Geographically Dispersed Resiliency for Power Systems regularly runs scripts to ensure the VMs can run on the standby site, but you should perform regular DR testing to check that your environment can run on the standby site without any problems.

There is no limit to the number of VM that you can manage with IBM Geographically Dispersed Resiliency for Power Systems.

VIOS requirements for virtual machines

All VMs must be move-capable to the other site (standby or backup). Therefore, these VMs must all have virtual I/O resources that are hosted from the VIOS. A VM cannot have any physical adapters that are defined to them, or have any dedicated resources.

Storage requirements

This section describes the storage requirements for the solution. Figure 2-2 shows the IBM Geographically Dispersed Resiliency for Power Systems storage zoning requirements.

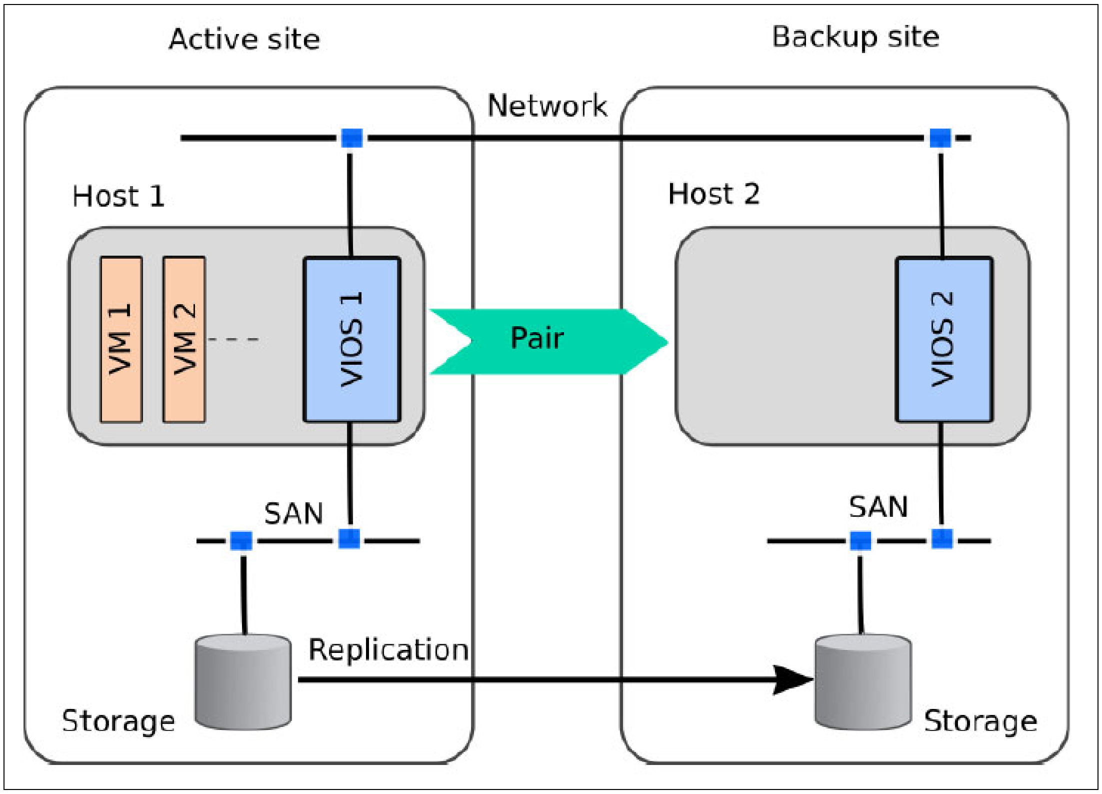


Figure 2-2 IBM Geographically Dispersed Resiliency storage zoning requirements

The IBM Geographically Dispersed Resiliency for Power Systems solution supports storage devices for only the Dell EMC VMAX family (VMAX1, VMAX2, and VMAX3). The Dell EMC Storage devices must be Symmetrix Remote Data Facility (SRDF)-capable, and must have Dell EMC Solutions Enabler SRDF family version 8.1.0.0 installed.

Note: Currently, only the SRDF/A (Asynchronous) replication mode is supported.

As shown in Figure 2-2, the storage area network (SAN) connectivity and zoning must be configured so that the VIOS can access the disks that are relevant to the hosts across the host pairs. For each disk that is connected to the VIOS, you must have a mirror of that disk connected to the VIOS of the paired host on the backup site.

Important: For the SAN configuration to meet the IBM Geographically Dispersed Resiliency for Power Systems requirement, the paired hosts Host 1 and Host 2 must be connected by mutually exclusive SAN switches from the VIOS. This configuration is important because VIOS performs checks on the SAN fabric that involves logging in to the connected SAN switches. If these hosts are both connected to the same SAN switch, then the operation causes conflicts, and the verification of the configuration might fail.

Network requirements

The following network requirements must be met:

- The VIOS must have a Shared Ethernet Adapter (SEA) configuration to bridge to the same network between hosts in the same site.
- The same Virtual LAN (VLAN) must be configured across the site.
- You must have a redundant connection from the KSYS to the HMC, and to the VIOS LPARs.

> **Tip:** It is important to ensure that there is no connectivity issues between the KSYS, HMC, and VIOS LPARs. Connection issues can cause disruptions to the regular data collection activity, and can affect the ability to invoke DR actions.

Administrative requirements

In addition to the previous requirements, it is important for you to check the following configuration before deploying IBM Geographically Dispersed Resiliency for Power Systems in your environment:

- KSYS should be deployed on the backup site only.
- The KSYS must be connected to all the HMCs across sites.
- Configure dual HMCs to ensure redundancy.
- All the VIOS partitions and disk pairs must be deployed correctly across sites.
- Ensure that the SAN connectivity and the zoning are configured to allow VIOS access to disks allocated to the hosts and host pairs.
- SAN fabrics of the VIOS on the paired hosts must be configured to not be able to connect to each other. These fabrics must be mutually exclusive, as described in "Storage requirements" on page 23.

3

Storage and SAN setup for the IBM Geographically Dispersed Resilience environment

This chapter provides practical guidance about the setup that must be performed in your storage and SAN environment when you implement the IIBM Geographically Dispersed Resiliency for Power Systems solution. It provides examples about how the pre-requisites can be met, including the steps that the residency team followed to successfully implement and test it during the elaboration of this book.

The following topics are described in this chapter:

- General considerations
- Storage components in the IBM Geographically Dispersed Resilience solution
- Setting up the Dell EMC Storage in the IBM Geographically Dispersed Resilience environment

3.1 General considerations

Disaster recovery (DR) involves setting up a methodology and enabling procedures to be followed in the event of a disaster so that you can recover your entire environment (or at least the most critical parts of your environment) and allow your company to continue operating with minimal or no impact to the business.

A DR solution involves also an automation of such procedures, which speeds the recovery of your servers and applications, and minimizes the mistakes that can happen due to human intervention during the running of the procedures. IBM Geographically Dispersed Resiliency for Power Systems is a DR solution that automates the recovery of your Power System server in case of failure.

To achieve this objective, the data that is used by your logical partitions (LPARs) or virtual machines (VMs) must be replicated to the storage that is available in the backup site, where these continue to run in the event of a failure at the main site. The IBM Geographically Dispersed Resiliency for Power Systems solution relies on storage subsystem-level data replication from the active site to the backup site. Each storage vendor can offer its own solution for data replication, for example, IBM offers Peer to Peer Remote Copy (PPRC), Dell EMC offers Symmetrix Remote Data Facility (SRDF), and Hitachi offers TrueCopy.

> **Important:** At the time of writing, only the Dell EMC Symmetrix Remote Data Facility Asynchronous (SRDF/A) is supported in the IBM Geographically Dispersed Resiliency for Power Systems solution. IBM intends to deliver enhancements to support other storage types.

The initial configuration of the replicated resources that are managed by the IBM Geographically Dispersed Resiliency for Power Systems must be manually set up with the SAN and UNIX administrators. The IBM Geographically Dispersed Resiliency for Power Systems solution must have a communication interface with the storage subsystem so that it can control the replication in the event of a disaster situation where it must recover your VMs at the backup site. The solution must also be able to query the status of the configuration during verification steps to ensure that the current configuration allows the running of the DR procedures in the event of a problem.

Depending on the type of your storage subsystem, enabling this communication interface between storage and IBM Geographically Dispersed Resiliency for Power Systems can involve installing a storage controller software in the controller system node (KSYS or KSYS node), allowing it to run commands on your storage subsystem to perform the replication operations. For more information about what a KSYS node is, see Chapter 1, “High availability and disaster recovery overview” on page 1.

The general storage management operations that the KSYS node must be able to perform on replicated resources include starting, stopping, suspending, reversing, resyncing, pausing, and resuming the replicated resources or disk pairs.

Figure 3-1 shows the positioning of the KSYS node in the IBM Geographically Dispersed Resiliency for Power Systems solution. As you can see, it must be able to communicate with the storage subsystems to query and control the replication status, direction, and health of the replicated volumes that are used by the VMs.

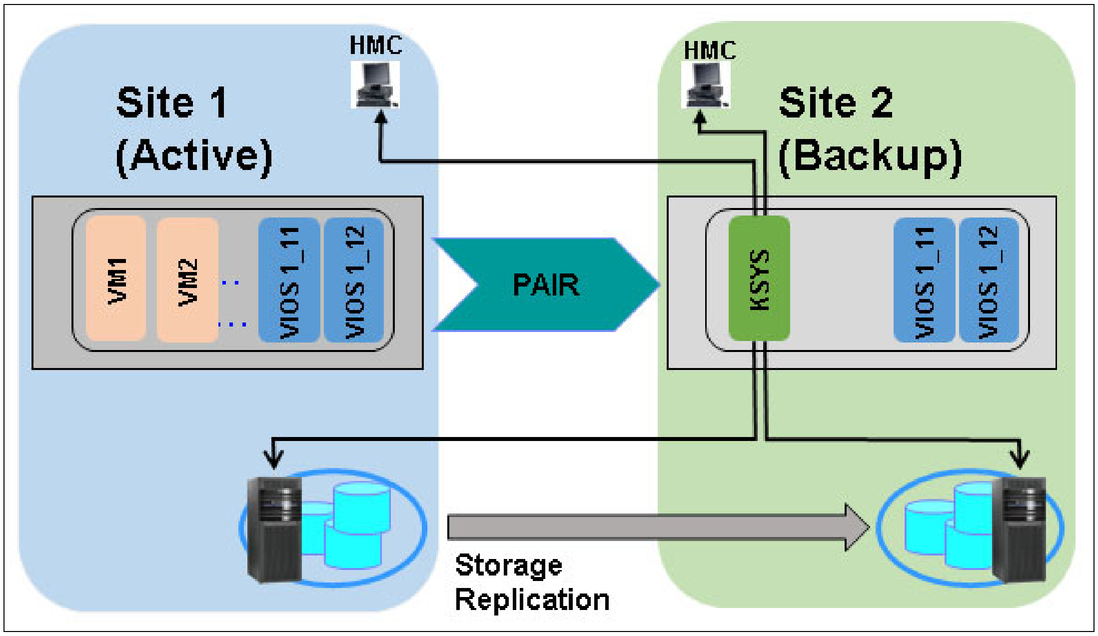


Figure 3-1 KSYS node communication with the storage subsystems controllers

The communication between the KSYS node and the storage subsystem can be direct (the KSYS node communicates through a TCP/IP network directly with the storage subsystem), or it can be through an intermediate host that is called a *storage controller*, which has the software that is used to manage the storage subsystem. The choice between direct communication or through a storage controller depends on the storage subsystem that is used in your environment.

Note: At the time of writing, the only supported storage replication is Dell EMC SRDF/A. For the Dell EMC Storage, the method of using a KSYS node to control the storage replication is through a storage controller.

3.2 Storage components in the IBM Geographically Dispersed Resilience solution

During the setup of the IBM Geographically Dispersed Resiliency for Power Systems environment, or more specifically during the configuration of the KSYS node, which is explained in Chapter 4, "Installation and configuration for the IBM Geographically Dispersed Resilience deployment" on page 129, you add a *storage agent* to your cluster.

The storage agent is basically the definition of the storage subsystems from both sites inside the KSYS configuration. The agent provides the information that the KSYS needs to contact the storages to query and control replicated resources, which are the disk pairs that are used by the VMs under the IBM Geographically Dispersed Resiliency for Power Systems solution. By adding a storage agent, you create an RMC resource, as shown in Example 3-1, that stores the information that is needed by KSYS to contact your storage and work with the replicated resources.

Example 3-1 RMC resource for the storage agents

```
# lsrsrc IBM.VMR_SA
Resource Persistent Attributes for IBM.VMR_SA
resource 1:
        SAname           = "sa_Poughkeepsie_508"
        SA_serial        = "196800508"
        storageType      = 227
        siteID           = 1
        ipAddr           = "10.40.0.30"
        userID           = "default"
        password         = "default"
        StgInfVendor     = "EMC"
        StgInfProductID  = "SYMMETRIX"
        StgInfRevision   = "5977"
        Phase            = "READY"
        PhaseDetail      = 0
        ActivePeerDomain = "itsocluster"
resource 2:
        SAname           = "sa_Austin_573"
        SA_serial        = "196800573"
        storageType      = 227
        siteID           = 2
        ipAddr           = "10.40.0.31"
        userID           = "default"
        password         = "default"
        StgInfVendor     = "EMC"
        StgInfProductID  = "SYMMETRIX"
        StgInfRevision   = "5977"
        Phase            = "READY"
        PhaseDetail      = 0
        ActivePeerDomain = "itsocluster"
```

The information that is provided in the storage agent might point to the storage controller, which can control the storage and routes the communication between the KSYS node and the storage subsystems.

Together with the storage agent and storage controller, there are other important storage components (and definitions) that you must keep in mind during the IBM Geographically Dispersed Resiliency for Power Systems solution configuration. These components are used by the storage subsystem for configuration and recovery operations, as shown in Table 3-1.

Table 3-1 Storage components in an IBM Geographically Dispersed Resiliency for Power Systems solution

Component	Definition
Storage agent	The storage subsystems definitions inside the KSYS configuration.
Storage controller	An intermediate node that contains the software to manage the Storage subsystems.[a]
Disk group	A group of disks (or volumes) from the same site.
Consistency group	A group of storage devices (or volumes) from multiple storage arrays (or storage subsystems). This group is used to maintain the consistency of data.[b]
Disk pair	The set of disks (volumes) or disk groups that are paired between storages on Source and Target sites.

a. With Dell EMC VMAX Storage, you must use a storage controller to bridge the communication between the KSYS node and the storage subsystem. The Dell EMC solution to implement a storage controller is the SYMAPI server, which is installed by using the Dell EMC Solutions Enabler software.

b. The Dell EMC definition for consistency group is called a *composite group* (CG).

3.3 Setting up the Dell EMC Storage in the IBM Geographically Dispersed Resilience environment

The next sections describe how the IBM Geographically Dispersed Resiliency for Power Systems solution communicates with Dell EMC Storage to query and control the SRDF replication. This section also describes how the replicated volume pairs are maintained by using a CG (also known as the consistency group), and examples are shown with the steps that you need to follow to successfully implement the required storage components in your IBM Geographically Dispersed Resiliency for Power Systems solution.

3.3.1 Topology of the communication between KSYS and Dell EMC Storage

With Dell EMC Storage, you can use the SRDF to replicate the data between storage arrays. The IBM Geographically Dispersed Resiliency for Power Systems solution can control the SRDF replication to automate the DR.

The SRDF pairs volumes between the storage arrays to replicate its data synchronously or asynchronously. In synchronous mode (SRDF/S), the primary storage writes the data and waits for the secondary storage to write the replicated data before acknowledging to the host that the data was written, which ensures that the backup storage has data as current as the primary storage, but also requires high bandwidth between storage and can cause latency. In asynchronous mode (SRDF/A), the primary storage transfers the data to the secondary storage in cycles or delta sets, accumulating a certain amount of data before transferring to the backup storage. The SRDF/A can also ensure the consistency of the data and reduces latency, but the data in the target storage can slightly lag from the source storage. For more information about Dell EMC SRDF/A and how to change the default cycle of the delta sets, see *Dell EMC Symmetrix Remote Data Facility (SRDF) Product Guide.*

Important: At the time of writing, only asynchronous mode is supported (SRDF/A). Dell EMC intends to deliver SRDF/S support in upcoming releases, but SRDF/S cannot be used with IBM Geographically Dispersed Resiliency for Power Systems currently.

The IBM Geographically Dispersed Resiliency for Power Systems solution uses the Dell EMC command-line interface (CLI) called SYMCLI to allow the KSYS node to run commands on the storage subsystem to query and control the replicated volumes. The SYMCLI software, which must be installed on the KSYS node, is provided by Dell EMC as part of the Dell EMC Solutions Enabler for AIX software. The storage agents in the KSYS node use the SYMCLI software to contact the storage controllers (from both sites), which routes the communication between the KSYS node and the storage array itself.

The storage controllers are VMs that also have the Dell EMC Solutions Enabler software that is installed, and also have Dell EMC disks that are presented to it (called gatekeeper disks). These do in-band management of the storage by using the gatekeeper disks to manage the Dell EMC Storage. The same Dell EMC Solutions Enabler software is used in the KSYS node to implement the SYMCLI (which is a client doing remote management of the storage array through the storage controllers), which is also used in the storage controllers for in-band management. The storage controllers must start the SYMAPI server daemon, allowing the KSYS node to use them to perform remote management of the storage arrays.

Tip: This publication often refers to the storage controller as the SYMAPI server.

Note: The Dell EMC Solutions Enabler software is available for several operating systems, including AIX, Linux, and Windows. You can use any operating system or platform as the storage controller if it can be configured as a SYMAPI server. Because the KSYS node must be an AIX 7200-01 LPAR, and that it also requires the Solutions Enabler software (to use the SYMCLI as a client of the storage controller or SYMAPI server) to be in the KSYS node, the Solutions Enabler for AIX must be used.

The distance between data centers might be large, so the KSYS node cannot do in-band management of the storage subsystem, requiring it to do remote management of the storage through the storage controllers. You need at least one storage controller per site, which does the in-band management and works as a router for the communication between the KSYS node and the storage subsystem. Figure 3-2 shows the communication between the KSYS node and storage controllers that are used to manage the Dell EMC Storage replication (SRDF/A).

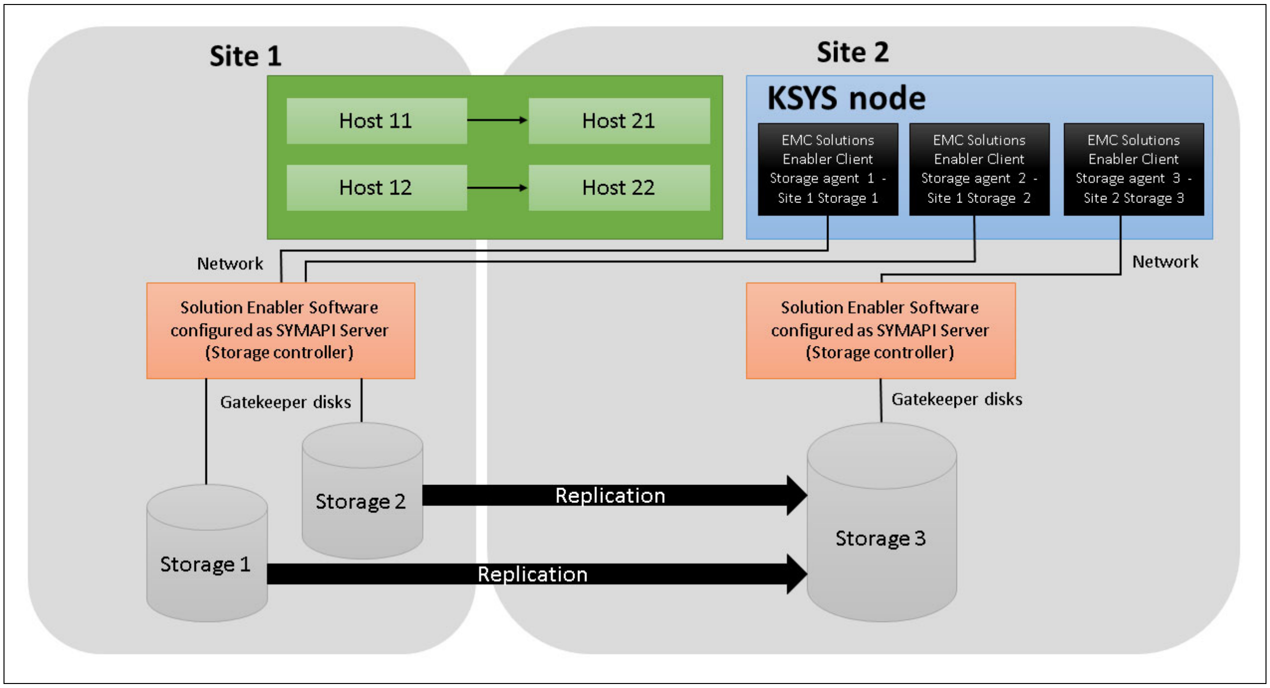


Figure 3-2 Communication between KSYS node and storage controllers for replication management

In summary, the IBM Geographically Dispersed Resiliency for Power Systems solution needs the following items to control the Dell EMC Storage replication:

- The Dell EMC Solutions Enabler software.
- The SYMAPI client software must be installed on the KSYS node.
- The SYMAPI server must be set up on an AIX or Linux LPAR (or other platform).

> **Tip:** If you have VMWARE Site Recovery Manager (SRM) in your environment, you can reuse the SYMAPI server that is used for VMWARE.

3.3.2 Management of the volume pairs by using a composite group

To configure the SRDF in your Dell EMC Storage, you must be aware of the *group* definitions that are described in this section.

SRDF groups or RDF groups

The SRDF groups are used to define the relationship between two storage subsystems, which are connected for replication purposes. The SRDF groups contain a group number and the logical ports from source and target storages that are used for replication.

> **Note:** The SRDF groups can also be called RDF groups or RA groups.

Each SRDF group has a unique group number. The volumes that are used for replication must belong to an SRDF group. The source volume of the replication is called R1, and the target volume is called R2. The SRDF group must be created on the source and target storages, but they do not need to have the same number.

You can provide volumes from multiple SRDF groups to the IBM Geographically Dispersed Resiliency for Power Systems solution, but because the number of SRDF groups in a Dell EMC Storage is limited, check the storage documentation for information regarding preferred practices for SRDF groups and which volumes should be grouped in the same SRDF group.

> **Important:** The volumes that are used in the IBM Geographically Dispersed Resiliency for Power Systems solution are part of a single CG and the type of replication that is used is SRDF/A. Due to storage limitations, some actions must be performed at the same time to all volumes that belong to an SRDF group. For example, if you need to include a new volume pair to an existing SRDF group in asynchronous mode, you must remove the existing pairs and then re-create all the pairs together, including the new pair, or use a temporary new RDF group to create the volume pairs and then move them to the RDF group with the remaining volumes of the managed VMs. If you want to use a new SRDF group, then you can create it with the new pairs, and the IBM Geographically Dispersed Resiliency for Power Systems takes care of including it to the existing CG.

Device groups

Device groups (DGs) are user-defined groups of volumes within a single storage array (or storage subsystem). These groups are used to manage all the volume pairs that belong to it. The DGs are not used in the IBM Geographically Dispersed Resiliency for Power Systems solution; instead, a CG is used.

Composite groups

The CGs are similar to a DG, but you can add volume pairs from multiple storage arrays (or storage subsystem) from the same site to a single CG.

In the IBM Geographically Dispersed Resiliency for Power Systems solution, *one* CG per site is created by the KSYS node, including all the volume pairs from the managed VMs. Because the replication operations (starting, stopping, reversing, suspending, and so on) are all performed at the CG level, this means that when IBM Geographically Dispersed Resiliency for Power Systems reverses the replication direction (to move the VMs to the DR site), all volume pairs are reversed, so all managed VMs must be moved together. This is why you can perform the **`move`** operation only at the *site* level.

> **Note:** At the time of writing, the move operation can be performed only at the site level. IBM intends to provide the ability to perform operations at the host level in upcoming releases.
>
> **Important:** The volume pairs that are managed by the KSYS node should not belong to any DG or CG, or the KSYS operation fails. The KSYS node creates the CG and manages it.

Consistency group

The consistency group in an SRDF replication is basically a CG that is created with special properties that allow RDF devices in different RDF groups to maintain dependent write consistency. The RDF groups within the consistency group can exist within a single storage array (the same VMAX Storage) or can be spread across multiple storage arrays (different VMAX Storages).

For more information about the groups definitions in Dell EMC Storage, see *An Overview of Groups in Dell EMC Symmetrix and Solutions Enabler Environments*.

3.3.3 IBM Geographically Dispersed Resilience storage topology

The environment that represented in Figure 3-3 is used to perform the installation, configuration, and DR tests with the IBM Geographically Dispersed Resiliency for Power Systems solution. This section describes the steps that are performed to install and configure the SYMAPI server and client, allowing the KSYS node to communicate with the Dell EMC Storages to query and control the SRDF/A replication.

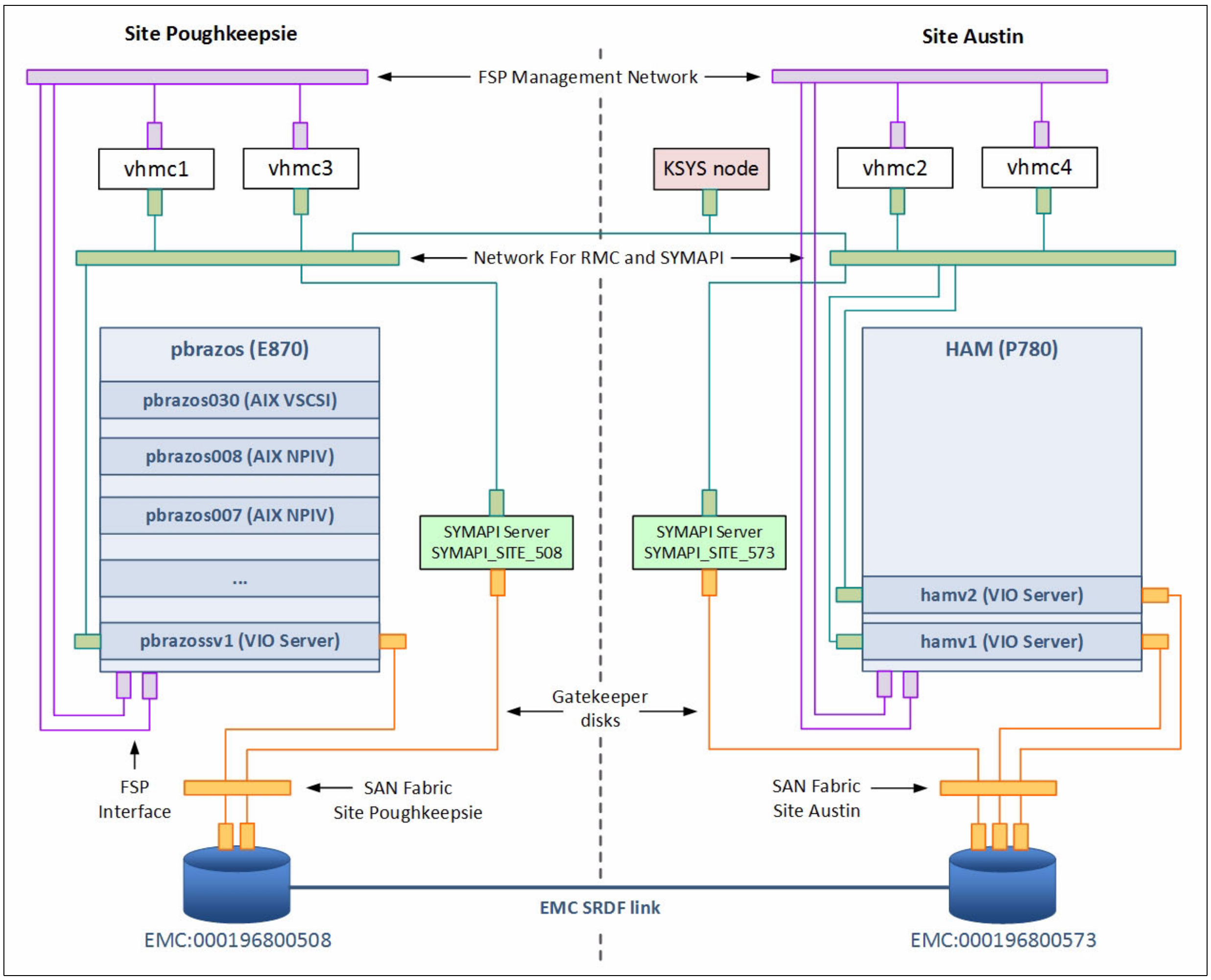


Figure 3-3 IBM Geographically Dispersed Resilience environment setup for this residency

3.3.4 Software and hardware requirements

The following list shows the software and hardware requirements for the SYMAPI servers (storage controllers) and client (KSYS node):

- The KSYS node, in which the SYMAPI client must run AIX 7.2 Technology Level 1 Service Pack 1 (7200-01-01) or later, and must have OpenSSL version 1.0.1.512 or later.
- The IBM Geographically Dispersed Resiliency for Power Systems solution supports storage devices for only the Dell EMC VMAX family (VMAX1, VMAX2, and VMAX3).
- Only SRDF/A is supported.
- The Dell EMC Solutions Enabler Version 8.1.0.0 or later is supported for the SYMAPI server and client.
- The SYMAPI server can run on different platforms and operating systems (not required for AIX for the SYMAPI server), but it must accept remote commands from other SYMAPI clients, including for SRDF purposes.[1]
- The storage setup must be created manually before adding the storage agents and managing the VMs in the IBM Geographically Dispersed Resiliency for Power Systems environment, which includes setting up the volume pairs replication and LUN masking on source and target storages.
- The SAN zoning configuration must be manually set up on both sites.
- The sites must have separate SAN fabrics (source and target storages cannot belong to the same fabric).
- If you are N_Port ID Virtualization (NPIV), on the active (or home) site, the zone must be between the client WWPNs and the source storage, and on the backup (or DR site), the zone must be between the same client WWPNs and the target storage.
- If you use VSCSI, on the active site, the zone must be between the VIOS WWPNs from the active host and the source storage, and on the backup site, the zone must be between the VIOS WWPNs from the backup host and the target storage.
- The managed VMs must have only virtual devices (no physical device is supported), and all the disks from the VMs must be replicated, including the disk where the operating system is installed (rootvg or boot disk).

The planning of the IBM Geographically Dispersed Resiliency for Power Systems solution is critical and must be done before starting the IBM Geographically Dispersed Resiliency for Power Systems implementation. For more information about the requirements in the IBM Geographically Dispersed Resiliency for Power Systems solution, see Chapter 2, “Planning for IBM Geographically Dispersed Resiliency” on page 19.

To properly add storage agents to the IBM Geographically Dispersed Resiliency for Power Systems solution and manage the VMs, the following tasks must be performed:

1. Install and configure the SYMAPI servers (storage controllers).
2. Install and configure the SYMAPI client on the KSYS node.
3. Set up storage for the VMs:
   a. Set up storage for VMs by using NPIV.
   b. Set up storage for VMs by using Virtual SCSI (VSCSI).

The next sections describe each of these steps based on the scenario that is described in 3.3.3, “IBM Geographically Dispersed Resilience storage topology” on page 33.

[1] This section shows how to set up a SYMAPI server running an AIX LPAR, but other platforms (for example, virtual or physical x86 machines) and operating systems (for example, Linux on ppc64 or x86_64) can also be used.

3.3.5 Installing and configuring the SYMAPI servers (storage controllers)

The SYMAPI servers are the storage controllers that are used by the KSYS node to bridge the communication between Dell EMC Storages and KSYS node to allow the KSYS to query and control the SRDF replication and its direction between active and backup sites.

The software that is used in the SYMAPI servers is the Dell EMC Solutions Enabler, which provides shared libraries and a CLI (**SYMCLI**) tool that is used to perform administrative operations on the Dell EMC VMAX storage. Such operations are performed through disks that are called *gatekeeper disks*, which allows in-band management of the storage. The Dell EMC Solutions Enabler also provides the SYMAPI server daemon (**storsrvd**), which receives remote commands from hosts with the Dell EMC Solutions Enabler installed (clients) and forwards these commands to the storage.

As mentioned in previous sections, the SYMAPI servers can be installed on several operating systems and platforms, including Power Systems (running AIX or Linux) and x86_64 systems (running Linux or Windows). This section describes the steps to download, install, and configure the Dell EMC Solutions Enabler in an AIX 7.2 VM, but disregarding the particulars of other operating systems, the steps should be similar when performed on other operating systems such as Linux and Windows.

> **Note:** The idea of this section of the book is not to cover all the possible configurations that you can do with the Dell EMC Solutions Enabler software, but to provide you the basic steps that must be performed to allow the KSYS node to control the Dell EMC Storage through a SYMAPI server. The same objective can be accomplished in several different ways, but this section shows you how the residency team performed the configuration for the test environment. For more information about the Dell EMC Solutions Enabler software and other options that can be used when configuring a SYMAPI server, see *Solutions Enabler Version 8.3 Installation and Configuration Guide*.

At least one SYMAPI server is required per site. If you have more than one Dell EMC VMAX Storage per site, and you plan to use in the IBM Geographically Dispersed Resiliency for Power Systems solution, you can use the same SYMAPI server to control all Dell EMC Storages, or you can set up multiple SYMAPI servers (one per storage). As shown in Figure 3-13 on page 57, in the scenario that is used during this residency, there are installed and configured *two* SYMAPI servers. The server that is named SYMAPI_SITE_508 is based on site Poughkeepsie and manages the Dell EMC VMAX Storage with Symmetrix ID (SID) 000196800508, and the server that is named SYMAPI_SITE_573 is based on site Austin and manages the Dell EMC VMAX Storage with SID 000196800573.

> **Note:** Although it is not required, it is preferable that you have a dedicated VM for the SYMAPI server role.

Downloading and installing the Solutions Enabler on the SYMAPI server

Use the Dell EMC Support website to download the Dell EMC Solutions Enabler software. You must register at the website by creating a user name and password for you to log in and download the documentation and the tools.

Complete the following steps:

1. Log in with your user name and password, and in the Support Tasks area, click **Get Downloads**, as shown in Figure 3-4.

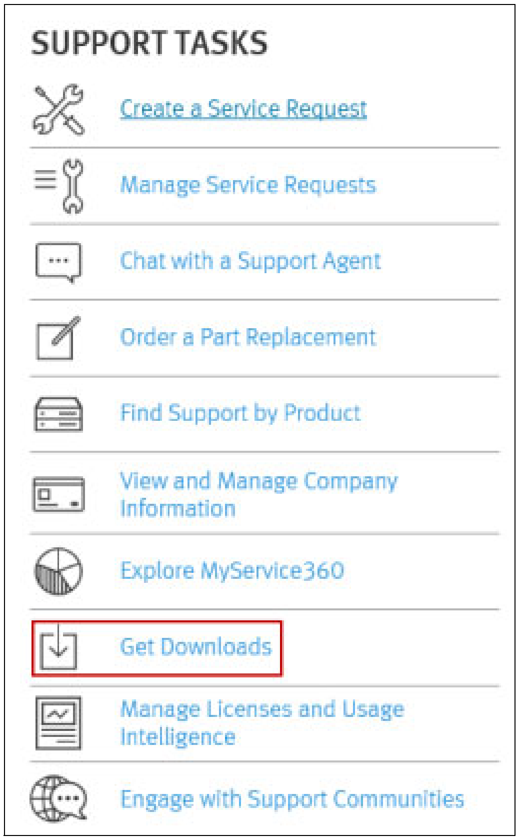


Figure 3-4 Get downloads from the Dell EMC website

2. Search for Solutions Enabler. After you receive the search results, choose the appropriate version for the operating system, as shown in Figure 3-5. Version 8.1 or later is required for the IBM Geographically Dispersed Resiliency for Power Systems solution.

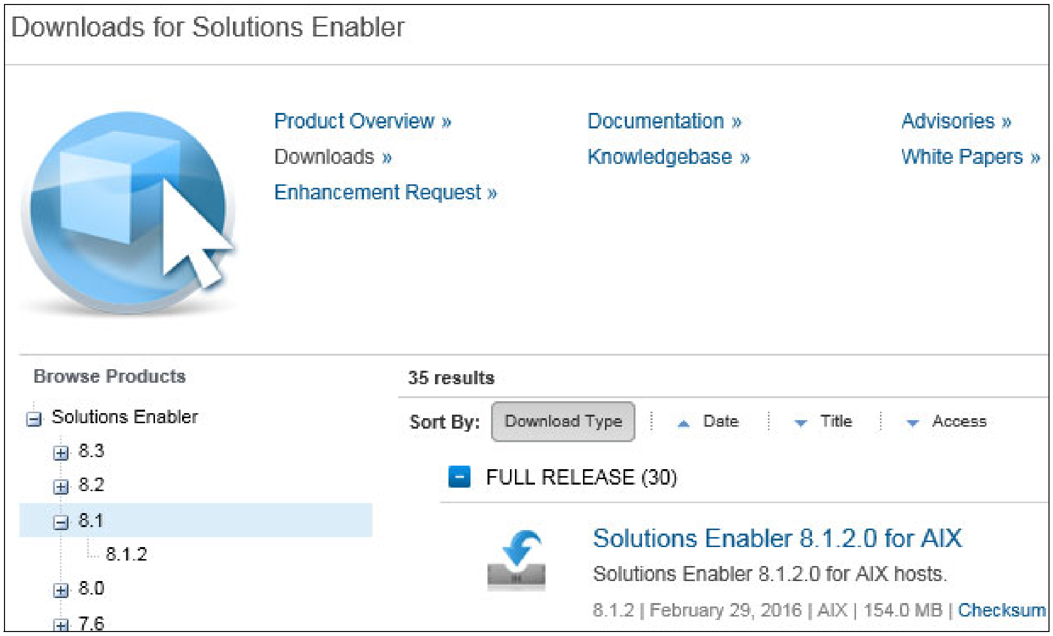


Figure 3-5 Download Solutions Enabler for AIX

> **Note:** In the IBM Geographically Dispersed Resiliency for Power Systems environment that is used for this publication, Solutions Enabler V8.1.0.0 for AIX is used. At the time of writing, the latest available and supported version is Version 8.3.0.0.

3. The `se8XXX-AIX-powerpc-ni.tar.gz` file (or similar name, according to the version and operating system that is selected) is downloaded. Place this file in the SYMAPI servers for further installation.

4. Change to the directory where the file is downloaded and extract the contents of the package. Run the following commands to extract the package:

```
# gzip -d se8100-AIX-powerpc-ni.tar.gz
# tar -xvf se8100-AIX-powerpc-ni.tar
```

   Example 3-2 shows the expected content after the files are extracted from the package.

Example 3-2 Files available in the Solutions Enabler installer package

```
# ls -l
total 545560
-rw-r--r--    1 root     system        2701 Sep 14 2015  .toc
-rw-r--r--    1 root     system   278943232 Sep 14 2015  SYMCLI.8.1.0.0.bff
-rw-r--r--    1 root     system         897 Sep 14 2015  public_key
-r-xr-xr-x    1 root     system      364939 Sep 14 2015  se8100_install.sh
```

5. Run the **se8100_install.sh** script with the **-install** flag to start the installation:

```
# ./se8100_install.sh -install
```

6. Example 3-3 shows the Solutions Enabler installation starting. Enter `N` (as in No) for the question `Do you want to run the Solutions Enabler daemons as non-root user` (to run as root).

Example 3-3 Start the Dell EMC Solutions Enabler installation

```
# ./se8100_install.sh -install -autostart=#

 #-----------------------------------------------------------------------------
 #                            EMC Installation Manager
 #-----------------------------------------------------------------------------
 Copyright (c) [1997-2015] EMC Corporation. All Rights Reserved.

 This software contains the intellectual property of EMC Corporation or is
 licensed to EMC Corporation from third parties. Use of this software and the
 intellectual property contained therein is expressly limited to the terms and
 conditions of the License Agreement under which it is provided by or on behalf
 of EMC.

 Solutions Enabler Native Installer Kit Location : /mnt/EMC/SE8100

 Checking for OS version compatibility......
 Checking for previous installation of Solutions Enabler......

 Following daemons can be set to run as a non-root user:
 storevntd, storgnsd, storrdfd, storsrvd, storstpd, storwatchd
 Do you want to run these daemons as a non-root user? [N]:N

 Checking for active processes.....

 Checking for active SYMCLI components...
```

7. Given that the **`-silent`** option is not used, this is an interactive installation. You are prompted to answer the questions about the installation and customization. Choose the options that best suits your environment, but consider that the SYMAPI server daemon must work and allow the KSYS node to run `REMOTE` (in the **`SYMCLI_CONNECT_TYPE`** variable) commands through this SYMAPI server.
8. In the environment that set up for this residency, default options are used and the default `Lockbox` password, which stores and protects sensitive information of the Dell EMC storage management, is used, as shown in Example 3-4.

Example 3-4 Default options that are used during the Solutions Enabler installation on the SYMAPI server

```
Install EMC Solutions Enabler Certificates for secure Client/Server operation ? [Y]:
Install All EMC Solutions Enabler Shared Libraries and Run Time Environment ? [Y]:
Install Symmetrix Command Line Interface SYMCLI ? [Y]:
Install Option to Enable JNI Interface for EMC Solutions Enabler APIs ? [N]:
Install EMC Solutions Enabler SRM Components ? [N]:
Install EMC Solutions Enabler SYMRECOVER Components ? [Y]:

Do you want to change default permission on /var/symapi directory from [755]? [N]:

Do you want to use the default Lockbox Password ? [N]:Y
Please confirm that you want to use the default Lockbox Password ? [N]:Y
```

After making these selections, the installation continues, and after completion, you should be able to see a message similar to the one as shown in Example 3-5.

Example 3-5 Dell EMC Solutions Enabler successful installation

```
Installation Program Complete

 The EMC Solutions Enabler V8.1.0.0-2054 installation program has completed
successfully.

 It is recommended that you perform a discover operation prior to using
Solutions Enabler.
 In addition, you must confirm that you have the appropriate number of
gatekeepers configured, preferably dedicated, to successfully run Solutions
Enabler.
 Refer to your Solutions Enabler documentation for details on gatekeeper
management.

 EMC recommends that you review the Solutions Enabler Release Notes and
 Solutions Enabler Installation Guide prior to using Solutions Enabler.

 #-----------------------------------------------------------------------------
 # The following HAS BEEN INSTALLED in /opt/emc via the installp utility.
 #-----------------------------------------------------------------------------
  ITEM  PRODUCT                                         VERSION
  01    EMC Solutions Enabler                           V8.1.0.0
        RT KIT
 #-----------------------------------------------------------------------------
```

9. Export the **PATH** and **MANPATH** variables to include the location of the Dell EMC Solutions Enabler software. Consider including the export commands in `/etc/environment` or your `.profile` file so that you do not need to export these variables every time.

```
# export MANPATH=$MANPATH:/usr/storapi/man:/usr/storapi/storman
# export PATH=$PATH:/usr/symcli/bin
```

The filesets that are shown in Example 3-6 are locally installed after this procedure.

Example 3-6 Filesets that are installed by the Dell EMC Solutions Enabler

```
# lslpp -l | grep SYMCLI
  SYMCLI.BASE.rte          8.1.0.0  COMMITTED  Shared Libraries and Runtime
  SYMCLI.CERT.rte          8.1.0.0  COMMITTED  EMC Solutions Enabler -
  SYMCLI.DATA.rte          8.1.0.0  COMMITTED  Data Component -  Core Library
  SYMCLI.SYMCLI.rte        8.1.0.0  COMMITTED  Symmetrix Command Line
                                               Interface (SYMCLI)
  SYMCLI.SYMRECOVER.rte    8.1.0.0  COMMITTED  EMC Solutions Enabler
  SYMCLI.THINCORE.rte      8.1.0.0  COMMITTED  Shared Libraries and Runtime
```

Configuring the Solutions Enabler on the SYMAPI server

After the installation is complete, the following tasks must be performed to conclude the configuration of the SYMAPI server. This section covers all these tasks:

1. Customize the configuration files.
2. Create and map gatekeeper disks to the SYMAPI Server VM.
3. Discover the Dell EMC storage through the gatekeeper disks.
4. Use the SYMCLI commands to test the communication with the Dell EMC Storage.
5. Start the daemons and configure them to start automatically after restart.

Complete the following steps:

1. The main file that must be customized is the `/var/symapi/config/options` configuration file. This file contains optional parameters that can be customized to change the behavior of the SYMCLI commands and also the SYMAPI calls, which are received by the SYMAPI server from the SYMAPI client and contain commands that should be forwarded to the Dell EMC storage.

   Modify this file by using the **vi** text editor and change the values of the parameters **SYMAPI_ALLOW_RDF_SYMFORCE** to `TRUE` and **SYMAPI_USE_RDFD** to `ENABLE`, as explained in Table 3-2.

Table 3-2 Parameters and values that are required in the /var/symapi/config/options file

Parameter	Set to	Explanation
SYMAPI_ALLOW_RDF_SYMFORCE	TRUE	Allows the flag **-symforce** during SRDF operations
SYMAPI_USE_RDFD	ENABLE	Allows the creation of RDF_CONSISTENCY CGs

Example 3-7 shows how the file should look after these modifications. In the original files, all lines are commented out. After these changes, at least the **SYMAPI_ALLOW_RDF_SYMFORCE** and **SYMAPI_USE_RDFD** are set. These changes are the minimal ones that you must perform in the SYMAPI server in the IBM Geographically Dispersed Resiliency for Power Systems solution (the KSYS node must perform such operations in the Dell EMC Storage subsystems, thus the requirement for modifying such parameters), but you can also customize other parameters in this file according to the requirements in your environment.

Example 3-7 The /var/symapi/config/options file with the minimum values that are required for IBM Geographically Dispersed Resiliency for Power Systems

```
# grep -v "\#" /var/symapi/config/options
SYMAPI_ALLOW_RDF_SYMFORCE = TRUE
SYMAPI_USE_RDFD = ENABLE
```

The next step involves creating gatekeeper disks and mapping them to the SYMAPI VM so that they can be used for in-band management of the Dell EMC VMAX Storage. The Dell EMC Solutions Enabler from the SYMAPI server communicates with the storage by using gatekeeper disks. The gatekeeper disks are any disks that come from the storage that you want to manage. Although you can use disks that are used by another application, it is preferable to create disks that are dedicated to the gatekeeper because when a command must be forwarded to the storage, the Solutions Enabler tries to lock the disk, which can cause problems to the other application if the application is using the same disk.

You can create small disks of 10 - 50 MB, which become useless for other applications but are enough for gatekeeper purposes. The residency environment used 10 disks of 10 MB each as gatekeeper disks.

Tip: If your SYMAPI server uses other disks from the same Dell EMC Storage it manages (for data purposes, such as when an operating system is installed on the Dell EMC disks, or if an application is installed and it is using the data for data), you can use the `/var/symapi/config/gkavoid` file to explicitly instruct the SYMAPI to avoid certain disks so that they are not used as gatekeeper disks. This option helps the SYMAPI server to avoid performing any unwanted action on the disks that are used for data purposes in your environment.

To create the gatekeeper disks, the residency environment implemented the disks by using Dell EMC Unisphere for VMAX. Dell EMC Unisphere for VMAX is a web-based GUI that allows remote management of the Dell EMC VMAX Storage. It provides tools to provision, manage, and monitor the VMAX Storage subsystem. The installation and configuration of Dell EMC Unisphere for VMAX is not covered in this book because the tool is used to facilitate only the storage management. For more information about Unisphere for VMAX and how to install it, see *Dell EMC Unisphere for VMAX Version 8.3.0 Installation Guide*.

Important: Dell EMC Unisphere for VMAX is not required in the IBM Geographically Dispersed Resiliency for Power Systems solution. The KSYS node does not use Unisphere. This tool is used only as a GUI to facilitate the storage administration, but the CLI can be used as well. If you cannot use Unisphere in your environment, the IBM Geographically Dispersed Resiliency for Power Systems solution can still be implemented because it requires communication only with the storage by using the Solutions Enabler software (SYMAPI server and client).

In this section, the gatekeeper creation is shown exclusively using the GUI, but you can perform similar actions by using the CLI. Complete the following steps:

1. To create and map the gatekeeper disks, you must create a `Host` definition in the Dell EMC Storage and the `initiators` of this host, which are the host ports (or the WWPN of the HBAs from the VM receiving the gatekeeper disks). Use the **`lsdev`** and **`lscfg`** commands to obtain the WWPN information of your HBAs, as shown in Example 3-8.

   Example 3-8 Obtain the AIX WWPNs by using lsdev and lscfg

```
# lsdev -Cc adapter | grep fcs
fcs0   Available 07-T1 Virtual Fibre Channel Client Adapter
fcs1   Available 07-T1 Virtual Fibre Channel Client Adapter

# lscfg -vl fcs0 | grep Network
        Network Address.............C0507601E9B60018

# lscfg -vl fcs1 | grep Network
        Network Address.............C0507601E9B6001A
```

2. With this information, log in to the Dell EMC Unisphere web interface and click **Hosts** → **Create Host**. Use the wizard that opens to create the SYMAPI server host for each site, as shown in Figure 3-6.

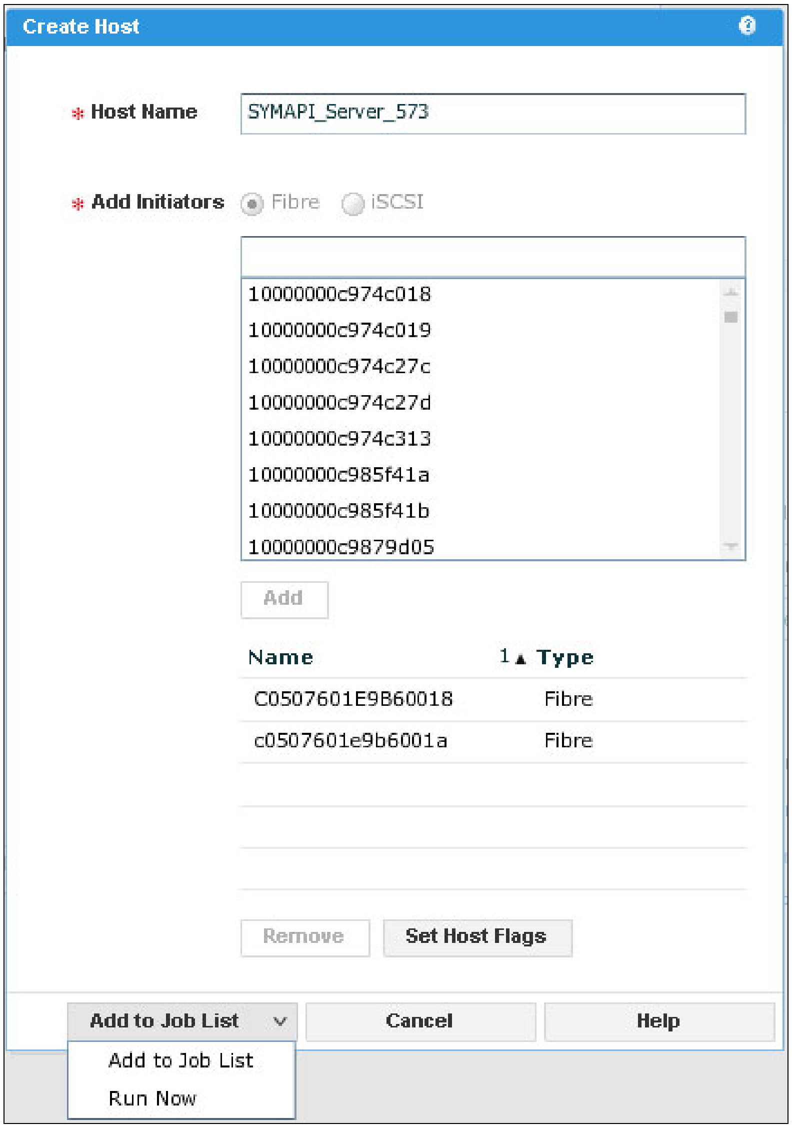


Figure 3-6 Create the SYMAPI server host in the Dell EMC Storage

3. If your host is already created, in the Dell EMC Unisphere GUI, click **Storage** → **Provision Storage to Host**, and use the wizard to create the gatekeeper disks. As mentioned before, use 10 disks of 10 MB each, as shown in Figure 3-7.

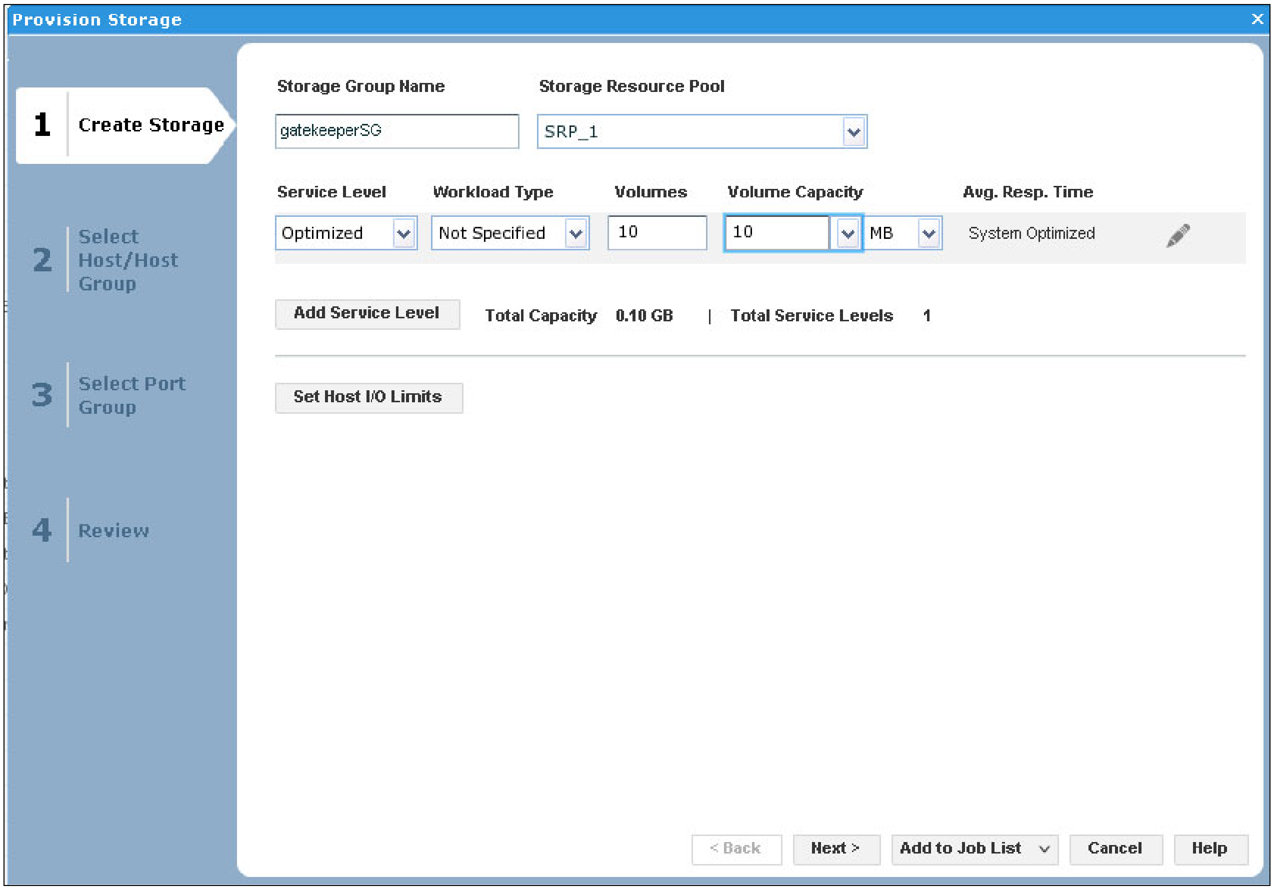


Figure 3-7 Create ten disks of 10 MB for gatekeeper usage

4. Click **Next** and use the search box to find the host that you previously created to use as the SYMAPI server. Select it and click **Next**, as shown in Figure 3-8.

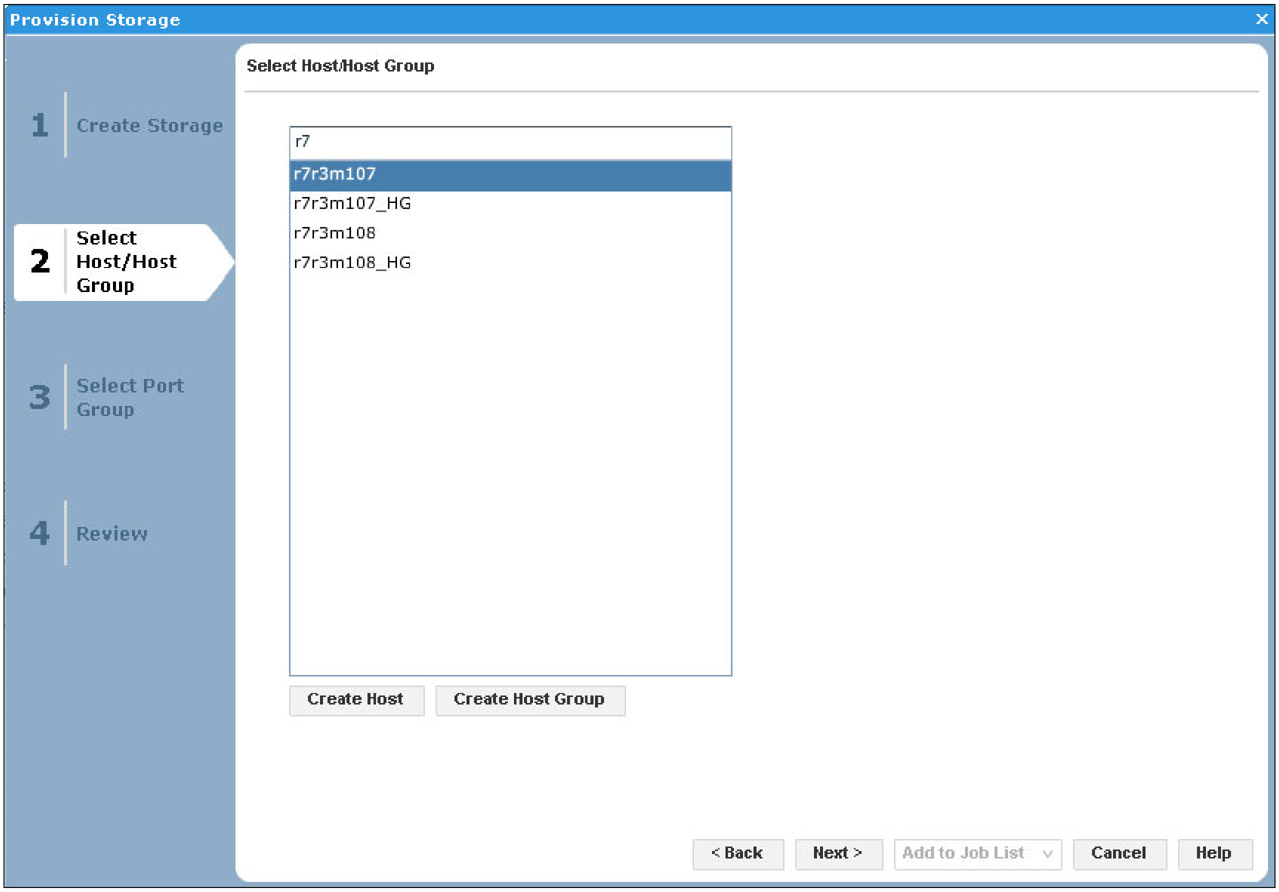


Figure 3-8 Select the SYMAPI server host to map the gatekeeper disks

5. Now, select the storage ports that you plan to use to map these disks to the SYMAPI server host. You need to properly set up the SAN zoning by using the SYMAPI WWPNs plus the Dell EMC ports WWPNs to allow the SYMAPI server to see the gatekeeper disks. Figure 3-9 shows the selection of the storage ports in the Provision Storage to host wizard.

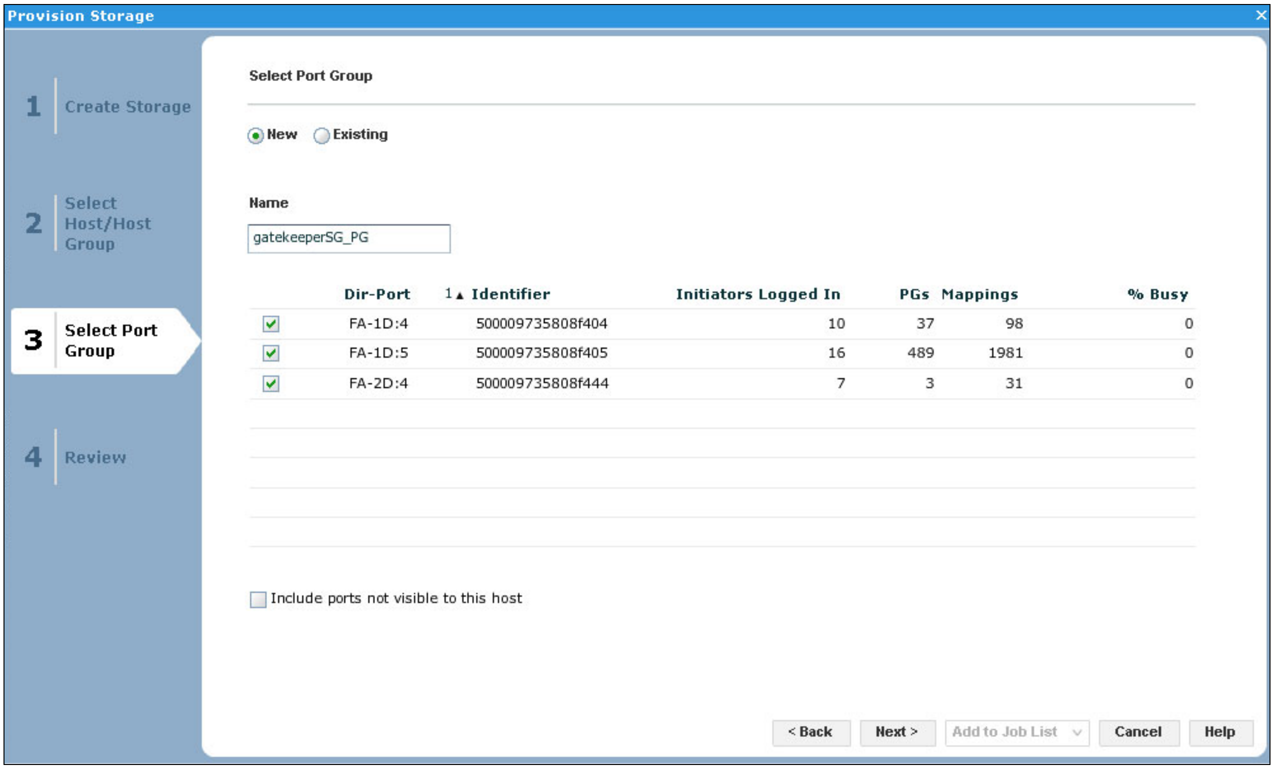


Figure 3-9 Select the storage ports to use to map the gatekeeper disks

6. Click **Next** and you are provided with a summary of the selections that you made. The name of the Masking View (which is the LUN masking configuration in the Dell EMC Storage) is automatically filled by the storage, but you can modify it. Click the down arrow next to the Add to Job List button and click **Run now**, as shown in Figure 3-10.

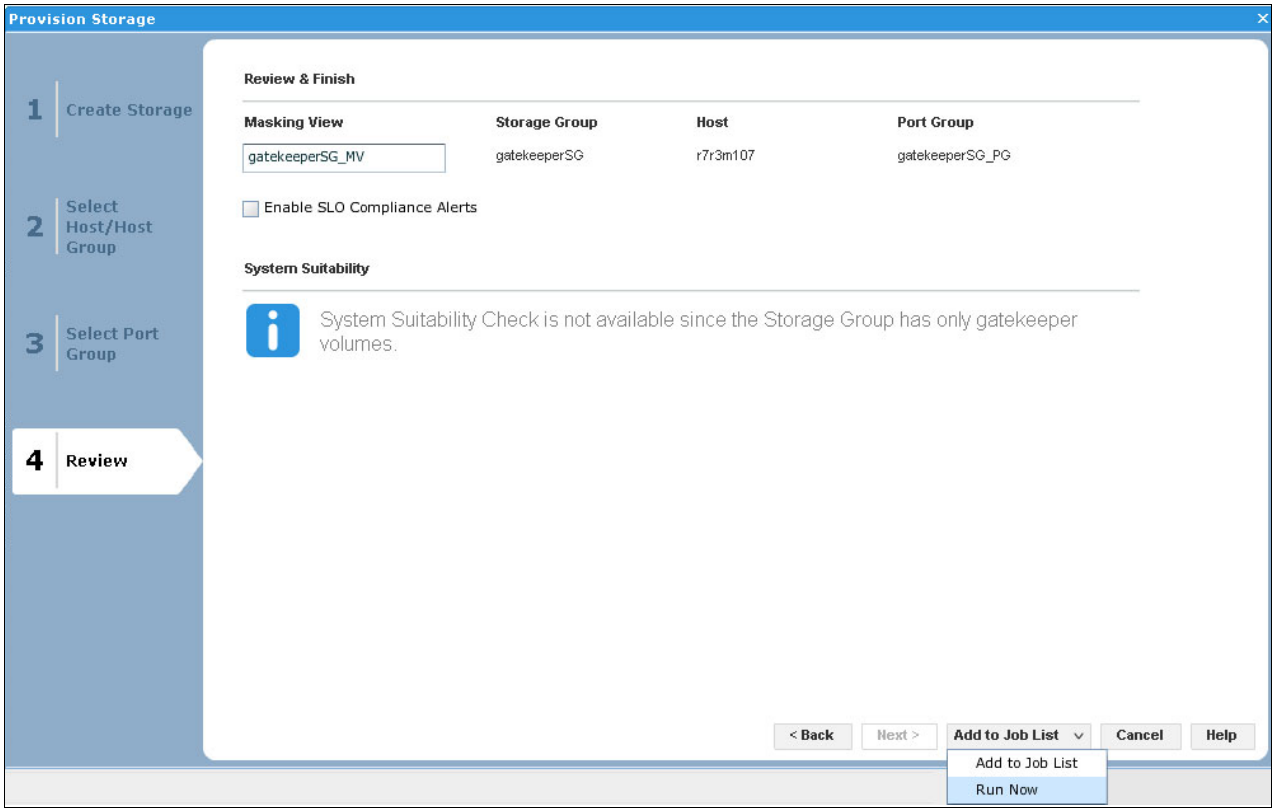


Figure 3-10 Review and finish creating and mapping the gatekeeper disks to the SYMAPI server

7. After mapping the gatekeeper disks, work with your SAN administrator and check that the zoning is properly configured.
8. Now, log in to the SYMAPI server and run the **cfgmgr** command. After running **cfgmgr**, the **lspv** command shows that the new disks are detected, as shown in Example 3-9.

Example 3-9 Gatekeeper disks that are detected by cfgmgr

```
# cfgmgr

# lspv
hdisk0          00f9e0a774b2614f                    rootvg          active
hdisk2          00f9e0a774d1c10f                    altinst_rootvg
hdisk3          00f9e0a774d1c143                    None
hdisk4          00f9e0a774d1c176                    None
hdisk5          00f9e0a774d1c1aa                    None
hdisk6          00f9e0a774d1c1de                    None
hdisk7          00f9e0a774d1c217                    None
hdisk8          00f9e0a774d1c24b                    None
hdisk9          00f9e0a774d1c27f                    None
hdisk10         none                                None
hdisk11         none                                None
hdisk12         none                                None
hdisk13         none                                None
```

```
hdisk14         none                                None
hdisk15         none                                None
hdisk16         none                                None
hdisk17         none                                None
hdisk18         none                                None
hdisk19         none                                None
```

Tip: You can use the Dell EMC **inq** tool to obtain more information about the disks, including the serial number and volume ID. You can check that the disks that are seen in the AIX host are the disks that you created with the Unisphere interface. You can download the **inq** tool from the Dell EMC Support website at this website.

If you already have the **inq** tool installed in your system, Example 3-10 shows the results when you query the gatekeeper disks.

Example 3-10 Use the inq tool to query the gatekeeper disks

```
# ./inq.aix64_51
Inquiry utility, Version V7.3-1159 (Rev 1.0)      (SIL Version V7.2.1.0 (Edit
Level 1159)
Copyright (C) by EMC Corporation, all rights reserved.
For help type inq -h.
...................
-------------------------------------------------------------------------
DEVICE        :VEND    :PROD            :REV   :SER NUM    :CAP(kb)
-------------------------------------------------------------------------
/dev/rhdisk0  :EMC     :SYMMETRIX       :5977  :73023f0000 :   104858880
/dev/rhdisk2  :EMC     :SYMMETRIX       :5977  :73023f2000 :   104858880
/dev/rhdisk3  :EMC     :SYMMETRIX       :5977  :73023f3000 :   104858880
/dev/rhdisk4  :EMC     :SYMMETRIX       :5977  :73023f4000 :   104858880
/dev/rhdisk5  :EMC     :SYMMETRIX       :5977  :73023f5000 :   104858880
/dev/rhdisk6  :EMC     :SYMMETRIX       :5977  :73023f6000 :   104858880
/dev/rhdisk7  :EMC     :SYMMETRIX       :5977  :73023f7000 :   104858880
/dev/rhdisk8  :EMC     :SYMMETRIX       :5977  :73023f8000 :   104858880
/dev/rhdisk9  :EMC     :SYMMETRIX       :5977  :73023f9000 :   104858880
/dev/rhdisk10 :EMC     :SYMMETRIX       :5977  :7302414000 :       11520
/dev/rhdisk11 :EMC     :SYMMETRIX       :5977  :7302415000 :       11520
/dev/rhdisk12 :EMC     :SYMMETRIX       :5977  :7302416000 :       11520
/dev/rhdisk13 :EMC     :SYMMETRIX       :5977  :7302417000 :       11520
/dev/rhdisk14 :EMC     :SYMMETRIX       :5977  :7302418000 :       11520
/dev/rhdisk15 :EMC     :SYMMETRIX       :5977  :7302419000 :       11520
/dev/rhdisk16 :EMC     :SYMMETRIX       :5977  :730241a000 :       11520
/dev/rhdisk17 :EMC     :SYMMETRIX       :5977  :730241b000 :       11520
/dev/rhdisk18 :EMC     :SYMMETRIX       :5977  :730241c000 :       11520
/dev/rhdisk19 :EMC     :SYMMETRIX       :5977  :730241d000 :       11520
```

9. After the gatekeeper disks are detected, you must wait for the Dell EMC daemons to detect the topology change by detecting the new disks. One minute should be enough, but you can run **`tail -f`** on the `/var/symapi/log/storrdfd.log0` file, and the message that is shown in Example 3-11 is displayed when the disks are detected.

Example 3-11 Topology change detected in /var/symapi/log/storrdfd.log0

```
# grep Topology storrdfd.log0
storrdfd.log0:       [10092990     rdfdLoggerThread] Oct-12 13:52:19.072 :
[rdfdMain()]  [rdfdMainThread @ 13:52:14] Topology change REFRESH issued
```

The `/var/symapi/log/storapid.log0` file also shows a similar message, as shown in Example 3-12.

Example 3-12 Topology change that is detected in file /var/symapi/log/storapid.log0

```
# grep "merged new topology" storapid.log0
        [6816226               GKMgt] Oct-12 13:52:48.184 :
[new_merge_topology()] Successfully merged new topology in 153.335 usec
```

10. Run the **`symcfg discover`** command to detect your Dell EMC VMAX Storage through the gatekeeper disks, as shown in Example 3-13.

Example 3-13 Use the symcfg discover command to detect the Dell EMC VMAX Storage

```
# /usr/symcli/bin/symcfg discover

This operation may take up to a few minutes. Please be patient...
```

Tip: If no gatekeeper disks are mapped to the SYMAPI server VM, the following messages are displayed when you run the **`symcfg discover`** command:

```
# /usr/symcli/bin/symcfg discover

This operation may take up to a few minutes. Please be patient...

The gatekeeper device (while using the Base Daemon) has an error (Please see
the Log file)
```

Also, in the `/var/symapi/log` directory, a file that is called `symapi-YYYYMMDD.log` is created (where YYYYMMDD means Year + Month + Day). You notice the message stating that no gatekeeper disks are found:

```
# cat /var/symapi/log/symapi-20161012.log
10/12/2016 13:31:16.312 10289554      1 EMC:SYMCFG
SymDiscover()        Function start
10/12/2016 13:31:20.596 10289554      1 EMC:SYMCFG
iFindandOpenGate     Failed to open pooled Gatekeeper: There is no
gatekeeper device that can be used to communicate with the symmetric
(000196800573)
```

11. Now you can use the **symcfg list** command to check that the Dell EMC VMAX Storage is detected properly, as shown in Example 3-14.

Example 3-14 Dell EMC VMAX Storage detected through the gatekeeper disks

```
# symcfg list

                                S Y M M E T R I X

                                       Mcode    Cache      Num Phys  Num Symm
    SymmID       Attachment  Model     Version  Size (MB)  Devices   Devices

    000196800573 Local       VMAX100K  5977      217088        19      9325
    000196800508 Remote      VMAX100K  5977      216064         0     12957
```

Note: From the output in Example 3-14, you notice that two Dell EMC Storages are detected, although only the disks from `000196800573` are mapped to the SYMAPI server. This is because the SRDF links are already configured. You can see from the output that our `Local` storage is `000196800573`.

12. Now that the Dell EMC Solutions Enabler is properly installed and configured, check that the daemons `storapid`, `storgnsd`, `storrdfd`, `storwatchd`, and `storsrvd` are started and configured to start automatically after the restart. Except for `storsrvd`, all daemons should be automatically started during the Dell EMC Solutions Enabler installation. You can use the **stordaemon** command to list the status of the daemons, start them, and configure them to automatically start after the restart, as shown in Example 3-15.

Example 3-15 Start daemons and configure them to autostart

```
Trying to start a daemon which is already started:

# stordaemon start storapid

 Daemon storapid is already running.

Trying to start a daemon which was stopped:

# stordaemon start storsrvd
  Waiting for daemon to start.  This may take several seconds.

Listing the daemons and its status ([*]) means that the daemon is running:

# stordaemon list

Available Daemons  ('[*]': Currently Running):

[*] storapid              EMC Solutions Enabler Base Daemon
[*] storgnsd              EMC Solutions Enabler GNS Daemon
[*] storrdfd              EMC Solutions Enabler RDF Daemon
    storevntd             EMC Solutions Enabler Event Daemon
[*] storwatchd            EMC Solutions Enabler Watchdog Daemon
    storsrmd              EMC Solutions Enabler SRM Daemon
    storstpd              EMC Solutions Enabler STP Daemon
[*] storsrvd              EMC Solutions Enabler SYMAPI Server Daemon

Configuring the daemon to automatically start after the reboot:
```

```
# stordaemon install storsrvd -autostart
```

Checking if the daemon is configured to automatically start after the reboot:

```
# stordaemon show storsrvd

 Daemon State                                     : Running
 Daemon Start Time                                : Sun Oct  2 12:02:45 2016
 Version                                          : V8.1-2054 (0.0) [64-bit]
 Auto-Restart by Watchdog                         : Enabled

 Total Number of Connections                      : 63797
 Number of Active Connections                     : 1
 Total Number of Requests                         : 26574941
 IPC Authentication                               : ShMem

 ANR0123I Show Server Details                     :

 SYMAPI Version                                   : V8.1.0.0   (Edit Level:
2054)
 SYMAPI Session Total/Active                      : 63803/1
 SYMAPI Session Port                              : 2707
 Security Level                                   : SECURE
 Show ANR Category                                : Disabled
 Show ANR Message Id                              : Enabled
 Enhanced Authentication                          : Disabled
 Client Verification Level                        : VERIFY
 Transfer Protocol Version                        : 3
 Maximum Sessions                                 : 100
 Maximum Sessions per Host                        : NOLIMIT
 Maximum Sessions per User                        : NOLIMIT
 Symapi Debug Permitted                           : SERVER
 Allow Wildcarded Certificates                    : Disabled
```

This concludes the installation and configuration of the SYMAPI server. You need at least one SYMAPI server per site. The residency scenario has one storage per site. Figure 3-11 shows the pieces of the IBM Geographically Dispersed Resiliency for Power Systems solution that are set up to this point.

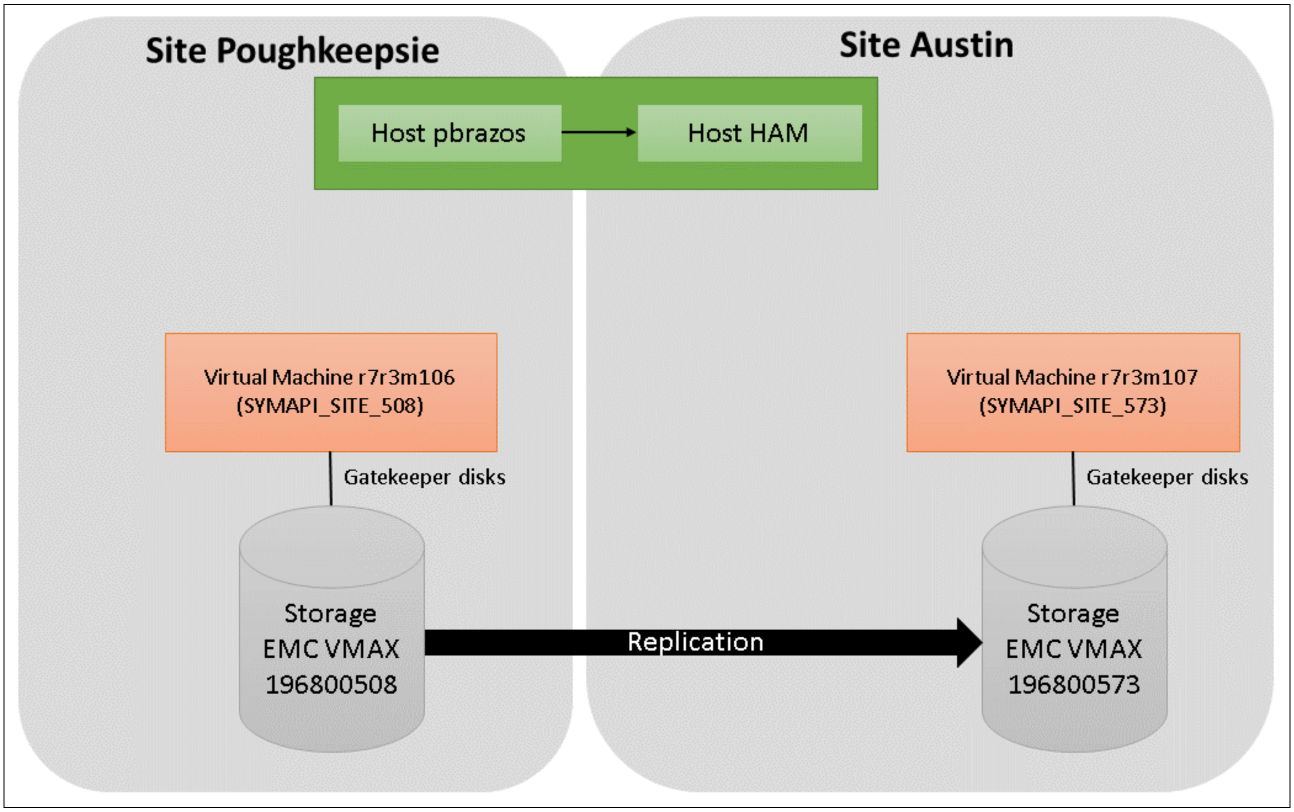


Figure 3-11 The SYMAPI servers in the residency environment

3.3.6 Installing and configuring the SYMAPI client on the KSYS node

The KSYS node needs an interface to query and control the SRDF replication on the Dell EMC Storages. The Dell EMC Solutions Enabler software provides the SYMCLI, which is the CLI that is used to perform such actions. This software must be installed on the KSYS node to provide the CLI with the storages that are involved in the IBM Geographically Dispersed Resiliency for Power Systems solution.

The KSYS node is an AIX 7.2 Technology Level 1 Service Pack 1 VM (or LPAR), so the Solutions Enabler for AIX must be used. Version 8.1 or later is required.

Because of the distance that might exist between the KSYS node and the Dell EMC Storages, out-of-band management is required. After installing and configuring the Dell EMC Solutions Enabler on the KSYS node, it uses the SYMAPI servers as storage controllers to bridge the communication with the Dell EMC VMAX Storages. For more information about the installation and configuration of the SYMAPI servers (or storage controllers), see 3.3.5, “Installing and configuring the SYMAPI servers (storage controllers)” on page 35.

The same Dell EMC Solutions Enabler software that is used on the SYMAPI servers is used in the KSYS node. The only difference is that the Dell EMC management is performed by a REMOTE connection by using TCP/IP instead of a local connection by using gatekeeper disks.

You can use the instructions that are provided in "Downloading and installing the Solutions Enabler on the SYMAPI server" on page 36 to download and install the Dell EMC Solutions Enabler on the KSYS node. The installation steps are the same, and the only difference is during the configuration steps.

Note: It is important to enter yes (Y), which is the default answer for the following question during the Solutions Enabler installation on the KSYS node:

```
Install EMC Solutions Enabler Certificates for secure Client/Server operation ?
[Y]:
```

If the Dell EMC Solutions Enabler Certificates for secure client and server operation are not installed on the KSYS node, the communication between the KSYS node and the Dell EMC Storage through the SYMAPI server fails, unless a **NONSECURE** configuration is performed, which is not recommended.

After the Dell EMC Solutions Enabler is installed on the KSYS node, the configuration file /var/symapi/config/netcnfg must be modified to include the SYMAPI servers IP addresses (and other pertinent configurations) that the SYMCLI uses to communicate with the Dell EMC Storages.

The netcnfg file creates the definition of a *service name*, which is basically a mapping to the IP address, host name, and port number of the SYMAPI servers that are listening to the SYMAPI functions that are performed through the SYMCLI commands. You can create one service name per storage. This service name is used to tell the SYMCLI which SYMAPI server is used to perform a command, hence determining which storage receives the commands from which site.

Table 3-3 shows the parameters that must be used in the /var/symapi/config/netcnfg file to create the service names.

Table 3-3 Parameters in /var/symapi/config/netcnfg for service name definition

Parameter	Explanation
Service name	The user can choose the value to be used as service name. This is used to determine which storage you want to run commands against. You can use a maximum of 31 characters.
Paring method	A "-" should be used to indicate that there is no pairing.
Protocol	The TCP/IP protocol must be used. This is the protocol that is used for communication with the SYMAPI server.
SYMAPI server host name	The host name of the SYMAPI server (maximum of 511 characters).
SYMAPI server IP address	The IP address of the SYMAPI server.
SYMAPI server port	The port that is used for communication with the SYMAPI server. The default port is 2707, but this port can be modified by the user. Confirm with the Dell EMC Storage admin which port is being used in the SYMAPI server.
Security level	You can choose between **SECURE**, **NONSECURE**, or **ANY** (which tries **SECURE** first and then **NONSECURE**, if available).

One service name per line must be defined in the `/var/symapi/config/netcnfg` file. The syntax that must be used is shown in Example 3-16.

Example 3-16 Syntax of the /var/symapi/config/netcnfg file

```
+-( Service Name )
|              +-( Pairing Method )
|              |  +-( Protocol )
|              |  |      +-( Server's Nodname )
|              |  |      |        +-( Server's Address )
|              |  |      |        |                +-(Listening Port )
|              |  |      |        |                |     +-( Security Level)
|              |  |      |        |                |     |
EMC_STOR_SITE1 -  TCPIP  node001  111.222.333.444  2707  ANY
EMC_STOR_SITE2 -  TCPIP  node002  111.222.333.555  2707  ANY
```

In this scenario, the `/var/symapi/config/netcnfg` file contains two service names. One points to the Dell EMC VMAX Storage with SID 000196800508 (from site Poughkeepsie) and the other points to the Dell EMC VMAX Storage with SID 196800573 (from site Austin). The IP address that is used in this file points to the SYMAPI servers, which have gatekeeper disks from such storages. Example 3-17 shows the contents of the `/var/symapi/config/netcnfg` file from the residency environment.

Example 3-17 Contents of the /var/symapi/config/netcnfg file from the residency environment

```
# grep -v "\#" /var/symapi/config/netcnfg

SYMAPI_SITE_508 - TCPIP r7r3m106 10.40.0.30 2707 ANY
SYMAPI_SITE_573 - TCPIP r7r3m107 10.40.0.31 2707 ANY
```

Now that the installation and configuration of the Dell EMC Solutions Enabler on the KSYS node is complete, use the SYMCLI commands to test whether the communication between the KSYS node and both Dell EMC VMAX Storages is working properly through the SYMAPI servers. To complete this task, you must export the variable **`SYMCLI_CONNECT`**, which contains the service name of the SYMAPI server that you plan to use (one of the names that is created in the `/var/symapi/config/netcnfg` file), and the variable **`SYMCLI_CONNECT_TYPE`**, which has the value of `REMOTE`, to specify that this is a remote operation that uses TCP/IP.

Example 3-18 shows the communication with storage `000196800508` (using the SYMAPI server **`SYMAPI_SITE_508`**). As explained before, both storages are displayed because the SRDF replication is already configured, but you can see that storage `000196800508` is `Local`, and storage `000196800573` is `Remote`.

Example 3-18 Test communication through SYMAPI_SITE_508

```
# export SYMCLI_CONNECT_TYPE=REMOTE
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symcfg list

                                S Y M M E T R I X

                                     Mcode    Cache      Num Phys  Num Symm
    SymmID       Attachment  Model     Version  Size (MB)  Devices   Devices

    000196800508 Local       VMAX100K  5977      216064        18     13001
    000196800573 Remote      VMAX100K  5977      217088         0      9387
```

Example 3-19 shows the communication with storage 000196800573 (using SYMAPI server SYMAPI_SITE_573). As explained before, both storages are displayed because the SRDF replication is already configured, but you can see that storage 000196800573 is Local, while 000196800508 storage is Remote.

Example 3-19 Test communication through SYMAPI_SITE_573

```
# export SYMCLI_CONNECT_TYPE=REMOTE
# export SYMCLI_CONNECT=SYMAPI_SITE_573
# symcfg list

                                S Y M M E T R I X

                                       Mcode    Cache      Num Phys  Num Symm
    SymmID       Attachment  Model     Version  Size (MB)  Devices   Devices

    000196800573 Local       VMAX100K  5977      217088        15      9387
    000196800508 Remote      VMAX100K  5977      216064         0     13001
```

Tip: If you do not remember which variables were exported, run **symcli -def** to see the currently exported environment variables that are relevant to the Dell EMC Solutions Enabler:

```
# symcli -def
Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)
Current settings of the SYMCLI environmental variables:
SYMCLI_CONNECT                : SYMAPI_SITE_508
SYMCLI_CONNECT_TYPE           : REMOTE
```

This concludes the installation and configuration of the Dell EMC Solutions Enabler on the KSYS node. The KSYS node works as a SYMAPI client, communicating with the Dell EMC Storages through the SYMAPI servers.

Figure 3-12 represents the parts of the IBM Geographically Dispersed Resiliency for Power Systems solution that are set up.

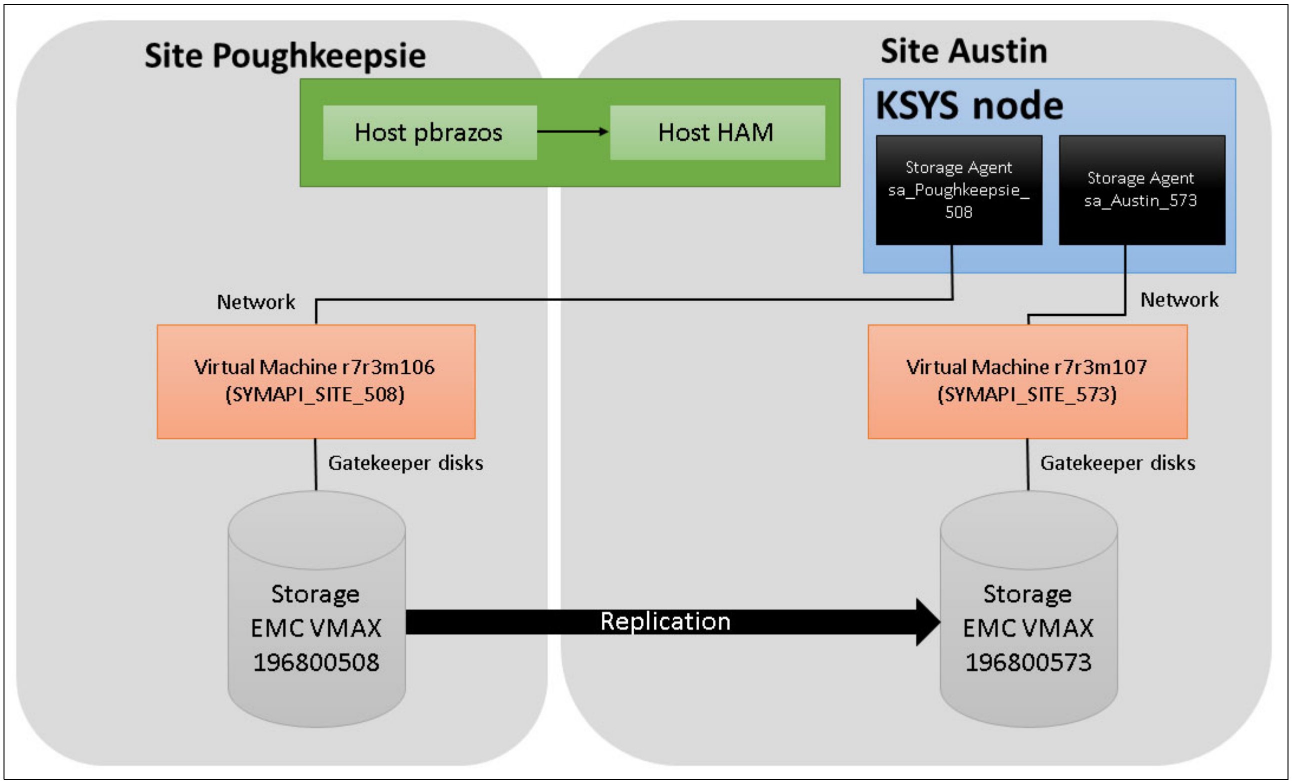


Figure 3-12 SYMAPI server and client setup for the IBM Geographically Dispersed Resiliency for Power Systems environment from this residency

Note: Now, the storage agent definition inside the KSYS can be set up. The storage agent configuration inside the KSYS node is covered in Chapter 4, "Installation and configuration for the IBM Geographically Dispersed Resilience deployment" on page 129, but the prerequisites in terms of the storage setup are complete, allowing the KSYS node to communicate with both Dell EMC VMAX Storages through the SYMAPI servers. The next sections of this chapter cover examples of the SRDF replication requirements for NPIV and VSCSI VMs.

3.3.7 Uninstalling the Dell EMC Solutions Enabler

If you need to uninstall the Dell EMC Solutions Enabler, the same script that is used during the installation (**se8100_install.sh**) can be used to accomplish this task. You can use the script that you extracted from the compressed file that you downloaded from the Dell EMC Support website, but it is preferable to use the script that you copied to your `/opt` filesystem during the product installation, as shown in Example 3-20.

Example 3-20 The installation script locally available under the /opt file system

```
# lslpp -w /opt/emc/SYMCLI/install/se8100_install.sh
  File                                        Fileset               Type
  ----------------------------------------------------------------------------
  /opt/emc/SYMCLI/install/se8100_install.sh   SYMCLI.BASE.rte       File
```

To uninstall the Dell EMC Solutions Enabler, run the script with the **-uninstall** flag, as shown in Example 3-21.

Example 3-21 Uninstall the Dell EMC Solutions Enabler

```
# ./se8100_install.sh -uninstall

 #----------------------------------------------------------------------------
 #                            EMC Installation Manager
 #----------------------------------------------------------------------------
 Copyright (c) [1997-2015] EMC Corporation. All Rights Reserved.

 This software contains the intellectual property of EMC Corporation or is
 licensed to EMC Corporation from third parties. Use of this software and the
 intellectual property contained therein is expressly limited to the terms and
 conditions of the License Agreement under which it is provided by or on behalf
 of EMC.

 Solutions Enabler Native Installer Kit Location : /mnt/EMC/SE8100

 Checking for OS version compatibility......
 Checking for previous installation of Solutions Enabler......
 Checking for previous installation version......

 Checking for active processes.....

 Checking for active SYMCLI daemons...
        WARNING: Daemon[storapid] is running.
        WARNING: Daemon[storgnsd] is running.
        WARNING: Daemon[storwatchd] is running.
 Do you want to shut down SYMCLI daemons [Y] or Exit setup [X]? [Y] : Y
 Disabled SE Daemons restarts for 10 minutes
 storgnsd                      Told to shut down
  Waiting for daemon(s) to shut down.  This may take several seconds.
 storapid                      Told to shut down
 storwatchd                    Told to shut down

 Checking for active SYMCLI components...

 Uninstalling autostart of SE Daemons....

 Uninstalling SYMCLI.SYMRECOVER.rte.....
 Uninstalling SYMCLI.SYMCLI.rte.....
 Uninstalling SYMCLI.BASE.rte.....
 Uninstalling SYMCLI.THINCORE.rte.....
 Uninstalling SYMCLI.CERT.rte.....
 Uninstalling SYMCLI.DATA.rte.....

 Solutions Enabler successfully uninstalled from your system.
```

3.3.8 Setting up storage for the virtual machines

You can add the storage agents to the IBM Geographically Dispersed Resiliency for Power Systems configuration. This section describes other actions that must be performed in the Dell EMC Storage to create and configure the SRDF/A replication of the devices of the VMs that are managed by the KSYS node.

> **Important:** The client VMs that are managed by the KSYS node exist only at the home site. There is no equivalent VM at the backup site. The KSYS node takes care of creating the VM, doing the mapping of the virtual adapters, reversing the direction of the SRDF replication, and starting the VM at the backup site during a `move` operation. Therefore, you do not need to create any VMs at the backup site (or target site).

Setting up storage volumes for virtual machines by using NPIV

This section assumes that you already created the LPAR that is used for the AIX or the Linux installation. Because the operating system disks (boot disks or rootvg) should also be replicated by SRDF/A, there is no operating system that is installed at this moment. This section describes the steps that are performed on the Dell EMC VMAX Storages and SAN switches to create and map volumes that are later used for the operating system's installation. The volumes are also used for the creation of data volume groups for the applications.

> **Note:** If your rootvg is already installed by using non-Dell EMC VMAX disks, the rootvg must be migrated to the Dell EMC VMAX Storage. This task can be accomplished by creating and mapping volumes from the Dell EMC Storage to the VM (or LPAR) and then using LVM commands to migrate the data.

To create the host and initiators (host ports) definitions in the Dell EMC Storage, you must obtain the WWPN of the VM by completing the following steps:

1. Log in to the Hardware Management Console (HMC), select the VM that you plan to manage with the IBM Geographically Dispersed Resiliency for Power Systems solution, and click **Properties**. Click the **Virtual Adapters** tab, select the **Virtual Fibre Channel Adapter (vFC)**, and click **Actions** → **Properties**. The WWPNs of the vFC adapter are displayed, as shown in Figure 3-13.

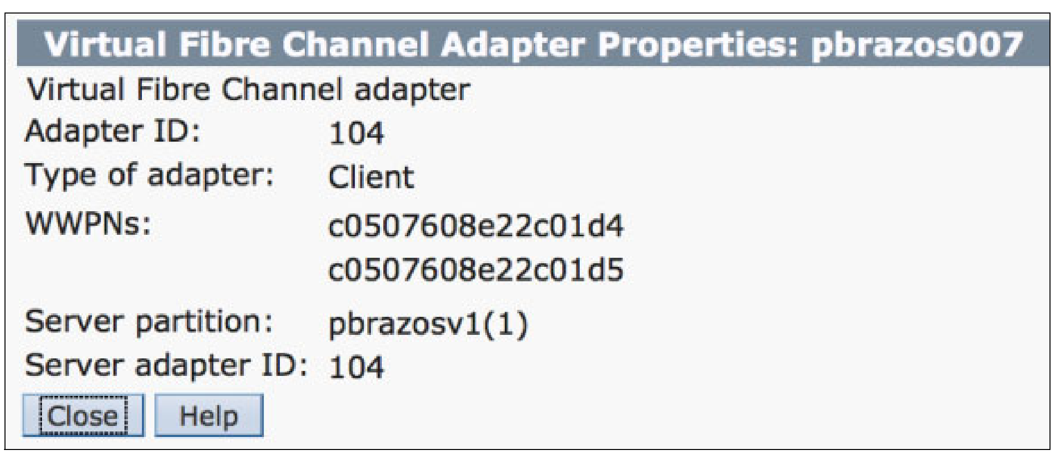


Figure 3-13 Check the Virtual Fibre Channel Client WWPN

2. Check that you also provided a corresponding parent adapter to the virtual I/O server (VIOS) by using Dynamic Logical Partitioning (DLPAR), and also added it to the VIOS profile. Also, ensure that the virtual adapter in the VIOS is mapped to a physical Fibre Channel adapter, as shown in Example 3-22.

Example 3-22 Map the corresponding vfchost adapter to a physical Fibre Channel adapter

```
(0) padmin @ pbrazosv1: /home/padmin
$ vfcmap -vadapter vfchost1 -fcp fcs1

(0) padmin @ pbrazosv1: /home/padmin
$ lsmap -vadapter vfchost1 -npiv
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost1      U9119.MME.21BBC47-V1-C104               3

Status:NOT_LOGGED_IN
FC name:fcs1                     FC loc code:U78CD.001.FZH1401-P1-C6-T2
Ports logged in:0
Flags:4<NOT_LOGGED>
VFC client name:                 VFC client DRC:
```

Now you need to set up the volumes (or LUNs) for this VM. This includes creating the host, creating the LUN, and setting up the LUN masking (or mapping) on both source and target Dell EMC VMAX Storages. It also involves setting up the zones in the SAN fabrics from source (home) and target (backup) sites.

You used the Dell EMC Unisphere for VMAX to perform actions on both source and target storages, and used Brocade switches to perform the zone configuration.

Note: Other SAN switches can be used in the IBM Geographically Dispersed Resiliency for Power Systems environment, but only the Brocade zone configuration is shown as an example. For instructions about how to set up the zoning, see the SAN switch vendor documentation if you have a different switch in your environment.

To create the host and volumes and perform the LUN masking, complete the following steps:

1. Log in to the Dell EMC Unisphere for VMAX and click the Dell EMC VMAX Storage from your source site (where the VM is), which in this case is the storage with SID 000196800508, as shown in Figure 3-14.

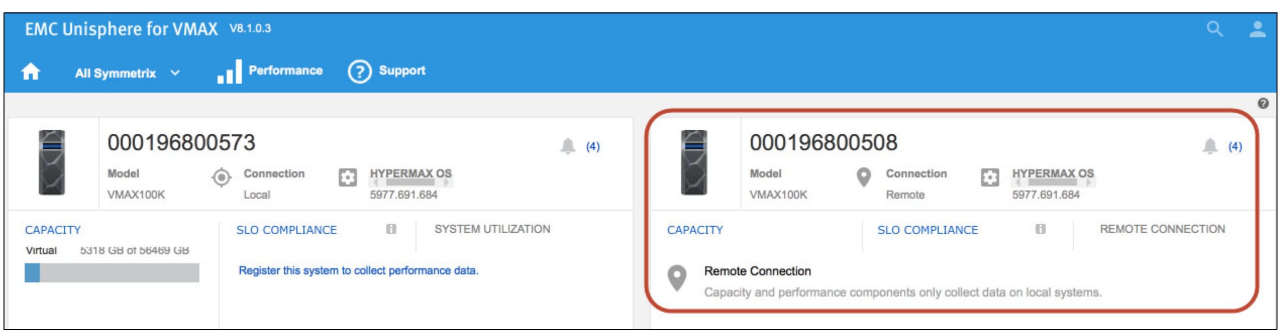


Figure 3-14 Log in to the Dell EMC Unisphere for VMAX and click the storage from the source site

2. Click **Hosts** → **Create Host**, as shown in Figure 3-15.

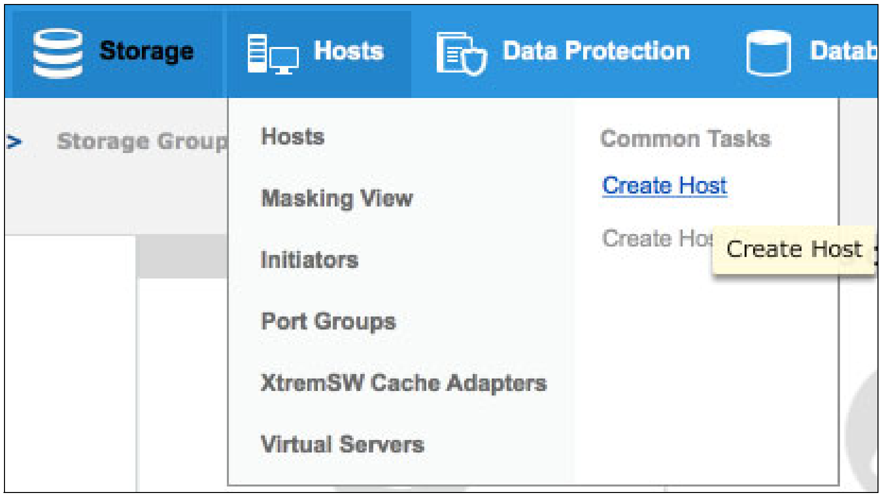


Figure 3-15 Create a host on the Dell EMC Unisphere for VMAX interface

3. Use the Create Host interface and provide the name for the host and select or type the WWPNs of the Virtual Fibre Channel Adapters to add as initiators (or host ports), as shown in Figure 3-16. After completing this task, click **Run Now**.

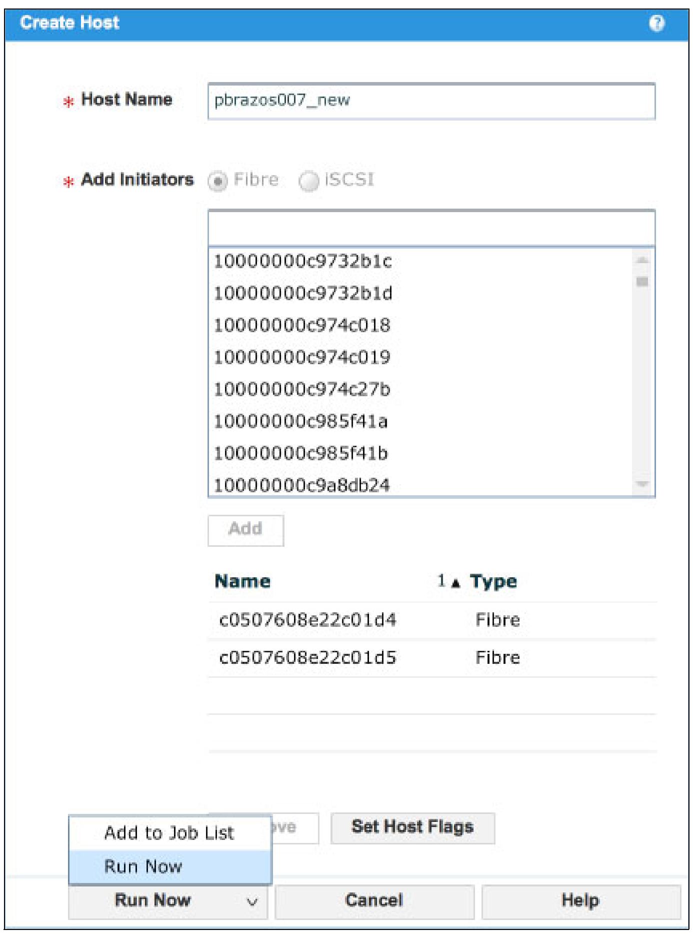


Figure 3-16 Add the host name and the initiators WWPNs

The host is created successfully and a message similar to Figure 3-17 is displayed.

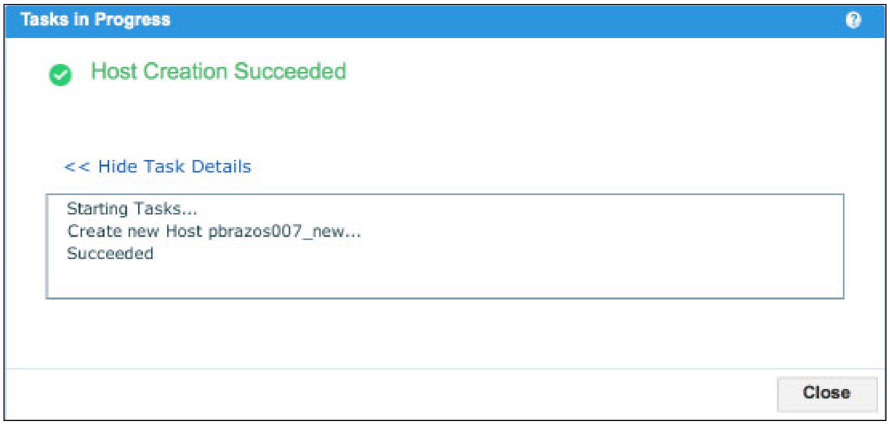


Figure 3-17   Host created successfully

4. Now, click **Storage** → **Storage Group Dashboard** and then click **Provision Storage to host**, as shown in Figure 3-18.

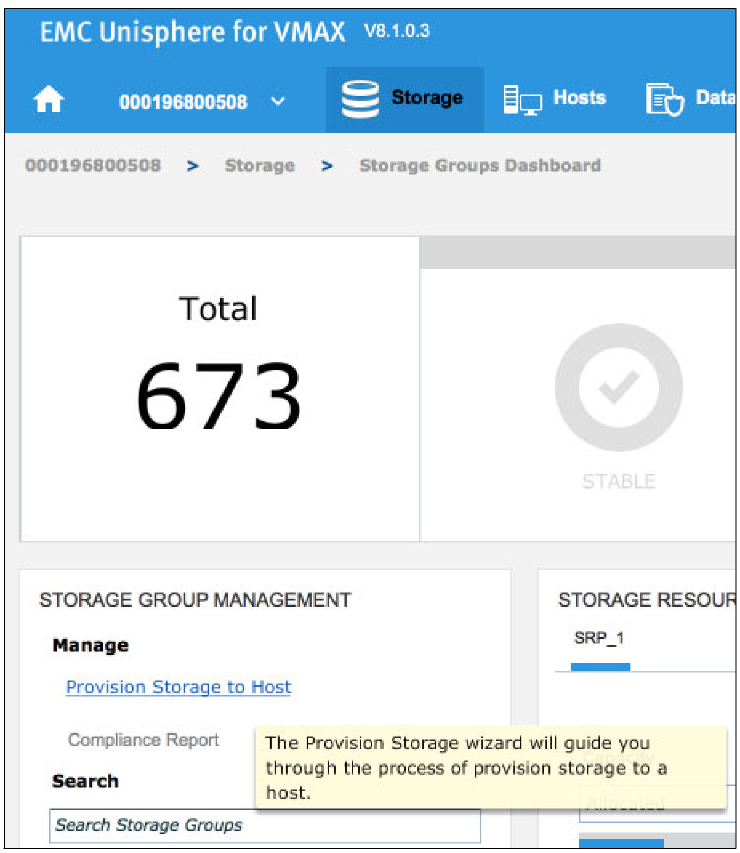


Figure 3-18   Provision storage to host

5. The Provision Storage wizard opens, which you can use to create the volumes, the storage group, and the LUN masking. Provide the Storage Group Name and select the amount of Volumes and their Volume Capacity, as shown in Figure 3-19. Click **Next**.

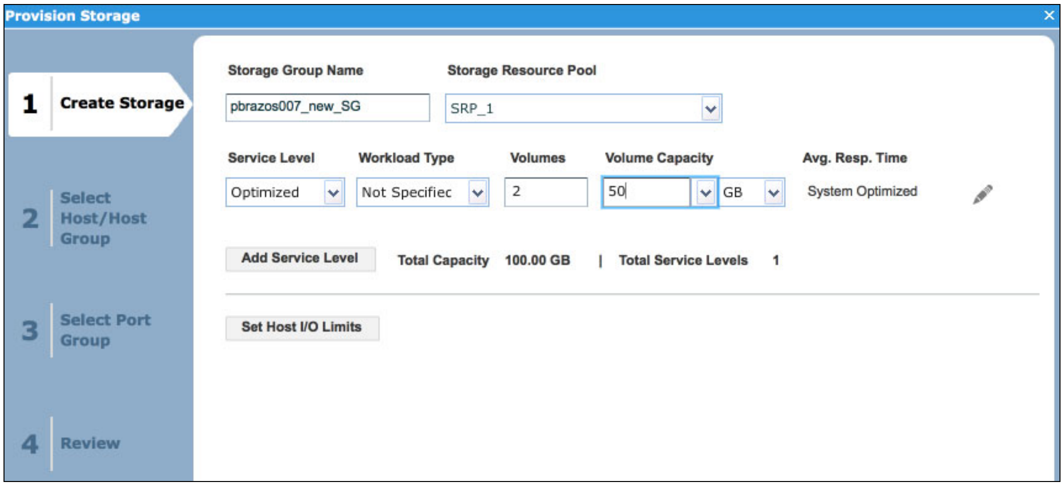


Figure 3-19 Create the number of volumes and their capacity

Tip: For the Dell EMC Storage, consider the following definitions:

- Volume: This is the disk that is created and mapped to the host (or, in this case, the VM). The volume is also called a LUN.
- Storage group: A container where you add volumes and the hosts.
- LUN masking: The storage authorization process that makes the LUN available to the host. In this process, you also choose which storage ports the host uses to access the LUN.

6. Select the host for which you want to map the volumes, as shown in Figure 3-20, and click **Next**.

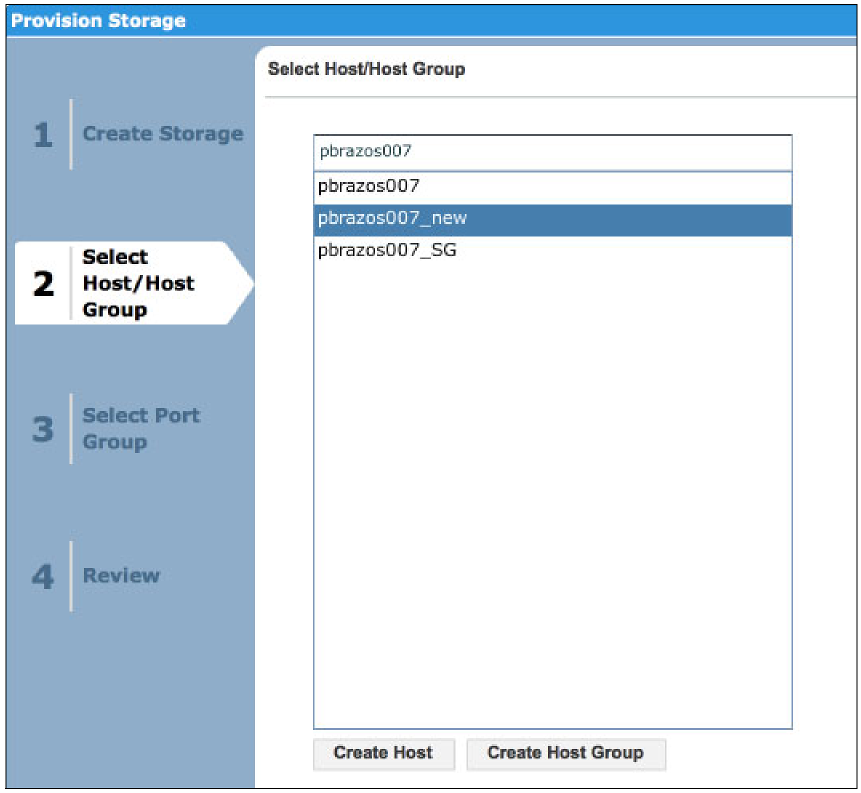


Figure 3-20 Select the host to add the volumes

7. Select the storage ports that you want to use to map these LUNs to the host, as shown in Figure 3-21. You must zone the host WWPNs with these ports WWPNs to allow the host to see the disks. After selecting the ports, click **Next**.

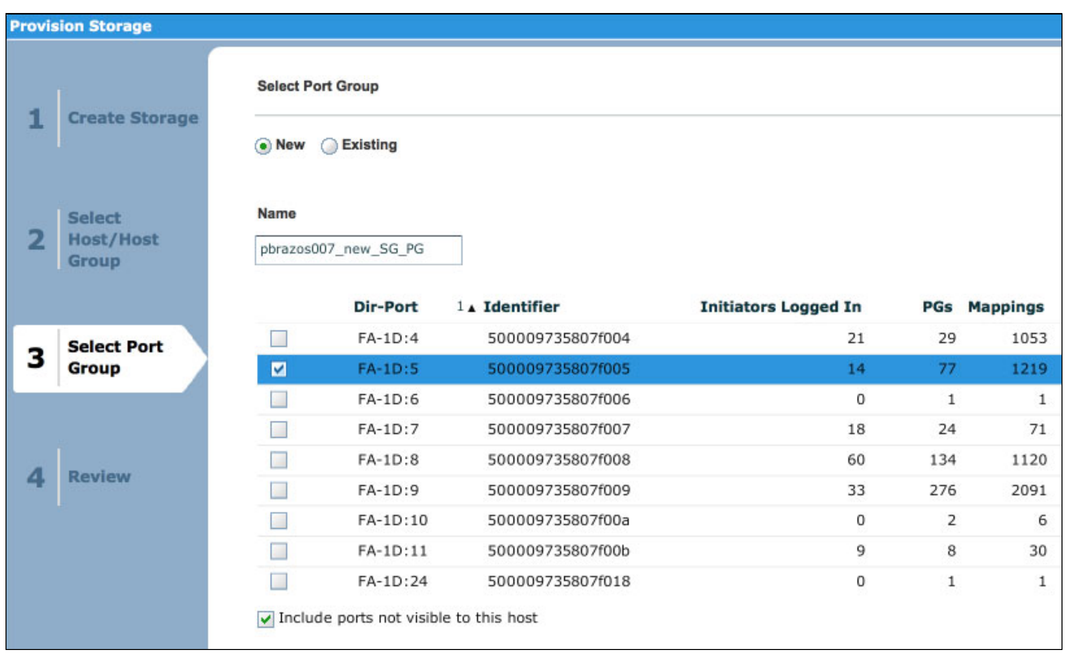


Figure 3-21 Select the storage ports

Note: The Dell EMC VMAX Storage has two directors (or controllers). It is preferable to map the volumes through at least one port from each controller for redundancy purposes. You can use the following command in the SYMCLI to obtain more information about the directors and their ports:

```
# symcfg -sid 000196800508 list -fa all -port
```

8. A name for your `Masking View` is suggested, and a summary of the selected actions are displayed. Modify the name of the masking view if required, and then click **Run Now**, as shown in Figure 3-22.

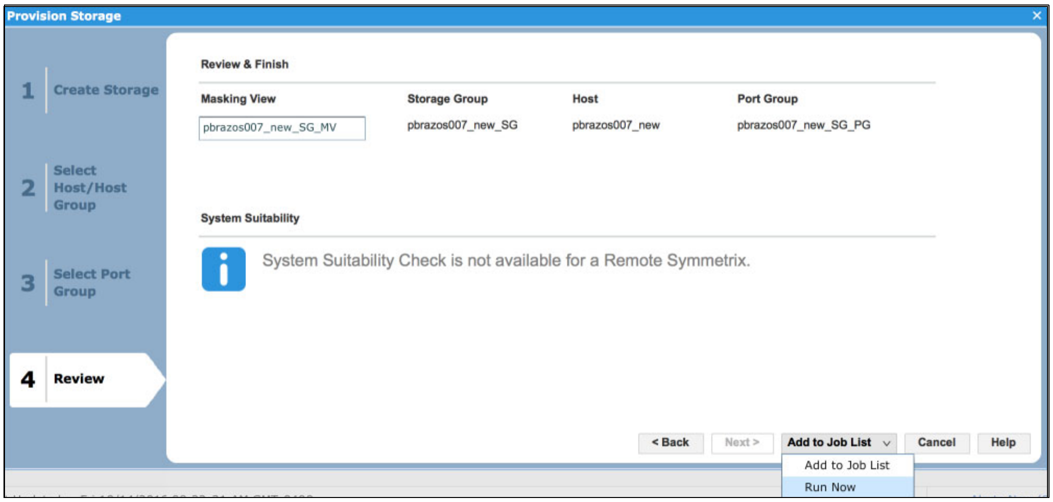


Figure 3-22 Name the masking view and click Run Now

9. A message is displayed, confirming the success of the masking view creation, as shown in Figure 3-23.

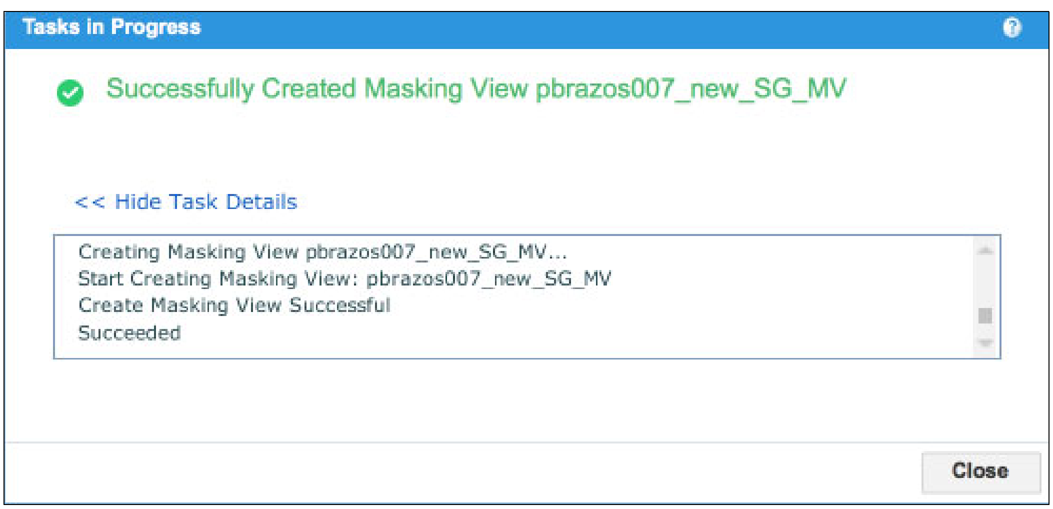


Figure 3-23 Masking view successfully created

10. Save the volume ID of the LUNs that are created for your host because you use information later when you configure the SRDF replication. Example 3-23 on page 64 shows how you can obtain the volume ID of the volumes that are created for your host.

You must know the storage group name (which was defined in step 5 on page 61) to run this command.

Example 3-23 Obtain the volume ID of the LUNs from the storage source

```
(0) root @ pbrazos001: /
# symaccess -sid 000196800508 -type storage show pbrazos007_new_SG

Symmetrix ID                 : 000196800508

Storage Group Name           : pbrazos007_new_SG
Last update time             : 07:33:56 AM on Fri Oct 14,2016
Group last update time       : 07:33:56 AM on Fri Oct 14,2016

   Number of Storage Groups : 0
   Storage Group Names      : None

   Devices                  : 0324F:03250

   Masking View Names
     {
       pbrazos007_new_SG_MV
     }
```

11. Now, repeat the steps on the Dell EMC VMAX Storage from the target (backup) site. Because the volumes are configured in an SRDF replication, the source and target volumes must be created. Log in to the Dell EMC Unisphere for VMAX interface and this time select the Dell EMC Storage from the target site, which in our case is SID 000196800573, as shown in Figure 3-24. Then, repeat the same steps starting from step 2 on page 59 to step 10 on page 63. Example 3-24 shows the target volumes that created on the storage from site Austin (backup or target site).

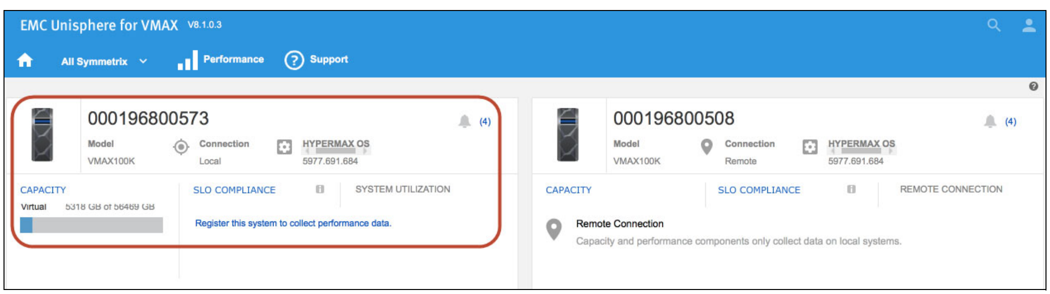


Figure 3-24 Select the target storage in the Dell EMC Unisphere for VMAX interface

Example 3-24 Obtain the volume ID of the LUNs from the target storage

```
# symaccess -sid 000196800573 -type storage show pbrazos007_new_SG

Symmetrix ID                 : 000196800573

Storage Group Name           : pbrazos007_new_SG
Last update time             : 07:47:42 AM on Fri Oct 14,2016
Group last update time       : 07:47:42 AM on Fri Oct 14,2016

   Number of Storage Groups : 0
   Storage Group Names      : None
```

```
   Devices                 : 02414:02415

   Masking View Names
     {
       pbrazos007_new_SG_MV
     }
```

12.Now, set up the zone on the source and the target fabrics. Run the **symaccess** command on both the source and target storages to obtain the WWPNs of the Virtual Fibre Channel adapter from the Host, and the WWPN of the Storage Ports that are assigned to the Masking View, as shown in Example 3-25.

Example 3-25 Use the symaccess command to obtain the WWPNs of host and storage ports

```
(0) root @ pbrazos001: /
# symaccess -sid 000196800508 show view pbrazos007_new_SG_MV

Symmetrix ID                : 000196800508

Masking View Name           : pbrazos007_new_SG_MV
Last update time            : 07:33:52 AM on Fri Oct 14,2016
View last update time       : 07:33:56 AM on Fri Oct 14,2016

Initiator Group Name        : pbrazos007_new

   Host Initiators
     {
       WWN  : c0507608e22c01d4
              [alias: c0507608e22c01d4/c0507608e22c01d4]
       WWN  : c0507608e22c01d5
              [alias: c0507608e22c01d5/c0507608e22c01d5]
     }

Port Group Name             : pbrazos007_new_SG_PG

   Director Identification
     {
        Director
      Ident  Port   WWN Port Name / iSCSI Target Name
      ------ ---- -------------------------------------------------------
      FA-1D   005 500009735807f005
     }

Storage Group Name          : pbrazos007_new_SG

   Number of Storage Groups : 0
   Storage Group Names      : None

Sym                                         Host
Dev     Dir:Port  Physical Device Name      Lun   Attr  Cap(MB)
------  --------  -----------------------  ----  ----  -------
0324F   01D:005   Not Visible                 0          51201
03250   01D:005   Not Visible                 1          51201
                                                       -------
Total Capacity                                          102402
```

```
(0) root @ pbrazos001: /
# symaccess -sid 000196800573 show view pbrazos007_new_SG_MV

Symmetrix ID                : 000196800573

Masking View Name           : pbrazos007_new_SG_MV
Last update time            : 07:47:28 AM on Fri Oct 14,2016
View last update time       : 05:51:43 PM on Fri Oct 14,2016

Initiator Group Name        : pbrazos007_new

   Host Initiators
     {
       WWN  : c0507608e22c01d4
              [alias: c0507608e22c01d4/c0507608e22c01d4]
       WWN  : c0507608e22c01d5
              [alias: c0507608e22c01d5/c0507608e22c01d5]
     }

Port Group Name             : pbrazos007_new_SG_PG

   Director Identification
     {
        Director
      Ident  Port   WWN Port Name / iSCSI Target Name
      ------ ---- -------------------------------------------------------
      FA-1D   009 500009735808f409
     }

Storage Group Name          : pbrazos007_new_SG

   Number of Storage Groups : 0
   Storage Group Names      : None

Sym                                          Host
Dev     Dir:Port  Physical Device Name     Lun   Attr  Cap(MB)
------  --------  -----------------------  ----  ----  -------
02414   01D:009   Not Visible                 0          51201
02415   01D:009   Not Visible                 1          51201
                                                       -------
Total Capacity                                          102402
```

13. To create the zone, log in to the SAN switch web interface from the fabric in the source site and click **Zone Admin**. Click the **Alias** tab and click **New Alias**. Provide a name for your alias and then include the WWPNs of the Virtual Fibre Channel adapters from your VM, as shown in Figure 3-25.

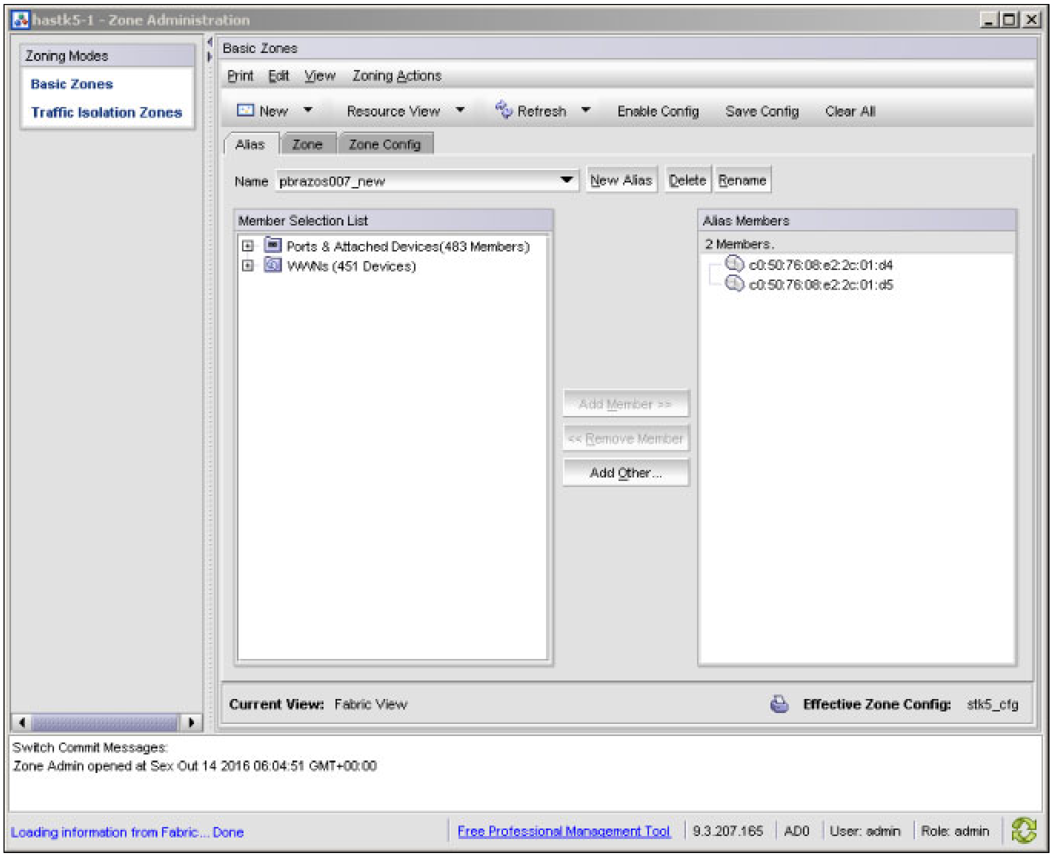


Figure 3-25 Create the alias for the virtual machine

> **Note:** Although it is not shown, a similar alias should be created for your storage ports (in this case, the source storage, SID 000196800508).

14.Click the **Zone** tab, click **New Zone**, and provide the name for this zone. Select the alias that was created in step 13 on page 67 and also the alias of the storage port (use the same port that was added in the Masking View) and click **Add Member**, as shown in Figure 3-26.

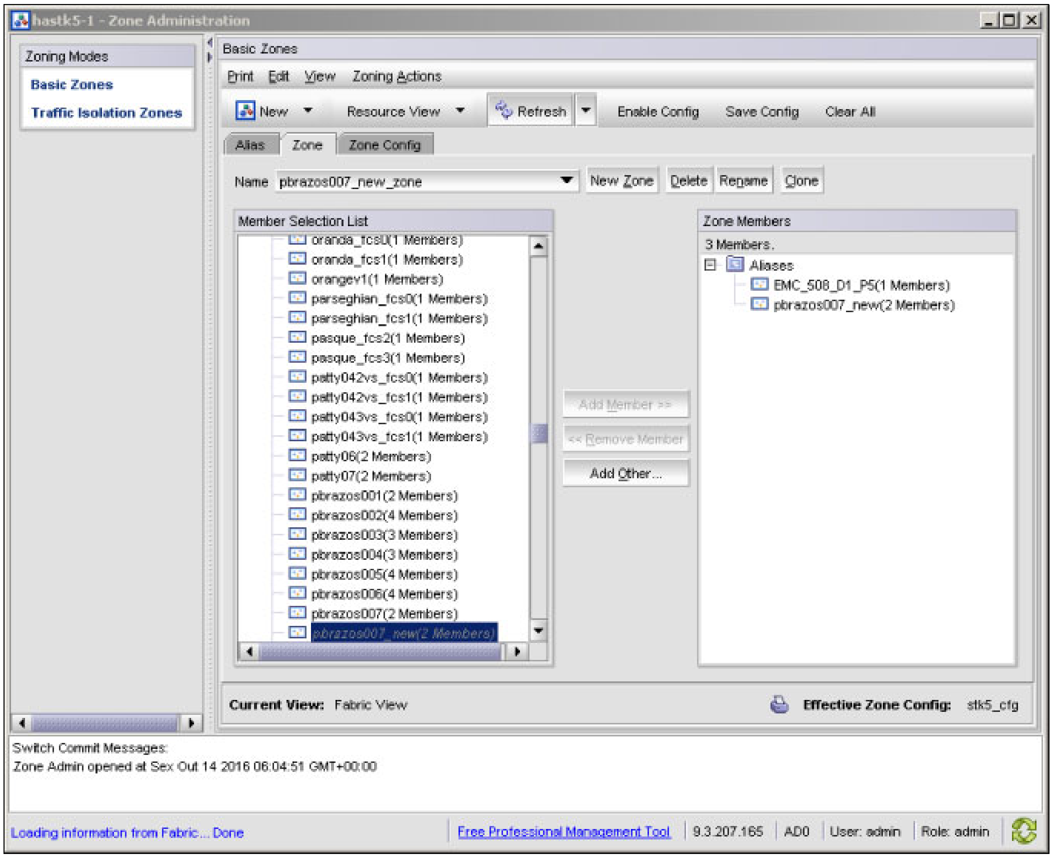


Figure 3-26 Create the zone with host and storage aliases

15. Now, click the **Zone Config** tab and add the zone that was created in step 14 on page 68 to the configuration, as shown in Figure 3-27. Click **Save Config** and then **Enable Config**.

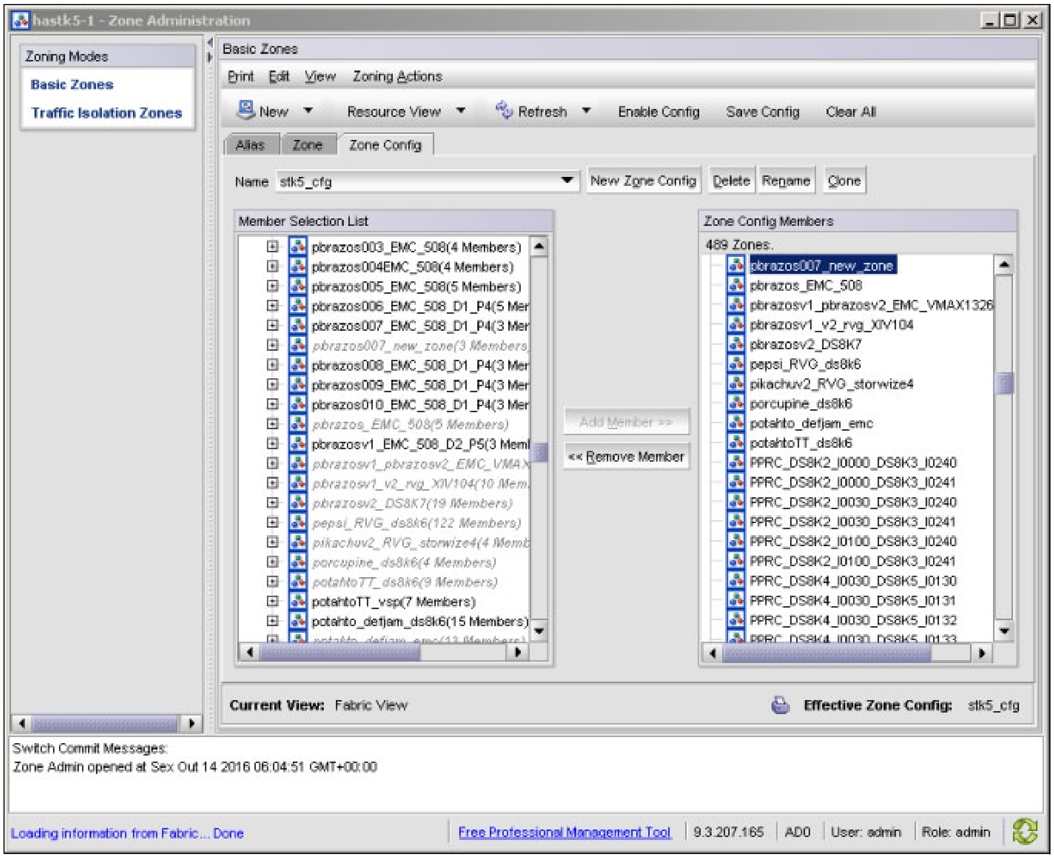


Figure 3-27 Add the zone to the configuration

16. Repeat the same steps on the source and on the target site fabrics. The zone on the source site contains the VM WWPN and the source Dell EMC VMAX Storage Port WWPN. The zone on the target site contains the VM WWPN (same WWPN as the one that is used when bringing up the VM on target site), and the target Dell EMC VMAX Storage Port WWPN (which is different because you use a different storage on target site when bringing up the VM). Example 3-26 shows the zones that are created on the source and on the target sites.

Example 3-26 Zones that are created on the source and on the target fabrics

```
Zone from Source Site:

hastk5-1:admin> zoneshow pbrazos007_new_zone
 zone:pbrazos007_new_zone
      EMC_508_D1_P5; pbrazos007_new

hastk5-1:admin> alishow pbrazos007_new
 alias:pbrazos007_new
      c0:50:76:08:e2:2c:01:d4; c0:50:76:08:e2:2c:01:d5

hastk5-1:admin> alishow EMC_508_D1_P5
 alias:EMC_508_D1_P5
      50:00:09:73:58:07:f0:05
```

```
Zone from Target Site:

hastk6-2:admin> zoneshow pbrazos007_new_zone
 zone:pbrazos007_new_zone
      EMC_573_D1_P9; pbrazos007_new

hastk6-2:admin> alishow pbrazos007_new
 alias:pbrazos007_new
      c0:50:76:08:e2:2c:01:d4; c0:50:76:08:e2:2c:01:d5

hastk6-2:admin> alishow EMC_573_D1_P9
 alias:EMC_573_D1_P9
      50:00:09:73:58:08:f4:09
```

Important: The source and the target sites must have different fabrics in the IBM Geographically Dispersed Resiliency for Power Systems solution.

17. Now, the volumes are created properly and mapped to the VM. You can now start the VM (activate the LPAR) and start the AIX or Linux installation by using the following resources:
    - For the AIX installation instructions, see IBM Knowledge Center.
    - For the Red Hat Enterprise Linux installation instructions, see this website.
    - For theSUSE Linux Enterprise Server installation instructions, see this website.
    - For the Ubuntu Server installation instructions, see this website.

Tip: For more information about supported Linux distributions for POWER8 servers, see this website.

Tip: To install the operating system (AIX or Linux), you can use a Virtual Media Repository or Virtual Optical Device. For more information about how to configure either of these devices, see this IBM Technote.

After completing the VM installation, remove the virtual SCSI adapter that is used for the Virtual Optical Device configuration, or the IBM Geographically Dispersed Resiliency for Power Systems solution can fail when starting the VM on the target site because this virtual SCSI device cannot be migrated.

After installing the VM, you should consider using a supported method for multipathing purposes. Both MPIO and Powerpath are supported from the IBM Geographically Dispersed Resiliency for Power Systems solution point of view. For compatibility matrix and support for your Dell EMC Storage and operating system, see the Dell EMC documentation.

Setting up storage volumes for virtual machines by using VSCSI

If your VMs use VSCSI disks, the steps that are used for setting up the storage volumes are similar to those that are described in “Setting up storage volumes for virtual machines by using NPIV” on page 57, with the difference that the storage volumes should be mapped to the VIOSs at the source and target sites. The following tasks should be performed:

1. Map the volumes to all VIOSs from both sites.
2. Detect the volumes on all VIOSs from both sites, and set the **`reserve_policy`** to `no_reserve`.
3. In the VIOSs from the source site, map the volumes to the vhost adapter.

Mapping the volumes to the virtual I/O servers

The following steps show how to create and map the volumes from source and target storages to source and target VIOSs:

1. Log in to the VIOS from the source site and obtain the WWPN of its Fibre Channel Adapter. You can run the **lscfg** command to obtain this information, as shown in Example 3-27. Repeat this step for both VIOSs in the source site if you have a dual VIOS setup.

Example 3-27 Use the lscfg command to obtain the WWPN of the HBA from the virtual I/O server

```
(0) root @ pbrazosv1: /mnt
# lscfg -vl fcs0
  fcs0             U78CD.001.FZH1401-P1-C6-T1  8Gb PCI Express Dual Port FC
Adapter (df1000f114108a03)

        Part Number.................10N9824
        Serial Number...............1B8390414B
        Manufacturer................001B
        EC Level....................D76482A
        Customer Card ID Number.....577D
        FRU Number..................10N9824
        Device Specific.(ZM)........3
        Network Address.............10000000C98047B6
        ROS Level and ID............027820F5
        Device Specific.(Z0)........31004549
        Device Specific.(Z1)........00000000
        Device Specific.(Z2)........00000000
        Device Specific.(Z3)........09030909
        Device Specific.(Z4)........FF781150
        Device Specific.(Z5)........027820F5
        Device Specific.(Z6)........077320F5
        Device Specific.(Z7)........0B7C20F5
        Device Specific.(Z8)........20000000C98047B6
        Device Specific.(Z9)........US2.03X5
        Device Specific.(ZA)........U2D2.03X5
        Device Specific.(ZB)........U3K2.03X5
        Device Specific.(ZC)........00000000
        Hardware Location Code......U78CD.001.FZH1401-P1-C6-T1
```

2. In case you already have other volumes (LUNs) that are mapped from the Dell EMC VMAX Storage to the VIOS, then the host definition exists on the storage and the zone configuration exists on the SAN fabric. If you must create the host and zones, use steps 1 on page 58 to 16 on page 69, but this time the WWPNs of the VIOSs are used.

Important: Repeat this action on both VIOSs (in case of dual VIOS configurations) in both sites (source and target). The volumes should be mapped to source and target VIOSs. The VIOS on the source site accesses disks from the source storage, and the VIOS on the target site accesses disks from the target storage.

3. If your VIOSs are already defined as a host on the source and target sites, you must identify what is its host name. Log in to the Dell EMC Unisphere for VMAX interface and click **Hosts** → **Initiators**, as shown in Figure 3-28.

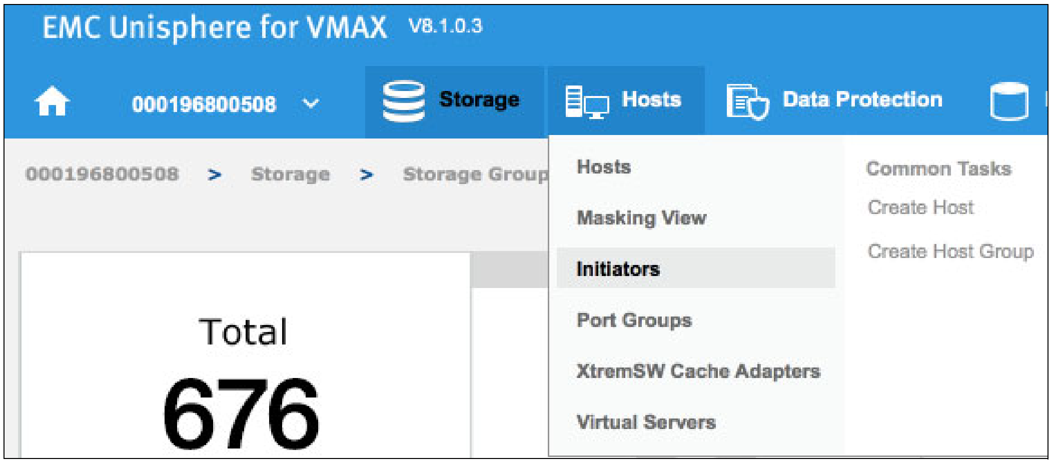


Figure 3-28 Dell EMC Unisphere accessing the Initiators interface

4. Use the filter button on the right of the window to filter by WWPN. Type the virtual I/O WWPN that was obtained in step 1 on page 71 to find it, and double-click the initiator when you find it, as shown in Figure 3-29.

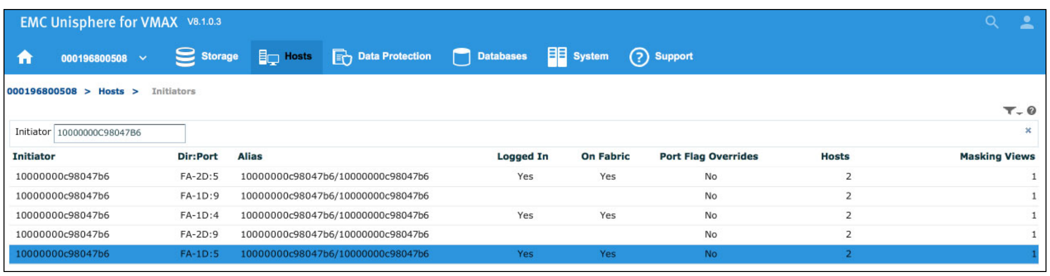


Figure 3-29 Find the virtual I/O initiator

5. The properties of the initiator are displayed. On the right of the window, in the Related Objects area, you see that this Initiator already belongs to a host. Click **Hosts**, as shown in Figure 3-30.

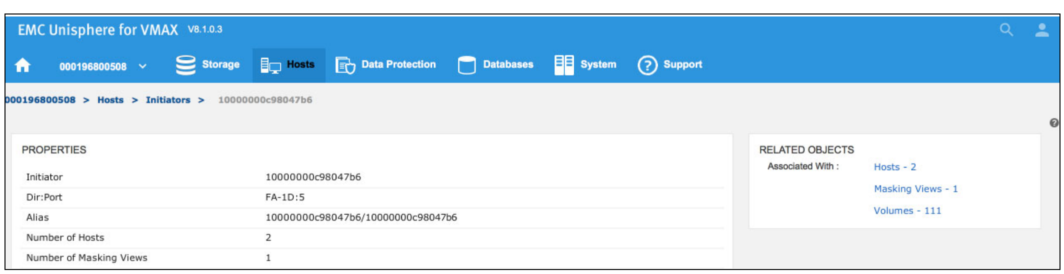


Figure 3-30 Initiator already belongs to a host

6. Now, you see the host to which this initiator belongs, as shown in Figure 3-31.

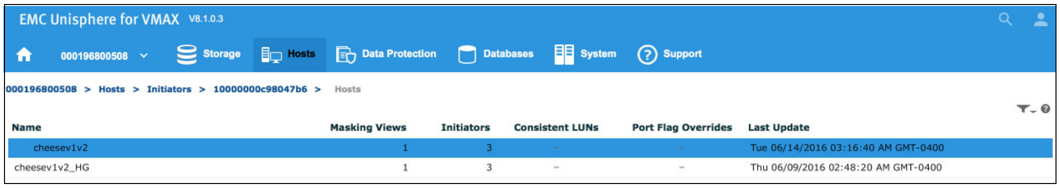


Figure 3-31 Host that contains the initiator

Tip: Alternatively, you can use the SYMCLI to find the host that is related to the WWPN of the VIOS (initiator) by running the following command:

```
(0) root @ pbrazos001: /
# symaccess -sid 000196800508 list -type initiator -wwn 10000000C98047B6
Symmetrix ID          : 000196800508
Initiator Group Name
--------------------------------
cheesev1v2
```

7. In the bottom area of the window, click **Provision Storage to Host**. The wizard starts and already knows the host that receives the volumes (if the wizard started in the Hosts area). Provide a name for the Storage Group, type the number of volumes that you want to create and their size, and click **Next**, as shown in Figure 3-32.

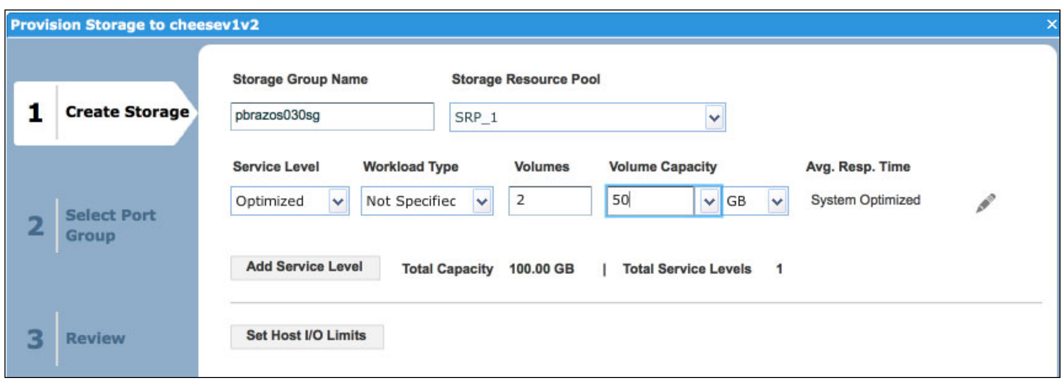


Figure 3-32 Provision storage to the host wizard

8. Select the storage ports that you want to use to map the volumes to the VIOS host and click **Next**, as shown in Figure 3-33.

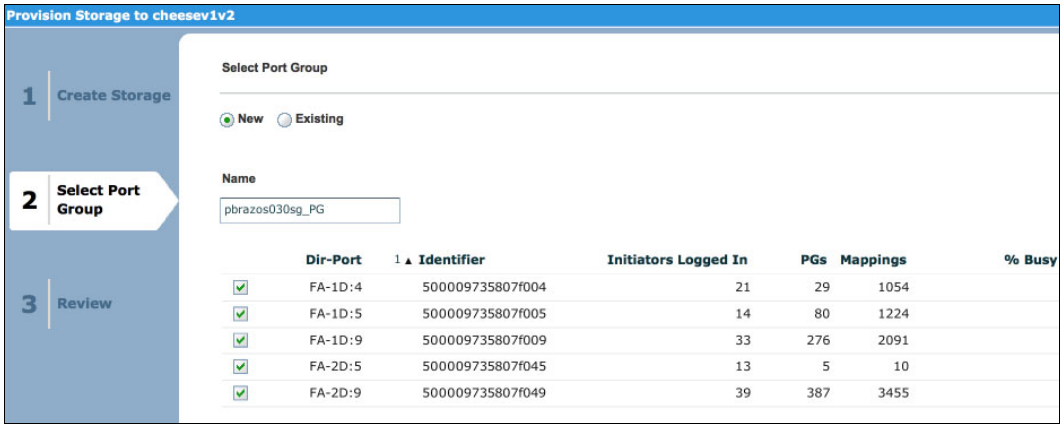


Figure 3-33 Select the storage ports that are used to provide the volume to the VIOS

9. Provide a name to the Masking View and click **Run Now**, as shown in Figure 3-34.

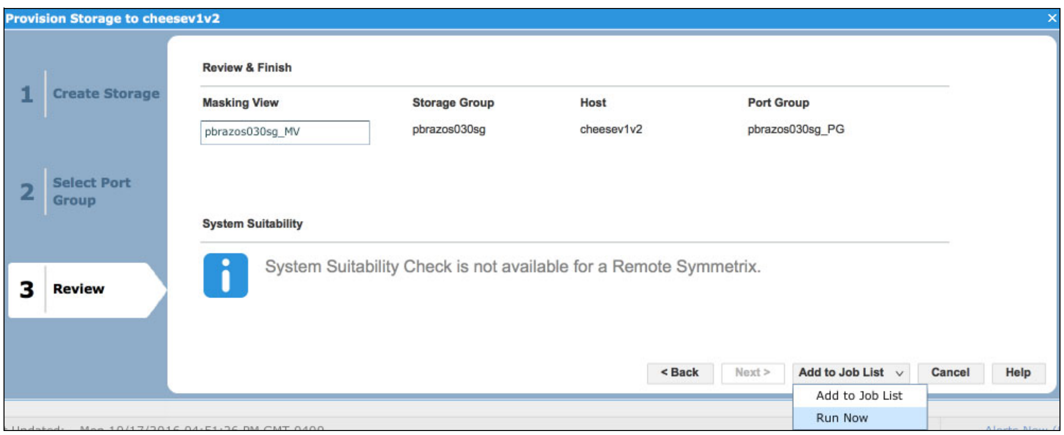


Figure 3-34 Provide the name of the Masking View for the VIOS

The volumes are mapped to all VIOSs from both sites. In the residency environment setup, the source site, Poughkeepsie, has a single VIOS, which is named pbrazosv1. The target site, Austin, has dual VIOSs, which are named hamv1 and hamv2. Figure 3-13 on page 57 shows an overview of this scenario.

Example 3-28 shows the two volumes that are created for the pbrazos030 VM. They are mapped to the pbrazosv1 VIOS, which is named cheesev1v2 in the Dell EMC Storage host definition. You can see the virtual I/O pbrazosv1 WWPN (10000000c98047b6) and the volumes 03254 and 03255 that are created in this step.

Example 3-28 Volumes that are created for the pbrazos030 VSCSI VM and mapped to the pbrazosv1 virtual I/O server

```
(0) root @ pbrazos001: /
# symaccess -sid 000196800508 show view pbrazos030sg_MV

Symmetrix ID                  : 000196800508

Masking View Name             : pbrazos030sg_MV
Last update time              : 04:04:30 PM on Mon Oct 17,2016
```

```
View last update time       : 04:04:30 PM on Mon Oct 17,2016

Initiator Group Name        : cheesev1v2

   Host Initiators
     {
       WWN  : 10000000c974c27a
              [alias: 10000000c974c27a/10000000c974c27a]
       WWN  : 10000000c9d1b2ee
              [alias: 10000000c9d1b2ee/10000000c9d1b2ee]
       WWN  : 10000000c98047b6
              [alias: 10000000c98047b6/10000000c98047b6]
     }

Port Group Name             : pbrazos030sg_PG

   Director Identification
     {
        Director
      Ident  Port   WWN Port Name / iSCSI Target Name
      ------ ---- --------------------------------------------------------
      FA-1D   004 500009735807f004
      FA-1D   005 500009735807f005
      FA-2D   005 500009735807f045
      FA-1D   009 500009735807f009
      FA-2D   009 500009735807f049
     }

Storage Group Name          : pbrazos030sg

   Number of Storage Groups : 0
   Storage Group Names      : None

Sym                                          Host
Dev     Dir:Port  Physical Device Name       Lun   Attr  Cap(MB)
------  --------  -----------------------  ----  ----  -------
03254   01D:004   Not Visible                  1         51201
        02D:005   Not Visible                  1
        01D:005   Not Visible                 6f
        01D:009   Not Visible                 6f
        02D:009   Not Visible                 6f
03255   01D:004   Not Visible                  2         51201
        02D:005   Not Visible                  2
        01D:005   Not Visible                 70
        01D:009   Not Visible                 70
        02D:009   Not Visible                 70
                                                         -------
Total Capacity                                            102402
```

Example 3-29 shows that the mentioned volumes (03255 and 03254) are properly detected on the VIOS pbrazosv1 from the home site Poughkeepsie.

Example 3-29 Volumes that are detected in the home virtual I/O server

```
(0) root @ pbrazosv1: /mnt
# ./inq.aix64_51 -showvol | egrep "03254|03255"
/dev/rhdisk1   :EMC     :SYMMETRIX       :5977  :0803254000 :   03254:    52429440
/dev/rhdisk2   :EMC     :SYMMETRIX       :5977  :0803255000 :   03255:    52429440

(0) root @ pbrazosv1: /mnt
# lspath -l hdisk1
Enabled hdisk1 fscsi0
Enabled hdisk1 fscsi0
Enabled hdisk1 fscsi0

(0) root @ pbrazosv1: /mnt
# lspath -l hdisk2
Enabled hdisk2 fscsi0
Enabled hdisk2 fscsi0
Enabled hdisk2 fscsi0

(0) root @ pbrazosv1: /mnt
# lscfg -vl fcs0 | grep Network
        Network Address.............10000000C98047B6
```

Example 3-30 shows the two equivalent volumes that are created for the pbrazos030 VM in the storage from the backup site Austin. These volumes are mapped to the hamv1 and hamv2 VIOSs. The HBAs from both VIOSs are inside the same host in the Dell EMC Storage, which is named hamv1v2 in the Dell EMC Storage host definition. You can see the virtual I/O hamv1 WWPN (10000000C9879D04) and the virtual I/O hamv2 WWPN (10000000C974C312), and the volumes 0241E and 0241F that were created in this step.

Example 3-30 Volumes that are created for pbrazos030 VSCSI VM mapped to virtual I/O server at a backup site

```
(0) root @ pbrazos001: /
# symaccess -sid 000196800573 show view pbrazos030sg_MV

Symmetrix ID                : 000196800573

Masking View Name           : pbrazos030sg_MV
Last update time            : 04:19:42 PM on Mon Oct 17,2016
View last update time       : 04:19:42 PM on Mon Oct 17,2016

Initiator Group Name        : hamv1v2

   Host Initiators
     {
       WWN  : 10000000c974c312
              [alias: 10000000c974c312/10000000c974c312]
       WWN  : 10000000c9879d04
              [alias: 10000000c9879d04/10000000c9879d04]
       WWN  : 10000090fab43c36
              [alias: 10000090fab43c36/10000090fab43c36]
       WWN  : 10000090fab43c37
```

```
            [alias: 10000090fab43c37/10000090fab43c37]
       WWN  : 10000090fab43c35
            [alias: 10000090fab43c35/10000090fab43c35]
     }

Port Group Name             : pbrazos030sg_PG

   Director Identification
     {
       Director
      Ident  Port   WWN Port Name / iSCSI Target Name
      ------ ---- ------------------------------------------------------
      FA-1D   004 500009735808f404
      FA-1D   005 500009735808f405
      FA-1D   009 500009735808f409
      FA-2D   009 500009735808f449
     }

Storage Group Name          : pbrazos030sg

   Number of Storage Groups : 0
   Storage Group Names      : None

Sym                                        Host
Dev     Dir:Port  Physical Device Name     Lun   Attr  Cap(MB)
------  --------  -----------------------  ----  ----  -------
0241E   01D:004   Not Visible                 0          51201
        02D:009   Not Visible                 0
        01D:005   Not Visible                6e
        01D:009   Not Visible                6e
0241F   01D:004   Not Visible                 1          51201
        02D:009   Not Visible                 1
        01D:005   Not Visible                6f
        01D:009   Not Visible                6f
                                                       -------
Total Capacity                                          102402
```

Example 3-31 shows the volumes that are detected in the VIOS hamv1 in the backup Austin site.

Example 3-31 Disks from the backup site that are detected by the virtual I/O server hamv1

```
(0) root @ hamv1: /mnt
# ./inq.aix64_51 -showvol | egrep "0241E|0241F"
/dev/rhdisk125 :EMC     :SYMMETRIX       :5977  :730241e000 :   0241E:    52429440
/dev/rhdisk126 :EMC     :SYMMETRIX       :5977  :730241f000 :   0241F:    52429440

(0) root @ hamv1: /mnt
# lspath -l hdisk125
Enabled hdisk125 fscsi0
Enabled hdisk125 fscsi0

(0) root @ hamv1: /mnt
# lspath -l hdisk126
Enabled hdisk126 fscsi0
Enabled hdisk126 fscsi0
```

```
(0) root @ hamv1: /mnt
# lscfg -vl fcs0 | grep Network
        Network Address.............10000000C9879D04
```

Example 3-32 shows the volumes that are detected in the VIOS hamv2 in the backup Austin site.

Example 3-32 Disks from the backup site that are detected by the virtual I/O server hamv2

```
(0) root @ hamv2: /mnt
# ./inq.aix64_51 -showvol | egrep "0241E|0241F"
/dev/rhdisk130 :EMC     :SYMMETRIX       :5977  :730241e000 :   0241E:    52429440
/dev/rhdisk131 :EMC     :SYMMETRIX       :5977  :730241f000 :   0241F:    52429440

(0) root @ hamv2: /mnt
# lspath -l hdisk130
Enabled hdisk130 fscsi0
Enabled hdisk130 fscsi0

(0) root @ hamv2: /mnt
# lspath -l hdisk131
Enabled hdisk131 fscsi0
Enabled hdisk131 fscsi0

(0) root @ hamv2: /mnt
# lscfg -vl fcs0 | grep Network
        Network Address.............10000000C974C312
```

Tip: In the examples that are presented above, the **inq** tool is used. This is a tool that is provided by Dell EMC to inquire about the volume details of the disks that are seen by the host where the command is run. You can obtain this tool from this website.

Setting the reservation policy of the disks

After detecting the disks, you must modify the **reserve_policy** to no_reserve in all VIOSs, allowing the disks to be mapped by multiple VIOSs to the client VM at the same time, providing multipathing at the VSCSI level. This action must be accomplished at both sites.

The following command is used to set the **reserve_policy**:

```
# chdev -l hdiskX -a reserve_policy=no_reserve
```

Example 3-33 shows the disks from all VIOSs with the **reserve_policy** defined as no_reserve.

Example 3-33 Disks in all virtual I/O servers with the reserved_policy defined as no_reserve

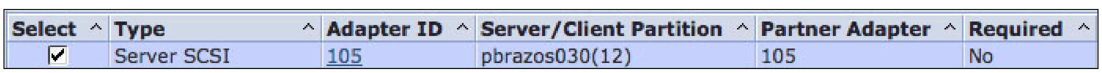
```
(0) root @ pbrazosv1: /mnt
# lsattr -E -l hdisk1 -a reserve_policy
reserve_policy no_reserve Reserve Policy True+

(0) root @ pbrazosv1: /mnt
# lsattr -E -l hdisk2 -a reserve_policy
reserve_policy no_reserve Reserve Policy True+

(0) root @ hamv1: /mnt
```

```
# lsattr -E -l hdisk125 -a reserve_policy
reserve_policy no_reserve Reserve Policy True+

(0) root @ hamv1: /mnt
# lsattr -E -l hdisk126 -a reserve_policy
reserve_policy no_reserve Reserve Policy True+

(0) root @ hamv2: /mnt
# lsattr -E -l hdisk130 -a reserve_policy
reserve_policy no_reserve Reserve Policy True+

(0) root @ hamv2: /mnt
# lsattr -E -l hdisk131 -a reserve_policy
reserve_policy no_reserve Reserve Policy True+
```

Mapping the disks to the vhost device

Now you need to map the disks to the VM VSCSI adapter. The VM does not exist in the backup site, but exists in the home site, so the mapping is performed exclusively in the home site. The KSYS node takes care of creating the VM at the backup site when a **move** operation is performed.

Log in to the VIOSs at your home site and locate the `vhost` adapter that was created to provide the disks by using VSCSI with your client LPAR. Figure 3-35 shows for the residency environment that the vhost adapter with slot number 105 is the desired one.



Select	Type	Adapter ID	Server/Client Partition	Partner Adapter	Required
☑	Server SCSI	105	pbrazos030(12)	105	No

Figure 3-35 Server SCSI adapter that is used to provide disks to pbrazos030

Example 3-34 shows that the adapter that needs to be used in this case is vhost17.

Example 3-34 Identify the vhost adapter to map the disks

```
(0) padmin @ pbrazosv1: /home/padmin
$ lsmap -all | grep C105
vhost17         U9119.MME.21BBC47-V1-C105                    0x0000000c
```

Use the **mkvdev** command to map the disks to the desired vhost adapter:

```
# mkvdev -vdev TargetDevice -vadapter vhostX [-dev DeviceName]
```

Example 3-35 shows that the disks are mapped to the vhost device used by VM pbrazos030 in the residency environment.

Example 3-35 Disks that are mapped to pbrazos030 VSCSI client VM

```
(1) padmin @ pbrazosv1: /home/padmin
$ lsmap -vadapter vhost17
SVSA            Physloc                                      Client Partition ID
--------------- -------------------------------------------- ------------------
vhost17         U9119.MME.21BBC47-V1-C105                    0x0000000c

VTD                   vtscsi23
Status                Available
LUN                   0x8100000000000000
Backing device        hdisk1
```

```
Physloc             U78CD.001.FZH1401-P1-C6-T1-W500009735807F004-L1000000000000
Mirrored            false

VTD                 vtscsi24
Status              Available
LUN                 0x8200000000000000
Backing device      hdisk2
Physloc             U78CD.001.FZH1401-P1-C6-T1-W500009735807F004-L2000000000000
Mirrored            false
```

Repeat the previous task on the second VIOS if you have a dual-VIOS environment at your home site.

After completing these tasks, you should be able to activate your VM (LPAR) and start the operating system installation by using the Dell EMC disks that are mapped through VSCSI. For more information about the operating system installation, see step 17 on page 70.

Considerations about port-based zones

As you did in "Setting up storage volumes for virtual machines by using NPIV" on page 57, you must prepare the volumes in a way that allows the VM to see the target disks if you must start them at the backup site. If you are working with VMs by using NPIV, you must perform the following tasks:

- Create the volumes in the Dell EMC VMAX Storage from the home site.
- Create the volumes in the Dell EMC VMAX Storage from the backup site.
- Configure the LUN masking in the Dell EMC VMAX Storage from the home site (by using the VM WWPN and source storage ports WWPNs).
- Configure the LUN masking in the Dell EMC VMAX Storage from the backup site (by using the VM WWPN and target storage ports WWPNs).
- Configure the zone in the fabric from the home site by using the client VM WWPNs and the source storage ports WWPNs.
- Configuring the zone in the fabric from the target site by using the client VM WWPNs and the target storage ports WWPNs.

As an alternative to reducing the number of zones that are created, you can set up zones on source and target sites by using the physical ports of the switch. The zone should contain the ports where the VIOSs are connected and the ports from the Dell EMC VMAX Storage at that site.

Figure 3-36 shows an example where a zone is created that contains the ports where the VIOS pbrazosv1 (from Poughkeepsie site) is connected, together with the port where the Dell EMC VMAX Storage 000196800508 (also from Poughkeepsie site) is connected.

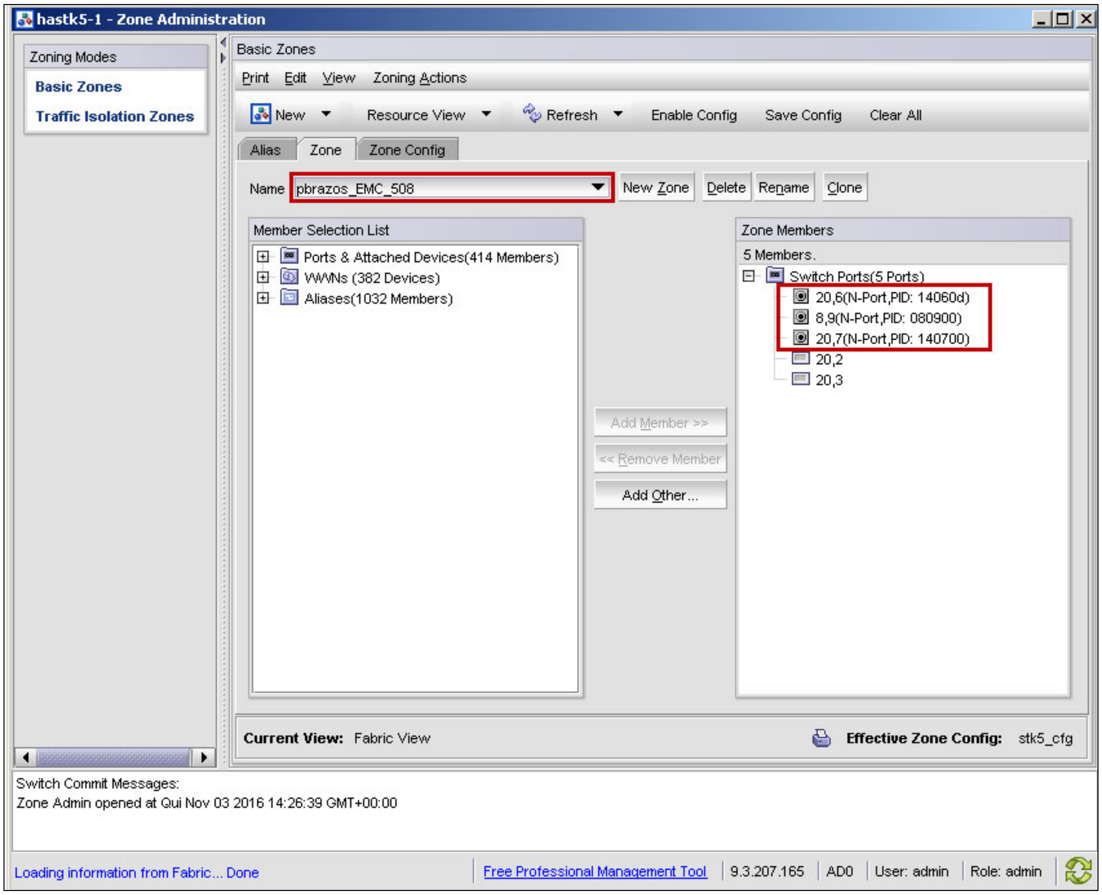


Figure 3-36 Port-based zone with virtual I/O server and Dell EMC Storage ports

Figure 3-37 shows that port 8,9 contains the WWPN from the Dell EMC Storage port.

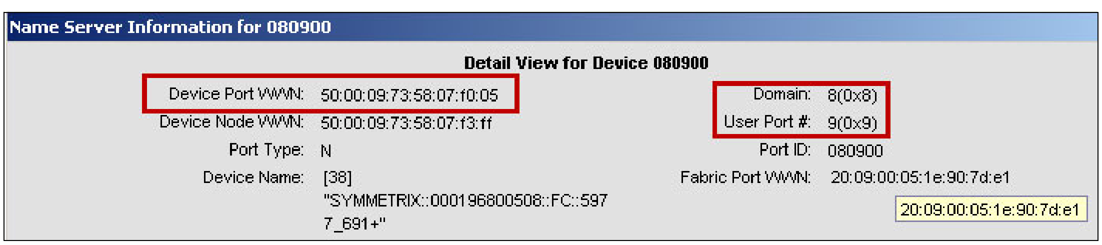


Figure 3-37 Port where the Dell EMC Storage is connected

Figure 3-38 shows that port 20,6 contains the WWPN of the fcs1 from the VIOS pbrazosv1 (which is used for NPIV).

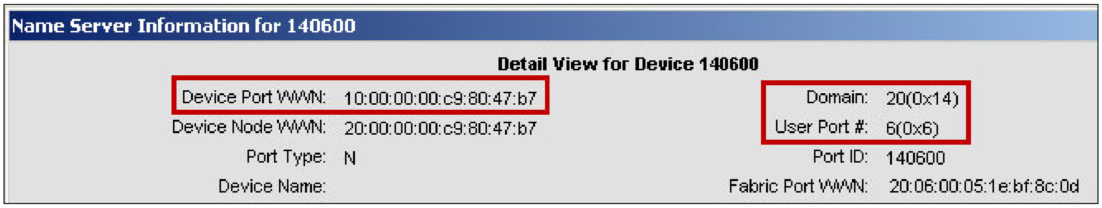


Figure 3-38 Port where the fcs1 from virtual I/O server pbrazosv1 is connected

Figure 3-39 shows the WWPN of the fcs0 from the VIOS pbrazosv1 (used for NPIV).

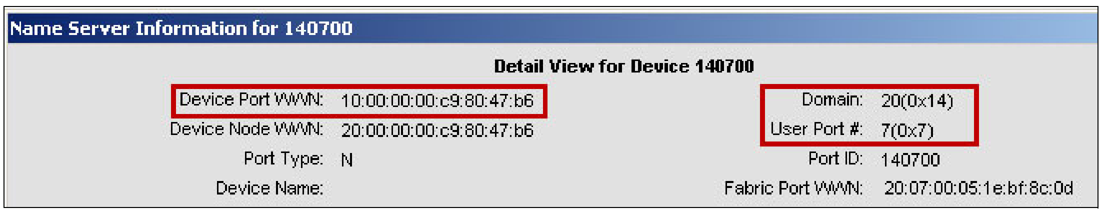


Figure 3-39 Port where the fcs0 from virtual I/O server pbrazosv1 is connected

The same type of zone can be set up in the fabric in the backup site, which in this case contains the physical ports of the VIOSs from the backup site (hamv1 and hamv2), and the physical ports of the target Dell EMC VMAX Storage (000196800573).

In this situation, you do not need to create zones in the home or backup sites for each of your VMs. From a security point of view, the fabric does not filter the ports that are seen by each VM, so all VMs can see all ports from the storage (within the port-based zone). In this case, the filter is done exclusively by the LUN masking at the Dell EMC Storage.

For security reasons, the alias-based zone (not port-based zone) is preferred. Check with your SAN Administrator about which type of zone should be used in your environment.

Configuring the SRDF/A replication of the volumes

To configure the SRDF replication for the volumes that you created, you must take two actions:

- Create an RDF group.
- Create the volume pair (which properly starts the replication).

> **Tip:** For concepts and definition of an RDF group, see "SRDF groups or RDF groups" on page 31.

The RDF group planning should be done with care. All the volumes from an RDF group should be managed together, which implies restrictions while handling the RDF groups and their volumes, specially when handling an asynchronous `rdf_mode` (which is the only supported mode in an IBM Geographically Dispersed Resiliency for Power Systems solution).

For example, you cannot simply include a new volume pair to an existing RDF group in async `rdf_mode` dynamically because this requires deleting the existing disk pairs and then re-creating all the previous pairs plus the new ones, which causes all the data to be synchronized from scratch. An alternative to avoid resynchronizing all the data is to create a temporary RDF group with the new volume pairs, and then move them to the RDF group where the remaining volumes are.

As another example, if for some reason you must unmanage certain VMs from the IBM Geographically Dispersed Resiliency for Power Systems solution, all the VMs with volumes in the same RDF group also must be unmanaged.

The IBM Geographically Dispersed Resiliency for Power Systems solution can manage multiple RDF groups, so the administrator should plan how many RDF groups will be created in the environment and what actions should be taken if you must add more volumes to the existing VMs. You can ensure that VMs that attend to the same workload, application, or department can be combined into an RDF group, creating several RDF groups to accommodate these VMs.

With multiple RDF groups, if a disruptive action must be performed to an RDF group, the VMs from that RDF group can be unmanaged in the IBM Geographically Dispersed Resiliency for Power Systems solution, and then the storage action can be run only on that specific RDF group, avoiding disturbing other VMs (which in this case belong to a different RDF group).

Also, with multiple RDF groups, you can solve the problem of adding volume pairs. You can do this task dynamically by creating an RDF group for the new volume pairs (if you must provide more volumes to existing VMs, for example, or create a VM). Instead of deleting all the volume pairs of the RDF group to re-create them, including the new volumes (or using a temporary RDF group and then move the new pair to the existing group), you can create a new RDF group and create the volume pairs in this new RDF group and not disturb the existing volume pairs.

Important: The maximum number of RDF groups is limited to 250 per Dell EMC VMAX Array, so you must carefully plan the RDF group creation to avoid exceeding this number.

This section shows how you can create the RDF group and the volume pairs. Both the web interface and CLI are shown.

Creating the RDF group by using the web interface

To create the RDF group by using the web interface, complete the following steps:

1. Identify which Dell EMC VMAX ports (director ports) are used for SRDF replication purposes. Log in to the Dell EMC Unisphere for VMAX web interface, click **Systems** → **System Dashboard**, and then click in the RDF area, as shown in Figure 3-40.

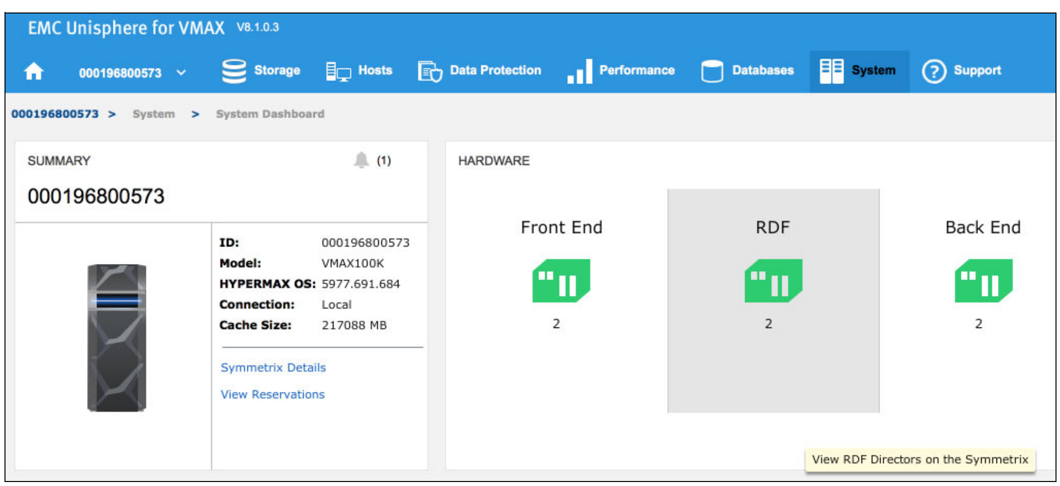
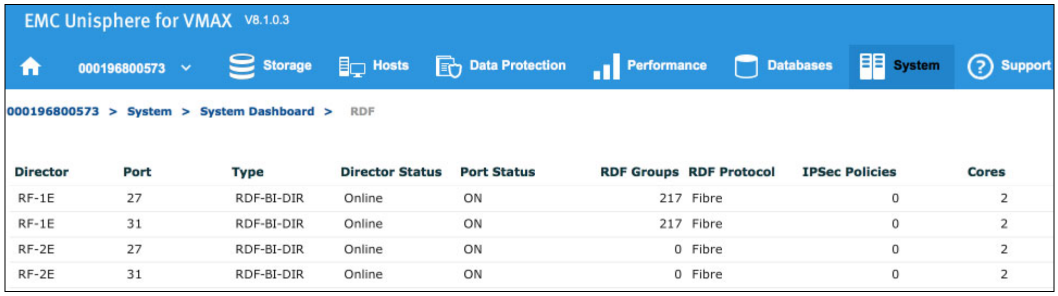


Figure 3-40 Use the System Dashboard to access the RDF groups

The ports are displayed, as shown in Figure 3-41.



Director	Port	Type	Director Status	Port Status	RDF Groups	RDF Protocol	IPSec Policies	Cores
RF-1E	27	RDF-BI-DIR	Online	ON	217	Fibre	0	2
RF-1E	31	RDF-BI-DIR	Online	ON	217	Fibre	0	2
RF-2E	27	RDF-BI-DIR	Online	ON	0	Fibre	0	2
RF-2E	31	RDF-BI-DIR	Online	ON	0	Fibre	0	2

Figure 3-41 Display ports that are used for SRDF replication purposes

2. Repeat step 1 on page 83 on the source (in our case, 000196800508 from site Poughkeepsie) and target (in our case, 000196800573 from site Austin) storages, and save this information because you must choose the port that is used for replication during the next steps.
3. Click **Data Protection** → **Create SRDF Group**, as shown in Figure 3-42.

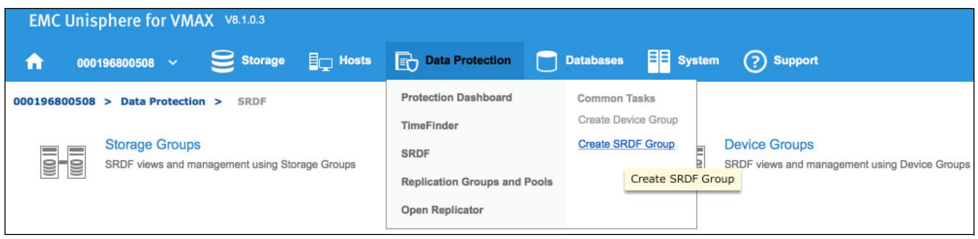


Figure 3-42 Create an SRDF group

4. When the Create SRDF Group wizard opens, select **FC** as the Communication Protocol, provide the SRDF Group Label, provide the SRDF Group Number, and choose the Director port (the port that is used for replication purposes). Also, choose the Remote Symmetrix ID (the target storage for this SRDF replication), provide the Remote SRDF Group Number (which does not need to be the same number as the local SRDF group number), and select the Remote Director (the port in the target storage that is used for replication purposes). Figure 3-43 shows the values that are used in the residency environment.

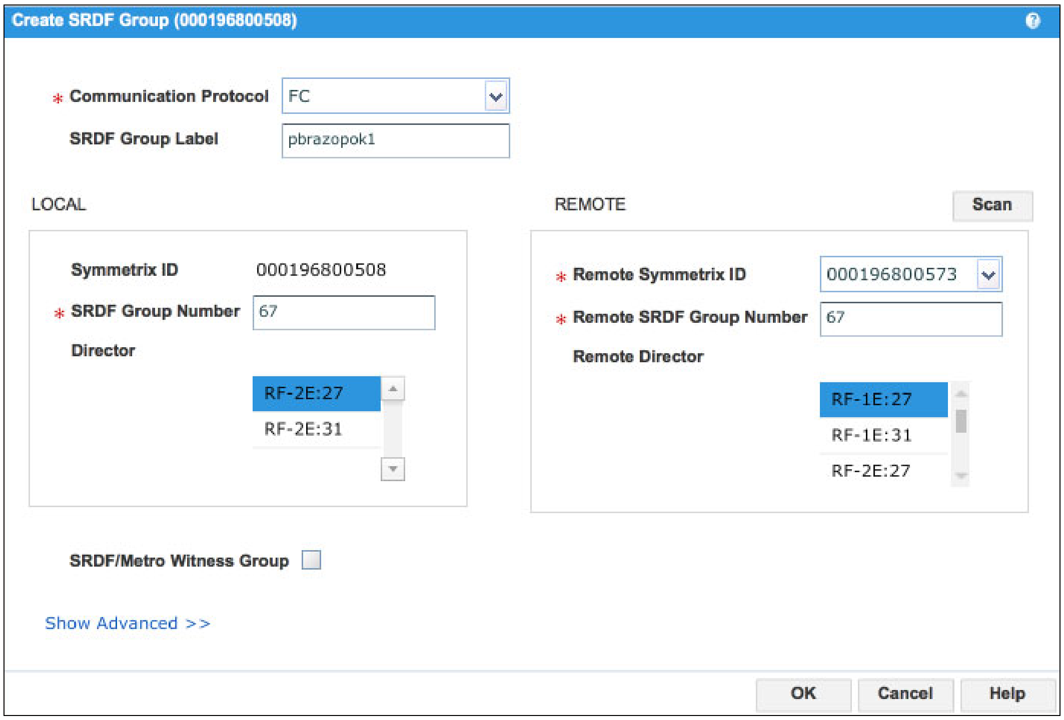


Figure 3-43 Create the RDF group

Tip: The SRDF group number is a unique number that identifies your RDF group within the Dell EMC Storage. The number that you provide must not be used by any other RDF group. To see the RDF groups that are created in your storage and find a free or available number, open the Dell EMC Unisphere for VMAX web interface and click **Data Protection** → **Replication Groups and Pools** → **SRDF Groups**.

After completing these tasks, you can proceed to create the volume pairs by using the steps from “Creating the SRDF volume pair by using the web interface” on page 88 or “Creating the SRDF volume pair by using SYMCLI” on page 92.

Creating the RDF group by using SYMCLI

The RDF group can also be created by using the CLI. During the setup of the environment that was used in this residency, this is the method that the team used. Now that the Dell EMC Solutions Enabler is installed in the KSYS node, use it to complete the following steps:

1. Log in to the KSYS node and export the **SYMCLI_CONNECT** and **SYMCLI_CONNECT_TYPE** variables to point to the storage from the source site, as shown in Example 3-36.

Example 3-36 Set the variables to manage the source storage

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_508

(0) root @ pbrazos001: /
# export SYMCLI_CONNECT_TYPE=REMOTE

(0) root @ pbrazos001: /
# symcli -def


Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)


Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT               : SYMAPI_SITE_508
  SYMCLI_CONNECT_TYPE          : REMOTE
```

2. Use the following command to find an available RDF group number. This command also shows the identifier of the director and ports being used for SRDF replication purpose.

```
# symcfg list -ra all -switched
```

Example 3-37 shows the output of the command from the residency environment. You can see that port 27 from controller 1E is being used. The list shows the available RDF groups (column RA Grp). The residency team decided to use number 67 because it was available (no RA Grp 67 is shown in this output).

Example 3-37 Use the symcfg command to show the RDF groups and director ports

```
(0) root @ pbrazos001: /var/symapi/config
# symcfg list -ra all -switched

Symmetrix ID: 000196800508 (Local)

            S Y M M E T R I X   R D F   D I R E C T O R S


         Local            Group      Link             Remote
--------------------- -------------- ---- -------------------------------
        Po                                                     Po
         r                         FLGS FLGS                    r
Ident    t  RA Grp   T Name       SH   SH  SymmID       Ident   t  RA Grp
------  -- -------- - -------------- ---- ------------ ------ -- --------

RF-1E   27   2 (01) D pbrazos54e ..   X.  000196800573 RF-1E  27   2 (01)
        27   3 (02) D RKSYS001   ..   X.  000196800573 RF-1E  27   3 (02)
```

```
        27   4 (03) D ksys1      ..   X.  000196800573 RF-1E  27   4 (03)
        27   5 (04) D ksys001    ..   X.  000196800573 RF-1E  27   5 (04)
        27   6 (05) D AIXVM_F1   ..   X.  000196800573 RF-1E  27   6 (05)
        27   7 (06) D AIXVM_F2   ..   X.  000196800573 RF-1E  27   7 (06)

.
. <Many lines were omitted>
.

Legend:
  Group (T)ype                    : D = Dynamic, S = Static, - = Unknown

  Group Flags                     :
      RDF (S)oftware Compression : X = Enabled, . = Disabled, - = N/A
      RDF (H)ardware Compression : X = Enabled, . = Disabled, - = N/A

  Link Flags                      :
      RDF (S)oftware Compression : X = Supported, . = Not supported, - = N/A
      RDF (H)ardware Compression : X = Supported, . = Not supported, - = N/A

Symmetrix ID: 000196800573 (Remote)

            S Y M M E T R I X    R D F    D I R E C T O R S


         Local            Group      Link             Remote
--------------------- -------------- ---- ------------------------------
        Po                                                  Po
         r                      FLGS FLGS                    r
Ident    t  RA Grp  T Name       SH   SH  SymmID       Ident  t  RA Grp
------  -- -------- - -------------- ---- ------------ ------ -- --------

RF-1E   27   2 (01) D pbrazos54e ..   X.  000196800508 RF-1E  27   2 (01)
        27   3 (02) D RKSYS001   ..   X.  000196800508 RF-1E  27   3 (02)
        27   4 (03) D ksys1      ..   X.  000196800508 RF-1E  27   4 (03)
        27   5 (04) D ksys001    ..   X.  000196800508 RF-1E  27   5 (04)
        27   6 (05) D AIXVM_F1   ..   X.  000196800508 RF-1E  27   6 (05)
        27   7 (06) D AIXVM_F2   ..   X.  000196800508 RF-1E  27   7 (06)

.
. <Many lines were omitted>
.

Legend:
  Group (T)ype                    : D = Dynamic, S = Static, - = Unknown

  Group Flags                     :
      RDF (S)oftware Compression : X = Enabled, . = Disabled, - = N/A
      RDF (H)ardware Compression : X = Enabled, . = Disabled, - = N/A

  Link Flags                      :
      RDF (S)oftware Compression : X = Supported, . = Not supported, - = N/A
      RDF (H)ardware Compression : X = Supported, . = Not supported, - = N/A
```

3. Run the **symrdf** command to create the RDF group. The command has the following syntax:

```
# symrdf addgrp -label  <RDF Group label> -rdfg <RDF Group Number> -sid
<Symmetrix ID of the Local Storage> -dir <Controller>:<Port> -remote_rdfg
<Remote RDF Group Number> -remote_sid <Symmetrix ID of the Remote Storage>
-remote_dir <Controller>:<Port>
```

   Example 3-38 shows the command that is used to create the RDF group 67, on both storage units, which is later used to configure the volume pairs.

   Example 3-38 Create the RDF group by using the command-line interface

```
(1) root @ pbrazos001: /var/symapi/config
# /usr/symcli/bin/symrdf addgrp -label  pbrazopok1 -rdfg 67 -sid 000196800508
-dir 01E:27 -remote_rdfg 67 -remote_sid 000196800573  -remote_dir 01E:27

Execute a Dynamic RDF Addgrp operation for group
'pbrazopok1' on Symm: 000196800508 (y/[n]) ? y

 Successfully Added Dynamic RDF Group 'pbrazopok1' for Symm: 000196800508
```

4. Example 3-39 shows that, by using the same command from step 2 on page 86, the RDF group is properly created. You can see two entries, which means one from storage 000196800508 and one from storage 000196800573.

   Example 3-39 RDF group is properly created on both storages

```
(0) root @ pbrazos001: /
# symcfg list -ra all -switched | grep pbrazopok1
        27  67 (42) D pbrazopok1 ..   X.  000196800573 RF-1E  27  67 (42)
        27  67 (42) D pbrazopok1 ..   X.  000196800508 RF-1E  27  67 (42)
```

After completing these tasks, you can proceed to create the volume pairs by using steps from "Creating the SRDF volume pair by using the web interface" on page 88 or "Creating the SRDF volume pair by using SYMCLI" on page 92.

Creating the SRDF volume pair by using the web interface

Now that the RDF group is created, create the volume pairs and add them to the RDF group. This action properly starts the replication between volumes. The R1 definition in an SRDF replication represents the source, and the R2 definition represents the target.

Complete the following steps:

1. Log in to the Dell EMC Unisphere for VMAX and find the volume ID of the volumes that you want to replicate. You must perform the task on both source and target storages. Figure 3-44 and Figure 3-45 show the volumes from the source and target storages.

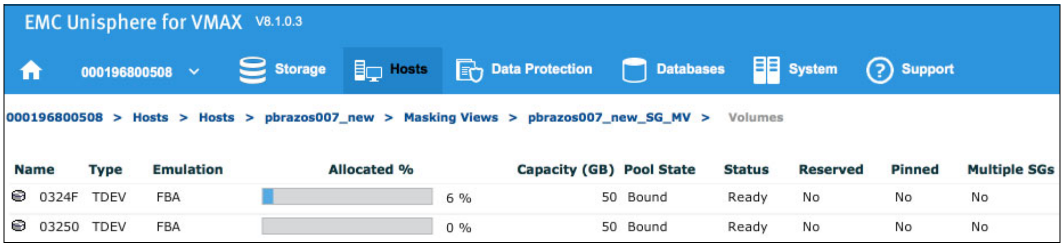


Figure 3-44 Volumes that are replicated from the source storage

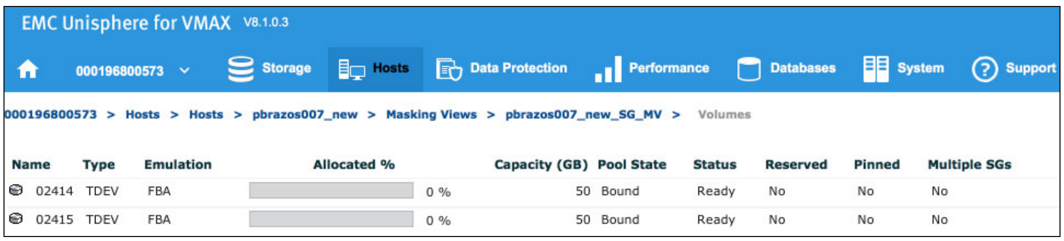


Figure 3-45 Volumes that are replicated from the target storage

This example uses the volumes that are created for VM pbrazos007, as described in "Setting up storage volumes for virtual machines by using NPIV" on page 57.

2. Using the source storage, open the Dell EMC Unisphere for VMAX interface and click **Data Protection** → **Replication Groups and Pools**, as shown in Figure 3-46.

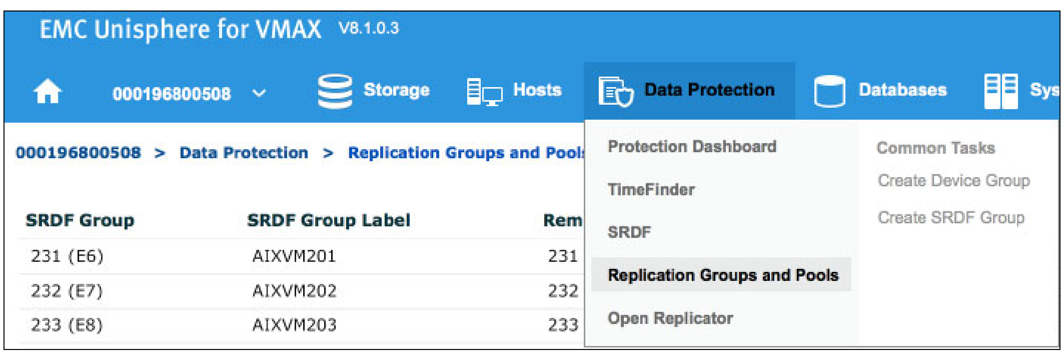


Figure 3-46 Access the replication groups and pools

3. Click **SRDF Groups**, as shown in Figure 3-47.

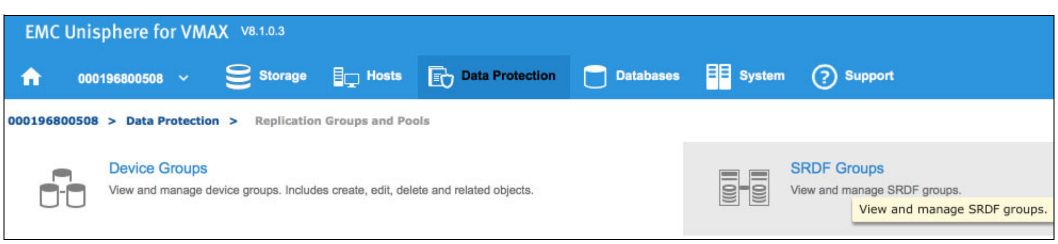


Figure 3-47 View and Manage SRDF Groups

4. Select the group where you want to create the pairs (in this case, the group that is created in “Creating the RDF group by using the web interface” on page 83 or “Creating the RDF group by using SYMCLI” on page 86), right-click the group, and click **Create Pairs**, as shown in Figure 3-48.

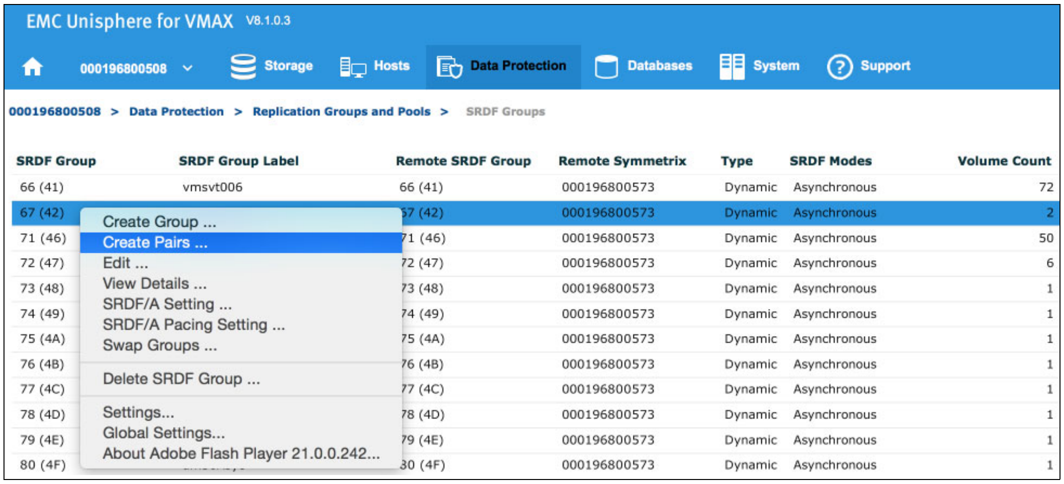


Figure 3-48 Create volume pairs

5. The Create SRDF Pairs wizard starts. Select **R1** as the Mirror Type, use **Asynchronous** as the SRDF Mode (at the time of writing, only SRDF/A is supported in the IBM Geographically Dispersed Resiliency for Power Systems solution), type the number of the local volume ID in Local Start Volume, select **1** in Number of Volumes in range, and type the volume ID of the target volume for Remote Start Volume. Click in **Show Advanced**, select **Establish**, and then click **OK**.

Figure 3-49 shows the Create SRDF Pairs wizard. Repeat this step for all volumes that you want to replicate in this RDF Group.

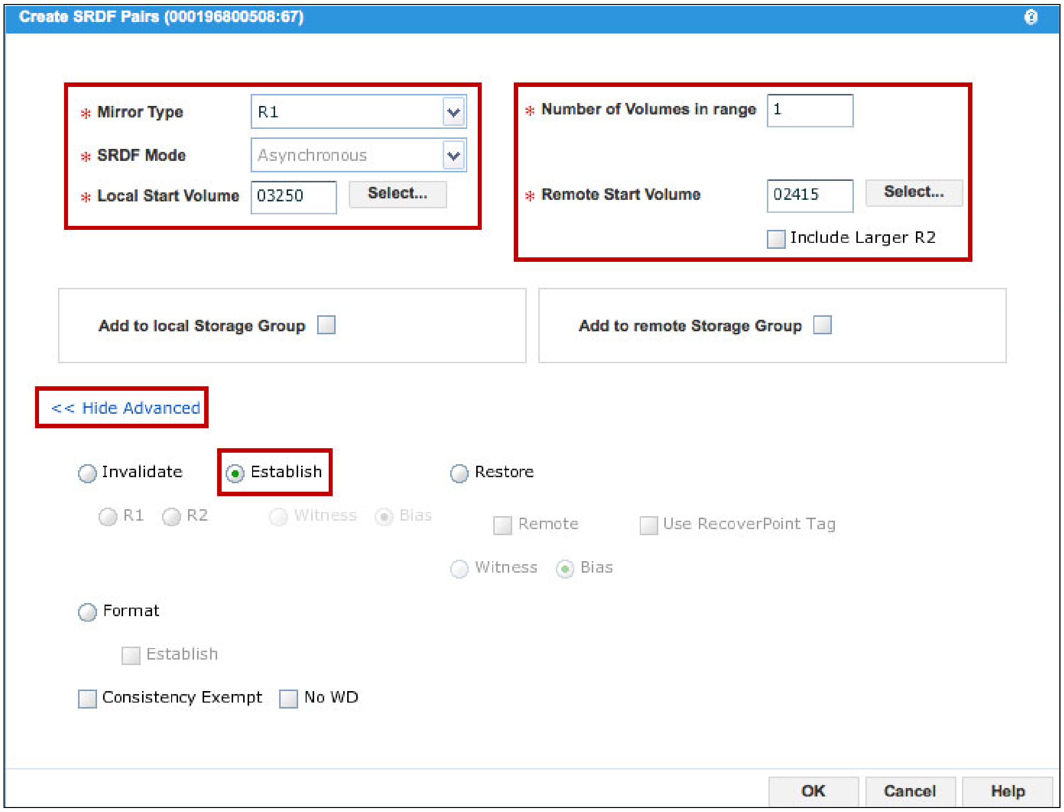
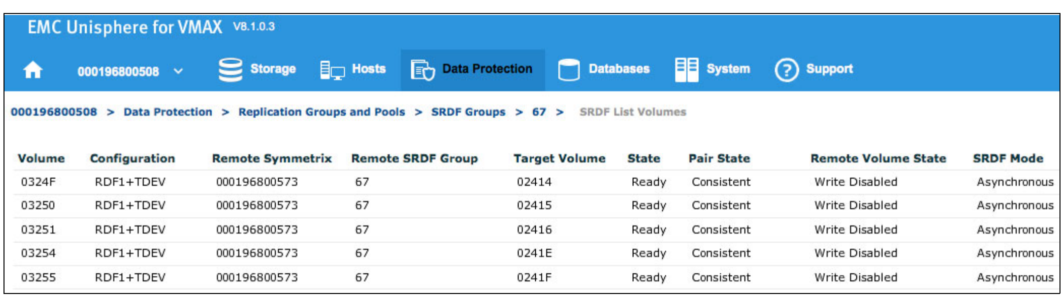


Figure 3-49 Create SRDF Pairs wizard

> **Tip:** If you do not remember the volume ID of the source or target volumes, click **Select** and an interface to search for the volumes opens. You can search for the volume size and other characteristics that can help you find the volumes.

6. To make sure that the volumes are properly created, double-click the RDF group and then, in the Related Objects area at the right of the window, click **SRDF Group Volumes**. The volume pairs in the group are shown. After a few minutes, you can see that the Pair State is Consistent, as shown in Figure 3-50.



Volume	Configuration	Remote Symmetrix	Remote SRDF Group	Target Volume	State	Pair State	Remote Volume State	SRDF Mode
0324F	RDF1+TDEV	000196800573	67	02414	Ready	Consistent	Write Disabled	Asynchronous
03250	RDF1+TDEV	000196800573	67	02415	Ready	Consistent	Write Disabled	Asynchronous
03251	RDF1+TDEV	000196800573	67	02416	Ready	Consistent	Write Disabled	Asynchronous
03254	RDF1+TDEV	000196800573	67	0241E	Ready	Consistent	Write Disabled	Asynchronous
03255	RDF1+TDEV	000196800573	67	0241F	Ready	Consistent	Write Disabled	Asynchronous

Figure 3-50 Volume pairs are created and consistent

If all the volumes from the VMs that are managed by IBM Geographically Dispersed Resiliency for Power Systems are replicated by using these instructions, the VMs can be managed by the KSYS node. The management of the VMs is explained in Chapter 4, "Installation and configuration for the IBM Geographically Dispersed Resilience deployment" on page 129.

Creating the SRDF volume pair by using SYMCLI

The creation of the volume pairs can also be done by using the CLI. This is the method that was used for creating the volume pairs during the setup of the environment that was used in this residency. Similar to what is shown in "Creating the SRDF volume pair by using the web interface" on page 88, the volume pairs are added to the RDF group that is created in "Creating the RDF group by using SYMCLI" on page 86 or "Creating the RDF group by using the web interface" on page 83. Therefore, remember the volume ID of the volumes that you want to replicate and also the RDF group number from the source and target storages.

The R1 definition means the source of the replication, and the R2 definition means the target. These definitions determine the direction of the replication.

The example that is described in this section shows the replication configuration for the volumes that are created in "Setting up storage volumes for virtual machines by using NPIV" on page 57. Complete the following steps:

1. Log in to the KSYS node where the Dell EMC Solutions Enabler is installed and export the variables **SYMCLI_CONNECT** and **SYMCLI_CONNECT_TYPE** to manage the source storage (in our case, 000196800508 from site Poughkeepsie), as shown in Example 3-40.

   Example 3-40 Export the environment variables to manage the source storage

   ```
   (0) root @ pbrazos001: /
   # export SYMCLI_CONNECT=SYMAPI_SITE_508

   (0) root @ pbrazos001: /
   # export SYMCLI_CONNECT_TYPE=REMOTE

   (0) root @ pbrazos001: /
   # symcli -def

   Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
   built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)

   Current settings of the SYMCLI environmental variables:

     SYMCLI_CONNECT              : SYMAPI_SITE_508
     SYMCLI_CONNECT_TYPE         : REMOTE
   ```

2. Create a text file with the volume ID of the volume pairs that you want to create. The file should contain the source volumes (R1) in the left column and the target volumes (R2) in the right column. The text file contains one volume pair per line, as shown in Example 3-41.

   Example 3-41 Text file that is used to create the volume pairs

   ```
   (0) root @ pbrazos001: /tmp
   # cat /tmp/pbrazos007.srdf
   0324F 02414
   03250 02415
   ```

Example 3-41 on page 92 shows 0324F, which is the source that replicates with 02414, which is the target. Volume 03250 is the source and replicates with `02415`, which is the target.

3. Run the **symrdf** command to create the volume pairs based on the text file as an input. The syntax of the command **symrdf** for this operation is as follows:

   ```
   # symrdf -file <input text file> createpair -type R1 -sid <Source Symmetrix ID>
   -rdfg <RDF Group Number> -establish -rdf_mode <sync/async> -nop -force
   ```

   > **Important:** At the time of writing, only SRDF/A is supported in the IBM Geographically Dispersed Resiliency for Power Systems solution, so the **rdf_mode** can be only `async`.

   Example 3-42 shows the volume pairs being created for the volumes of the pbrazos007 client VM, which were created in "Setting up storage volumes for virtual machines by using NPIV" on page 57.

   Example 3-42 Create the SRDF volume pairs by using the command-line interface

   ```
   (0) root @ pbrazos001: /tmp
   # symrdf -file /tmp/pbrazos007.srdf createpair -type R1 -sid 000196800508 -rdfg
   67 -establish -rdf_mode async -nop -force

   An RDF 'Create Pair' operation execution is in progress for device
   file '/tmp/pbrazos007.srdf'. Please wait...

       Create RDF Pair in (0508,067)....................................Started.
       Create RDF Pair in (0508,067)....................................Done.
       Mark target device(s) in (0508,067) for full copy from source....Started.
       Devices: 324F-3250 in (0508,067).................................Marked.
       Mark target device(s) in (0508,067) for full copy from source....Done.
       Merge track tables between source and target in (0508,067).......Started.
       Devices: 324F-3250 in (0508,067).................................Merged.
       Merge track tables between source and target in (0508,067).......Done.
       Resume RDF link(s) for device(s) in (0508,067)...................Started.
       Resume RDF link(s) for device(s) in (0508,067)...................Done.

   The RDF 'Create Pair' operation successfully executed for device
   file '/tmp/pbrazos007.srdf'.
   ```

4. Run the **symrdf list** command to check whether the volume pairs are created successfully. Initially, its status is displayed as `SyncInProg`, but after completing the replication, the status changes to `Consistent`. More information about the possible replication states of the volume pairs is in "Dell EMC SRDF status and operations" on page 125. If you run the command with the variable **SYMCLI_CONNECT** exported to run commands on your source storage, then you see the RDF Type listed as `R1`, as shown in Example 3-43.

   Example 3-43 Show the SRDF volume pairs in the source storage

   ```
   (0) root @ pbrazos001: /tmp
   # symrdf list

   Symmetrix ID: 000196800508

                                 Local Device View
   ---------------------------------------------------------------------------
                         STATUS    MODES                   RDF  S T A T E S
   ```

```
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
.
. < Some lines were omitted>
.
0324F 02414   R1:67  RW RW RW  A..1.       0       0 RW  WD   Consistent
03250 02415   R1:67  RW RW RW  A..1.       0       0 RW  WD   Consistent

Total                                ------- -------
  Track(s)                            299465  489507
  MB(s)                              37433.1 61188.4

Legend for MODES:

 M(ode of Operation)   : A = Async, S = Sync, E = Semi-sync, C = Adaptive Copy
                       : M = Mixed, T = Active
 D(omino)              : X = Enabled, . = Disabled
 A(daptive Copy)       : D = Disk Mode, W = WP Mode, . = ACp off
 (Mirror) T(ype)       : 1 = R1, 2 = R2
 (Consistency) E(xempt): X = Enabled, . = Disabled, M = Mixed, - = N/A
```

5. If you run the command with the variable **SYMCLI_CONNECT** exported to run commands on your target storage, then you see the RDF Type listed as R2, as shown in Example 3-44.

Example 3-44 Show the SRDF volume pairs in the target storage

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_573

(0) root @ pbrazos001: /
# symrdf list

Symmetrix ID: 000196800573

                              Local Device View
---------------------------------------------------------------------------
                     STATUS    MODES                   RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
.
. <Some lines were omitted>
.
02414 0324F   R2:67  RW WD RW  A..2.       0       0 WD  RW   Consistent
02415 03250   R2:67  RW WD RW  A..2.       0       0 WD  RW   Consistent

Total                                ------- -------
  Track(s)                              1415  101490
  MB(s)                                176.9 12686.2

Legend for MODES:

 M(ode of Operation)   : A = Async, S = Sync, E = Semi-sync, C = Adaptive Copy
                       : M = Mixed, T = Active
 D(omino)              : X = Enabled, . = Disabled
```

```
A(daptive Copy)       : D = Disk Mode, W = WP Mode, . = ACp off
(Mirror) T(ype)       : 1 = R1, 2 = R2
(Consistency) E(xempt): X = Enabled, . = Disabled, M = Mixed, - = N/A
```

The storage setup for your VMs is complete. If all the volumes from all the VMs you want IBM Geographically Dispersed Resiliency for Power Systems to manage are properly replicated, you can use the **ksysmgr** command to manage the VMs, as explained in Chapter 4, “Installation and configuration for the IBM Geographically Dispersed Resilience deployment” on page 129.

Including a volume pair in an existing RDF group (disruptive)

As explained in “Configuring the SRDF/A replication of the volumes” on page 82, the RDF group must be planned with care. Due to Dell EMC SRDF restrictions for RDF groups in asynchronous mode, you cannot include a new volume pair in an existing RDF group. To complete this action, you must delete the existing volume pairs and re-create them, including the new pairs, which involve replicating all the data from scratch.

In an environment with a few, small volumes, this situation might be acceptable, but in an environment with many large volumes, replicating all the data from scratch can be a problem because it can take many hours to complete the synchronization, leaving the environment exposed during this period (given that the replication is not consistent, there is no possibility of DR in a failure in the primary site). In this situation, it might be better to repeat the previous steps and create an RDF group to accommodate the new volume pairs.

> **Tip:** As an alternative, you can create the new volume pair in a temporary RDF group and then move it to the RDF group. This action dynamically adds the volume pair to the existing group without the need to resynchronize all the data from the volume pairs. For more information about how to perform this alternative method, see “Including a volume pair in an existing RDF group (dynamic)” on page 98.

To include more pairs in the same RDF group, complete the following steps:

1. Example 3-45 shows that two volume pairs are initially created in the RDF group 67.

Example 3-45 Initial volume pairs creation in the RDF group 67

```
(0) root @ pbrazos001: /
# cat /tmp/disks-pbrazoscluster/pbrazos007.srdf
0324F 02414
03250 02415

(0) root @ pbrazos001: /
# symrdf -file /tmp/disks-pbrazoscluster/pbrazos007.srdf  createpair -type R1
-sid 000196800508 -rdfg 67 -establish -rdf_mode async -nop -force

An RDF 'Create Pair' operation execution is in progress for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'. Please wait...

    Create RDF Pair in (0508,067)..................................Started.
    Create RDF Pair in (0508,067)..................................Done.
    Mark target device(s) in (0508,067) for full copy from source....Started.
    Devices: 324F-3250 in (0508,067)...............................Marked.
    Mark target device(s) in (0508,067) for full copy from source....Done.
    Merge track tables between source and target in (0508,067).......Started.
    Devices: 324F-3250 in (0508,067)...............................Merged.
```

```
    Merge track tables between source and target in (0508,067).......Done.
    Resume RDF link(s) for device(s) in (0508,067)...................Started.
    Resume RDF link(s) for device(s) in (0508,067)...................Done.

The RDF 'Create Pair' operation successfully executed for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'.
```

2. Create a file that contains a new volume pair and try to include it in the same RDF group. As you can see in Example 3-46, due to the SRDF restriction for asynchronous mode, you cannot not include it.

Example 3-46 Failure for including a new volume pair in the existing RDF group

```
(0) root @ pbrazos001: /
# cat /tmp/disks-pbrazoscluster/pbrazos008.srdf
03251 02416

(0) root @ pbrazos001: /
# symrdf -file /tmp/disks-pbrazoscluster/pbrazos008.srdf  createpair -type R1
-sid 000196800508 -rdfg 67 -establish -rdf_mode async -nop -force

An RDF 'Create Pair' operation execution is in progress for device
file '/tmp/disks-pbrazoscluster/pbrazos008.srdf'. Please wait...


The request is not allowed for SRDF/A-capable devices in async mode
```

3. To correct this situation, remove the existing volume pairs. Perform an RDF disable operation against the existing volume pairs, as shown in Example 3-47.

Example 3-47 Perform an SRDF disable operation on the volume pairs

```
(1) root @ pbrazos001: /
# symrdf -sid 000196800508  -file /tmp/disks-pbrazoscluster/pbrazos007.srdf
disable -nop -force -rdfg 67 -force

An RDF 'Disable' operation execution is in progress for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'. Please wait...


The RDF 'Disable' operation successfully executed for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'.
```

4. Perform a split operation against the existing volume pairs, as shown in Example 3-48.

Example 3-48 Perform a split operation on the volume pairs

```
(23) root @ pbrazos001: /
# symrdf -sid 000196800508  -file /tmp/disks-pbrazoscluster/pbrazos007.srdf
split -nop -force -rdfg 67 -force -symforce

An RDF 'Split' operation execution is in progress for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'. Please wait...

    Suspend RDF link(s) for device(s) in (0508,067)..................Started.
    Suspend RDF link(s) for device(s) in (0508,067)..................Done.
    Read/Write Enable device(s) in (0508,067) on RA at target (R2)...Done.
```

```
    Suspend RDF link(s) for device(s) in (0508,067)..................Started.
    Suspend RDF link(s) for device(s) in (0508,067)..................Done.

The RDF 'Split' operation successfully executed for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'.
```

5. Delete the existing volume pairs, as shown in Example 3-49.

Example 3-49 Delete the volume pairs

```
(0) root @ pbrazos001: /
# symrdf -sid 000196800508  -file /tmp/disks-pbrazoscluster/pbrazos007.srdf
deletepair -nop -force -rdfg 67 -force

An RDF 'Delete Pair' operation execution is in progress for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'. Please wait...

    Delete RDF Pair in (0508,067)....................................Started.
    Delete RDF Pair in (0508,067)....................................Done.

The RDF 'Delete Pair' operation successfully executed for device
file '/tmp/disks-pbrazoscluster/pbrazos007.srdf'.
```

6. A new file is created that contains all the volume pairs that you want in the RDF group (the ones that are already part of the group, and the new ones that you want to include), as shown in Example 3-50.

Example 3-50 Create an input file that contains all volume pairs that should be in the RDF group

```
(0) root @ pbrazos001: /
# cat /tmp/disks-pbrazoscluster/all.luns
0324F 02414
03250 02415
03251 02416
03254 0241E
03255 0241F
```

7. Re-create all the volume pairs together, as shown in Example 3-51.

Example 3-51 Re-creating the volume pairs based on the new input file

```
(0) root @ pbrazos001: /
# symrdf -file /tmp/disks-pbrazoscluster/all.luns  createpair -type R1 -sid
000196800508 -rdfg 67 -establish -rdf_mode async -nop -force

An RDF 'Create Pair' operation execution is in progress for device
file '/tmp/disks-pbrazoscluster/all.luns'. Please wait...

    Create RDF Pair in (0508,067)....................................Started.
    Create RDF Pair in (0508,067)....................................Done.
    Mark target device(s) in (0508,067) for full copy from source....Started.
    Devices: 324F-3251, 3254-3255 in (0508,067)......................Marked.
    Mark target device(s) in (0508,067) for full copy from source....Done.
    Merge track tables between source and target in (0508,067).......Started.
    Devices: 324F-3251, 3254-3255 in (0508,067)......................Merged.
    Merge track tables between source and target in (0508,067).......Done.
    Resume RDF link(s) for device(s) in (0508,067)...................Started.
```

```
    Resume RDF link(s) for device(s) in (0508,067)...................Done.

The RDF 'Create Pair' operation successfully executed for device
file '/tmp/disks-pbrazoscluster/all.luns'.
```

8. Check that the replication state of the volume pairs is **Consistent**, as shown in Example 3-52.

Example 3-52 Check the SRDF state of the volume pairs

```
(127) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
0324F 02414   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03250 02415   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03251 02416   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03254 0241E   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03255 0241F   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
```

To avoid problems with your environment due to the replication limitation, you must carefully plan the creation of the RDF groups before creating the volume pairs. As explained in "Configuring the SRDF/A replication of the volumes" on page 82, the IBM Geographically Dispersed Resiliency for Power Systems solution can manage multiple RDF groups. During the discovery operation, these groups are placed in a CG and the KSYS node uses this CG to control the direction of the replication in a move to the backup site.

Including a volume pair in an existing RDF group (dynamic)

An alternative method to avoid disruption is to use a temporary RDF group while creating the new volume pairs. Instead of deleting the existing volume pairs of the RDF group and re-creating them all together, including the new pair, as an alternative method you can use a temporary RDF group to create the new pair, move it to the existing RDF group, and then discard the temporary RDF group. To perform this alternative method, complete the following steps:

1. In the initial status of the example that is used in this section, there is an existing RDF group with ID 143. This RDF group has six volume pairs, which all belong to a VM that is called pbrazos016_PHA1. This VM is managed by an IBM Geographically Dispersed Resiliency for Power Systems environment with a KSYS Cluster that is called itso4_cluster.

   Now, a new VM that is called pbrazos015_RedHat is created and uses the volume pair 0243D-03269. You want to manage this existing VM in the same IBM Geographically Dispersed Resiliency for Power Systems environment.

   To complete such task, create a temporary RDF group with ID 140, as shown in Example 3-53 on page 99. The volume pair 0243D-03269 belongs to this temporary RDF group 140. Later, this section shows how to move this volume pair to the existing RDF group 143 and then manage the VM pbrazos015_RedHat in the same cluster.

   > **Note:** This scenario manages the new VM with the RDF group 140. This RDF group is included in the existing CG automatically when KSYS performs the discover action, but this scenario shows how to add more volumes to a single RDF group dynamically, avoiding too many RDF groups, given that the number of RDF groups that you can create is limited.

Example 3-53 Volume pairs in the RDF groups 143 and 140

```
# symrdf list|egrep "\:140|\:143"
0075C 0018F   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
0174E 00192   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
01751 00194   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
01B84 00196   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
01C56 00198   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
0243D 03269   R1:140 RW RW RW  A..1.       0       0 RW  WD   Consistent
02443 0326F   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
```

2. Example 3-54 shows the current CG containing six volume pairs, all belonging to RDF group 143.

Example 3-54 Volumes from the composite group

```
# symrdf -cg VMRDG_itso4_cluster_ITSO4_Austin query

Composite Group Name      :  VMRDG_itso4_cluster_ITSO4_Austin
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  NONE

Symmetrix ID                : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800508    (Microcode Version: 5977)
RDF (RA) Group Number       : 143 (8E)

         Source (R1) View              Target (R2) View     MODE
--------------------------------    ----------------------- ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
-------------------------------- -- ----------------------- ---- ------------
DEV001   02443 RW       0       0 RW 0326F WD       0       0 A... Consistent
DEV002   0075C RW       0       0 RW 0018F WD       0       0 A... Consistent
DEV003   0174E RW       0       0 RW 00192 WD       0       0 A... Consistent
DEV004   01751 RW       0       0 RW 00194 WD       0       0 A... Consistent
DEV005   01B84 RW       0       0 RW 00196 WD       0       0 A... Consistent
DEV006   01C56 RW       0       0 RW 00198 WD       0       0 A... Consistent
```

3. The first action to be done is to disable the consistency of the CG, as shown in Example 3-55.

Example 3-55 Disable the consistency of the composite group

```
# symcg -cg VMRDG_itso4_cluster_ITSO4_Austin disable

# symrdf -cg VMRDG_itso4_cluster_ITSO4_Austin query

Composite Group Name      :  VMRDG_itso4_cluster_ITSO4_Austin
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  NONE
```

```
Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800508    (Microcode Version: 5977)
RDF (RA) Group Number        : 143 (8E)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   02443 RW       0       0 RW 0326F WD       0       0 A... Consistent
DEV002   0075C RW       0       0 RW 0018F WD       0       0 A... Consistent
DEV003   0174E RW       0       0 RW 00192 WD       0       0 A... Consistent
DEV004   01751 RW       0       0 RW 00194 WD       0       0 A... Consistent
DEV005   01B84 RW       0       0 RW 00196 WD       0       0 A... Consistent
DEV006   01C56 RW       0       0 RW 00198 WD       0       0 A... Consistent
```

4. Then, you must suspend the CG, which suspends the replication from all volume pairs within that CG, and also suspends the replication of the new volume pair. You can see that the status of the volume pairs changes to `Suspended`, as shown in Example 3-56.

Example 3-56 Suspend the composite group replication

```
# symrdf -cg VMRDG_itso4_cluster_ITSO4_Austin suspend
# symrdf suspend -file /tmp/redhat.srdf -sid 000196800573 -rdfg 140

# symrdf list|egrep "\:140|\:143"
0075C 0018F   R1:143 RW RW NR  A..1.       0       0 RW  WD   Suspended
0174E 00192   R1:143 RW RW NR  A..1.       0       0 RW  WD   Suspended
01751 00194   R1:143 RW RW NR  A..1.       0       0 RW  WD   Suspended
01B84 00196   R1:143 RW RW NR  A..1.       0       0 RW  WD   Suspended
01C56 00198   R1:143 RW RW NR  A..1.       0       0 RW  WD   Suspended
0243D 03269   R1:140 RW RW NR  A..1.       0       0 RW  WD   Suspended
02443 0326F   R1:143 RW RW NR  A..1.       0      29 RW  WD   Suspended
```

5. Move the new disk pair from the temporary RDF group, 140, to the existing RDF group (143) where the remaining volume pairs of the managed VMs are, as shown in Example 3-57.

Example 3-57 Move the new volume pair to the existing RDF group

```
# symrdf movepair -file /tmp/redhat.srdf -sid 000196800573 -rdfg 140 -new_rdfg
143
```

6. You can see that the new volume pair is added to the existing RDF group 143, as shown in Example 3-58.

Example 3-58 The new volume pair is moved to the existing RDF group

```
# symrdf list|egrep "\:140|\:143"
0075C 0018F   R1:143 RW RW NR  A..1.      0       0 RW  WD   Suspended
0174E 00192   R1:143 RW RW NR  A..1.      0       0 RW  WD   Suspended
01751 00194   R1:143 RW RW NR  A..1.      0       0 RW  WD   Suspended
01B84 00196   R1:143 RW RW NR  A..1.      0       0 RW  WD   Suspended
01C56 00198   R1:143 RW RW NR  A..1.      0       0 RW  WD   Suspended
0243D 03269   R1:143 RW RW NR  A..1.      0       0 RW  WD   Suspended
02443 0326F   R1:143 RW RW NR  A..1.      0      36 RW  WD   Suspended
```

7. Now, use a text file containing all volume pairs from the RDF group 143 (including the new volume that was just moved to it), and resume the data synchronization, as shown in Example 3-59.

Example 3-59 Resume the data synchronization

```
# cat /temp/new.srdf
0075C 0018F
0174E 00192
01751 00194
01B84 00196
01C56 00198
02443 0326F
0243D 03269

# symrdf -file /tmp/new.srdf -sid 573 -rdfg 143 establish
```

8. Monitor the synchronization process and wait until it is synchronized, as shown in Example 3-60.

Example 3-60 Waiting for data synchronization to complete

```
# symrdf list|egrep "\:140|\:143"
0075C 0018F   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
0174E 00192   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
01751 00194   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
01B84 00196   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
01C56 00198   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
0243D 03269   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
02443 0326F   R1:143 RW RW RW  A..1.      0      43 RW  WD   SyncInProg
...
# symrdf list|egrep "\:140|\:143"
0075C 0018F   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
0174E 00192   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
01751 00194   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
01B84 00196   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
01C56 00198   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
0243D 03269   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
02443 0326F   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
```

9. If your IBM Geographically Dispersed Resiliency for Power Systems environment is configured (see Chapter 4, “Installation and configuration for the IBM Geographically Dispersed Resilience deployment” on page 129), you can manage the new VM and then run a discover and verify operation:

```
# ksysmgr manage vm uuid=5BA0080B-0DC2-417A-9D21-70B489462676
# ksysmgr discover site <sitename>
# ksysmgr verify site <sitename>
```

10. After the discover and verify tasks are complete, you can check that the CG now has seven volumes, as shown in Example 3-61.

Example 3-61 Composite group now has seven volume pairs

```
# symrdf -cg  VMRDG_itso4_cluster_ITSO4_Austin  query

Composite Group Name      :  VMRDG_itso4_cluster_ITSO4_Austin
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  MSC

Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800508    (Microcode Version: 5977)
RDF (RA) Group Number        : 143 (8E)

         Source (R1) View                Target (R2) View     MODE
--------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
-------------------------------- -- ------------------------ ---- ------------
DEV001   02443 RW       0       0 RW 0326F WD       0       0 A.X. Consistent
DEV002   0075C RW       0       0 RW 0018F WD       0       0 A.X. Consistent
DEV003   0174E RW       0       0 RW 00192 WD       0       0 A.X. Consistent
DEV004   01751 RW       0       0 RW 00194 WD       0       0 A.X. Consistent
DEV005   01B84 RW       0       0 RW 00196 WD       0       0 A.X. Consistent
DEV006   01C56 RW       0       0 RW 00198 WD       0       0 A.X. Consistent
DEV007   0243D RW       0       0 RW 03269 WD       0       0 A.X. Consistent
```

Checking whether replicated volumes belong to a device or composite group

In the IBM Geographically Dispersed Resiliency for Power Systems solution, you should not manually include the volume pairs that are created for your VMs in any DG or CG in the Dell EMC VMAX Storage. If you include a volume in one of these groups, the Discovery operation of the KSYS node fails and cannot manage the DR of your VMs.

During the Discovery operation, the KSYS node automatically creates a CG at the Dell EMC VMAX Storage and includes all volume pairs from all *managed* VMs. One CG per site is created and all volumes from that site are included in this group. The CG name is always *VMRDG_<clustername>_<sitename>*.

Tip: VMRDG stands for VM restart disk group.

Considering the residency environment, which has the sites Poughkeepsie (home) and Austin (backup), one CG at each site is created. Example 3-62 shows the CG VMRDG_itsocluster_Poughkeepsie, which is created in site Poughkeepsie (Storage Dell EMC VMAX with SID 000196800508), and contains the volume pairs that were created during the previous steps in this chapter.

Example 3-62 Composite group in site Poughkeepsie

```
(0) root @ pbrazos001: /
# symcli -def

Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)

Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT              : SYMAPI_SITE_508
  SYMCLI_CONNECT_TYPE         : REMOTE

(0) root @ pbrazos001: /
# symcg list

                      C O M P O S I T E   G R O U P S

                                  Number of         Number of
  Name                 Type   Valid Symms RAGs  DGs  Devs  BCVs  VDEVs   TGTs

  VMRDG_itso3_cluster_S* RDF2    Yes      1     2    0     9     0      0      0
  VMRDG_itso4_cluster_I* RDF2    Yes      1     1    0     7     0      0      0
  VMRDG_itso4cluster_IT* RDF2    Yes      1     1    0     1     0      0      0
  VMRDG_itsocluster2_IT* RDF2    Yes      0     0    0     0     0      0      0
  VMRDG_itsocluster_Pou* RDF1    Yes      1     1    0     5     0      0      0
  VMRDG_ksyscluster_IND* RDF1    Yes      1     4    0    86     0      0      0
  VMRDG_test_cluster_Au* RDF2    Yes      1     1    0    80     0      0      0
  VMRDG_vmdr_Austin      RDF1    Yes      1     1    0     1     0      0      0
```

Example 3-63 shows the CG VMRDG_itsocluster_Austin, which is created in site Austin. The Storage Dell EMC VMAX with SID 000196800573 contains the equivalent volume pairs from site Austin.

Example 3-63 Composite group in site Austin

```
(0) root @ pbrazos001: /
# symcli -def

Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)

Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT              : SYMAPI_SITE_573
  SYMCLI_CONNECT_TYPE         : REMOTE

(0) root @ pbrazos001: /
# symcg list
```

```
                         C O M P O S I T E   G R O U P S

                                        Number of          Number of
 Name                    Type   Valid  Symms RAGs  DGs  Devs  BCVs  VDEVs  TGTs

 VMRDG_itso3_cluster_S* RDF1    Yes       1     2    0     9     0      0     0
 VMRDG_itso4_cluster_I* RDF1    Yes       1     1    0     7     0      0     0
 VMRDG_itso4cluster_IT* RDF1    Yes       1     1    0     1     0      0     0
 VMRDG_itsocluster2_IT* RDF1    Yes       0     0    0     0     0      0     0
 VMRDG_itsocluster_Aus* RDF2    Yes       1     1    0     5     0      0     0
 VMRDG_ksyscluster_USA  RDF2    Yes       1     4    0    86     0      0     0
 VMRDG_test_cluster_In* RDF1    Yes       1     1    0    80     0      0     0
 VMRDG_vmdr_India       RDF2    Yes       1     1    0     1     0      0     0
```

You can run the command **symcg show <composite_group_name>** to view all volume pairs from a CG. Example 3-64 shows the details of the CG from site Poughkeepsie.

Example 3-64 Details of the composite group from site Poughkeepsie

```
(0) root @ pbrazos001: /
# symcli -def

Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)

Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT              : SYMAPI_SITE_508
  SYMCLI_CONNECT_TYPE         : REMOTE

(0) root @ pbrazos001: /
# symcg show VMRDG_itsocluster_Poughkeepsie

Composite Group Name:  VMRDG_itsocluster_Poughkeepsie

  Composite Group Type                              : RDF1
  Valid                                             : Yes
  CG in PowerPath                                   : No
  CG in GNS                                         : No
  RDF Consistency Protection Allowed                : Yes
  RDF Consistency Mode                              : MSC
  Concurrent RDF                                    : No
  Cascaded RDF                                      : No

  Number of RDF (RA) Groups                         :    1
  Number of STD Devices                             :    5
  Number of CRDF STD Devices                        :    0
  Number of BCV's (Locally-associated)              :    0
  Number of VDEV's (Locally-associated)             :    0
  Number of TGT's Locally-associated                :    0
  Number of CRDF TGT Devices                        :    0
  Number of RVDEV's (Remotely-associated VDEV)      :    0
  Number of RBCV's (Remotely-associated STD-RDF)    :    0
  Number of BRBCV's (Remotely-associated BCV-RDF)   :    0
  Number of RRBCV's (Remotely-associated RBCV)      :    0
  Number of RTGT's (Remotely-associated)            :    0
```

```
  Number of Hop2 BCV's (Remotely-assoc'ed Hop2 BCV)   :    0
  Number of Hop2 VDEV's (Remotely-assoc'ed Hop2 VDEV) :    0
  Number of Hop2 TGT's (Remotely-assoc'ed Hop2 TGT)   :    0
  Number of Device Groups                             :    0
  Device Group Names                                  : N/A

  Number of Symmetrix Units (1):
    {

    1) Symmetrix ID                                   : 000196800508
       Microcode Version                              : 5977
       Number of STD Devices                          :    5
       Number of CRDF STD Devices                     :    0
       Number of BCV's (Locally-associated)           :    0
       Number of VDEV's (Locally-associated)          :    0
       Number of TGT's Locally-associated             :    0
       Number of CRDF TGT Devices                     :    0
       Number of RVDEV's (Remotely-associated VDEV)   :    0
       Number of RBCV's (Remotely-associated STD_RDF) :    0
       Number of BRBCV's (Remotely-associated BCV-RDF):    0
       Number of RTGT's (Remotely-associated)         :    0
       Number of RRBCV's (Remotely-associated RBCV)   :    0
       Number of Hop2BCV's (Remotely-assoc'ed Hop2BCV):    0
       Number of Hop2VDEVs(Remotely-assoc'ed Hop2VDEV):    0
       Number of Hop2TGT's (Remotely-assoc'ed Hop2TGT):    0

       Number of RDF (RA) Groups (1):
         {

         1) RDF (RA) Group Number    :  67 (42)
            Remote Symmetrix ID      : 000196800573
            Microcode Version        : 5977
            Recovery RA Group        : N/A            (N/A)
            RA Group Name            : N/A

            STD Devices (5):
              {
              ----------------------------------------------------------------------
                                         Sym   Device             Flags     Cap
              LdevName    PdevName       Dev   Config       Sts   CSRT      (MB)
              ----------------------------------------------------------------------
              DEV001      N/A            03254 RDF1+TDEV    RW    XAM1     51201
              DEV002      N/A            03255 RDF1+TDEV    RW    XAM1     51201
              DEV003      N/A            03251 RDF1+TDEV    RW    XAM1     51201
              DEV004      N/A            0324F RDF1+TDEV    RW    XAM1     51201
              DEV005      N/A            03250 RDF1+TDEV    RW    XAM1     51201
              }
         }
     }

Legend:
  RDFA Flags:
       C(onsistency)   : X = Enabled, . = Disabled, - = N/A
       (RDFA) S(tatus) : A = Active, I = Inactive, - = N/A
```

```
R(DFA Mode)     : S = Single-session mode, M = MSC mode, - = N/A
(Mirror) T(ype) : 1 = R1, 2 = R2, - = N/A
```

Example 3-65 shows the details of the CG from site Austin.

Example 3-65 Details of the composite group from site Austin

```
(0) root @ pbrazos001: /
# symcli -def

Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)

Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT                : SYMAPI_SITE_573
  SYMCLI_CONNECT_TYPE           : REMOTE

(0) root @ pbrazos001: /
# symcg show VMRDG_itsocluster_Austin

Composite Group Name:  VMRDG_itsocluster_Austin

  Composite Group Type                                : RDF2
  Valid                                               : Yes
  CG in PowerPath                                     : No
  CG in GNS                                           : No
  RDF Consistency Protection Allowed                  : Yes
  RDF Consistency Mode                                : NONE
  Concurrent RDF                                      : No
  Cascaded RDF                                        : No

  Number of RDF (RA) Groups                           :    1
  Number of STD Devices                               :    5
  Number of CRDF STD Devices                          :    0
  Number of BCV's (Locally-associated)                :    0
  Number of VDEV's (Locally-associated)               :    0
  Number of TGT's Locally-associated                  :    0
  Number of CRDF TGT Devices                          :    0
  Number of RVDEV's (Remotely-associated VDEV)        :    0
  Number of RBCV's (Remotely-associated STD-RDF)      :    0
  Number of BRBCV's (Remotely-associated BCV-RDF)     :    0
  Number of RRBCV's (Remotely-associated RBCV)        :    0
  Number of RTGT's (Remotely-associated)              :    0
  Number of Hop2 BCV's (Remotely-assoc'ed Hop2 BCV)   :    0
  Number of Hop2 VDEV's (Remotely-assoc'ed Hop2 VDEV) :    0
  Number of Hop2 TGT's (Remotely-assoc'ed Hop2 TGT)   :    0
  Number of Device Groups                             :    0
  Device Group Names                                  : N/A

  Number of Symmetrix Units (1):
    {

    1) Symmetrix ID                                   : 000196800573
       Microcode Version                              : 5977
       Number of STD Devices                          :    5
```

```
        Number of CRDF STD Devices                  :    0
        Number of BCV's (Locally-associated)        :    0
        Number of VDEV's (Locally-associated)       :    0
        Number of TGT's Locally-associated          :    0
        Number of CRDF TGT Devices                  :    0
        Number of RVDEV's (Remotely-associated VDEV)   :    0
        Number of RBCV's (Remotely-associated STD_RDF) :    0
        Number of BRBCV's (Remotely-associated BCV-RDF):    0
        Number of RTGT's (Remotely-associated)      :    0
        Number of RRBCV's (Remotely-associated RBCV)   :    0
        Number of Hop2BCV's (Remotely-assoc'ed Hop2BCV):    0
        Number of Hop2VDEVs(Remotely-assoc'ed Hop2VDEV):    0
        Number of Hop2TGT's (Remotely-assoc'ed Hop2TGT):    0

        Number of RDF (RA) Groups (1):
          {

          1) RDF (RA) Group Number    :  67 (42)
             Remote Symmetrix ID      : 000196800508
             Microcode Version        : 5977
             Recovery RA Group        : N/A           (N/A)
             RA Group Name            : N/A

             STD Devices (5):
               {
               -------------------------------------------------------------------
                                           Sym   Device            Flags     Cap
               LdevName    PdevName        Dev   Config       Sts   CSRT     (MB)
               -------------------------------------------------------------------
               DEV001      N/A             0241E RDF2+TDEV     WD    XAM2    51201
               DEV002      N/A             0241F RDF2+TDEV     WD    XAM2    51201
               DEV003      N/A             02416 RDF2+TDEV     WD    XAM2    51201
               DEV004      N/A             02414 RDF2+TDEV     WD    XAM2    51201
               DEV005      N/A             02415 RDF2+TDEV     WD    XAM2    51201
               }
          }
      }

Legend:
  RDFA Flags:
       C(onsistency)   : X = Enabled, . = Disabled, - = N/A
       (RDFA) S(tatus) : A = Active, I = Inactive, - = N/A
       R(DFA Mode)     : S = Single-session mode, M = MSC mode, - = N/A
       (Mirror) T(ype) : 1 = R1, 2 = R2, - = N/A
```

You must know the full name of the CG to use the **symcg show** command, but the **symcg list** command shows only a truncated name output. You can export the environment variable **SYMCLI_FULL_NAME** with a value of 1 to show the full name of the CGs, as shown in Example 3-66.

Example 3-66 Use the SYMCLI_FULL_NAME environment variable

```
(0) root @ pbrazos001: /
# export SYMCLI_FULL_NAME=1

(0) root @ pbrazos001: /
```

```
# symcli -def

Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)

Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT              : SYMAPI_SITE_573
  SYMCLI_CONNECT_TYPE         : REMOTE
  SYMCLI_FULL_NAME            : 1

(0) root @ pbrazos001: /
# symcg list

                      C O M P O S I T E   G R O U P S

                                                     Number of        Number of
  Name                              Type Valid Symms RAGs DGs Devs BCVs VDEVs TGTs

  VMRDG_itso3_cluster_Site_ShangHai RDF1  Yes    1    2  0    9    0     0    0
  VMRDG_itso4_cluster_ITSO4_Austin  RDF1  Yes    1    1  0    7    0     0    0
  VMRDG_itso4cluster_ITSO4_active   RDF1  Yes    1    1  0    1    0     0    0
  VMRDG_itsocluster2_ITSO2_backup   RDF1  Yes    0    0  0    0    0     0    0
  VMRDG_itsocluster_Austin          RDF2  Yes    1    1  0    5    0     0    0
  VMRDG_ksyscluster_USA             RDF2  Yes    1    4  0   86    0     0    0
  VMRDG_test_cluster_India          RDF1  Yes    1    1  0   80    0     0    0
  VMRDG_vmdr_India                  RDF2  Yes    1    1  0    1    0     0    0
```

As mentioned in “Configuring the SRDF/A replication of the volumes” on page 82, you can have multiple RDF groups in the IBM Geographically Dispersed Resiliency for Power Systems environment. All volume pairs from all the RDF groups from the managed VMs are combined into a single CG at each site.

Important: All volume pairs inside an RDF group that is managed by the KSYS node should belong to VMs that are *managed* by the KSYS node. If you have VMs that are *unmanaged*, their volume pairs should not be placed in the same RDF group as other managed VMs.

Example 3-67 shows an environment with sites ShangHai and BeiJing. You can see that the CGs VMRDG_itso3_cluster_Site_ShangHai and VMRDG_itso3_cluster_Site_BeiJing have two RDF groups each (column number of RAGs).

Example 3-67 Composite groups with more than one RDF groups

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_573

(0) root @ pbrazos001: /
# symcg list

                      C O M P O S I T E   G R O U P S

                                        Number of          Number of
  Name                   Type   Valid Symms RAGs  DGs  Devs BCVs   VDEVs TGTs
```

```
  VMRDG_itso3_cluster_S* RDF1     Yes      1      2     0      9     0         0    0
  VMRDG_itso4_cluster_I* RDF1     Yes      1      1     0      7     0         0    0
  VMRDG_itso4cluster_IT* RDF1     Yes      1      1     0      1     0         0    0
  VMRDG_itsocluster2_IT* RDF1     Yes      0      0     0      0     0         0    0
  VMRDG_itsocluster_Aus* RDF2     Yes      1      1     0      5     0         0    0
  VMRDG_ksyscluster_USA  RDF2     Yes      1      4     0     86     0         0    0
  VMRDG_test_cluster_In* RDF1     Yes      1      1     0     80     0         0    0
  VMRDG_vmdr_India       RDF2     Yes      1      1     0      1     0         0    0

(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_508

(0) root @ pbrazos001: /
# symcg list

                      C O M P O S I T E   G R O U P S

                                        Number of          Number of
  Name                   Type    Valid Symms RAGs  DGs  Devs BCVs   VDEVs TGTs

  VMRDG_itso3_cluster_S* RDF2     Yes      1      2     0      9     0         0    0
  VMRDG_itso4_cluster_I* RDF2     Yes      1      1     0      7     0         0    0
  VMRDG_itso4cluster_IT* RDF2     Yes      1      1     0      1     0         0    0
  VMRDG_itsocluster2_IT* RDF2     Yes      0      0     0      0     0         0    0
  VMRDG_itsocluster_Pou* RDF1     Yes      1      1     0      5     0         0    0
  VMRDG_ksyscluster_IND* RDF1     Yes      1      4     0     86     0         0    0
  VMRDG_test_cluster_Au* RDF2     Yes      1      1     0     80     0         0    0
  VMRDG_vmdr_Austin      RDF1     Yes      1      1     0      1     0         0    0
```

Example 3-68 shows the details of a CG where you can see the volume pairs from the two RDF groups.

Example 3-68 Details of the composite groups with more than one RDF groups

```
(0) root @ pbrazos001: /
# SYMCLI_CONNECT=SYMAPI_SITE_573 symcg show VMRDG_itso3_cluster_Site_ShangHai

Composite Group Name:  VMRDG_itso3_cluster_Site_ShangHai

  Composite Group Type                               : RDF1
  Valid                                              : Yes
  CG in PowerPath                                    : No
  CG in GNS                                          : No
  RDF Consistency Protection Allowed                 : Yes
  RDF Consistency Mode                               : MSC
  Concurrent RDF                                     : No
  Cascaded RDF                                       : No

  Number of RDF (RA) Groups                          :    2
  Number of STD Devices                              :    9
  Number of CRDF STD Devices                         :    0
  Number of BCV's (Locally-associated)               :    0
  Number of VDEV's (Locally-associated)              :    0
  Number of TGT's Locally-associated                 :    0
  Number of CRDF TGT Devices                         :    0
  Number of RVDEV's (Remotely-associated VDEV)       :    0
```

```
Number of RBCV's (Remotely-associated STD-RDF)      :    0
Number of BRBCV's (Remotely-associated BCV-RDF)     :    0
Number of RRBCV's (Remotely-associated RBCV)        :    0
Number of RTGT's (Remotely-associated)              :    0
Number of Hop2 BCV's (Remotely-assoc'ed Hop2 BCV)   :    0
Number of Hop2 VDEV's (Remotely-assoc'ed Hop2 VDEV) :    0
Number of Hop2 TGT's (Remotely-assoc'ed Hop2 TGT)   :    0
Number of Device Groups                             :    0
Device Group Names                                  : N/A

Number of Symmetrix Units (1):
  {

  1) Symmetrix ID                                   : 000196800573
     Microcode Version                              : 5977
     Number of STD Devices                          :    9
     Number of CRDF STD Devices                     :    0
     Number of BCV's (Locally-associated)           :    0
     Number of VDEV's (Locally-associated)          :    0
     Number of TGT's Locally-associated             :    0
     Number of CRDF TGT Devices                     :    0
     Number of RVDEV's (Remotely-associated VDEV)   :    0
     Number of RBCV's (Remotely-associated STD_RDF) :    0
     Number of BRBCV's (Remotely-associated BCV-RDF):    0
     Number of RTGT's (Remotely-associated)         :    0
     Number of RRBCV's (Remotely-associated RBCV)   :    0
     Number of Hop2BCV's (Remotely-assoc'ed Hop2BCV):    0
     Number of Hop2VDEVs(Remotely-assoc'ed Hop2VDEV):    0
     Number of Hop2TGT's (Remotely-assoc'ed Hop2TGT):    0

     Number of RDF (RA) Groups (2):
       {

       1) RDF (RA) Group Number    : 140 (8B)
          Remote Symmetrix ID      : 000196800508
          Microcode Version        : 5977
          Recovery RA Group        : N/A            (N/A)
          RA Group Name            : N/A

          STD Devices (1):
            {
            -------------------------------------------------------------------
                                        Sym   Device            Flags     Cap
            LdevName    PdevName        Dev   Config       Sts   CSRT     (MB)
            -------------------------------------------------------------------
            DEV002      N/A             0243D RDF1+TDEV     RW    XAM1    40961
            }

       2) RDF (RA) Group Number    :  68 (43)
          Remote Symmetrix ID      : 000196800508
          Microcode Version        : 5977
          Recovery RA Group        : N/A            (N/A)
          RA Group Name            : N/A

          STD Devices (8):
```

```
            {
            -------------------------------------------------------------------
                                            Sym   Device            Flags     Cap
            LdevName     PdevName           Dev   Config        Sts  CSRT     (MB)
            -------------------------------------------------------------------
            DEV001       N/A                02425 RDF1+TDEV     RW    XAM1   102401
            DEV003       N/A                02421 RDF1+TDEV     RW    XAM1    51201
            DEV004       N/A                02422 RDF1+TDEV     RW    XAM1    51201
            DEV005       N/A                02423 RDF1+TDEV     RW    XAM1    51201
            DEV006       N/A                02424 RDF1+TDEV     RW    XAM1    51201
            DEV007       N/A                02426 RDF1+TDEV     RW    XAM1    10241
            DEV008       N/A                02427 RDF1+TDEV     RW    XAM1    10241
            DEV009       N/A                02420 RDF1+TDEV     RW    XAM1   102401
            }
        }
    }

Legend:
  RDFA Flags:
       C(onsistency)   : X = Enabled, . = Disabled, - = N/A
       (RDFA) S(tatus) : A = Active, I = Inactive, - = N/A
       R(DFA Mode)     : S = Single-session mode, M = MSC mode, - = N/A
       (Mirror) T(ype) : 1 = R1, 2 = R2, - = N/A


(0) root @ pbrazos001: /
# SYMCLI_CONNECT=SYMAPI_SITE_508 symcg show VMRDG_itso3_cluster_Site_BeiJing

Composite Group Name:  VMRDG_itso3_cluster_Site_BeiJing

  Composite Group Type                                : RDF2
  Valid                                               : Yes
  CG in PowerPath                                     : No
  CG in GNS                                           : No
  RDF Consistency Protection Allowed                  : Yes
  RDF Consistency Mode                                : NONE
  Concurrent RDF                                      : No
  Cascaded RDF                                        : No

  Number of RDF (RA) Groups                           :    2
  Number of STD Devices                               :    9
  Number of CRDF STD Devices                          :    0
  Number of BCV's (Locally-associated)                :    0
  Number of VDEV's (Locally-associated)               :    0
  Number of TGT's Locally-associated                  :    0
  Number of CRDF TGT Devices                          :    0
  Number of RVDEV's (Remotely-associated VDEV)        :    0
  Number of RBCV's (Remotely-associated STD-RDF)      :    0
  Number of BRBCV's (Remotely-associated BCV-RDF)     :    0
  Number of RRBCV's (Remotely-associated RBCV)        :    0
  Number of RTGT's (Remotely-associated)              :    0
  Number of Hop2 BCV's (Remotely-assoc'ed Hop2 BCV)   :    0
  Number of Hop2 VDEV's (Remotely-assoc'ed Hop2 VDEV) :    0
  Number of Hop2 TGT's (Remotely-assoc'ed Hop2 TGT)   :    0
  Number of Device Groups                             :    0
```

```
Device Group Names                              : N/A

Number of Symmetrix Units (1):
  {

  1) Symmetrix ID                               : 000196800508
     Microcode Version                          : 5977
     Number of STD Devices                      :    9
     Number of CRDF STD Devices                 :    0
     Number of BCV's (Locally-associated)       :    0
     Number of VDEV's (Locally-associated)      :    0
     Number of TGT's Locally-associated         :    0
     Number of CRDF TGT Devices                 :    0
     Number of RVDEV's (Remotely-associated VDEV)   :    0
     Number of RBCV's (Remotely-associated STD_RDF) :    0
     Number of BRBCV's (Remotely-associated BCV-RDF):    0
     Number of RTGT's (Remotely-associated)     :    0
     Number of RRBCV's (Remotely-associated RBCV)   :    0
     Number of Hop2BCV's (Remotely-assoc'ed Hop2BCV):    0
     Number of Hop2VDEVs(Remotely-assoc'ed Hop2VDEV):    0
     Number of Hop2TGT's (Remotely-assoc'ed Hop2TGT):    0

     Number of RDF (RA) Groups (2):
       {

       1) RDF (RA) Group Number    : 140 (8B)
          Remote Symmetrix ID      : 000196800573
          Microcode Version        : 5977
          Recovery RA Group        : N/A           (N/A)
          RA Group Name            : N/A

          STD Devices (1):
            {
            -------------------------------------------------------------------
                                        Sym   Device            Flags     Cap
            LdevName    PdevName        Dev   Config       Sts   CSRT     (MB)
            -------------------------------------------------------------------
            DEV002      N/A             03269 RDF2+TDEV    WD    XAM2    40961
            }

       2) RDF (RA) Group Number    :  68 (43)
          Remote Symmetrix ID      : 000196800573
          Microcode Version        : 5977
          Recovery RA Group        : N/A           (N/A)
          RA Group Name            : N/A

          STD Devices (8):
            {
            -------------------------------------------------------------------
                                        Sym   Device            Flags     Cap
            LdevName    PdevName        Dev   Config       Sts   CSRT     (MB)
            -------------------------------------------------------------------
            DEV001      N/A             03252 RDF2+TDEV    WD    XAM2   102401
            DEV003      N/A             03256 RDF2+TDEV    WD    XAM2    51201
            DEV004      N/A             03257 RDF2+TDEV    WD    XAM2    51201
```

```
              DEV005      N/A             03258 RDF2+TDEV     WD    XAM2    51201
              DEV006      N/A             03259 RDF2+TDEV     WD    XAM2    51201
              DEV007      N/A             0325B RDF2+TDEV     WD    XAM2    10241
              DEV008      N/A             0325C RDF2+TDEV     WD    XAM2    10241
              DEV009      N/A             03253 RDF2+TDEV     WD    XAM2   102401
              }
         }
     }

Legend:
  RDFA Flags:
       C(onsistency)   : X = Enabled, . = Disabled, - = N/A
       (RDFA) S(tatus) : A = Active, I = Inactive, - = N/A
       R(DFA Mode)     : S = Single-session mode, M = MSC mode, - = N/A
       (Mirror) T(ype) : 1 = R1, 2 = R2, - = N/A
```

Check that the volume pairs that you create for your VMs do not belong to any CG or DG before the KSYS node Discovery operation. The KSYS node creates the CG and adds the volumes to it.

To check whether your volume belongs to any DG or CG, run the command **symdev list -wwn -sid <Symmetrix_ID>** to obtain the WWN of the device, as shown in Example 3-69.

Example 3-69 Obtaining the WWN of the device

```
(0) root @ pbrazos001: /
# symdev list -wwn -sid 000196800508 | egrep "0324F|03250|03251|03254|03255"
0324F Not Visible           RDF1+TDEV         60000970000196800508533033323446
03250 Not Visible           RDF1+TDEV         60000970000196800508533033323530
03251 Not Visible           RDF1+TDEV         60000970000196800508533033323531
03254 Not Visible           RDF1+TDEV         60000970000196800508533033323534
03255 Not Visible           RDF1+TDEV         60000970000196800508533033323535
```

Run the command **symdev show -wwn <device_WWN>** to display the details of the volume. If the volume does not belong to any CG or DG, no CG or DG information is displayed in the output, as shown in Example 3-70.

Example 3-70 Show details of a volume that does not belong to any device or composite group

```
(1) root @ pbrazos001: /
# symdev show -wwn 60000970000196800508533033323446

    Device Physical Name     : Not Visible

    Device Symmetrix Name    : 0324F
    Device Serial ID         : N/A
    Symmetrix ID             : 000196800508

    Number of RAID Groups    : 0
    Encapsulated Device      : No
    Encapsulated WWN         : N/A
    Encapsulated Device Flags: None

    Encapsulated Array ID    : N/A
    Encapsulated Device Name : N/A
    Attached BCV Device      : N/A
```

```
    Attached VDEV TGT Device : N/A

    Vendor ID                : EMC
    Product ID               : SYMMETRIX
    Product Revision         : 5977
    Device WWN               : 60000970000196800508533033323446
    Device Emulation Type    : FBA
    Device Defined Label Type: N/A
    Device Defined Label     : N/A
    Device Sub System Id     : 0x0001
    Cache Partition Name     : N/A
    Bound Pool Name          : SRP_1

    Device Block Size        : 512

    Device Capacity
        {
        Cylinders            :      27307
        Tracks               :     409605
        512-byte Blocks      :  104858880
        MegaBytes            :      51201
        KiloBytes            :   52429440

        Geometry Limited     : No
        }
.
. <Several lines were omitted>
.
```

When you run a discover operation in your KSYS node, the CG is automatically created by the KSYS node, and the volume pairs of the managed VMs are included in it. Example 3-71 shows the details of a volume that already belongs to a CG.

Example 3-71 Details of a volume that already belongs to a composite group

```
(0) root @ pbrazos001: /
# symdev show -wwn 60000970000196800508533033323446

    Device Physical Name     : Not Visible

    Device Symmetrix Name    : 0324F
    Device Serial ID         : N/A
    Symmetrix ID             : 000196800508

    Composite Group Name     : VMRDG_itsocluster_Poughkeepsie
    CG Device Logical Name   : DEV004

    Number of RAID Groups    : 0
    Encapsulated Device      : No
    Encapsulated WWN         : N/A
    Encapsulated Device Flags: None

    Encapsulated Array ID    : N/A
    Encapsulated Device Name : N/A
    Attached BCV Device      : N/A
```

```
    Attached VDEV TGT Device : N/A

    Vendor ID                : EMC
    Product ID               : SYMMETRIX
    Product Revision         : 5977
    Device WWN               : 60000970000196800508533033323446
    Device Emulation Type    : FBA
    Device Defined Label Type: N/A
    Device Defined Label     : N/A
    Device Sub System Id     : 0x0001
    Cache Partition Name     : N/A
    Bound Pool Name          : SRP_1

    Device Block Size        : 512

    Device Capacity
        {
        Cylinders            :        27307
        Tracks               :       409605
        512-byte Blocks      :    104858880
        MegaBytes            :        51201
        KiloBytes            :     52429440

        Geometry Limited     : No
        }
.
. <Several lines were omitted>
.
```

In summary, check that your volume does not belong to any device or CG, as shown in Example 3-70 on page 113 before the KSYS node discover operation. After the discovery, your device belongs to a CG, as shown in Example 3-71 on page 114.

3.3.9 Additional storage operations

This section shows a few Dell EMC Storage administration commands that are useful while performing storage administration during the setup of the IBM Geographically Dispersed Resiliency for Power Systems environment. The objective is to help UNIX administrators that are not familiar with the Dell EMC command line or web interface to understand how to perform such actions in the storage. However, it is preferable to work with your Dell EMC Storage administrator to perform such operations in your environment.

How to relate an AIX physical volume to a Dell EMC LUN

It is useful to relate your AIX physical volume to the Dell EMC volume ID so that you can identify the volume in the Dell EMC Storage and perform the appropriate maintenance actions, especially during SRDF operations.

You can use the Dell EMC **inq** tool to find the SID of the storage, volume ID, and WWN of the disks. The **inq** tool can be downloaded from this website.

This website provides direct access to the latest AIX **inq** version at the time of writing.

Example 3-72 shows useful options for the **inq** tool.

Example 3-72 Example of the inq tool output

```
# /mnt/inq.aix64_51 -showvol -sid -sym_wwn
Inquiry utility, Version V7.3-1159 (Rev 1.0)      (SIL Version V7.2.1.0 (Edit
Level 1159)
Copyright (C) by EMC Corporation, all rights reserved.
For help type inq -h.

..

-----------------------------------------------------------------------
Symmetrix DeviceSymm Serial #  Device #  WWN
-----------------------------------------------------------------------
/dev/rhdisk0  000196800508   0324F     60000970000196800508533033323446
/dev/rhdisk1  000196800508   03250     60000970000196800508533033323530
```

Table 3-4 shows the explanation of the options that are used with this command.

Table 3-4 Explanation of some of the options that are available for the inq tool

Option	Explanation
-showvol	Shows the volume ID of the AIX PV in the Dell EMC Storage.
-sid	Shows the SID of the Dell EMC Storage providing volumes.
-sym_wwn	Shows the WWN of the volume in the Dell EMC Storage.

Tip: If your server uses the Dell EMC Power Path solution for multipathing purposes, you can also check the volume ID by running the **powermt display dev=all** or **powermt display dev=hdiskpowerX** commands:

```
# powermt display dev=hdiskpower0

Pseudo name=hdiskpower0
Symmetrix ID=000XXXXXXXXX
Logical device ID=00FC
state=alive; policy=SymmOpt; priority=0; queued-IOs=0
==============================================================================
---------------- Host --------------- - Stor - -- I/O Path - -- Stats ---
###  HW Path   I/O Paths  Interf. Mode   State   Q-IOs Errors
==============================================================================
     1  fscsi1 hdisk150   FA 7gA  active alive   0     0
     0  fscsi0 hdisk37    FA 10gA active alive   0     0
```

It is also useful to find the volumes of your VMs that are managed by the KSYS node. The KSYS node creates a Resource Class called IBM.VMR_DG (VM restart disk group) to store the configuration of the managed Disk Groups. From the KSYS point of view, the Disk Group is equivalent to the CG from the Dell EMC Storage. You can use the following command to list the details of the IBM.VMR_DG resource class:

```
# lsrsrc IBM.VMR_DG
```

Example 3-73 shows a cluster that is called itso4cluster with sites ITSO4_active and ITSO4_backup. The CGs VMRDG_itso4cluster_ITSO4_active and VMRDG_itso4cluster_ITSO4_backup are created in the Dell EMC Storages.

Example 3-73 Disk groups resource class in the KSYS node storing the composite group information

```
(0) root @ pvcnet2: /
# lsrsrc IBM.VMR_DG
Resource Persistent Attributes for IBM.VMR_DG
resource 1:
        Name             = "VMRDG_itso4cluster_ITSO4_backup"
        SiteID           = 2
        StorageIDs       = {"196800508"}
        HostUuidList     = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        VmGroupID        = 1
        MirrorGroup      = {["VMRDG_itso4cluster_ITSO4_backup",0,{""}]}
        ActivePeerDomain = "itso4cluster"
resource 2:
        Name             = "VMRDG_itso4cluster_ITSO4_active"
        SiteID           = 1
        StorageIDs       = {"196800573"}
        HostUuidList     = {"8405b4db-629d-3f8d-907e-201d1ffd8f13"}
        VmGroupID        = 1
        MirrorGroup      = {["VMRDG_itso4cluster_ITSO4_active",0,{""}]}
        ActivePeerDomain = "itso4cluster"
```

Another resource class, which is named IBM.VMR_DP (VM restart disk pair), is created to store the volume pairs information. You can use the following command to list its contents:

```
# lsrsrc IBM.VMR_DP
```

Example 3-74 shows the details of the volume pairs from the resource class IBM.VMR_DP. It shows the volume pairs that belong to the VMs that are managed by the KSYS node. You can see that each resource represents one volume pair. In the StorageID entry, it shows the SID of the storages of these volume pairs. The VolumeID shows the WWN of the volumes that are involved in this volume pair. The same order is displayed in the StorageID and the VolumeID entries (the VolumeID on the left belongs to the StorageID on the left, and the VolumeID on the right belongs to the StorageID on the right).

Example 3-74 Disk pair details from the resource class IBM.VMR_DP

```
(0) root @ pvcnet2: /
# lsrsrc IBM.VMR_DP
Resource Persistent Attributes for IBM.VMR_DP
resource 1:
        Name             = "196800573:60000970000196800573533031423834"
        HostGroupList    = {"8405b4db-629d-3f8d-907e-201d1ffd8f13"}
        VmGroupID        = 1
        StorageID        = {"196800573","196800508"}
        VolumeID         =
{"60000970000196800573533031423834","60000970000196800508533030313936"}
        ActivePeerDomain = "itso4cluster"
resource 2:
        Name             = "196800573:60000970000196800573533031433536"
        HostGroupList    = {"8405b4db-629d-3f8d-907e-201d1ffd8f13"}
        VmGroupID        = 1
        StorageID        = {"196800573","196800508"}
```

```
        VolumeID         =
{"600009700001968005735330314335336","60000970000196800508533030313938"}
        ActivePeerDomain = "itso4cluster"
.
. <Several lines were omitted>
.
```

With the StorageID and VolumeID, and the WWN of the disk, you can use the following Dell EMC command to find the VolumeID of the volume in the storage:

```
# symdev list -wwn -sid <Symmetrix_ID> | grep <Disk_WWN>
```

Then, run the following command to see the SRDF replication status for such volume:

```
# symrdf list | grep <VolumeID>
```

Example 3-75 shows the output of the previous commands for this environment.

Example 3-75 Output of symdev and symrdf commands to relate the volume pairs with disk pairs

```
# symdev list -wwn -sid 000196800573 | grep 60000970000196800573533031423834
01B84 Not Visible           RDF1+TDEV        60000970000196800573533031423834

# symdev list -wwn -sid 000196800508 | grep 60000970000196800508533030313936
00196 Not Visible           RDF2+TDEV        60000970000196800508533030313936

# SYMCLI_CONNECT=SYMAPI_SITE_508 symrdf list | grep 00196
00196 01B84   R2:143 WD WD RW  A..2.       0       0 WD  RW   Consistent

# SYMCLI_CONNECT=SYMAPI_SITE_573 symrdf list | grep 01B84
01B84 00196   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
```

How to remove a SRDF/A volume pair from a composite group

If you must unmanage a previously managed VM from the IBM Geographically Dispersed Resiliency for Power Systems solution, you also must remove the volume pair of that VM from the CG and RDF group.

If the VM is unmanaged, but the volumes are left in the RDF group, the KSYS discover and verify operations fail and produce a message about a volume count mismatch because the RDF group has more volumes than the sum of the managed VMs volumes.

You can dynamically remove a volume pair from a CG without disturbing the replication of the remaining volume pairs (from other VMs, which continue to be managed). This section shows an example of removing one volume pair that belongs to a VM that is called pbrazos15_RedHat that you want to unmanage from the IBM Geographically Dispersed Resiliency for Power Systems environment.

Complete the following steps:

1. The IBM Geographically Dispersed Resiliency for Power Systems environment has three managed VMs: pbrazos016_PHA1, pbrazos017_PHA2 and pbrazos015_RedHat. There are eight LUNs that belong to the three VMs, all included in RDF group number 143. The VM pbrazos015_RedHat has only one volume pair, 03269 0243D, as shown in Example 3-76.

Example 3-76 Volumes that belong to RDF group 143

```
# symrdf list|egrep "\:143"
0018F 0075C   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00192 0174E   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00194 01751   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00196 01B84   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00198 01C56   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
03269 0243D   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
0326E 02442   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
0326F 02443   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
```

The RDF group and its volumes belong to the CG VMRDG_itso4_cluster_ITSO4_NewYork, as shown in Example 3-77.

Example 3-77 Composite group information for volume 03269

```
# symrdf -cg  VMRDG_itso4_cluster_ITSO4_NewYork  query

Composite Group Name      :  VMRDG_itso4_cluster_ITSO4_NewYork
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  NONE

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        : 143 (8E)

         Source (R1) View              Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                 LI       ST
Standard        A                  N        A
Logical  Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   0326F RW       0       0 RW 02443 WD       0       0 A... Consistent
DEV002   0018F RW       0       0 RW 0075C WD       0       0 A... Consistent
DEV003   00192 RW       0       0 RW 0174E WD       0       0 A... Consistent
DEV004   00194 RW       0       0 RW 01751 WD       0       0 A... Consistent
DEV005   0326E RW       0       0 RW 02442 WD       0       0 A... Consistent
DEV006   00196 RW       0       0 RW 01B84 WD       0       0 A... Consistent
DEV007   00198 RW       0       0 RW 01C56 WD       0       0 A... Consistent
DEV008   03269 RW       0       0 RW 0243D WD       0       0 A... Consistent
```

2. Considering that the goal is to unmanage the VM pbrazos0015_RedHat, first disable the consistency of the CG and then delete the CG from both sites, as shown in Example 3-78.

Example 3-78 Disable the consistency and deleting the composite groups

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508

# /usr/symcli/bin/symcg -cg  VMRDG_itso4_cluster_ITSO4_NewYork -noprompt
disable -force
A consistency 'Disable' operation execution is
in progress for composite group 'VMRDG_itso4_cluster_ITSO4_NewYork'. Please
wait...
The consistency 'Disable' operation successfully executed for
composite group 'VMRDG_itso4_cluster_ITSO4_NewYork'.

# symcg delete  VMRDG_itso4_cluster_Site_NewYork -force

# export SYMCLI_CONNECT=SYMAPI_SITE_573
# symcg delete  VMRDG_itso4_cluster_Site_Austin -force
```

3. Suspend the SRDF replication from the volume pair of the pbrazos15_RedHat VM only, as shown in Example 3-79.

Example 3-79 Suspend the SRDF replication of a single volume pair

```
#cat /tmp/redhat.srdf
03269 0243D

# symrdf suspend -file /tmp/redhat.srdf -sid 000196800508 -rdfg 143
-cons_exempt

# symrdf list|egrep "\:143"
0018F 0075C   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00192 0174E   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00194 01751   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00196 01B84   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00198 01C56   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
03269 0243D   R1:143 RW RW NR  A..1X      0    3205 RW  WD   Suspended
0326E 02442   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
0326F 02443   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
```

4. Delete the volume pair that belongs to pbrazos015_RedHat, as shown in Example 3-80.

Example 3-80 Delete a single SRDF volume pair

```
# symrdf -sid 000196800508 -file /tmp/redhat.srdf deletepair -nop -force -rdfg
143

# symrdf list|egrep "\:143|:\146|:\147|:\140"
0018F 0075C   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00192 0174E   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00194 01751   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00196 01B84   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
00198 01C56   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
0326E 02442   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
0326F 02443   R1:143 RW RW RW  A..1.      0       0 RW  WD   Consistent
```

5. Now, in the KSYS node, perform an unmanage operation, followed by a new discover and verify operation, as shown in Example 3-81.

Example 3-81 Unmanage the virtual machine

```
# ksysmgr unmanage vm uuid=5BA0080B-0DC2-417A-9D21-70B489462676
VM 5BA0080B-0DC2-417A-9D21-70B489462676 was successfully unmanaged
# ksysmgr q vm state=manage|more
Managed VMs:
        pbrazos016_PHA1
        pbrazos017_PHA2
```

6. During the discover and verify operations, the CGs are re-created by the KSYS node, and these groups now have only seven volumes, as shown in Example 3-82.

Example 3-82 Composite group re-created by the KSYS node during the discover operation

```
# symrdf -cg  VMRDG_itso4_cluster_ITSO4_NewYork  query

Composite Group Name      :  VMRDG_itso4_cluster_ITSO4_NewYork
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  MSC

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        : 143 (8E)

         Source (R1) View               Target (R2) View     MODE
-------------------------------    ------------------------ ---- ------------
               ST                 LI       ST
Standard        A                  N        A
Logical  Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv      RDF Pair
Device   Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks MACE STATE
------------------------------- -- ------------------------ ---- ------------
DEV001   0326F RW       0       0 RW 02443 WD       0       0 A.X. Consistent
DEV002   0018F RW       0       0 RW 0075C WD       0       0 A.X. Consistent
DEV003   00192 RW       0       0 RW 0174E WD       0       0 A.X. Consistent
DEV004   00194 RW       0       0 RW 01751 WD       0       0 A.X. Consistent
DEV005   0326E RW       0       0 RW 02442 WD       0       0 A.X. Consistent
DEV006   00196 RW       0       0 RW 01B84 WD       0       0 A.X. Consistent
DEV007   00198 RW       0       0 RW 01C56 WD       0       0 A.X. Consistent
```

How to delete the SRDF/A volume pairs and the CG

To delete the CGs and volume pairs from the Dell EMC Storage in an IBM Geographically Dispersed Resiliency for Power Systems environment, complete the following steps:

1. Using a text file that contains all the volume pairs that you want to delete, perform a disable operation, as shown in Example 3-83.

Example 3-83 Perform a disable operation on the volume pairs

```
(0) root @ pbrazos001: /
# cat /tmp/disk/all.luns
0324F 02414
03250 02415
```

```
03251 02416
03254 0241E
03255 0241F

(130) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# symcli -def

Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)

Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT              : SYMAPI_SITE_508
  SYMCLI_CONNECT_TYPE         : REMOTE

(0) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# symrdf -sid 000196800508 -file /tmp/disk/all.luns disable -nop -force -rdfg
67 -force

An RDF 'Disable' operation execution is in progress for device
file '/tmp/disk/all.luns'. Please wait...
The RDF 'Disable' operation successfully executed for device
file '/tmp/disk/all.luns'.
```

2. Perform a split operation against the SRDF volume pairs, as shown in Example 3-84.

Example 3-84 Perform a split operation

```
(0) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# symrdf -sid 000196800508 -file /tmp/disk/all.luns split -nop -force -rdfg 67
-force

An RDF 'Split' operation execution is in progress for device
file '/tmp/disk/all.luns'. Please wait...

Suspend RDF link(s) for device(s) in (0508,067)..................Started.
Suspend RDF link(s) for device(s) in (0508,067)..................Done.
Read/Write Enable device(s) in (0508,067) on RA at target (R2)...Done.
Suspend RDF link(s) for device(s) in (0508,067)..................Started.
Suspend RDF link(s) for device(s) in (0508,067)..................Done.

The RDF 'Split' operation successfully executed for device
file '/tmp/disk/all.luns'.
```

3. Delete the volume pairs, as shown in Example 3-85.

Example 3-85 Delete the volume pairs

```
(0) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# symrdf -sid 000196800508 -file /tmp/disk/all.luns deletepair -nop -force
-rdfg 67 -force

An RDF 'Delete Pair' operation execution is in progress for device
file '/tmp/disk/all.luns'. Please wait...

    Delete RDF Pair in (0508,067)..................................Started.
    Delete RDF Pair in (0508,067)..................................Done.
```

```
The RDF 'Delete Pair' operation successfully executed for device
file '/tmp/disk/all.luns'.
```

4. Finally, delete the CGs from both sites, as shown in Example 3-86.

Example 3-86 Deleting the composite groups

```
(0) root @ pbrazos001: /
# SYMCLI_CONNECT=SYMAPI_SITE_573 symcg delete VMRDG_itsocluster_Austin -force

(0) root @ pbrazos001: /
# SYMCLI_CONNECT=SYMAPI_SITE_508 symcg delete VMRDG_itsocluster_Poughkeepsie
-force
```

Tip for deleting a volume on Dell EMC VMAX Storage

When you delete a volume on Dell EMC VMAX Storage, you might receive the following error if case the volume is still being used:

```
Device is not in the correct state to be deleted. A free of all allocations is
required.
```

In this situation, you must unmap the volume from the storage ports by running the command that is shown in Example 3-87.

Example 3-87 Perform a free all operation on a volume

```
(1) root @ pbrazos001: /tmp
# symdev -sid 000196800573 -devs 0246F free -all

Execute a 'FreeAll Start' operation for devices in the specified set of ranges
(y/[n]) ? y

'FreeAll Start' operation succeeded for devices in set of ranges.
```

After the operation completes, delete the volume. Find the volume with its masking view, right-click the volume that you want to delete. and click **Remove Volume**, as shown in Figure 3-51.

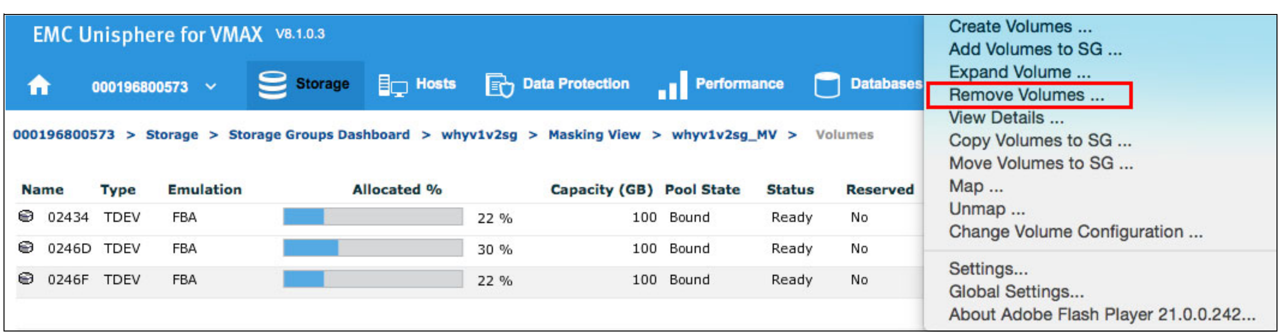


Figure 3-51 Delete a volume from the Dell EMC VMAX Storage

How to include a new volume pair on an existing RDF group

As explained in "Configuring the SRDF/A replication of the volumes" on page 82, the RDF group configuration must be carefully planned because it is not possible to add a volume pair to an existing RDF group dynamically. To perform such an operation, complete the following steps:

1. Create a text file with the current volume pairs from the RDF group to use as command input.
2. Disable the existing volume pairs by using the text file as input for the following command:

```
# symrdf -sid <sid> -file <inputfile> disable -nop -force -rdfg <rdfgnum>
-force
```

3. Split the existing volume pairs by using the text file as input for the following command:

```
# symrdf -sid <sid> -file <inputfile> split -nop -force -rdfg <rdfgnum> -force
-symforce
```

4. Delete the existing volume pairs by using the text file as input for the following command:

```
# symrdf -sid <sid> -file <inputfile> deletepair -nop -force -rdfg <rdfgnum>
-force
```

5. Include the new volume pairs in the text file that is used as input.
6. Re-create the volume pairs by using the updated text file by running the following command:

```
# symrdf -file <inputfile> createpair -type R1 -sid <sid> -rdfg <rdfgnum>
-establish -rdf_mode async -nop -force
```

For a detailed example of how to perform these steps, see "Including a volume pair in an existing RDF group (disruptive)" on page 95.

Important: You can use the alternative method of creating a temporary RDF group with the new volume pair, and then move the new volume pair to the existing RDF Group. For more information about this alternative method, see "Including a volume pair in an existing RDF group (dynamic)" on page 98.

How to create volume pairs and include them in a new RDF group

If you do not want to disturb the existing volume pairs in an RDF group, consider creating a new RDF Group to accommodate your new volume pairs. The KSYS node can add all RDF groups of the managed VMs to a single CG and manage them. To create an RDF group and volume pairs, complete the following steps:

1. Create the RDF group by running the following command:

```
# symrdf addgrp -label <rdfg_label> -rdfg <rdfgnum> -sid <symid> -dir
<storage_port> -remote_rdfg <remote_rdfgnum> -remote_sid <remote_symid>
-remote_dir <remote_storage_port>
```

2. Create a text file with the volume pairs that you want to add.
3. Create the volume pairs by running the following command:

```
symrdf -file <input_file> createpair -type R1 -sid <sym_id> -rdfg <rdfgnum>
-establish -rdf_mode async -nop -force
```

For detailed examples about how to perform this operation, see "Creating the RDF group by using SYMCLI" on page 86 and "Creating the SRDF volume pair by using SYMCLI" on page 92.

Dell EMC SRDF status and operations

During the IBM Geographically Dispersed Resiliency for Power Systems move operations, when you are moving your VMs between sites, the KSYS node controls the SRDF replication by using the storage agents to perform actions at the CG level. These actions are required, for example, to reverse the replication direction so that the VMs can start in the backup site and replicate the data from backup to home sites to keep the storage at the home site consistent so that you can move the VMs back to it.

This section explains some of the CG statuses and some of the actions that are performed by the KSYS node during such move operations. It also explains some of the actions that might need to be manually performed after unplanned moves:

- Planned move: An operation that is initiated by the administrator even when there is no disaster event in progress. In a planned move situation, the KSYS node moves the VMs from the home site to the backup site and after moving them, the replication is reestablished in a reverse direction (the previous source storage becomes the new target storage and the previous target storage becomes the new source storage). The disks are left in a consistent state.
- Unplanned move: An operation that is initiated by the administrator when a disaster occurs. In this situation the previously active site cannot be reached. In this situation, the KSYS node will write-enable the volumes in the storage on the target (or backup) site and the VMs are started on the backup site. In this situation, the volumes might not be left in a consistent state.

In an unplanned move situation, some actions must be manually performed by the administrator to reestablish the replication when the previous home site is back online.

Table 3-5 shows some of the possible states of the CG in an SRDF replication.

Table 3-5 Composite group states

Composite group state	Description
SyncinProg	Data is still being synchronized between the source and target storages.
Synchronized	Data between the source and target storages is fully synchronized. There is no I/O pending in the source site.
Split	No I/O happens between the source and target storages. The volume pairs are write-enabled in both the source and target storages in this situation so that both can receive I/Os and no data is replicated between them.
Failed over	In this situation, the source volume is still considered a source (R1), and the target volume is still considered a target (R2), but the source is write-disabled and the target is write-enabled.
R1 updated	There are no invalid tracks and the replication is enabled at the link.
R1 UpdinProg	There are some invalid tracks that are data that is copied from R2 to R1. In this situation, the R1 is still obtaining updates from the R2.
Suspended	Similar to split. In this state, there is no replication between volumes. There might be pending data to be transferred between volumes, which are transferred after the replication resumes.
Partitioned	There is no communication between both storages. This situation happens when the replication link between storages is broken. In this situation, both volumes are write-enabled.

Composite group state	Description
Invalid	A situation where the storage is presented a wrong behavior and the content of the volume is considered invalid.
Mixed	In this situation, the composite group has volumes in several different states, for example, some volumes are synchronized, other volumes are failed over, and other volumes are suspended.
Consistent	Similar to the synchronized state, but in this case it applies to asynchronous replication, which means that the data between the source and target volumes are consistently replicated.

During a planned move operation from the source or home site to the target or backup site, the following operations are performed on the target storage. These operations are automatically performed by the KSYS node through the storage agents.

1. CG_DisableConsistency: Disables the consistency of the CG.
2. CG_EnableAcpMode: Enables the adaptive disk mode, which allows the volumes to have more than one I/O out of sync. It is used to perform copies between R1 and R2 when there are many tracks pending to synchronize. The objective of this mode is to complete the synchronization of the data faster.
3. Wait4State synchronous: This operation waits for the sync state to be achieved, which means that afterward that there are no invalid tracks between the source and target.
4. CG_WriteDisable r1: Disables the write at R1 so that there are no more writes in the source site.
5. CG_Failover: Fails over the replication so that the target becomes write-enabled and the source becomes write-disabled.
6. CG_Swap: Swaps the personalities of the volume pairs. Before you run this command, the source site volumes are R1 and the target site volumes are R2. After you run this command, the source site volumes become R2 and the target site volumes become R1. The source becomes the target and the target becomes the source.
7. CG_Establish: Establishes the connection between the volumes to resume replication.
8. CG_AsyncMode: Enables asynchronous mode for the CG.
9. CG_EnableConsistency: Enables the consistency of the CG.
10. Wait4State cg_consistent: Waits for the CG to reach a consistent state.

When you move back to the home site in a *planned move*, you might find the CG in a failed state because R2 is write-enabled and R1 is write-disabled. In this case, the KSYS nodes perform the following steps at the Dell EMC Storages through the storage agents:

1. CG_DisableConsistency: Disables the consistency of the CG.
2. CG_EnableAcpMode: Enables the adaptive disk mode so that volumes can have more than one I/O out of sync. It is used to perform copies between R1 and R2 when there are many tracks pending to synchronize. The objective of this mode is to complete the synchronization of the data faster.
3. CG_WriteDisable r2: Disables the write at R2.
4. CG_Failback: Reverses the order, making R1 write-enabled and R2 write-disabled.
5. CG_AsyncMode: Enables the asynchronous mode for the CG.

6. CG_EnableConsistency: Enables the consistency of the CG.
7. Wait4State cg_consistent: Waits for the CG to reach a consistent state.

In an *unplanned move*, you cannot contact the storage from the source site because a disaster situation has occurred and the site is unreachable. In this situation, there is no replication in progress between source and target because the link between sites is broken or the source site is down. In this case, the KSYS node prioritizes enabling the write on R2, the target site, and starts the VMs at that site. In this situation, you do not wait for pending tracks to be replicated from the source to the target site, so there might be some invalid tracks. Ignore them and enable the write on R2 to move the VMs there.

The following actions are performed at the Dell EMC target storage by the KSYS node through the storage agent. The CG is in a Consistent state.

1. CG_DisableConsistency: Disables the consistency of the CG.
2. CG_WriteDisable r1: Disables the write at R1 so that there is no more write in the source site. You can try this operation, but do not wait for its answer because the source storage might be unreachable because it is an unplanned move.
3. CG_Failover: Fails over the replication so that the target becomes write-enable and the source becomes write-disable.
4. CG_EnableConsistency: Enables the consistency of the CG.

> **Note:** From the Dell EMC Storage perspective, the difference between a planned and unplanned move is that in the unplanned move, you are not waiting for any pending I/O to be completed between the source and the target sites.

There might also be a situation where the CG state is Failed Over and you need to do an *unplanned move* operation. In this situation, the KSYS node performs the following steps at Dell EMC Storage:

1. CG_DisableConsistency: Disables the consistency of the CG.
2. CG_WriteDisable R2: Disables the write at R2. You try to perform this operation, but because R2 is unreachable, you do not wait for the answer from this command.
3. CG_Failback: Reverses the order, making R1 write-enable and R2 write-disable.
4. CG_EnableConsistency: Enables the consistency of the CG.

Table 3-6 shows some of the Dell EMC Module Interfaces that are used by the KSYS node to manage Dell EMC Storage. They are shell script files that should not be modified.

Table 3-6 Dell EMC Module Interfaces

EMC module name	Description
get_emc_pair_disk	Fetches the replication disk detail.
get_emc_disk_group	Fetches details of the CG for a specific disk.
create_emc_group	Creates an EMC CG.
add_emc_disk_to_group	Adds a disk to an existing CG.
remove_emc_disk_to_group	Removes a disk from a CG.
remove_emc_group	Deletes a CG.
validate_emc_group	Validates a CG and check whether disks have a valid state, mode, and size compared to the target disks.

In a *planned move*, all the Dell EMC Storage operations are automatically performed by the KSYS node, but in an unplanned move, the storage from the failing site might not be reachable at the time of the move, so the volume pairs might be left in a partitioned or split state. When the problem is solved and the communication between sites is restored, you must complete some manual actions to reestablish storage replication before moving the VMs back to the home site. To accomplish this task, run the following Dell EMC commands :

1. Disable the consistency attribute of a CG:

```
# symcg -cg <Composite_Group_name> -noprompt disable -force
```

2. Check whether the consistency is enabled:

```
# symrdf -cg <Composite_Group_name> query
```

> **Tip:** Look for the column “`MACE`”. A value of `A...` means that the volume pair is asynchronous and consistency is disabled. A value of `A.X.` means that the volume pair is asynchronous and consistency is enabled.

3. Perform the Swap Personality operation (reversing the R1 and R2 volumes):

```
# symrdf -cg <Composite_Group_name> swap -noprompt
```

4. Perform an establish operation, which synchronizes the data between volume pairs (with the current volumes R1 and R2):

```
# symrdf -cg <Composite_Group_name> establish -noprompt
```

> **Important:** When you run the establish operation, the direction of the replication is from the current R1 to the current R2 volume. Before running the **`establish`** command, check that the R1 volumes are the ones currently in use (from the site where the VMs are currently operating). A mistake in this operation can cause unwanted results. If the establish operation is performed while the R1/R2 volume order is incorrect, you can end up replicating old data and overwriting the current data.

5. Enable the consistency attribute of a CG:

```
# symcg -cg <Composite_Group_name> -noprompt enable
```

Chapter 6, “Testing scenarios” on page 287 includes several scenarios where planned and unplanned move operations are performed. Sections 6.5, “Unplanned failure of all HMCs at active site” on page 320 and 6.7, “Unplanned broken SRDF link” on page 343 show examples of unplanned situations where these manual steps must be performed after solving the problem between sites and before moving the VMs back to the home site. Also, see 6.5.5, “Recovering the SRDF/A status” on page 328, which includes a detailed example of the manual actions being performed after the communication between sites is reestablished.

4

Installation and configuration for the IBM Geographically Dispersed Resilience deployment

This chapter explains how to set up an IBM Geographically Dispersed Resiliency for Power Systems environment, including how to download, install, and configure the controller system (KSYS) node. During the configuration steps, this chapter shows how to add sites, Hardware Management Consoles (HMCs), hosts, host pairs, and storage agents. Later, the chapter shows how to discover the resources, manage the virtual machines, and verify the environment. At last, a planned move is demonstrated to show how the IBM Geographically Dispersed Resiliency for Power Systems moves the virtual machines between sites.

The following topics are described in this chapter:

- IBM Geographically Dispersed Resiliency for Power Systems topology overview
- IBM Geographically Dispersed Resiliency for Power Systems deployment overview: Installation and configuration
- IBM Geographically Dispersed Resiliency for Power Systems test topology
- Obtaining IBM Geographically Dispersed Resiliency for Power Systems filesets
- Installing IBM Geographically Dispersed Resiliency for Power Systems
- Configuring IBM Geographically Dispersed Resiliency for Power Systems
- Moving virtual machines between sites
- Daily checks that are performed by the KSYS node
- Uninstalling IBM Geographically Dispersed Resiliency for Power Systems

4.1 IBM Geographically Dispersed Resiliency for Power Systems topology overview

The IBM Geographically Dispersed Resiliency for Power Systems consists of several components, which all together deliver a disaster recovery solution for your environment:

- KSYS node: The AIX logical partition where the KSYS file sets are installed. This node is the orchestrator of the disaster recovery solution, performing actions on other components of the solution to recover your virtual machines in a disaster situation.
- Sites: A logical definition of your sites or data centers that determines the home (where your workload is running) and the backup locations (where the VMs should be started if there is a disaster in the home site).
- Hosts: T Your managed systems, or Power Systems servers.
- Host pairs: A logical definition that determines which host from your backup site receives the workload from the host in the home site.
- Storage: Your storage subsystems that are involved in the solution, which provides disk replication for your virtual machine disks.[1]
- Storage controllers: The host that contains the software to manage the storage subsystem.
- Storage agents: A logical definition in the KSYS node (which might also involve the installation of the storage management software on the KSYS node) to allow it to communicate with the storage subsystems (through the storage controllers) to query and control the disk replication.
- Virtual I/O Servers (VIOS): The VIOS from your hosts in the home and backup sites.
- Hardware Management Console (HMC): The HMCs that manage your hosts at the home and backup sites.
- Virtual machines: The AIX or Linux virtual machines (or logical partitions) that the KSYS node manages.

[1] At the time this publication was written, only the Dell EMC VMAX Storages were supported (using SRDF/A replication).

Figure 4-1 shows an overview of the IBM Geographically Dispersed Resiliency for Power Systems components, demonstrating the IBM Geographically Dispersed Resiliency for Power Systems deployment model.

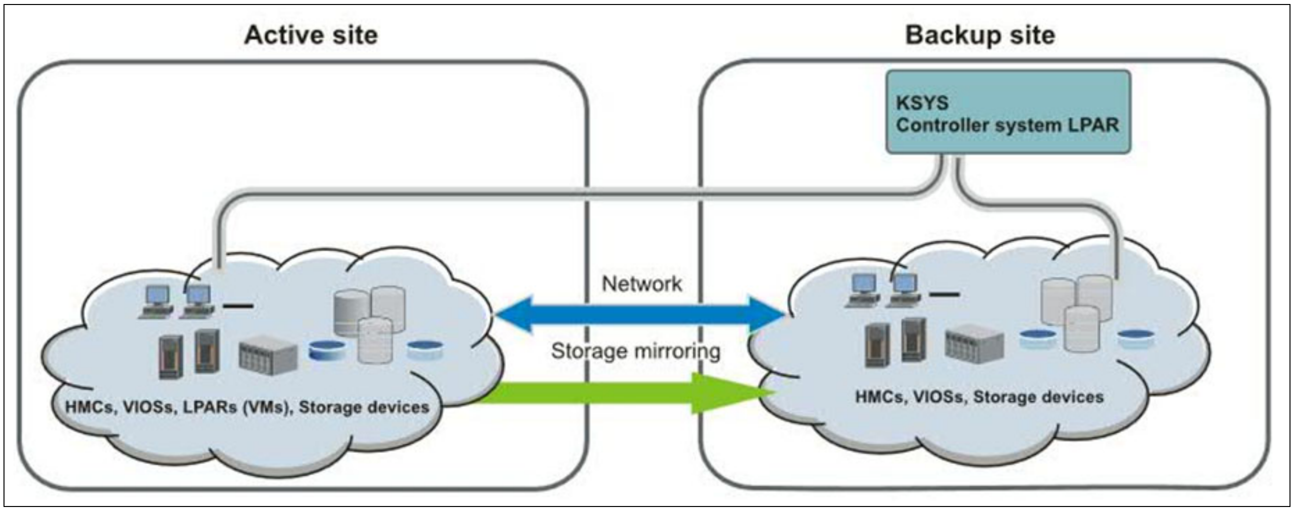


Figure 4-1 IBM Geographically Dispersed Resiliency for Power Systems deployment model

Figure 4-2 shows the components and how they interact in an IBM Geographically Dispersed Resiliency for Power Systems environment.

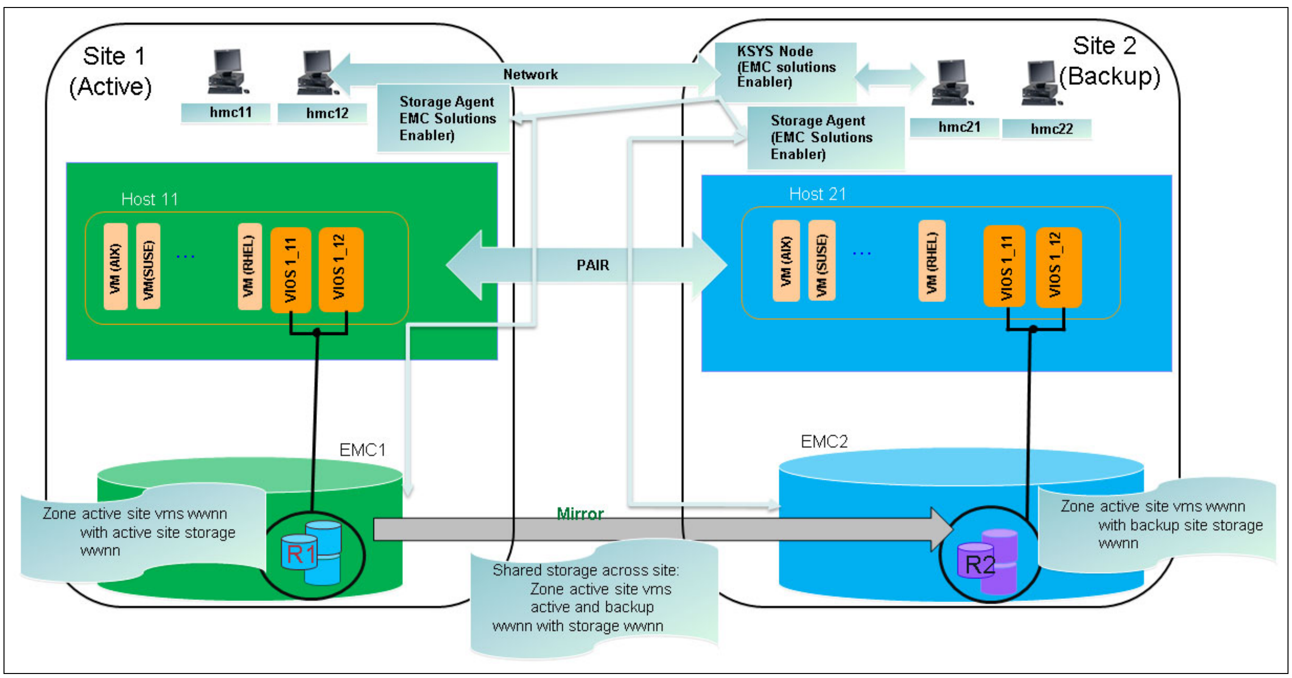


Figure 4-2 IBM Geographically Dispersed Resiliency for Power Systems environment components

The IBM Geographically Dispersed Resiliency for Power Systems solution provides the KSYS file sets, which are installed in the KSYS node (AIX 7.2 Technology Level 1 Service Pack 1 or later LPAR) to orchestrate, manage, and control the disaster recovery environment.

Important: Install the KSYS node at the backup site, so, if a problem with the home site occurs, the KSYS node is still operating to perform the move of the virtual machines over to the backup site. At the time this publication was written, there was no high availability for the KSYS node. IBM intends to deliver this high availability feature for the KSYS node in later software releases.

For a detailed description of the components that are involved in the IBM Geographically Dispersed Resiliency for Power Systems solution, see Chapter 1, “High availability and disaster recovery overview” on page 1.

Throughout this chapter, notice that the installation and configuration of the KSYS node is straightforward. Before starting the installation of the KSYS node file sets, the assumption is that the other components of the solution are installed and configured. This includes the HMCs, Virtual I/O Servers, virtual machines, and storage controllers. This chapter focuses on the KSYS node installation and configuration.

Important:

- Be sure that the *Dell EMC Solutions Enabler* software is properly working on the KSYS node logical partition before starting the KSYS configuration, so you can use it to add the *storage agents to the KSYS* configuration and start managing your storage subsystems. To complete this task, you must have properly set up at least one *storage controller* at each site (which is also the *Dell EMC Solutions Enabler*, but in this case by using in-band management through *gatekeeper* disks), so the Dell EMC Solutions Enabler software on the KSYS node can communicate with the storage controllers by using TCPIP to manage the Dell EMC Storages.
- Properly set up the Symmetrix Remote Data Facility (SRDF) replication of the virtual machines you plan to manage with the IBM Geographically Dispersed Resiliency for Power Systems solution. Chapter 3, “Storage and SAN setup for the IBM Geographically Dispersed Resilience environment” on page 25 covers all storage controller and SRDF replication configuration steps.

4.2 IBM Geographically Dispersed Resiliency for Power Systems deployment overview: Installation and configuration

Before starting the KSYS node installation and configuration, carefully plan your IBM Geographically Dispersed Resiliency for Power Systems solution. The planning includes choosing the managed system and the logical partition that will be the KSYS node. This is a critical part of the IBM Geographically Dispersed Resiliency for Power Systems solution and must be placed in a server that is not affected by any unavailability at your home site (where your critical virtual machines are running), so the KSYS node is still operational in a disaster situation, and allows you to use it to move the virtual machines over to the backup site.

For more information about planning the IBM Geographically Dispersed Resiliency for Power Systems solution, see Chapter 2, “Planning for IBM Geographically Dispersed Resiliency” on page 19.

This section provides an overview of the steps that are involved in the installation and configuration of the KSYS node to deploy the IBM Geographically Dispersed Resiliency for Power Systems solution.

4.2.1 IBM Geographically Dispersed Resiliency for Power Systems deployment high-level steps flowchart

After detailed planning of the IBM Geographically Dispersed Resiliency for Power Systems solution deployment, you can start integrating it with your existing environment. Figure 4-3 shows a flow chart of high-level steps that are involved in the IBM Geographically Dispersed Resiliency for Power Systems solution deployment, including installation and configuration steps of the KSYS node.

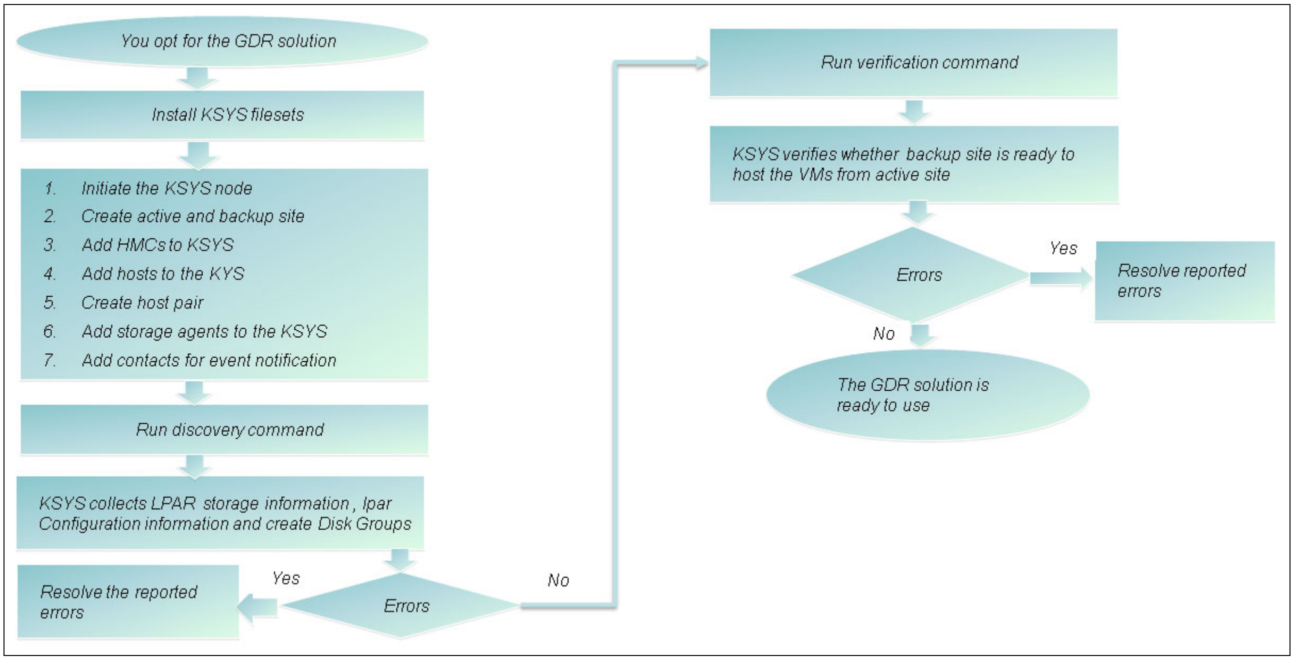


Figure 4-3 IBM Geographically Dispersed Resiliency for Power Systems deployment high-level steps flow chart

The next sections briefly describe each of these steps, which are detailed and demonstrated later in this chapter.

4.2.2 Installation

The KSYS node, or controlling system node, is the fundamental component of the IBM Geographically Dispersed Resiliency for Power Systems solution. Its installation is the first step of the IBM Geographically Dispersed Resiliency for Power Systems solution deployment (considering that the other components, including the storage controllers, HMCs, VIOS, and LPARs are already prepared in your environment).

The KSYS software runs in an AIX 7.2 Technology Level 01 Service Pack 01 or later (AIX 7200-01-01 or later) logical partition (LPAR). This node controls the entire environment for disaster recovery purposes and should be deployed in a safe server (suggested in the backup site), which will not be affected by any unavailability at your home site. In such a case, the KSYS node must be functional to initiate the move of your virtual machines, and to recover them in a disaster.

To manage the servers and data replication across both sites, the KSYS node must be connected to all HMCs and storage controllers from both sites. In the case of the HMCs, the KSYS node must be able to communicate by using TCP/IP with HMCs from both sites. In the case of the storage controllers, the KSYS node must be able to perform out-of-band management of the storage subsystems from both sites through the storage controllers, communicating with them using TCP/IP.

4.2.3 Configuration

After installing the KSYS file sets on the KSYS node, it must be properly configured by creating a one-node KSYS cluster[2] and configuring all the IBM Geographically Dispersed Resiliency for Power Systems entities or components by using the **ksysmgr** command, provided by the KSYS file sets. The following steps are performed at this phase of the configuration:

1. Create a one-node cluster for the KSYS node.
2. Create home and backup sites.
3. Add HMCs to the corresponding sites.
4. Add hosts (or managed systems or Power servers) to the corresponding sites.
5. Pair the hosts by determining which host from the backup site will serve as a backup for a specific host from the home site.
6. Add storage agents to the corresponding sites, which means providing to the KSYS node the mechanism to communicate with the storage controllers to query and control the storage replication.
7. Add contacts details for receiving alerts in case of an error notification.

Important: Ensure that the Resource Monitoring and Control (RMC) communication is working properly at the Virtual I/O Servers from both sites. The HMC needs to use RMC to obtain information from the virtual machines through the VIOS. If RMC is not working properly (dynamic LPAR also fails), you might see the following error message while trying to add the hosts to the KSYS configuration:

```
(0) root @ pbrazos001: /mnt/GDR_61ksys110
# ksysmgr add host pbrazos_9119-MME-21BBC47 site=Poughkeepsie
ERROR: Adding host pbrazos_9119-MME-21BBC47 had issues
       0000-169 Error - No VIOS with supported OS version found on this host .
```

Further analysis through RSCT traces reveals the following error message:

```
[20] 10/14/16 _VMR 14:42:33.343930DEBUG VMR_CEC.C[724]: VIOS RMC state is not
active, so cannot get the VIOS version info for VIOS
:2128DDCE-5C3D-4015-A630-B770BAC2CA7D
```

You can use the following commands to format and view the RSCT traces in the KSYS node that are relevant to the IBM Geographically Dispersed Resiliency for Power Systems solution:

```
# cd /var/ct/<clustername>/log/mc/IBM.VMR
# rpttr -o dct trace.* > tr.out
# vi tr.out
```

[2] A one-node KSYS cluster will create an RSCT domain, which will serve as a base for future releases to include high-availability for the KSYS node.

4.2.4 Discovery

After installing the KSYS file sets on the KSYS node and preparing the initial configuration steps (described in 4.2.3, “Configuration” on page 134), run a *Discovery* action in the KSYS node by using the **`ksysmgr discover site <sitename>`** command. This process discovers all components that are managed by the IBM Geographically Dispersed Resiliency for Power Systems solution at the home and backup sites.

At the *Discovery* phase, the KSYS node contacts the HMCs from both sites to discover the configuration details of the virtual machines (or LPARs) that are managed by the IBM Geographically Dispersed Resiliency for Power Systems solution. The node also uses the HMCs to contact the Virtual I/O Servers from both sites to obtain information about the disk and network mapping for such virtual machines.

The KSYS node also discovers the disks that are used by each managed virtual machine and contacts the storage controllers (by using the storage agents) to check whether they are properly configured for replication. During this phase, the KSYS node also validates that the volume pairs do not belong to any consistency group and creates one consistency group at each site, adding all the volume pairs to them, to properly manage the storage replication. For more information about consistency groups and how to properly set up the replication volume pairs for the virtual machines in an IBM Geographically Dispersed Resiliency for Power Systems environment, see Chapter 3, “Storage and SAN setup for the IBM Geographically Dispersed Resilience environment” on page 25. In case the virtual machines disks are not properly configured for replication, the discovery operation fails and you are notified about the volumes that are not mirrored. All disks from all managed virtual machines must be replicated. These disks can use N_Port ID Virtualization (NPIV) or virtual SCSI (VSCSI) or a combination of these modes.

Note: Only raw disk-backed VSCSI devices are supported. You cannot use LV-backed VSCSI devices because you would not be able to start your virtual machine at the backup site.

During the Discovery operation, KSYS uses the HMC to obtain information from the hosts, such as system processor, memory, hardware information, and WWPN of the Fibre Channel adapters. It also checks for VIOS capability for the disaster recovery operation and collects information about host, LPARs, VIOS states, and IP addresses involved.

Tip: As mentioned in 4.2.3, “Configuration” on page 134, ensure that RMC communication is working properly between HMCs and the Virtual I/O Servers because the HMC uses the RMC mechanism to obtain virtual machines information from the Virtual I/O Servers during the Discovery operation.

The information is stored in RSCT resource classes at the KSYS node disk, which serves as a database to store the KSYS configuration and information about its managed components. Status is displayed during the command execution, and it is also logged in to files under the `/var/ksys/log/` directory. The RSCT resource classes and its resources are created under the `/var/ct/<clustername>/registry/local_tree` location. Example 4-1 shows the RSCT resource class structure from a KSYS node.

Example 4-1 RSCT resource class structure

```
(0) root @ pbrazos001: /var/ct/itsocluster/registry/local_tree
# ls -l
total 600
-rw-r--r--  1 root  system   309 Nov 08 11:29 IBM,AgFileSystem,Class
```

```
-rw-r--r--  1 root  system  4959 Nov 08 11:30 IBM,AgFileSystem,Resources
-rw-r--r--  1 root  system   205 Nov 08 11:29 IBM,CommunicationGroup,Class
-rw-r--r--  1 root  system   930 Nov 08 11:29 IBM,CommunicationGroup,Resources
-rw-r--r--  1 root  system   470 Nov 08 11:29 IBM,Disk,Class
-rw-r--r--  1 root  system  1424 Nov 08 11:30 IBM,Disk,Resources
-rw-r--r--  1 root  system   385 Nov 08 11:29 IBM,FenceAgent,Class
-rw-r--r--  1 root  system   470 Nov 08 11:29 IBM,FenceAgent,Resources
-rw-r--r--  1 root  system   339 Nov 08 11:29 IBM,FenceGroup,Class
-rw-r--r--  1 root  system   414 Nov 08 11:29 IBM,FenceGroup,Resources
-rw-r--r--  1 root  system   140 Nov 08 11:29 IBM,HeartbeatInterface,Class
-rw-r--r--  1 root  system   497 Nov 08 11:29 IBM,HeartbeatInterface,Resources
-rw-r--r--  1 root  system   196 Nov 08 11:29 IBM,LogicalVolume,Class
-rw-r--r--  1 root  system  5522 Nov 08 11:30 IBM,LogicalVolume,Resources
-rw-r--r--  1 root  system   248 Nov 08 11:29 IBM,NetworkInterface,Class
-rw-r--r--  1 root  system  1467 Nov 08 11:29 IBM,NetworkInterface,Resources
-rw-r--r--  1 root  system   196 Nov 08 11:29 IBM,Partition,Class
-rw-r--r--  1 root  system  1064 Nov 08 11:29 IBM,Partition,Resources
-rw-r--r--  1 root  system  1665 Nov 08 11:29 IBM,PeerNode,Class
-rw-r--r--  1 root  system  1342 Nov 08 11:29 IBM,PeerNode,Resources
-rw-r--r--  1 root  system   751 Nov 08 11:29 IBM,RSCTParameters,Class
-rw-r--r--  1 root  system   629 Nov 08 11:29 IBM,TieBreaker,Class
-rw-r--r--  1 root  system  1177 Nov 08 11:29 IBM,TieBreaker,Resources
-rw-r--r--  1 root  system   497 Nov 08 11:29 IBM,VMR_CEC,Class
-rw-r--r--  1 root  system 10826 Nov 11 09:18 IBM,VMR_CEC,Resources
-rw-r--r--  1 root  system   399 Nov 08 11:29 IBM,VMR_DG,Class
-rw-r--r--  1 root  system 11772 Nov 11 00:13 IBM,VMR_DG,Resources
-rw-r--r--  1 root  system   399 Nov 08 11:29 IBM,VMR_DP,Class
-rw-r--r--  1 root  system  2323 Nov 08 12:33 IBM,VMR_DP,Resources
-rw-r--r--  1 root  system   247 Nov 08 11:29 IBM,VMR_HMC,Class
-rw-r--r--  1 root  system  8317 Nov 09 23:21 IBM,VMR_HMC,Resources
-rw-r--r--  1 root  system 10353 Nov 08 11:47 IBM,VMR_LPAR,Class
-rw-r--r--  1 root  system 84697 Nov 11 09:17 IBM,VMR_LPAR,Resources
-rw-r--r--  1 root  system   481 Nov 08 11:29 IBM,VMR_SA,Class
-rw-r--r--  1 root  system  8140 Nov 11 09:17 IBM,VMR_SA,Resources
-rw-r--r--  1 root  system  3168 Nov 08 11:31 IBM,VMR_SITE,Class
-rw-r--r--  1 root  system 14074 Nov 11 09:18 IBM,VMR_SITE,Resources
-rw-r--r--  1 root  system   399 Nov 08 11:29 IBM,VMR_VIOS,Class
-rw-r--r--  1 root  system  1425 Nov 08 11:48 IBM,VMR_VIOS,Resources
-rw-r--r--  1 root  system   303 Nov 08 11:29 IBM,VolumeGroup,Class
-rw-r--r--  1 root  system  1004 Nov 08 11:30 IBM,VolumeGroup,Resources
```

These files are binary and should not be opened with regular text editors. If, for some reason, you need to see the content of these files, use the **lsrsrc** command as Example 4-2 shows. The current IBM Geographically Dispersed Resiliency for Power Systems resource classes are displayed and then the content of the `IBM.VMR_HMC` resource class is shown. This contains the information for the KSYS node to contact the HMCs that were added to its configuration.

Example 4-2 RSCT resource classes that are used for storage configuration at the KSYS node

```
(0) root @ pbrazos001: /var/ct/itsocluster/registry/local_tree
# lsrsrc | grep VMR
"IBM.VMR_HMC"
"IBM.VMR_CEC"
"IBM.VMR_LPAR"
"IBM.VMR_VIOS"
"IBM.VMR_SITE"
```

```
"IBM.VMR_SA"
"IBM.VMR_DP"
"IBM.VMR_DG"

(0) root @ pbrazos001: /var/ct/itsocluster/registry/local_tree
# lsrsrc IBM.VMR_HMC
Resource Persistent Attributes for IBM.VMR_HMC
resource 1:
        Name                    = "vhmc4"
        SiteID                  = 2
        HmcIP                   = "9.3.18.37"
        UserName                = "hscroot"
        Password                = "{#####}A9D917 0F66C6B2C5C327ECFD7C676 A"
        CecList                 =
{["AUSTIN_host2","66ce9bad-bbdb-31f5-afb8-7e02a852d122"],["why2_9117-MMD-105E61P_3
2CPU256G","d02a74f4-b551-37b4-a9b8-034d416d0feb"],["why1_9179-MHD-10BF1CR_16CPU-1T
B","093a18ec-40be-3187-a094-b6b64204befc"],["doit4-8233-E8B-06DA5AR","9f5fd671-059
7-31b8-a950-f2d043c864f8"],["kumquat_9179-MHD-105E67P","c15e9b0c-c822-398a-b0a1-61
80872c8518"],["AUSTIN_host1","7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8"],["gsk1_8233-E
8B-1000ADP","346f184d-bace-36f5-97b5-3955c62a6929"],["bacon_8202-E4C-10F477R","fa6
47d48-a06f-3f08-9c16-94573cc1b66e"],["e10m4","caffee0a-4206-3ee7-bfc2-f9d2bd3e866f
"],["rar1m6","ae115482-3a50-32f3-935a-7ff9be433e33"],["HAM-9179-MHD-SN106DBEP","84
05b4db-629d-3f8d-907e-201d1ffd8f13"],["doit2-8233-E8B-06DA57R","651b7677-3478-3f2a
-bb71-034e76c25ee4"]}
        HmcRestApiTimeout       = 0
        MaxJobs                 = 0
        ViosPassThruApiTimeout  = 0
        SwXSDVersion            = "V8R8.6.0"
        clean_LPARS             = {}
        ActivePeerDomain        = "itsocluster"
        NodeNameList            = {}
resource 2:
        Name                    = "vhmc3"
        SiteID                  = 1
        HmcIP                   = "9.3.18.36"
        UserName                = "hscroot"
        Password                = "{#####}AB60F1BFFEDD805923B6F9BBEAFF42B8"
        CecList                 =
{["doit3-8233-E8B-06DA59R","b6966940-52f1-306b-9b2b-2d8447acc14f"],["RootBeer-8408
-E8D-SN21ED67T","895c36ce-a7d4-367e-80af-ec625f9cafa4"],["orange-9179-MHD-SN107895
P","67ff62ec-ecb5-3ad4-9b35-0a2c75bb7fe4"],["pbrazos_9119-MME-21BBC47","6ce366c5-f
05d-3a12-94f8-94a3fdfc1319"],["Cheese-9179-MHD-SN10788CP","d87b349c-efc1-3df7-9276
-23c29f5749c8"],["AUSTIN_host2","66ce9bad-bbdb-31f5-afb8-7e02a852d122"],["AUSTIN_h
ost1","7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8"],["rar1m5","b3880199-3b8b-3ade-b360-f
76146c2d7f3"],["sausage_8202-E4C-10F478R","29112b0d-c681-3123-bb05-e40d19d85602"]}
        HmcRestApiTimeout       = 0
        MaxJobs                 = 0
        ViosPassThruApiTimeout  = 0
        SwXSDVersion            = "V8R8.6.0"
        clean_LPARS             = {}
        ActivePeerDomain        = "itsocluster"
        NodeNameList            = {}
```

Tip: All RSCT resource classes in the IBM Geographically Dispersed Resiliency for Power Systems solution are named starting with `IBM.VMR` (which stands for *virtual machine restart*).

4.2.5 Verification

The verify task is initiated by the **`ksysmgr verify site <sitename>`** command. During this phase, the KSYS node contacts the HMCs to determine whether the backup site contains enough resources to host the virtual machines from the home site in a disaster situation. The node also contacts the storage controllers to determine whether the managed virtual machines disks are properly replicated.

4.2.6 Move

This task is initiated by the administrator whenever the administrator wants to properly move the virtual machines from the home site to the backup site. The move operation can be a planned or unplanned move.

In a planned move, the home site and all its resources and components are still available. The move can be initiated by the administrator to validate the IBM Geographically Dispersed Resiliency for Power Systems solution, or to move the virtual machines to the backup site during maintenance at the home site. In this situation, the following operations occur:

- Virtual machines are powered off at the home site.
- The KSYS node ensures that the disk replication is consistent and there are no pending tracks to be replicated from the home to the backup site.
- The storage replication is reversed, promoting the disks from the backup site to read/write and making them the new source of the replication.
- The virtual machines are created and initiated at the backup site.

To trigger a planned move, the following command is used:

```
ksysmgr move site from=<home_site_name> to=<backup_site_name> dr_type=planned
```

In an unplanned move, the home site might no longer be available, which represents a real disaster situation. Because the KSYS node should be at the backup site, it is still online and is able to initiate a move operation. In this situation, the KSYS node tries to power off the virtual machines at the home site, but does not wait for the result. If the site is not reachable, errors are ignored. Next, it tries to write-disable the disks from the home site, but the result of this command is also ignored. Then, a failover is performed at the replicated volume pairs and the volumes are promoted from the backup site to write-enable. Finally, the virtual machines are created and initiated at the backup site. To trigger an unplanned move, the administrator uses the following command:

```
ksysmgr move site from=<home_site_name> to=<backup_site_name> dr_type=unplanned
```

Important: The KSYS node never automatically initiates a move operation. In a failure, the administrator is notified and manually initiates the move operation to the backup site after evaluating the situation. This means that the KSYS node automates the move from home to backup site when initiated by the administrator, but does not take the decision of moving the virtual machines.

Note: The KSYS node does not communicate with the virtual machine (VM) directly. All operations are performed by way of the HMC. The KSYS does not automatically start any application within the VM. Only the VM is started automatically at the target or backup host after a move operation. If the applications are automatically started during the boot, the VM (for example, by using `/etc/inittab`), then the application is also started automatically after the VM is brought online.

4.2.7 Recovery

Recovery is an optional step that can be used if any failure occurs during the move operation of the VMs. Use the **`ksysmgr recover`** command to move the failed VMs to the backup site.

The recovery can be performed for a specific VM by using the **`ksysmgr recover vm`** command, so the KSYS node tries once more to move only that single VM to the backup site. Or the move can be performed for the entire site by using the **`ksysmgr recover site`** command, where the KSYS node tries to move all failed virtual machines to the backup site.

4.2.8 Cleanup

After completing the move, the virtual machines from the home site must be removed, or cleaned because they are now running at the backup site. If the move is planned, the KSYS node automatically removes the virtual machines and all their virtual devices from the host and Virtual I/O Servers in the home site. If the move is unplanned, you must manually run the cleanup operation at the KSYS node when the communication with the home site is restored. This cleanup operation can be performed by using the **`ksysmgr cleanup site`** or the **`ksysmgr cleanup vm`** commands, which start the cleanup operation in the KSYS node. In this case, if the virtual machines at the home site are still active, they are first powered off, and then the cleanup operations are performed, removing the virtual machines and their resources at the home site.

Note: In an unplanned move situation, you must manually reestablish the storage replication in the correct direction. This means that the virtual machines are running at the backup site and the order should be replicating from backup to home site. For more information about performing this action, see section 6.5.5, “Recovering the SRDF/A status” on page 328.

4.3 IBM Geographically Dispersed Resiliency for Power Systems test topology

The residency team created the environment that is shown in Figure 4-4 to demonstrate the installation and configuration of an IBM Geographically Dispersed Resiliency for Power Systems solution that is presented in this chapter.

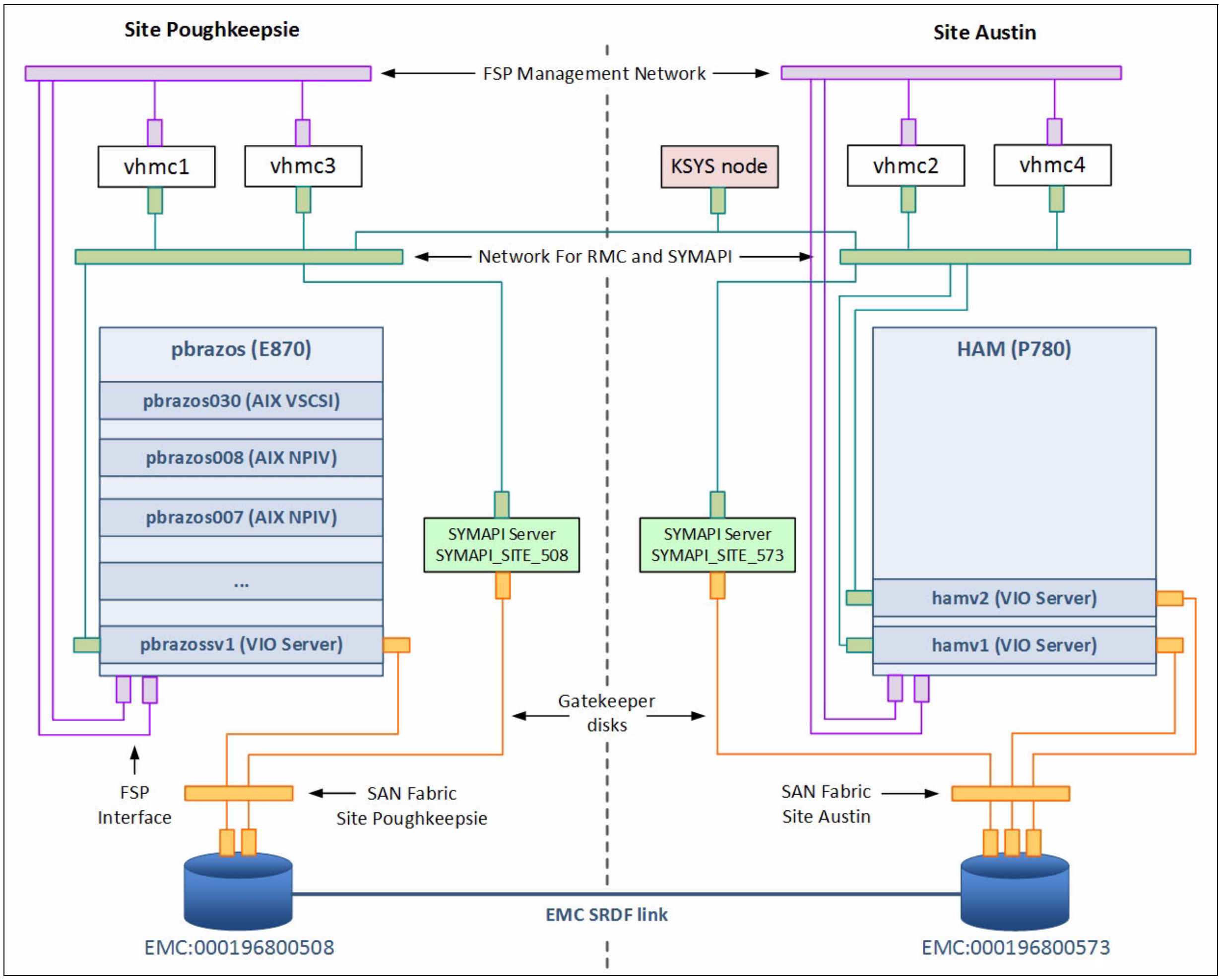


Figure 4-4 IBM Geographically Dispersed Resiliency for Power Systems environment setup for this publication

> **Note:** To parallelize the team activities, more than one IBM Geographically Dispersed Resiliency for Power Systems environment was created for this publication, but the scenarios are all similar to the one in Figure 4-4 because all use the same components, including the HMCs and storage. Other virtual machines running Linux operating systems were also tested during the residency.

In the scenario, two sites were created, Poughkeepsie (home) and Austin (backup). Each site has a Power System server with similar resources (CPU, memory, and I/O adapters). Site Poughkeepsie has a Power System server E870 (9119-MME), where the virtual machines run. Site Austin has a Power System server P780 (9179-MHD) with free resources available to receive the workload from the Poughkeepsie site in a disaster.

Note: The host from the backup site does not necessarily need to have the same amount of resources from the home site. Elastic Capacity On Demand (Elastic CoD, which was formerly known as On/Off CoD) or Power Enterprise Pools might be used to enable processor and memory resources at the backup site in case it needs to receive the workload from the home site.

Each site has two HMCs managing the host from its respective site. The HMCs are 7042 servers running HMC V8R8.6.0.0. The host `pbrazos`, from the Poughkeepsie site, runs a single Virtual I/O Server version 2.2.5.00; the host `HAM`, from the Austin site, runs dual Virtual I/O Servers version 2.2.5.00.

The virtual machines pbrazos007, pbrazos008, and pbrazos030 all run at the Poughkeepsie site using exclusively SAN-based disks (some using NPIV and others using VSCSI disks).

One Dell EMC VMAX3 100 K storage array is at each site, which provides disks for the virtual machines from the respective site. Each storage array is managed by a storage controller, which is a host with Dell EMC Solutions Enabler software managing the storage using gatekeeper disks.

The KSYS node is based at the Austin site (in this case, it is a logical partition at a third host, different from pbrazos and HAM) and it is able to communicate with the storage controllers and HMCs from both sites.

Note: The KSYS node can be placed in a host that is not managed by the IBM Geographically Dispersed Resiliency for Power Systems solution or in one of the hosts that are used in the IBM Geographically Dispersed Resiliency for Power Systems solution. Having the KSYS node at a Frame in the backup site is only suggested so it is still working in case of failure at the home site.

All the storage configuration was previously prepared and replication is made from the Dell EMC storage at site Poughkeepsie to the Dell EMC Storage at site Austin using SRDF in Asynchronous Mode (SRDF/A). First, to be set up was the storage controllers from each site, and then the Dell EMC Solutions Enabler as a client at the KSYS node, the SRDF/A replication for the virtual machines disks. Then, the KSYS file sets were installed and configured. The storage setup is described in Chapter 3, “Storage and SAN setup for the IBM Geographically Dispersed Resilience environment” on page 25.

Table 4-1 summarizes the components that are involved in this scenario.

Table 4-1 Components that are deployed in the IBM Geographically Dispersed Resiliency environment for this residency

Component	Description
Site Poughkeepsie	Logical site definition in the KSYS node that is used to define the components of the Poughkeepsie site (home site).
Site Austin	Logical site definition in the KSYS node that is used to define the components of the Austin site (backup site).
vHMC1	Hardware Management Console M/T 7042-CR7 with HMC V8R8.6.0.0.
vHMC2	Hardware Management Console M/T 7042-CR7 with HMC V8R8.6.0.0.
vHMC3	Hardware Management Console M/T 7042-CR8 with HMC V8R8.6.0.0.
vHMC4	Hardware Management Console M/T 7042-CR8 with HMC V8R8.6.0.0.

Component	Description
host pbrazos	An IBM Power System E870 Server (9119-MME).
host HAM	An IBM Power System 780 Server (9179-MHD).
pbrazosv1	A Virtual I/O Server version 2.2.5.00 running at the pbrazos host.
hamv1	A Virtual I/O Server version 2.2.5.00 running at the HAM host.
hamv2	A Virtual I/O Server version 2.2.5.00 running at the HAM host.
pbrazos007	An AIX 7100-04-02-1614 virtual machine running at the pbrazos host using NPIV SAN-based disks. This virtual machine is managed by the KSYS node in the IBM Geographically Dispersed Resiliency for Power Systems solution.
pbrazos008	An AIX 7100-04-02-1614 virtual machine running at the pbrazos host using NPIV SAN-based disks. This virtual machine is managed by the KSYS node in the IBM Geographically Dispersed Resiliency for Power Systems solution.
pbrazos030	An AIX 7100-04-02-1614 virtual machine running at the pbrazos host using VSCSI SAN-based disks. This virtual machine is managed by the KSYS node in the IBM Geographically Dispersed Resiliency for Power Systems solution.
SYMAPI_SITE_508	An AIX 7200-00-02-1614 LPAR with Dell EMC Solutions Enabler 8.1.0.0 managing the Dell EMC VMAX 0001968000508 storage through gatekeeper disks (in-band management) and acting as a Storage Controller to the IBM Geographically Dispersed Resiliency for Power Systems environment.
SYMAPI_SITE_573	An AIX 7200-00-02-1614 LPAR with Dell EMC Solutions Enabler 8.1.0.0 managing the Dell EMC VMAX 0001968000573 storage through gatekeeper disks (in-band management) and acting as a Storage Controller to the IBM Geographically Dispersed Resiliency for Power Systems environment.
KSYS node	An AIX 7100-01-01 LPAR with Dell EMC Solutions Enabler 8.1.0.0 using out-of-band management to manage both Dell EMC VMAX storages through the storage controllers SYMAPI_SITE_508 and SYMAPI_SITE_573 (through TCP/IP communication), it also has the KSYS file sets version 1.1.0.0.
SAN Fabric Poughkeepsie	A SAN Fabric that is made of 11 IBM/Brocade switches at Poughkeepsie site.
SAN Fabric Austin	A SAN Fabric that is made of 11 IBM/Brocade switches at Austin site.
Dell EMC 0001968000508	A Dell EMC VMAX 3 VMAX 100 K Storage at the Poughkeepsie site (with Symmetrix ID 0001968000508).
Dell EMC 0001968000573	A Dell EMC VMAX 3 VMAX 100 K Storage at the Austin site (with Symmetrix ID 0001968000573).
Dell EMC SRDF Link	A segregated link through a dedicated Fabric to provide SRDF communication between Storages.

Consider this environment as being used only for describing the installation and configuration steps for deploying an IBM Geographically Dispersed Resiliency for Power Systems solution. Your environment can have different components, which all can use the same deployment, installation, and configuration methods demonstrated in this chapter. For information about the supported components in an IBM Geographically Dispersed Resiliency for Power Systems solution, see Chapter 2, “Planning for IBM Geographically Dispersed Resiliency” on page 19.

4.4 Obtaining IBM Geographically Dispersed Resiliency for Power Systems filesets

The IBM Geographically Dispersed Resiliency for Power Systems software was introduced in November 2016. Downloading the IBM Geographically Dispersed Resiliency for Power Systems software basically means downloading the KSYS file sets. You can obtain the KSYS file sets at the IBM Entitled Systems Support web page.

IBM Geographically Dispersed Resiliency for Power Systems is licensed software, so you must be entitled to download it from the IBM web page.

> **IBM Customer Number (ICN):** You must link your IBMid with your IBM customer number before downloading any entitled software from the Entitled Systems Support web page. For information about how to perform the link, see the Announcement web page.

After being entitled, you can download the software by following these steps:

1. Log in with your IBMid.
2. Select **Software Downloads**.
3. Select the **Power (AIX)** brand.
4. Select your **IBM Customer Number** (ICN).
5. Locate the IBM Geographically Dispersed Resiliency for Power Systems software and download it.

If you have questions about the download process, or if you need help obtaining the installation files, contact your IBM sales representative to purchase the IBM Geographically Dispersed Resiliency software.

4.5 Installing IBM Geographically Dispersed Resiliency for Power Systems

After you complete planning your IBM Geographically Dispersed Resiliency for Power Systems environment, you can start the installation of the IBM Geographically Dispersed Resiliency for Power Systems software. The software basically contains the KSYS file sets that are installed on an `AIX 7.2 Technology Level 01 Service Pack 01` logical partition at the backup site and coordinates the disaster recovery of your environment. The IBM Geographically Dispersed Resiliency for Power Systems software uses other subsystems, which must have been previously prepared, before the installation of the KSYS file sets.

The IBM Geographically Dispersed Resiliency for Power Systems solution is enabled by the following subsystems:

- KSYS or controller system

  This is the `AIX 7.2 Technology Level 01 Service Pack 01` logical partition that has the KSYS file sets installed. The KSYS monitors and controls the disaster recovery of the IBM Geographically Dispersed Resiliency for Power Systems environment. Check that the KSYS software is installed in an LPAR running AIX 7200-01-01 or later.

- Hardware Management Console (HMC)

  The HMCs manage the IBM Power Systems at both the home and backup sites. You can have redundant HMCs added to the IBM Geographically Dispersed Resiliency for Power Systems solution, so if an HMC fails, the KSYS node is still able to contact the backup HMC to perform its operations. The KSYS node must be able to communicate with the HMCs at both the home and backup sites using TCP/IP communication.

- Virtual I/O Server (VIOS) partitions

  The Virtual I/O Servers at the hosts from both sites are used to virtualize and manage network and storage for the virtual machines. You can either have single or dual Virtual I/O Servers per host, although having dual Virtual I/O Servers at both sites is suggested. However, if the backup site has only a single VIOS, the KSYS node is still able to perform the move of the virtual machines between sites by using the `lose_vios_redundancy` option. For more information about this option, see Chapter 6, “Testing scenarios” on page 287).

- Storage subsystems (arrays) and storage controllers

  The storage subsystems at both home and backup sites that provide disks for the virtual machines and the servers at both sites. The storage software that is installed is able to perform operations at the storage subsystem (depending on the storage solution that is used in your environment, the storage controller software can be in a virtualized host or embedded inside the storage subsystem). For more information about the Storage Setup in the IBM Geographically Dispersed Resiliency for Power Systems solution, see Chapter 3, “Storage and SAN setup for the IBM Geographically Dispersed Resilience environment” on page 25.

The KSYS software can be installed on any LPAR that meets the requirement, but the preference is to use an LPAR that is dedicated exclusively for the KSYS function. This LPAR should be placed at the backup site using resources that should not be affected by any outage at the home site. Therefore, the KSYS node remains functioning even after a failure at the home site and is able to notify you during of the failure situation, and you can use the node to move the VMs to the backup site.

4.5.1 Hardware and software requirements

This section briefly covers the hardware and software requirements while implementing the IBM Geographically Dispersed Resiliency for Power Systems solution. For requirements and considerations about planning that must be made before the IBM Geographically Dispersed Resiliency for Power Systems environment deployment, see Chapter 2, “Planning for IBM Geographically Dispersed Resiliency” on page 19.

Hardware requirements

The following list includes the hardware requirements for deploying the IBM Geographically Dispersed Resiliency for Power Systems solution. These were the current requirements at the time this publication was written:

- Only two sites can be configured in the KSYS node (home and backup sites). No KSYS limitation exists regarding distance between sites. The limits are imposed by the storage replication solution that is used in your environment. Because the KSYS node must be able to communicate using TCP/IP with the HMCs from both sites, consider this communication requirement while planning the distance between sites.
- Only one KSYS node can be configured currently. The KSYS node must preferably be placed at the backup site.
- Each host must be an IBM Power Systems with POWER7 processors or later.
- The target host, which will receive the virtual machines in a disaster situation, must have sufficient resources (CPU and memory) to host the virtual machines. These resources can be obtained using Capacity on Demand (Elastic CoD or Enterprise Pools).
- The virtual machines that are managed by the IBM Geographically Dispersed Resiliency for Power Systems solution should not have any physical adapters.
- At the time this publication was written, the IBM Geographically Dispersed Resiliency for Power Systems solution supported only the Dell EMC VMAX family (VMAX1, VMAX2, and VMAX3). These must be capable of using Symmetrix Remote Data Facility (SRDF) in Asynchronous Mode (SRDF/A) because this mode is the only supported mode.[3]
- All VMs managed by the IBM Geographically Dispersed Resiliency for Power Systems solution should use virtual resources through the Virtual I/O Servers. The VMs should not be connected to any physical I/O device.
- Both virtual SCSI and NPIV are supported. In case of virtual SCSI, LVM-based backed devices are not allowed. A dedicated volume from the Dell EMC Storage must be used as the backing device. This volume should be replicated using SRDF/A and the target volume must be mapped to the Virtual I/O Servers at the backup site. For more information about NPIV and VSCSI configuration, see 3.3.8, “Setting up storage for the virtual machines” on page 57.
- The Virtual I/O Servers must have a shared Ethernet adapter (SEA) configuration to bridge the same Ethernet network between hosts in the same site.
- The same virtual LAN (VLAN) must be configured on both home and backup sites.
- The VMs on the home and backup sites must be on the same network subnet.

> **Note:** If you require a site-specific IP address, you can also set up a script to customize the IP address configuration while activating the virtual machine at the backup site.

- The KSYS must be connected to all the HMCs at home and backup sites.
- All the Virtual I/O Servers and replicated volume pairs must be correctly deployed at home and backup sites.
- Storage Area Network (SAN) zoning and storage connectivity must be properly set as required on both sites.

[3] IBM intends to deliver enhancements to support other storages and replication modes.

Software requirements

The following list includes the software requirements for deploying the IBM Geographically Dispersed Resiliency for Power Systems solution. These were the current requirements at the time this publication was written:

- The KSYS node must be installed at AIX 7200-01-01, or later.
- The IBM Geographically Dispersed Resiliency for Power Systems solution requires these versions:
  - HMC version 8.60, or later.
  - VIOS version 2.2.5, or later.
  - Dell EMC Solutions Enabler 8.1.0.0, or later. Ensure that the Solutions Enabler software is properly set up before starting the KSYS installation. For more information about setup, see Chapter 3, “Storage and SAN setup for the IBM Geographically Dispersed Resilience environment” on page 25.
- At least 30 MB of free space under `/opt` during KSYS file sets installation.
- At least 200 MB of free space under `/var` after installing the KSYS file sets.
- Each managed VM (or LPAR) must use one of the following operating systems:
  - IBM AIX version 6.1, or later.
  - Red Hat Enterprise Linux for Power Systems.
  - SUSE Linux Enterprise Server for Power Systems.
  - Ubuntu Linux for Power Systems.

Important: Clarify that the IBM Geographically Dispersed Resiliency for Power Systems solution *does not require PowerVM Enterprise Edition*. PowerVM Standard Edition is enough to enable an environment for the IBM Geographically Dispersed Resiliency for Power Systems solution. For more information about the editions of PowerVM, see the following website.

Important information about IBM Geographically Dispersed Resiliency for Power Systems and Simplified Remote Restart

Although IBM Geographically Dispersed Resiliency for Power Systems functions might seem similar to the Simplified Remote Restart, this capability is not a requirement in the IBM Geographically Dispersed Resiliency for Power Systems solution. A managed system with the PowerVM Partition Simplified Remote Restart Capable set to False can still be used in the IBM Geographically Dispersed Resiliency for Power Systems environment. The following output shows that the host `pbrazos`, which is used in our environment, has the Simplified Remote Restart functionality, and the host `HAM`, which also is used in our environment does not have this Capability. IBM Geographically Dispersed Resiliency for Power Systems supports POWER7, which does not have such capability available:

```
hscroot@vmhmc1:~> lssyscfg -r sys -F
name,powervm_lpar_simplified_remote_restart_capable | grep pbrazos
pbrazos_9119-MME-21BBC47,1

hscroot@vmhmc2:~> lssyscfg -r sys -F
name,powervm_lpar_simplified_remote_restart_capable | grep HAM
HAM-9179-MHD-SN106DBEP,0
```

You can also see that none of the virtual machines use in this setup has the Simplified Remote Restart option enabled:

```
hscroot@vmhmc1:~> lssyscfg -r lpar -m pbrazos_9119-MME-21BBC47 -F
name,simplified_remote_restart_capable | egrep "pbrazos030|pbrazos008|pbrazos007"
pbrazos030,0
pbrazos008,0
pbrazos007,0
```

4.5.2 KSYS file sets and installation structure

The KSYS package consists of the following five file sets:

- ksys.license

  Contains licensing information files.
- ksys.main.cmds

  Contains the main commands that are used in the KSYS node (including the **ksysmgr** binary).
- ksys.main.msg.en_US.cmds

  Provides the message catalog that is used by the IBM Geographically Dispersed Resiliency for Power Systems commands.
- ksys.main.rte

  Contains the main part of the software, including the daemon used by the KSYS node.
- ksys.mirror.emc.rte

  Contains the scripts and commands that are used by the KSYS node to communicate with the Dell EMC Storages.

Example 4-3 shows the KSYS file sets installed in the KSYS node in this environment.

Example 4-3 File sets installed by the KSYS package

```
# lslpp -l ksys*
  Fileset                      Level  State      Description
  ----------------------------------------------------------------------------
Path: /usr/lib/objrepos
  ksys.license               1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.cmds             1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.msg.en_US.cmds   1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.rte              1.1.0.0  COMMITTED  Base Server Runtime
  ksys.mirror.emc.rte        1.1.0.0  COMMITTED  Base Server Runtime

Path: /etc/objrepos
  ksys.main.cmds             1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.rte              1.1.0.0  COMMITTED  Base Server Runtime
  ksys.mirror.emc.rte        1.1.0.0  COMMITTED  Base Server Runtime
```

Table 4-2 shows the installation structure of the KSYS file sets; it lists the important files that are placed in the KSYS node. When the file sets are installed, the binary and configuration files are placed in the designated directories.

Table 4-2 Important binary and configuration files that are provided by KSYS file sets

Type of file	File name	Directory where the file is placed
KSYS administration command	`ksysmgr`	`/opt/IBM/ksys`
CPU and memory capacity management command	`ksysrppmgr`	`/opt/IBM/ksys`
Storage scripts	Multiple Dell EMC scripts	`/opt/IBM/ksys/storages/EMC/`
Sample files for configuration	► `data_collection` ► `setup_dr` ► `setup_dr_HBAs` ► `setup_dr_ethernet` ► `setup_dr_hadiskhbs` ► `setup_dr_hostname_ip` ► `setup_dr_vgs` ► `failover_config.cfg` ► `README` ► `setup_dr_hostname_ip_vis_config_file`	`/opt/IBM/ksys/samples/site_specific_nw/AIX`
	► `postscript` ► `prescript`	`/opt/IBM/ksys/samples/custom_validation/`
	`event_script_template`	`/opt/IBM/ksys/samples/event_handler`
Snap script directory	`vmsnap`	`/usr/lib/ras/snapscripts/`
Log directory	`events.log`	`/var/ksys/`
	► `ksysmgr.log` ► `ksys.log` ► `ksys_srdf.log`	`/var/ksys/log/`

4.5.3 Installing the KSYS file sets

After you obtain the IBM Geographically Dispersed Resiliency for Power Systems or KSYS software (as explained in 4.4, "Obtaining IBM Geographically Dispersed Resiliency for Power Systems filesets" on page 143), place the files in a directory or file system with enough free space at your KSYS node. After you extract the files, you see content similar to Example 4-4.

Example 4-4 KSYS installation files

```
(0) root @ pbrazos001: /mnt/GDR_61ksys110/latest/inst.images
# ls -l
total 37456
-rw-r--r--    1 nobody   nobody        3689 Nov 06 02:57 .toc
-rwxrwxrwx    1 root     system      971776 Nov 06 02:57 ksys.license
-rwxrwxrwx    1 root     system     3814400 Nov 06 02:57 ksys.main.cmds
-rwxrwxrwx    1 root     system       20480 Nov 06 02:57 ksys.main.msg.en_US.cmds
-rwxrwxrwx    1 root     system    14181376 Nov 06 02:57 ksys.main.rte
-rwxrwxrwx    1 root     system      173056 Nov 06 02:57 ksys.mirror.emc.rte
```

With these files, you can perform the installation using the **`geninstall`** command or **`SMIT`**.

Installing by using the command line

To install the KSYS file sets by using the command-line interface (CLI), considering that the KSYS installation directory contains exclusive KSYS installation files, use the following steps:

1. Access the directory where the installation files were extracted.
2. Run the following command:

```
# geninstall -I "a -cgNQqwXY -J" -Z -d . -f ksys.*
```

Installing by using SMIT

To install the KSYS file sets using SMIT, log in to the KSYS node and access the directory where the KSYS installation files were extracted, then perform the following steps:

1. Run the following command:

```
# smitty install
```

2. Select **Install and Update Software** → **Install Software**.
3. In the **INPUT device / directory for software** field, enter a period character (`.`) if you are currently at the directory where the installation files are, or type the full path of the directory that contains the installation files.
4. Make the selections according to your situation and press Enter to start the installation. Set the `ACCEPT new license agreements?` question to `yes`, otherwise the installation does not proceed. A selection similar to what is shown in Example 4-5 successfully installs the KSYS file sets.

Example 4-5 Selections that are made during the KSYS file sets installation

```
Install Software

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]                                                  [Entry Fields]
* INPUT device / directory for software                 .
* SOFTWARE to install                                  [_all_latest]    +
  PREVIEW only? (install operation will NOT occur)      no              +
  COMMIT software updates?                              yes             +
  SAVE replaced files?                                  no              +
  AUTOMATICALLY install requisite software?             yes             +
  EXTEND file systems if space needed?                  yes             +
  OVERWRITE same or newer versions?                     no              +
  VERIFY install and check file sizes?                  no              +
  Include corresponding LANGUAGE filesets?              yes             +
  DETAILED output?                                      yes             +
  Process multiple volumes?                             yes             +
  ACCEPT new license agreements?                        yes             +
  Preview new LICENSE agreements?                       no              +
```

After completing the installation, the file sets (Example 4-6) are properly installed in your KSYS node.

Example 4-6 File sets installed at the KSYS node

```
(0) root @ pbrazos001: /mnt/GDR_61ksys110/latest/inst.images
# lslpp -l ksys*
  Fileset                      Level  State      Description
  ----------------------------------------------------------------------------
Path: /usr/lib/objrepos
  ksys.license               1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.cmds             1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.msg.en_US.cmds   1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.rte              1.1.0.0  COMMITTED  Base Server Runtime
  ksys.mirror.emc.rte        1.1.0.0  COMMITTED  Base Server Runtime

Path: /etc/objrepos
  ksys.main.cmds             1.1.0.0  COMMITTED  Base Server Runtime
  ksys.main.rte              1.1.0.0  COMMITTED  Base Server Runtime
  ksys.mirror.emc.rte        1.1.0.0  COMMITTED  Base Server Runtime
```

Tip: Run the command **`lppchk -v`** after completing the installation to check for a successful installation. When successful, the output is empty. If any other output is displayed, handle the errors.

4.6 Configuring IBM Geographically Dispersed Resiliency for Power Systems

Now that the KSYS file sets are properly installed in the KSYS node, start configuring the IBM Geographically Dispersed Resiliency for Power Systems solution. As explained in 4.2.3, “Configuration” on page 134, use the **`ksysmgr`** command to add the several components of the IBM Geographically Dispersed Resiliency for Power Systems solution under the management of the KSYS node. Currently, you add the following entities to the KSYS node:

- Sites
- HMCs
- hosts (managed systems)
- Virtual machines
- Storage agents

This addition allows the KSYS node to monitor and control such entities. Figure 4-5 shows a flowchart of the steps you follow to perform the KSYS node configuration during the deployment of the IBM Geographically Dispersed Resiliency for Power Systems solution.

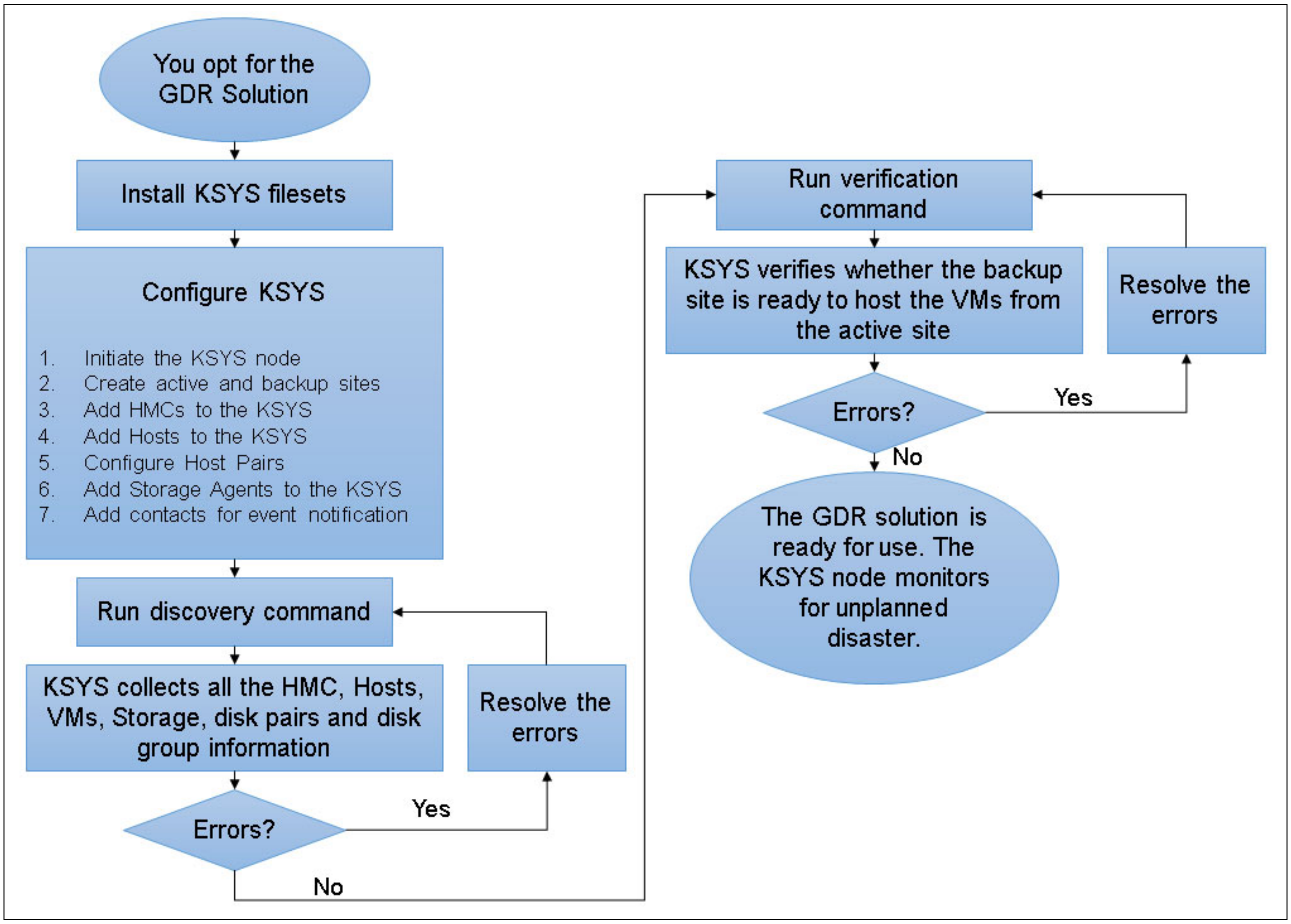


Figure 4-5 Flowchart of the KSYS node configuration

Before starting the IBM Geographically Dispersed Resiliency for Power Systems configuration, complete the following steps in your KSYS node:

- Include the `/opt/IBM/ksys` directory to the `PATH` variable, so you do not need to provide the full path to the **`ksysmgr`** command every time run it:

  ```
  # export PATH=$PATH:/opt/IBM/ksys
  ```

  You can also add this command to the `.profile` file under your root home directory, so you do not have to export such variable every time.

  > **Tip:** You can also include the directory of the software that is used to control your storage subsystems in this case Dell EMC so that you do not need to provide the full path when using the Dell EMC command line interface:
  >
  > ```
  > # export PATH=$PATH:/opt/emc/SYMCLI/bin
  > ```

- Check that no RSCT peer domain is at the node where the KSYS is being configured. The output of the following command should be empty:

  ```
  # lsrpdomain
  ```

The KSYS node creates an RSCT peer domain as part of its initialization, so the node where you are performing the initial KSYS configuration should not be part of another cluster: Spectrum Scale, IBM Tivoli® System Automation (TSA) or PowerHA SystemMirror. Do not proceed if your host is already part of an RSCT peer domain.

- During the KSYS file sets installation, several resource classes are automatically created. These classes are used to store the KSYS node configuration. Use the commands as shown in Example 4-7 to check that these classes are properly created in your KSYS node.

Example 4-7 Resource classes that are created during the KSYS file sets installation

```
(0) root @ pbrazos001: /
# lssrc -a | grep VMR
 IBM.VMR          rsct_rm                       inoperative

(0) root @ pbrazos001: /
# lsrsrc | grep VMR
"IBM.VMR_HMC"
"IBM.VMR_CEC"
"IBM.VMR_LPAR"
"IBM.VMR_VIOS"
"IBM.VMR_SITE"
"IBM.VMR_SA"
"IBM.VMR_DP"
"IBM.VMR_DG"
```

After you verify that no RSCT peer domain is created in your KSYS node (before the configuration) and that the resource classes exist, then your are ready to start configuring the IBM Geographically Dispersed Resiliency for Power Systems solution in your system.

The ksysmgr command

In the following sections, the **ksysmgr** command is used to start adding resources to the KSYS node configuration. You notice that the **ksysmgr** command accepts aliases, for example, using the **ksysmgr create cluster** command also has the same effect as using the **ksysmgr add ksyscluster** command:

```
# ksysmgr add cluster -h

ksysmgr add ksyscluster
      [<ksysclustername>]
      ksysnodes=<ksysnode#1>
      sync=[yes|no]
    add => create, make

    ksyscluster => ksyscl*, cl*
```

To find the syntax and aliases of every action or parameter that is accepted by the **ksysmgr** command, use the **-h** option, as shown in Example 4-8.

Example 4-8 Finding the syntax and aliases of every action or parameter accepted by ksysmgr

```
# ksysmgr -h
Here is a list of available actions for ksysmgr:
Available actions
         add
         delete
```

```
         discover
         help
         manage
         unmanage
         modify
         move
         query
         recover
         restore
         report
         cleanup
         sync
         pair
         verify

# ksysmgr add -h
Available classes for add:
         host
         ksyscluster
         hmc
         notify
         script
         site
         snapshot
         storage_agent

# ksysmgr add cluster -h

ksysmgr add ksyscluster
      [<ksysclustername>]
      ksysnodes=<ksysnode#1>
      sync=[yes|no]
    add => create, make

    ksyscluster => ksyscl*, cl*
```

4.6.1 Creating the cluster, initiating the KSYS node

To initiate the KSYS configuration and start the daemons that enable the IBM Geographically Dispersed Resiliency for Power Systems solution, you must first create the KSYS cluster. The KSYS software uses RSCT clustering to create its cluster.

Note: In IBM Geographically Dispersed Resiliency for Power Systems version 1.1, a one node cluster is created for the KSYS node. IBM intents to deliver enhancements for a high availability KSYS node to allow the creation of a cluster with two nodes.

After initiating the KSYS node by way of creating the KSYS cluster, several RSCT and KSYS daemons are activated, which allow the KSYS node to process the commands you later run to configure the components of the IBM Geographically Dispersed Resiliency for Power Systems solution.

You can initiate the KSYS cluster with a sequence of three commands, or you can optionally use a single command line, which performs the same actions that the three commands perform.

Initiating the KSYS cluster with three commands

Use the following steps to create a one-node KSYS cluster (also see “Initiating the KSYS cluster with a single command”):

1. Create a cluster and add the KSYS node to the cluster (Example 4-9). The host name that is used in the **ksysnodes** parameter must be resolvable.

Example 4-9 Creating the cluster and adding the KSYS node to the cluster

```
(0) root @ pbrazos001: /
# hostname
pbrazos001.ausprv.stglabs.ibm.com

(0) root @ pbrazos001: /
# host pbrazos001
pbrazos001.ausprv.stglabs.ibm.com is 10.40.2.201,  Aliases:   pbrazos001

(0) root @ pbrazos001: /
# ksysmgr add cluster itsocluster ksysnodes=pbrazos001
Adding node to current cluster configuration
Ksyscluster has been created, run: "ksysmgr verify ksyscluster
<ksysclustername>"
```

2. Use the verify action to verify the KSYS cluster configuration (Example 4-10).

Example 4-10 Running the verify action

```
(0) root @ pbrazos001: /
# ksysmgr verify ksyscluster itsocluster
Verified, Please run: "ksysmgr sync ksyscluster <ksysclustername>"
```

3. Run the sync action, which properly initiates the KSYS cluster and starts its daemons (Example 4-11).

Example 4-11 Running the sync action and initiating the KSYS cluster

```
(0) root @ pbrazos001: /
# ksysmgr sync ksyscluster itsocluster
Starting KSYS subsystem ...
KSYS subsystem has started, you can begin adding site defintions, HMCs,
storage_agents, etc
```

Initiating the KSYS cluster with a single command

Instead of running the three commands that are used to initiate the KSYS cluster in the previous section (“Initiating the KSYS cluster with three commands”), you can optionally use a single command to perform the same actions (Example 4-12).

Example 4-12 Create the one-node KSYS cluster with a single command

```
(0) root @ pbrazos001: /
# ksysmgr add cluster itsocluster ksysnodes=pbrazos001 sync=yes
Adding node to current cluster configuration
Ksyscluster has been created, running verify now
```

```
Ksyscluster has been verified, running sync now
Starting KSYS subsystem ...
KSYS subsystem has started, you can begin adding site defintions, HMCs,
storage_agents, etc
```

Now the KSYS cluster is properly created, the KSYS node is added to the cluster, and the daemons are started. You can start adding the components of the IBM Geographically Dispersed Resiliency for Power Systems solution to your KSYS cluster. Before doing that, verify that the RSCT peer domain is properly created and the `IBM.VMR` daemon is properly started (Example 4-13).

Example 4-13 Verifying KSYS cluster, RSCT peer domain, and IBM.VMR daemon

```
(0) root @ pbrazos001: /
# ksysmgr query ksyscluster
Name:            itsocluster
State:           Online

(0) root @ pbrazos001: /
# lsrpdomain
Name        OpState RSCTActiveVersion MixedVersions TSPort GSPort
itsocluster Online  3.2.2.0           No            12347  12348

(0) root @ pbrazos001: /
# lssrc -a | grep VMR
 IBM.VMR          rsct_rm          19268040     active
```

Note: If the commands do not display any output, run the **ksysmgr sync ksyscluster <clustername>** command.

4.6.2 Creating the sites

Now add your site definitions to the IBM Geographically Dispersed Resiliency for Power Systems solution. The sites are a logical representation of your data centers. At the current version, only two sites can be added to the IBM Geographically Dispersed Resiliency for Power Systems environment referred to as the home and backup sites. You must add a home site, which is the active site, where all your workload is running, and a backup site, which receives the workload from the home site in a disaster situation.

After creating the site definitions, start adding the remaining components to the corresponding sites, including the HMCs, hosts, storage agents, and virtual machines.

The site type role is dynamic, which means that it can change according to the events that occur in your environment. For example, initially, Poughkeepsie is the home site (where the virtual machines are running), and Austin is the backup site. If the virtual machines are moved to the Austin site, it becomes the home site, and Poughkeepsie becomes the backup site.

The site name can be up to 64 characters long and should contain no special characters or spaces. Use the following steps to add the sites to your IBM Geographically Dispersed Resiliency for Power Systems environment:

1. Create the home (or active) site and set the site name (Example 4-14).

Example 4-14 Adding the home site

```
(0) root @ pbrazos001: /
# ksysmgr add site Poughkeepsie sitetype=home
Site Poughkeepsie was added
```

2. Create the backup site and set the site name (Example 4-15).

Example 4-15 Adding the backup site

```
(0) root @ pbrazos001: /
# ksysmgr add site Austin sitetype=backup
Site Austin was added
```

3. Optionally run the **query** command to ensure that the sites are properly created (Example 4-16).

Example 4-16 Checking whether the sites were properly added

```
(0) root @ pbrazos001: /
# ksysmgr query site
Name:            Austin
Sitetype:        backup

Name:            Poughkeepsie
Sitetype:        ACTIVE
```

4. During this phase, the IBM.VMR_SITE resource class is populated with the site definitions (Example 4-17).

Example 4-17 IBM.VMR_SITE resource class that is properly created with site definition

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_SITE
Resource Persistent Attributes for IBM.VMR_SITE
resource 1:
        Name             = "Austin"
        AliasName        = ""
        SiteID           = 2
        Repository       = ""
        KDiskInfo        = ""
        SiteDiskGroupList = ""
        Node_List        = ""
        SiteState        = ""
        SiteType         = "backup"
        PeerSites        = {}
        Phase            = "READY"
        PhaseDetail      = 0
        ActivePeerDomain  = "itsocluster"
resource 2:
        Name             = "Poughkeepsie"
        AliasName        = ""
        SiteID           = 1
```

```
Repository        = ""
KDiskInfo         = ""
SiteDiskGroupList = ""
Node_List         = ""
SiteState         = ""
SiteType          = "home"
PeerSites         = {}
Phase             = "READY"
PhaseDetail       = 0
ActivePeerDomain  = "itsocluster"
```

Now that the sites are created, start adding the resources definitions to it.

4.6.3 Adding the HMCs to the KSYS node

The only point of contact that is required between the KSYS node and the virtual machines is the HMCs to recover if disaster occurs. The KSYS node uses the HMCs from both home and backup sites to communicate with the hosts and its Virtual I/O Servers, and uses the HMCs to discover all virtual machines from the hosts and its resources, including network and disks (NPIV and VSCSI). The node also uses the HMCs to perform verification operations to check that the host in the backup site has enough resources to host the virtual machines from the home site if disaster occurs. The HMCs are also used when you perform the move operation to shut down the VMs from the home site, and create and activate the VMs at the backup site. Other operations such as recovery and cleanup are also performed through the HMCs, which makes the HMCs critical components of the IBM Geographically Dispersed Resiliency for Power Systems solution.

When adding the HMCs to the KSYS node, provide a user name and a password, which are stored in a Resource Class (the password information is encrypted). You can use the `hscroot` user, or optionally create a user that is specific for the IBM Geographically Dispersed Resiliency for Power Systems solution.

> **Tip:** Create users who will be used only in the IBM Geographically Dispersed Resiliency for Power Systems solution instead of using the `hscroot` user. The reason for this suggestion is so that you will know that all operations that are seen in the HMC logs with the IBM Geographically Dispersed Resiliency for Power Systems user are performed by the KSYS node, and operations with the `hscroot` user are manually performed by a system administrator.

If you decide to create a dedicated user for the IBM Geographically Dispersed Resiliency for Power Systems (at each HMC), the user name that is provided must have the `hmcsuperadmin` task role, with remote access enabled. To create a user with those privileges:

1. Access your HMC and click **HMC Management** → **Manage User Profiles and Access** (Administration).
2. Click **User** → **Add**.
3. The Add User window opens (Figure 4-6 on page 158). Provide this information:
   – User ID (name).
   – Description.
   – Password.

– Enable **AllSystemResources** in Managed Resource Roles.
– Select **hmcsuperadmin** as the Task Role.

4. Click **User Properties**.

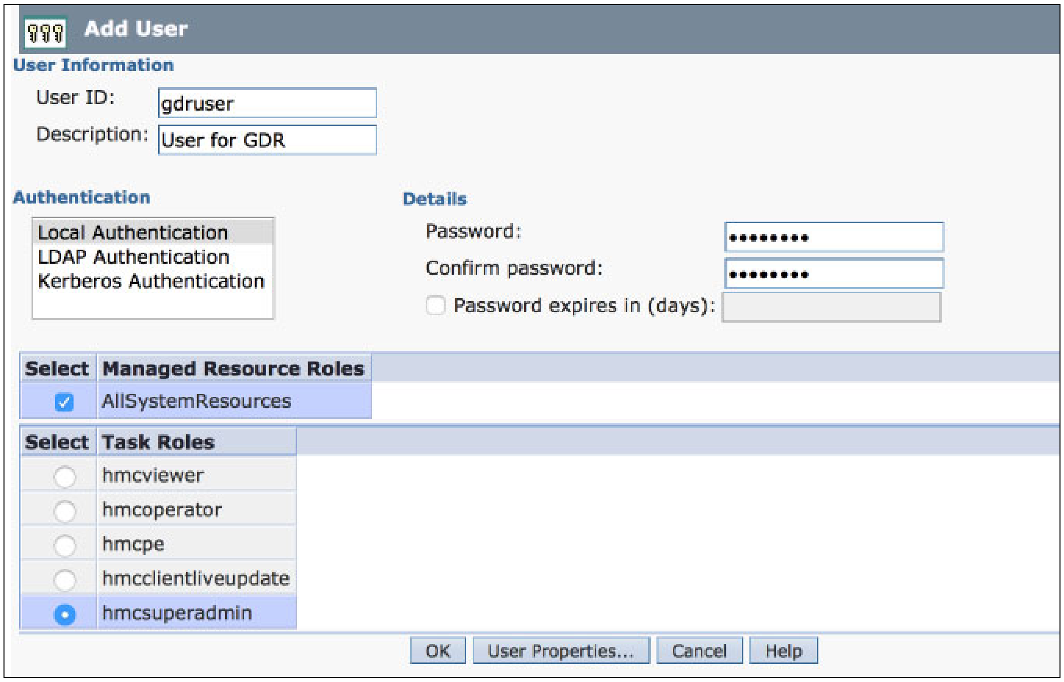


Figure 4-6 Optionally creating an HMC user for the IBM Geographically Dispersed Resiliency for Power Systems solution

5. The User Properties window opens (Figure 4-7). Enable the **Allow remote access via the web** option.

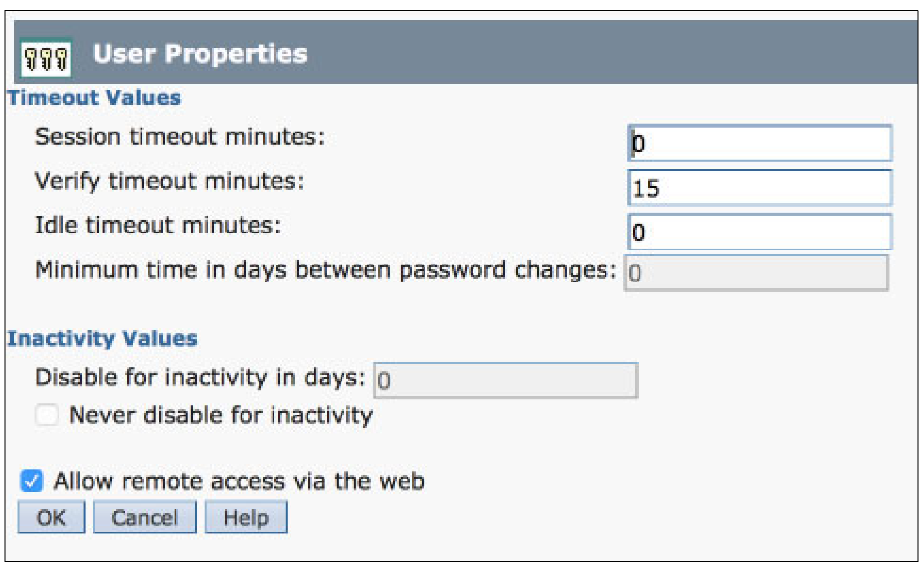


Figure 4-7 Enabling the remote access to the user

This is the only user name and password you need to provide to the KSYS node to manage your virtual machines. The KSYS node contacts the HMCs to obtain information from the VMs through the Virtual I/O Servers, so be sure that RMC communication is working properly between the HMCs and the Virtual I/O Servers.

> **Tip:** Use the **lspartition -dlpar** command in your HMC to check the status of the RMC communication with your Virtual I/O Servers. The expected value is `1` in the `Active` field as shown in the following example:
>
> ```
> <#10> Partition:<1*9119-MME*21BBC47, pbrazosv1.ausprv.stglabs.ibm.com, 10.40.1.245>
>        Active:<1>, OS:<AIX, 6.1, 6100-09-08-1642>, DCaps:<0x14f8f>, CmdCaps:<0x4000003b, 0x3b>, PinnedMem:<1394>
> ```

The KSYS node uses the HMC Representational State Transfer (REST) application program interfaces (APIs) to communicate with your HMCs, so you must add the HMC details to the IBM Geographically Dispersed Resiliency for Power Systems solution.[4]

You can add multiple HMCs to each site. Therefore, you can use dual HMCs per host to have redundant communication with each host. In case of failure to communicate with one HMC, the KSYS node automatically switches to the other HMC. For a demonstration of an HMC failure and the KSYS node behavior during such failure, refer to 6.4, “Planned hardware management console failure at the active site” on page 312.

To add the HMCs, use the command line as shown in Example 4-18.

Example 4-18 Command line that is used to add the HMC to the KSYS node

```
# ksysmgr add hmc -h

ksysmgr add hmc <hmcname>
      login=<username>
      [password=<password>]
      hostname|ip=<hostname|ip>
      site=<site_name>
      [hmctimeout=##]
      [maxjobs=##]
      [SwXSDVersion=##]
    add => create, make
    hmc => hmcs, hmces
```

> **Note:** If you do not want to provide the password at the command line, you can omit this parameter. The command prompts you to enter the password. This information is stored encrypted in the resource class.

[4] IBM intends to deliver enhancements to use IBM PowerVM NovaLink in future releases of the IBM Geographically Dispersed Resiliency for Power Systems solution.

In the IBM Geographically Dispersed Resiliency for Power Systems environment setup for this publication, there are four HMCs (two HMCs per site) as shown in Example 4-19.

Example 4-19 HMCs available in the environment setup for this publication

```
(0) root @ pbrazos001: /
# grep hmc /etc/hosts
9.3.18.34       vhmc1   # Site Poughkeepsie
9.3.18.35       vhmc2   # Site Austin
9.3.18.36       vhmc3   # Site Poughkeepsie
9.3.18.37       vhmc4   # Site Austin
```

Complete these steps while adding the HMC configuration to the environment:

1. Add the HMCs to the Poughkeepsie site (Example 4-20). You notice that while adding vhmc3_Poughkeepsie, the password is omitted, so you are prompted to provide the password.

   Example 4-20 Adding HMCs to the Poughkeepsie site

   ```
   (0) root @ pbrazos001: /
   # ksysmgr add hmc vhmc1_Poughkeepsie login=hscroot password=abc123 ip=9.3.18.34
   site=Poughkeepsie
   HMC vhmc1_Poughkeepsie was added

   (0) root @ pbrazos001: /
   # ksysmgr add hmc vhmc3_Poughkeepsie login=hscroot ip=9.3.18.36
   site=Poughkeepsie
   Enter Password for hmc: ******
   Re-Enter Password: ******
   HMC vhmc3_Poughkeepsie was added
   ```

2. Add the HMCs for the Austin backup site (Example 4-21). Note that this time the **hostname** parameter is used instead of the **ip** parameter. This requires the HMC host name to be resolvable.

   Example 4-21 Adding HMCs to the Austin site

   ```
   (0) root @ pbrazos001: /
   # ksysmgr add hmc vhmc2_Austin login=hscroot password=abc123 hostname=vhmc2
   site=Austin
   HMC vhmc2_Austin was added

   (0) root @ pbrazos001: /
   # ksysmgr add hmc vhmc4_Austin login=hscroot password=abc123 hostname=vhmc4
   site=Austin
   HMC vhmc4_Austin was added
   ```

3. Use the **ksysmgr query hmc** command to show the HMC information that was added to the KSYS node. The output shows the managed systems, managed by each of the HMCs, which indicates that the KSYS node is successfully able to communicate with the HMCs (Example 4-22).

   Example 4-22 Output of the ksysmgr query hmc command

   ```
   (0) root @ pbrazos001: /
   # ksysmgr query hmc
   Name:           vhmc4_Austin
   Site:           Austin
   ```

```
Ip:             9.3.18.37
Login:          hscroot

                       Managed host List:

host Name                              Uuid
=========                              ====
AUSTIN_host2                           66ce9bad-bbdb-31f5-afb8-7e02a852d122
why2_9117-MMD-105E61P_32CPU256G        d02a74f4-b551-37b4-a9b8-034d416d0feb
why1_9179-MHD-10BF1CR_16CPU-1TB        093a18ec-40be-3187-a094-b6b64204befc
doit4-8233-E8B-06DA5AR                 9f5fd671-0597-31b8-a950-f2d043c864f8
kumquat_9179-MHD-105E67P               c15e9b0c-c822-398a-b0a1-6180872c8518
AUSTIN_host1                           7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8
gsk1_8233-E8B-1000ADP                  346f184d-bace-36f5-97b5-3955c62a6929
bacon_8202-E4C-10F477R                 fa647d48-a06f-3f08-9c16-94573cc1b66e
e10m4                                  caffee0a-4206-3ee7-bfc2-f9d2bd3e866f
rar1m6                                 ae115482-3a50-32f3-935a-7ff9be433e33
HAM-9179-MHD-SN106DBEP                 8405b4db-629d-3f8d-907e-201d1ffd8f13
doit2-8233-E8B-06DA57R                 651b7677-3478-3f2a-bb71-034e76c25ee4
============================================================================

Name:           vhmc2_Austin
Site:           Austin
Ip:             9.3.18.35
Login:          hscroot

                       Managed host List:

host Name                              Uuid
=========                              ====
rar1m6                                 ae115482-3a50-32f3-935a-7ff9be433e33
doit4-8233-E8B-06DA5AR                 9f5fd671-0597-31b8-a950-f2d043c864f8
orange-9179-MHD-SN107895P              67ff62ec-ecb5-3ad4-9b35-0a2c75bb7fe4
bacon_8202-E4C-10F477R                 fa647d48-a06f-3f08-9c16-94573cc1b66e
HYDERABAD_host2                        b8621161-082d-398f-9e3f-9ba82235c999
10.40.0.111                            4c70efdc-2796-3b23-a7b7-7b723aafb42a
HAM-9179-MHD-SN106DBEP                 8405b4db-629d-3f8d-907e-201d1ffd8f13
rmn_8233-E8B-10345DP                   1dd0f332-fd51-3cf6-9bec-9861b7641f17
e10m4                                  caffee0a-4206-3ee7-bfc2-f9d2bd3e866f
HYDERABAD_host1                        21b4b05f-9b84-349c-9ce9-d03f0e78f9f7
r7r5m1_9117-MMB-1001F5P                86872ae4-f9e7-34f0-a600-57486a032525
e11m5_8233-E8B-100052P                 6e04539f-9d4b-3bbd-831d-92e213430e7c
doit2-8233-E8B-06DA57R                 651b7677-3478-3f2a-bb71-034e76c25ee4
============================================================================

Name:           vhmc3_Poughkeepsie
Site:           Poughkeepsie
Ip:             9.3.18.36
Login:          hscroot

                       Managed host List:

host Name                              Uuid
=========                              ====
doit3-8233-E8B-06DA59R                 b6966940-52f1-306b-9b2b-2d8447acc14f
RootBeer-8408-E8D-SN21ED67T            895c36ce-a7d4-367e-80af-ec625f9cafa4
orange-9179-MHD-SN107895P              67ff62ec-ecb5-3ad4-9b35-0a2c75bb7fe4
pbrazos_9119-MME-21BBC47               6ce366c5-f05d-3a12-94f8-94a3fdfc1319
Cheese-9179-MHD-SN10788CP              d87b349c-efc1-3df7-9276-23c29f5749c8
AUSTIN_host2                           66ce9bad-bbdb-31f5-afb8-7e02a852d122
```

```
AUSTIN_host1                        7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8
rar1m5                              b3880199-3b8b-3ade-b360-f76146c2d7f3
sausage_8202-E4C-10F478R            29112b0d-c681-3123-bb05-e40d19d85602
========================================================================

Name:           vhmc1_Poughkeepsie
Site:           Poughkeepsie
Ip:             9.3.18.34
Login:          hscroot

                       Managed host List:

host Name                           Uuid
=========                           ====
AUSTIN_host2                        66ce9bad-bbdb-31f5-afb8-7e02a852d122
RootBeer-8408-E8D-SN21ED67T         895c36ce-a7d4-367e-80af-ec625f9cafa4
doit1-8233-E8B-06DA56R              d1e42e9e-f611-3049-a1be-b4d88902d1fe
doit3-8233-E8B-06DA59R              b6966940-52f1-306b-9b2b-2d8447acc14f
rar1m5                              b3880199-3b8b-3ade-b360-f76146c2d7f3
sausage_8202-E4C-10F478R            29112b0d-c681-3123-bb05-e40d19d85602
pbrazos_9119-MME-21BBC47            6ce366c5-f05d-3a12-94f8-94a3fdfc1319
Cheese-9179-MHD-SN10788CP           d87b349c-efc1-3df7-9276-23c29f5749c8
tea_8231-E2C-100966R                331727db-0dbc-351f-95cb-042354deda2e
kumquat_9179-MHD-105E67P            c15e9b0c-c822-398a-b0a1-6180872c8518
AUSTIN_host1                        7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8
========================================================================
```

4. All HMC information is stored in the `IBM.VMR_HMC` resource class, which can be queried by using the **lsrsrc** command (Example 4-23). The password is encrypted.

Example 4-23 Output of the lsrsrc IBM.VMR_HMC command

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_HMC
Resource Persistent Attributes for IBM.VMR_HMC
resource 1:
        Name                    = "vhmc4_Austin"
        SiteID                  = 2
        HmcIP                   = "9.3.18.37"
        UserName                = "hscroot"
        Password                = "{#####}F076AC9ED89F413A37821663EEE37031"
        CecList                 =
{["AUSTIN_host2","66ce9bad-bbdb-31f5-afb8-7e02a852d122"],["why2_9117-MMD-105E61
P_32CPU256G","d02a74f4-b551-37b4-a9b8-034d416d0feb"],["why1_9179-MHD-10BF1CR_16
CPU-1TB","093a18ec-40be-3187-a094-b6b64204befc"],["doit4-8233-E8B-06DA5AR","9f5
fd671-0597-31b8-a950-f2d043c864f8"],["kumquat_9179-MHD-105E67P","c15e9b0c-c822-
398a-b0a1-6180872c8518"],["AUSTIN_host1","7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8"
],["gsk1_8233-E8B-1000ADP","346f184d-bace-36f5-97b5-3955c62a6929"],["bacon_8202
-E4C-10F477R","fa647d48-a06f-3f08-9c16-94573cc1b66e"],["e10m4","caffee0a-4206-3
ee7-bfc2-f9d2bd3e866f"],["rar1m6","ae115482-3a50-32f3-935a-7ff9be433e33"],["HAM
-9179-MHD-SN106DBEP","8405b4db-629d-3f8d-907e-201d1ffd8f13"],["doit2-8233-E8B-0
6DA57R","651b7677-3478-3f2a-bb71-034e76c25ee4"]}
        HmcRestApiTimeout       = 0
        MaxJobs                 = 0
        ViosPassThruApiTimeout  = 0
        SwXSDVersion            = "V8R8.6.0"
        clean_LPARS             = {}
        ActivePeerDomain        = "itsocluster"
```

```
        NodeNameList            = {}
resource 2:
        Name                    = "vhmc2_Austin"
        SiteID                  = 2
        HmcIP                   = "9.3.18.35"
        UserName                = "hscroot"
        Password                = "{#####}F0FE6B6EB5D6D07A99ACF693A29C57E4"
        CecList                 =
{["rar1m6","ae115482-3a50-32f3-935a-7ff9be433e33"],["doit4-8233-E8B-06DA5AR","9
f5fd671-0597-31b8-a950-f2d043c864f8"],["orange-9179-MHD-SN107895P","67ff62ec-ec
b5-3ad4-9b35-0a2c75bb7fe4"],["bacon_8202-E4C-10F477R","fa647d48-a06f-3f08-9c16-
94573cc1b66e"],["HYDERABAD_host2","b8621161-082d-398f-9e3f-9ba82235c999"],["10.
40.0.111","4c70efdc-2796-3b23-a7b7-7b723aafb42a"],["HAM-9179-MHD-SN106DBEP","84
05b4db-629d-3f8d-907e-201d1ffd8f13"],["rmn_8233-E8B-10345DP","1dd0f332-fd51-3cf
6-9bec-9861b7641f17"],["e10m4","caffee0a-4206-3ee7-bfc2-f9d2bd3e866f"],["HYDERA
BAD_host1","21b4b05f-9b84-349c-9ce9-d03f0e78f9f7"],["r7r5m1_9117-MMB-1001F5P","
86872ae4-f9e7-34f0-a600-57486a032525"],["e11m5_8233-E8B-100052P","6e04539f-9d4b
-3bbd-831d-92e213430e7c"],["doit2-8233-E8B-06DA57R","651b7677-3478-3f2a-bb71-03
4e76c25ee4"]}
        HmcRestApiTimeout       = 0
        MaxJobs                 = 0
        ViosPassThruApiTimeout  = 0
        SwXSDVersion            = "V8R8.6.0"
        clean_LPARS             = {}
        ActivePeerDomain        = "itsocluster"
        NodeNameList            = {}
resource 3:
        Name                    = "vhmc3_Poughkeepsie"
        SiteID                  = 1
        HmcIP                   = "9.3.18.36"
        UserName                = "hscroot"
        Password                = "{#####}59A785441CDD3BD31D 7117176BFFE8C"
        CecList                 =
{["doit3-8233-E8B-06DA59R","b6966940-52f1-306b-9b2b-2d8447acc14f"],["RootBeer-8
408-E8D-SN21ED67T","895c36ce-a7d4-367e-80af-ec625f9cafa4"],["orange-9179-MHD-SN
107895P","67ff62ec-ecb5-3ad4-9b35-0a2c75bb7fe4"],["pbrazos_9119-MME-21BBC47","6
ce366c5-f05d-3a12-94f8-94a3fdfc1319"],["Cheese-9179-MHD-SN10788CP","d87b349c-ef
c1-3df7-9276-23c29f5749c8"],["AUSTIN_host2","66ce9bad-bbdb-31f5-afb8-7e02a852d1
22"],["AUSTIN_host1","7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8"],["rar1m5","b388019
9-3b8b-3ade-b360-f76146c2d7f3"],["sausage_8202-E4C-10F478R","29112b0d-c681-3123
-bb05-e40d19d85602"]}
        HmcRestApiTimeout       = 0
        MaxJobs                 = 0
        ViosPassThruApiTimeout  = 0
        SwXSDVersion            = "V8R8.6.0"
        clean_LPARS             = {}
        ActivePeerDomain        = "itsocluster"
        NodeNameList            = {}
resource 4:
        Name                    = "vhmc1_Poughkeepsie"
        SiteID                  = 1
        HmcIP                   = "9.3.18.34"
        UserName                = "hscroot"
        Password                = "{#####} 47F78D78098B31D4C8A4D5C593DAF30"
```

```
        CecList                = 
{["AUSTIN_host2","66ce9bad-bbdb-31f5-afb8-7e02a852d122"],["RootBeer-8408-E8D-SN
21ED67T","895c36ce-a7d4-367e-80af-ec625f9cafa4"],["doit1-8233-E8B-06DA56R","d1e
42e9e-f611-3049-a1be-b4d88902d1fe"],["doit3-8233-E8B-06DA59R","b6966940-52f1-30
6b-9b2b-2d8447acc14f"],["rar1m5","b3880199-3b8b-3ade-b360-f76146c2d7f3"],["saus
age_8202-E4C-10F478R","29112b0d-c681-3123-bb05-e40d19d85602"],["pbrazos_9119-MM
E-21BBC47","6ce366c5-f05d-3a12-94f8-94a3fdfc1319"],["Cheese-9179-MHD-SN10788CP"
,"d87b349c-efc1-3df7-9276-23c29f5749c8"],["tea_8231-E2C-100966R","331727db-0dbc
-351f-95cb-042354deda2e"],["kumquat_9179-MHD-105E67P","c15e9b0c-c822-398a-b0a1-
6180872c8518"],["AUSTIN_host1","7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8"]}
        HmcRestApiTimeout      = 0
        MaxJobs                = 0
        ViosPassThruApiTimeout = 0
        SwXSDVersion           = "V8R8.6.0"
        clean_LPARS            = {}
        ActivePeerDomain       = "itsocluster"
        NodeNameList           = {}
```

Use the same steps to add the HMCs to your IBM Geographically Dispersed Resiliency for Power Systems environment.

4.6.4 Adding hosts to the KSYS node

Now, add your hosts or managed systems that will be managed by the KSYS node. Currently, you are adding the hosts from the home and backup sites, but you are not defining the host pairs.

For example, if you have two hosts in your home site (host_11 and host_12) and two in your backup site (host_21 and host_22), you are adding all four hosts to the KSYS node. You specify which site a host belongs to but you are not determining which host from the backup site will back up host_11 from the home site. In 4.6.5, "Configuring host pairs" on page 168, you determine such host pairs, specifying, for example, that host_21 is backed up by host_11 and host_22 is backed up by host_12.

> **Important:** IBM Power Systems using POWER7 processors, or later, are supported in the IBM Geographically Dispersed Resiliency for Power Systems solution.

Use the following command to add the hosts to the KSYS node:

```
# ksysmgr add host -h

ksysmgr add host <hostname>
      <site=sitename>
      [uuid=<uuid>]
      [hostname|ip=<hostname|ip>]
    add => create, make
    host => serv*, mach*, cec*, ho*

    Note: fspname may be used in place of hostname
```

Note: You can have multiple hosts per site, but at the time of writing this publication, each host must be paired with a single host from the other site. For example, you cannot have two hosts at the home site and a single host at the backup (this backs up the virtual machines from both hosts from home site). If you want to provide disaster recovery solution for both hosts from home site, you also need two nodes at the backup site, so each node from the home site has a corresponding backup host.

In this scenario, host `pbrazos_9119-MME-21BBC47` is added to the home site (where the virtual machines are currently running) and the host `HAM-9179-MHD-SN106DBEP` is added to the backup site (to serve as a backup of the `pbrazos_9119-MME-21BBC47` host), as shown in Example 4-24. (Use the **`ksysmgr query hmc`** command, which is shown in Example 4-22 on page 160 to obtain the name of your host and its UUID.)

Example 4-24 Adding hosts to the environment setup for this publication

```
(0) root @ pbrazos001: /
# ksysmgr add host pbrazos_9119-MME-21BBC47 site=Poughkeepsie
uuid=6ce366c5-f05d-3a12-94f8-94a3fdfc1319
 pbrazos_9119-MME-21BBC47 6ce366c5-f05d-3a12-94f8-94a3fdfc1319
 pbrazos_9119-MME-21BBC47 6ce366c5-f05d-3a12-94f8-94a3fdfc1319
host pbrazos_9119-MME-21BBC47 was added

(0) root @ pbrazos001: /
# ksysmgr add host HAM-9179-MHD-SN106DBEP site=Austin
uuid=8405b4db-629d-3f8d-907e-201d1ffd8f13
 HAM-9179-MHD-SN106DBEP 8405b4db-629d-3f8d-907e-201d1ffd8f13
 HAM-9179-MHD-SN106DBEP 8405b4db-629d-3f8d-907e-201d1ffd8f13
host HAM-9179-MHD-SN106DBEP was added
```

Important: Ensure that the RMC communication is working properly between your Virtual I/O Servers and the HMCs, otherwise adding the hosts can fail with the following error message:

```
(0) root @ pbrazos001: /mnt/GDR_61ksys110
# ksysmgr add host pbrazos_9119-MME-21BBC47 site=Poughkeepsie
ERROR: Adding host pbrazos_9119-MME-21BBC47 had issues
        0000-169 Error - No VIOS with supported OS version found on this host .
```

Formatting the RMC traces with the following command reveals the reason for the error:

```
# cd /var/ct/<clustername>/log/mc/IBM.VMR
# rpttr -o dct trace.* > tr.out
# vi tr.out
```

In this case, the following message is displayed during the trace:

```
[20] 10/14/16 _VMR 14:42:33.343930DEBUG VMR_CEC.C[724]: VIOS RMC state is not
active, so cannot get the VIOS version info for VIOS
:2128DDCE-5C3D-4015-A630-B770BAC2CA7D
```

After adding the hosts, you can query whether they are successfully added by using the **ksysmgr query host** command (Example 4-25).

Example 4-25 Checking if the hosts are properly added

```
(0) root @ pbrazos001: /
# ksysmgr query host
Name:            HAM-9179-MHD-SN106DBEP
UUID:            8405b4db-629d-3f8d-907e-201d1ffd8f13
FspIp:
Pair:            None
Site:            Austin
VIOS:            hamv2
                 hamv1
HMCs:            vhmc2_Austin
                 vhmc4_Austin

Name:            pbrazos_9119-MME-21BBC47
UUID:            6ce366c5-f05d-3a12-94f8-94a3fdfc1319
FspIp:
Pair:            None
Site:            Poughkeepsie
VIOS:            pbrazosv1
HMCs:            vhmc1_Poughkeepsie
                 vhmc3_Poughkeepsie
```

Currently, the resource class IBM.VMR_CEC is populated with your host definitions (one resource per host is created), as shown in Example 4-26.

Example 4-26 Resource class IBM.VMR_CEC populated with the host definitions

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_CEC
Resource Persistent Attributes for IBM.VMR_CEC
resource 1:
        CecUuid              = "8405b4db-629d-3f8d-907e-201d1ffd8f13"
        Name                 = "HAM-9179-MHD-SN106DBEP"
        FspIP                = ""
        SiteID               = 2
        DR_PartnerCecUuidList = {}
        MachineType          = ""
        MachineModel         = ""
        MachineSerial        = ""
        PhypVersion          = "AM780_FW780.50 (76)"
        ConfigStatus         = 0
        ConfigValues         = {}
        ProcValues           = {}
        MemValues            = {}
        Vios                 =
{"4887E8B4-6B6F-4607-836E-1B0282B65468","7701C0AC-D31E-43C8-B64A-6C86EAE5D87B"}
        HMCs                 = {"vhmc2_Austin","vhmc4_Austin"}
        LPARs                =
{"5FBA11F2-CAD6-4C0D-8F5D-D2622DD0745B","7C9C8323-47DB-435E-91FB-7105625A5386","7B
42CD08-D003-4AA8-8CFC-E4A88D9A911B","612EEF68-95C5-48DC-994D-C46597E2125D","5BA008
0B-0DC2-417A-9D21-70B489462676","1A2EA573-53E4-4743-9057-FE5822158E78","0647FBE2-B
8B5-4A2E-86ED-4242702F036C","3CE82119-A851-4DCB-BB18-79AF61021F73","1B10A101-E3A4-
```

```
418A-8DF2-07A391960C56","616D4AF1-8BE0-4A4C-8253-5CB7F45F8658","0C448266-DAD9-4921
-B880-0FE43E2AD5EF"}
        Phase                  = "READY"
        PhaseDetail            = 0
        ErrMsg                 = ""
        Memory                 = "524288"
        Processors             = "48"
        ActivePeerDomain       = "itsocluster"
resource 2:
        CecUuid                = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        Name                   = "pbrazos_9119-MME-21BBC47"
        FspIP                  = ""
        SiteID                 = 1
        DR_PartnerCecUuidList = {}
        MachineType            = ""
        MachineModel           = ""
        MachineSerial          = ""
        PhypVersion            = "SC830_FW830.10 (68)"
        ConfigStatus           = 0
        ConfigValues           = {}
        ProcValues             = {}
        MemValues              = {}
        Vios                   = {"2128DDCE-5C3D-4015-A630-B770BAC2CA7D"}
        HMCs                   = {"vhmc1_Poughkeepsie","vhmc3_Poughkeepsie"}
        LPARs                  =
{"648E8CB5-35B7-4078-93EA-C241FFF81923","3AA6357E-9160-4B05-9BAA-845248E41809","46
7D7430-618B-494E-A094-66373135B272","7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7","4685C7
2C-26FA-41A7-AB4C-B65C92217F75","3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606","00D26E0E-B
E4B-4D33-804F-3B6CC2AD593A","6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C","42BF8AE3-83BF-
4DBD-A51C-645352B88EE5","034685A8-01D2-44F8-B698-ECE28DCCEF11","27841FE1-F0B7-4C38
-B7E1-A4B563550B9C","02C67958-C7FF-4C91-8F5D-7D0BBF432E30","189DEA82-07EF-46C5-A27
1-261792E8D8B2","74401E84-F759-4BDE-A39E-6B6FC8071ECE","539BB1FF-C3CB-4693-B38C-21
AF4143D872"}
        Phase                  = "READY"
        PhaseDetail            = 0
        ErrMsg                 = ""
        Memory                 = "2097152"
        Processors             = "80"
        ActivePeerDomain       = "itsocluster"
```

The resource class IBM.VMR_VIOS is also populated with the Virtual I/O Server information, which is obtained through the HMCs (Example 4-27).

Example 4-27 Resource class IBM.VMR_VIOS populated with the Virtual I/O Servers information

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_VIOS
Resource Persistent Attributes for IBM.VMR_VIOS
resource 1:
        Name             = "hamv1"
        ViosVersion      = "VIOS 2.2.5.00 "
        ViosUuid         = "7701C0AC-D31E-43C8-B64A-6C86EAE5D87B"
        CecUuid          = "8405b4db-629d-3f8d-907e-201d1ffd8f13"
        SSPClusterID     = "xyz"
        SiteID           = 2
        ActivePeerDomain = "itsocluster"
resource 2:
```

```
        Name            = "hamv2"
        ViosVersion     = "VIOS 2.2.5.00 "
        ViosUuid        = "4887E8B4-6B6F-4607-836E-1B0282B65468"
        CecUuid         = "8405b4db-629d-3f8d-907e-201d1ffd8f13"
        SSPClusterID    = "xyz"
        SiteID          = 2
        ActivePeerDomain = "itsocluster"
resource 3:
        Name            = "pbrazosv1"
        ViosVersion     = "VIOS 2.2.5.00 "
        ViosUuid        = "2128DDCE-5C3D-4015-A630-B770BAC2CA7D"
        CecUuid         = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        SSPClusterID    = "xyz"
        SiteID          = 1
        ActivePeerDomain = "itsocluster"
```

After completing this step, you configure the host pairs.

4.6.5 Configuring host pairs

After the hosts from the home and the backup site are added to the IBM Geographically Dispersed Resiliency for Power Systems cluster, a requirement is to pair the hosts. This pairing indicates that the hosts from the backup site will back up the hosts from the home site, establishing a relationship between them. The KSYS node uses this pairing to move the virtual machines from the home to the backup site when necessary. This pairing is also considered when running the discover and verify operations, which, for example, checks whether the host from the backup site has enough resources to receive the virtual machines from the home site.

The following guidelines must be observed when pairing the hosts:

- Each host in a pair must belong to a different site.
- The host from the backup site must have enough resources (CPU and memory) to host the virtual machines from its pair in the home site. If the resources are not enough, the verify process issues warnings.
- If the host from the backup site does not have enough resources, you can use the Elastic Capacity on Demand or Power Enterprise Pools to provide resources for this host before moving the virtual machines from the home to the backup site.

> **Tip:** For more information about the Capacity on Demand offerings, see the Power Systems Capacity on Demand web page.

- The pairing does not require the same processor technology. For example, you can pair a POWER8 server with a POWER7 server.

You use the **ksysmgr pair host** command to perform the pairing operation:

```
# ksysmgr pair host -h

ksysmgr pair host <hostname>
      pair=<hostname> | pair=none
    pair => map
    host => serv*, mach*, cec*, ho*
```

Example 4-28 shows the pairing at the environment that was set up for this publication. The example shows that, initially, when the **ksysmgr query host** command runs, the hosts added (in 4.6.4, “Adding hosts to the KSYS node” on page 164) had no pair, then the hosts are paired; using the query command shows that the hosts are now paired.

Example 4-28 Pairing the hosts in the environment setup for this residency

```
(0) root @ pbrazos001: /
# ksysmgr query host
Name:            HAM-9179-MHD-SN106DBEP
UUID:            8405b4db-629d-3f8d-907e-201d1ffd8f13
FspIp:
Pair:            None
Site:            Austin
VIOS:            hamv2
                 hamv1
HMCs:            vhmc2_Austin
                 vhmc4_Austin

Name:            pbrazos_9119-MME-21BBC47
UUID:            6ce366c5-f05d-3a12-94f8-94a3fdfc1319
FspIp:
Pair:            None
Site:            Poughkeepsie
VIOS:            pbrazosv1
HMCs:            vhmc1_Poughkeepsie
                 vhmc3_Poughkeepsie

(0) root @ pbrazos001: /
# ksysmgr pair host pbrazos_9119-MME-21BBC47 pair=HAM-9179-MHD-SN106DBEP
host pbrazos_9119-MME-21BBC47 was paired with HAM-9179-MHD-SN106DBEP

(0) root @ pbrazos001: /
# ksysmgr query host
Name:            HAM-9179-MHD-SN106DBEP
UUID:            8405b4db-629d-3f8d-907e-201d1ffd8f13
FspIp:
Pair:            pbrazos_9119-MME-21BBC47
Site:            Austin
VIOS:            hamv2
                 hamv1
HMCs:            vhmc2_Austin
                 vhmc4_Austin

Name:            pbrazos_9119-MME-21BBC47
UUID:            6ce366c5-f05d-3a12-94f8-94a3fdfc1319
FspIp:
Pair:            HAM-9179-MHD-SN106DBEP
Site:            Poughkeepsie
VIOS:            pbrazosv1
HMCs:            vhmc1_Poughkeepsie
                 vhmc3_Poughkeepsie
```

Example 4-29 shows that, after pairing the hosts, the `IBM.VMR_CEC` resource class is updated with the UUID of the host pairs.

Example 4-29 IBM.VMR_CEC resource class updated with host pairs UUID

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_CEC
Resource Persistent Attributes for IBM.VMR_CEC
resource 1:
        CecUuid               = "8405b4db-629d-3f8d-907e-201d1ffd8f13"
        Name                  = "HAM-9179-MHD-SN106DBEP"
        FspIP                 = ""
        SiteID                = 2
        DR_PartnerCecUuidList = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        MachineType           = ""
        MachineModel          = ""
        MachineSerial         = ""
        PhypVersion           = "AM780_FW780.50 (76)"
        ConfigStatus          = 0
        ConfigValues          = {}
        ProcValues            = {}
        MemValues             = {}
        Vios                  =
{"4887E8B4-6B6F-4607-836E-1B0282B65468","7701C0AC-D31E-43C8-B64A-6C86EAE5D87B"}
        HMCs                  = {"vhmc2_Austin","vhmc4_Austin"}
        LPARs                 =
{"5FBA11F2-CAD6-4C0D-8F5D-D2622DD0745B","7C9C8323-47DB-435E-91FB-7105625A5386","7B
42CD08-D003-4AA8-8CFC-E4A88D9A911B","612EEF68-95C5-48DC-994D-C46597E2125D","5BA008
0B-0DC2-417A-9D21-70B489462676","1A2EA573-53E4-4743-9057-FE5822158E78","0647FBE2-B
8B5-4A2E-86ED-4242702F036C","3CE82119-A851-4DCB-BB18-79AF61021F73","1B10A101-E3A4-
418A-8DF2-07A391960C56","0C448266-DAD9-4921-B880-0FE43E2AD5EF","616D4AF1-8BE0-4A4C
-8253-5CB7F45F8658"}
        Phase                 = "READY"
        PhaseDetail           = 0
        ErrMsg                = ""
        Memory                = "524288"
        Processors            = "48"
        ActivePeerDomain      = "itsocluster"
resource 2:
        CecUuid               = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        Name                  = "pbrazos_9119-MME-21BBC47"
        FspIP                 = ""
        SiteID                = 1
        DR_PartnerCecUuidList = {"8405b4db-629d-3f8d-907e-201d1ffd8f13"}
        MachineType           = ""
        MachineModel          = ""
        MachineSerial         = ""
        PhypVersion           = "SC830_FW830.10 (68)"
        ConfigStatus          = 0
        ConfigValues          = {}
        ProcValues            = {}
        MemValues             = {}
        Vios                  = {"2128DDCE-5C3D-4015-A630-B770BAC2CA7D"}
        HMCs                  = {"vhmc1_Poughkeepsie","vhmc3_Poughkeepsie"}
        LPARs                 =
{"648E8CB5-35B7-4078-93EA-C241FFF81923","3AA6357E-9160-4B05-9BAA-845248E41809","46
```

```
7D7430-618B-494E-A094-66373135B272","7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7","4685C7
2C-26FA-41A7-AB4C-B65C92217F75","3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606","00D26E0E-B
E4B-4D33-804F-3B6CC2AD593A","6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C","42BF8AE3-83BF-
4DBD-A51C-645352B88EE5","034685A8-01D2-44F8-B698-ECE28DCCEF11","27841FE1-F0B7-4C38
-B7E1-A4B563550B9C","02C67958-C7FF-4C91-8F5D-7D0BBF432E30","189DEA82-07EF-46C5-A27
1-261792E8D8B2","74401E84-F759-4BDE-A39E-6B6FC8071ECE","539BB1FF-C3CB-4693-B38C-21
AF4143D872"}
        Phase                = "READY"
        PhaseDetail          = 0
        ErrMsg               = ""
        Memory               = "2097152"
        Processors           = "80"
        ActivePeerDomain     = "itsocluster"
```

4.6.6 Managing and unmanaging virtual machines

When the hosts are added to the IBM Geographically Dispersed Resiliency for Power Systems scope and then paired, the virtual machines that are running in each of the hosts are added to the KSYS node. These virtual machines are automatically managed by the KSYS node, as shown in Example 4-30. You can use the **ksysmgr unmanage vm** command to unmanage the VMs for which you do not want the KSYS node to act in a disaster. If you need to manage a VM that you previously unmanaged, you can use the **ksysmgr manage vm** command to add the virtual machine to the KSYS node management scope.

Example 4-30 Output of the ksysmgr query vm command

```
(130) root @ pbrazos001: /
# ksysmgr query vm
Unmanaged VMs:

Managed VMs:
        pbrazos004
        pbrazos007
        pbrazos006
        pbrazos008
        pbrazos030
        pbrazos003
        pbrazos031

All VMs:
Name:            pbrazos004
UUID:            42BF8AE3-83BF-4DBD-A51C-645352B88EE5
host:            pbrazos_9119-MME-21BBC47
State:           READY

Name:            pbrazos007
UUID:            6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C
host:            pbrazos_9119-MME-21BBC47
State:           READY

Name:            pbrazos006
UUID:            00D26E0E-BE4B-4D33-804F-3B6CC2AD593A
host:            pbrazos_9119-MME-21BBC47
State:           READY
```

```
Name:           pbrazos008
UUID:           3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos030
UUID:           4685C72C-26FA-41A7-AB4C-B65C92217F75
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos003
UUID:           7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos031
UUID:           467D7430-618B-494E-A094-66373135B272
host:           pbrazos_9119-MME-21BBC47
State:          READY
```

After the hosts are added and paired, the virtual machine information is added to the `IBM.VMR_LPAR` resource class, as shown in Example 4-31. You can see that only the basic information of the virtual machines is added currently. Notice that the `LCB` information is empty currently. The LPAR Control Block (LCB) information is populated after the discovery operation.

> **Note:** The LCB contains the details of the profile of the LPAR. It is binary data that is obtained from the HMC, which is used to create the LPAR with the same configuration at the backup site in case you need to move your virtual machines. The KSYS node does not try to interpret this data, but stores it and uses it if it needs to create the virtual machines at the backup site for disaster recovery purposes.

Example 4-31 Output of the IBM.VMR_LPAR resource class

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_LPAR
Resource Persistent Attributes for IBM.VMR_LPAR
resource 1:
        Name                = "pbrazos004"
        LparUuid            = "42BF8AE3-83BF-4DBD-A51C-645352B88EE5"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 0
        LCB                 = ""
        BootDiskList        = {}
        CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg              = ""
        Phase               = "READY"
        PhaseDetail         = 0
        Memory              = ""
        Processors          = ""
        ActivePeerDomain    = "itsocluster"
resource 2:
        Name                = "pbrazos007"
        LparUuid            = "6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C"
```

```
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 0
        LCB                 = ""
        BootDiskList        = {}
        CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg              = ""
        Phase               = "READY"
        PhaseDetail         = 0
        Memory              = ""
        Processors          = ""
        ActivePeerDomain    = "itsocluster"
resource 3:
        Name                = "pbrazos006"
        LparUuid            = "00D26E0E-BE4B-4D33-804F-3B6CC2AD593A"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 0
        LCB                 = ""
        BootDiskList        = {}
        CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg              = ""
        Phase               = "READY"
        PhaseDetail         = 0
        Memory              = ""
        Processors          = ""
        ActivePeerDomain    = "itsocluster"
resource 4:
        Name                = "pbrazos008"
        LparUuid            = "3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 0
        LCB                 = ""
        BootDiskList        = {}
        CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg              = ""
        Phase               = "READY"
        PhaseDetail         = 0
        Memory              = ""
        Processors          = ""
        ActivePeerDomain    = "itsocluster"
resource 5:
        Name                = "pbrazos030"
        LparUuid            = "4685C72C-26FA-41A7-AB4C-B65C92217F75"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 0
        LCB                 = ""
        BootDiskList        = {}
        CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg              = ""
        Phase               = "READY"
        PhaseDetail         = 0
        Memory              = ""
```

```
        Processors         = ""
        ActivePeerDomain   = "itsocluster"
resource 6:
        Name               = "pbrazos003"
        LparUuid           = "7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7"
        LparIPList         = {}
        SiteCleanupTastList = {}
        ActiveSiteID       = 0
        LCB                = ""
        BootDiskList       = {}
        CecUuid            = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg             = ""
        Phase              = "READY"
        PhaseDetail        = 0
        Memory             = ""
        Processors         = ""
        ActivePeerDomain   = "itsocluster"
resource 7:
        Name               = "pbrazos031"
        LparUuid           = "467D7430-618B-494E-A094-66373135B272"
        LparIPList         = {}
        SiteCleanupTastList = {}
        ActiveSiteID       = 0
        LCB                = ""
        BootDiskList       = {}
        CecUuid            = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg             = ""
        Phase              = "READY"
        PhaseDetail        = 0
        Memory             = ""
        Processors         = ""
        ActivePeerDomain   = "itsocluster"
```

Use the **ksysmgr unmanage | manage vm** command if you need to unmanage or manage a virtual machine as follows:

```
# ksysmgr unmanage vm -h

ksysmgr unmanage vm
    name=<vmname> host=<hostname> | uuid=<lparuuid>
    unmanage => unman*, umg
    vm => lp*, vm

# ksysmgr manage vm -h

ksysmgr manage vm
    name=<vmname> host=<hostname> | uuid=<lparuuid>
    manage => man*, mg
    vm => lp*, vm
```

Example 4-32 on page 175 shows the virtual machines that are not included in this IBM Geographically Dispersed Resiliency for Power Systems residency environment (those are unmanaged). The command is executed for one VM at a time.

Example 4-32 Virtual machines being unmanaged in the environment setup for this residency

```
(0) root @ pbrazos001: /
# ksysmgr unmanage vm uuid=42BF8AE3-83BF-4DBD-A51C-645352B88EE5
VM 42BF8AE3-83BF-4DBD-A51C-645352B88EE5 was successfully unmanaged

(0) root @ pbrazos001: /
# ksysmgr unmanage vm uuid=00D26E0E-BE4B-4D33-804F-3B6CC2AD593A
VM 00D26E0E-BE4B-4D33-804F-3B6CC2AD593A was successfully unmanaged

(0) root @ pbrazos001: /
# ksysmgr unmanage vm uuid=7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7
VM 7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7 was successfully unmanaged

(0) root @ pbrazos001: /
# ksysmgr unmanage vm uuid=467D7430-618B-494E-A094-66373135B272
VM 467D7430-618B-494E-A094-66373135B272 was successfully unmanaged
```

The KSYS node starts to manage the disaster recovery of your virtual machines only after the discover and verify operations. To perform such operations, your managed virtual machines must already be properly set according to the requirements specified during the planning phase. The disks that are used by the virtual machines must already be replicated properly (as described in 3.3.8, “Setting up storage for the virtual machines” on page 57). So, if you have virtual machines whose disks were not replicated and are not part of the IBM Geographically Dispersed Resiliency for Power Systems environment, you should unmanage them before performing the discover and verify operations, otherwise the operations fail.

Important: If you have virtual machines using PowerHA SystemMirror Enterprise Edition, which deals with replicated resources (including Dell EMC SRDF replication), this means that the PowerHA software is already handling the disaster recovery of those virtual machines. It also means that they should not be part of the IBM Geographically Dispersed Resiliency for Power Systems environment, and therefore these virtual machines should be unmanaged.

If you have virtual machines using PowerHA SystemMirror Standard Edition, the high availability is provided within the same site, then it is likely to be the home site that is used in the IBM Geographically Dispersed Resiliency for Power Systems solution. In this case, you can include these virtual machines in the IBM Geographically Dispersed Resiliency for Power Systems environment by following these guidelines:

- Add all the virtual machines from your PowerHA cluster to the IBM Geographically Dispersed Resiliency for Power Systems management.
- Perform a test of moving the virtual machines to the backup site (using the IBM Geographically Dispersed Resiliency for Power Systems) and validate whether the PowerHA cluster starts correctly.

For PowerHA SytstemMirror Version 7.1.0, or later, additional steps are required to start the cluster. Those steps are required because of the UUID change of the repository disk that is used by Cluster Aware AIX (CAA); although the data is replicated, the backup site uses a different volume, and CAA is sensitive to such change. For more information about these additional steps, see 6.8, “Planning a PowerHA cluster move” on page 357.

After unmanaging the virtual machines, run the **ksysmgr query vm** command against to ensure that only the virtual machines that you want are managed by the KSYS node as shown in Example 4-33.

Example 4-33 Output of the ksysmgr query vm command after unmanaging some VMs

```
(0) root @ pbrazos001: /
# ksysmgr query vm
Unmanaged VMs:
        pbrazos004
        pbrazos006
        pbrazos003
        pbrazos031

Managed VMs:
        pbrazos007
        pbrazos008
        pbrazos030


All VMs:
Name:           pbrazos004
UUID:           42BF8AE3-83BF-4DBD-A51C-645352B88EE5
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED

Name:           pbrazos007
UUID:           6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos006
UUID:           00D26E0E-BE4B-4D33-804F-3B6CC2AD593A
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED

Name:           pbrazos008
UUID:           3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos030
UUID:           4685C72C-26FA-41A7-AB4C-B65C92217F75
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos003
UUID:           7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED

Name:           pbrazos031
UUID:           467D7430-618B-494E-A094-66373135B272
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED
```

> **Tip:** The State of the managed virtual machines is READY. This State changes to READY_TO_MOVE after a successful verify operation.

In this case, the resource equivalent to the virtual machine in the IBM.VMR_LPAR resource class has its Phase changed to UNMANAGED too, as shown in Example 4-34.

Example 4-34 IBM.VMR_LPAR resource class showing an UNMANAGED VM

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_LPAR
Resource Persistent Attributes for IBM.VMR_LPAR
.
. <Many lines were omitted>
.
resource 7:
        Name                = "pbrazos031"
        LparUuid            = "467D7430-618B-494E-A094-66373135B272"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 0
        LCB                 = ""
        BootDiskList        = {}
        CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg              = ""
        Phase               = "UNMANAGED"
        PhaseDetail         = 0
        Memory              = "8192"
        Processors          = "2"
        ActivePeerDomain    = "itsocluster"
```

4.6.7 Adding storage agents to the KSYS node

In the IBM Geographically Dispersed Resiliency for Power Systems solution, the data integrity is guaranteed by using storage replication to replicate the data from the home site to the backup site (and reverse the direction of the replication in case you need to move the virtual machines to the backup site). The KSYS node manages the storage subsystems from both sites to query the status and control the replication of the volumes to enable the disaster recovery operations.

To manage the storage subsystems from both sites, the KSYS node relies on the management tools, or APIs, provided by the storage vendor. Such tools must be previously installed and configured in the KSYS node when required before adding the storage agents to the KSYS node configuration. This software must allow the KSYS node to contact the storage subsystems to perform identification of volume pairs, create disk groups, and control the replication directions (reverse the replication when necessary).

Important: All the software that is required to perform management of the storage subsystems must be installed in the KSYS node before adding the storage agents to the configuration. Depending on the storage subsystem that is used in your environment, download the storage management tool from the storage vendor website, and install and configure at the KSYS node. Also, depending on the storage solution, you might be required to set up storage controllers at each site that are hosts able to perform in-band management of the storage array. For more information about how to set up the storage management in your environment before adding the storage agents to the KSYS node, see Chapter 3, "Storage and SAN setup for the IBM Geographically Dispersed Resilience environment" on page 25.

Note: At the time of writing this publication, only the Dell EMC VMAX Storage is supported in the IBM Geographically Dispersed Resiliency for Power Systems solution. The currently supported method of disk replication is SRDF Asynchronous (SRDF/A). The Dell EMC tool that is used to control the Dell EMC VMAX Storage is the Dell EMC Solutions Enabler software, which must be properly set up at the KSYS node. For more information about how to set up the Dell EMC tools to manage the Storage subsystems in the IBM Geographically Dispersed Resiliency for Power Systems solution, see 3.3, "Setting up the Dell EMC Storage in the IBM Geographically Dispersed Resilience environment" on page 29.

All storage units that are involved in the IBM Geographically Dispersed Resiliency for Power Systems solution from both sites must be added to the KSYS node.

Adding Dell EMC storage devices

For Dell EMC VMAX storage, the KSYS node uses SYMAPI commands to communicate with the storage subsystems. Such commands are provided by the Dell EMC package, named Dell EMC Solutions Enabler, which must be properly set up in the KSYS node. For more information about setting up the Dell EMC Solutions Enabler software at the KSYS node, see 3.3.6, "Installing and configuring the SYMAPI client on the KSYS node" on page 51.

The Dell EMC Solutions Enabler from the KSYS node contacts SYMAPI servers, which are denominated storage controllers in the IBM Geographically Dispersed Resiliency for Power Systems solution, to manage the storage subsystems.

See these sections:

- For more information about how to set up the storage controllers, see 3.3.5, "Installing and configuring the SYMAPI servers (storage controllers)" on page 35.
- The topology that is used by the KSYS node through the Dell EMC Solutions Enabler software to control the Dell EMC Storages from both sites is explained in 3.3.3, "IBM Geographically Dispersed Resilience storage topology" on page 33.
- For a better understanding of the storage setup in the IBM Geographically Dispersed Resiliency for Power Systems environment, review Chapter 3, "Storage and SAN setup for the IBM Geographically Dispersed Resilience environment" on page 25.

Currently, considering that the Dell EMC Solutions Enabler software is already set up and tested in the KSYS node, perform the following steps to add the storage agents from both sites to the IBM Geographically Dispersed Resiliency for Power Systems solution. The examples that are shown here are for the environment that was used when writing this publication.

1. Check the `/var/symapi/config/netcnfg` file for the SYMAPI servers (or storage controller) definitions that were previously configured in your environment (Example 4-35). You also need the IP address of the storage controllers.

Example 4-35 Obtaining the IP Addresses of the SYMAPI servers

```
(0) root @ pbrazos001: /
# grep -v "\#" /var/symapi/config/netcnfg

SYMAPI_SITE_508 - TCPIP r7r3m106 10.40.0.30 2707 ANY
SYMAPI_SITE_573 - TCPIP r7r3m107 10.40.0.31 2707 ANY
```

2. Export the Dell EMC Solutions Enabler variables to manage one of the storages and run the **symcfg list** command to obtain the 12-digit Symmetrix ID (SID). Because the SRDF replication is already set up, the command shows the SID from both storage areas (from both sites). If necessary, repeat the procedure for other storage that is not communicating between them, and obtain the SID from all storage that will be added to the KSYS node (from both sites), as shown in Example 4-36.

Example 4-36 Obtaining the SID of the Dell EMC Storages

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_508

(0) root @ pbrazos001: /
# export SYMCLI_CONNECT_TYPE=REMOTE

(0) root @ pbrazos001: /
# symcfg list

                                S Y M M E T R I X

                                       Mcode    Cache      Num Phys  Num Symm
    SymmID       Attachment  Model     Version  Size (MB)  Devices   Devices

    000196800508 Local       VMAX100K  5977      216064        18     13010
    000196800573 Remote      VMAX100K  5977      217088         0      9414
```

3. Use the **ksysmgr** command to add the storage agents. Repeat this command for all storage agents that are involved in your IBM Geographically Dispersed Resiliency for Power Systems environment. Use the following syntax:

```
# ksysmgr add storage_agent -h

ksysmgr add storage_agent <storage_agent_name>
      hostname | ip =<hostname | ip>
      site=<sitename>
      storagetype=<type>
      serialnumber=<number>
    add => create, make
    storage_agent => storage*, sta
```

The `ip` that is provided is the IP address of the storage controller (or SYMAPI server) obtained from the `/var/symapi/config/netcnfg` file. The `serialnumber` is the SID of the Dell EMC Storage, and the `storagetype` is `emc` in this case.

Example 4-37 shows the storage agents being added at the environment setup for this publication.

Example 4-37 Adding storage agents in the environment setup for this residency

```
(0) root @ pbrazos001: /
# ksysmgr add storage_agent sa_Poughkeepsie_508 site=Poughkeepsie
serialnumber=000196800508 storagetype=emc ip=10.40.0.30
Adding storage agent this may take a few minutes...
Storage_agent sa_Poughkeepsie_508 was added

(0) root @ pbrazos001: /
# ksysmgr add storage_agent sa_Austin_573 site=Austin serialnumber=000196800573
storagetype=emc ip=10.40.0.31
Adding storage agent this may take a few minutes...
Storage_agent sa_Austin_573 was added
```

Tip: During this step, among other actions, the KSYS node uses the script `/opt/IBM/ksys/storages/EMC/get_emc_stg_info` to contact the storage controller and obtain information about the storage you are adding. For information about this operation, see the `/var/ksys/log/ksys_srdf.log` log file.

4. Use the **`ksysmgr query storage_agent`** command to determine whether the storage agents were added properly (Example 4-38).

Example 4-38 Checking if the storage agents were added

```
(0) root @ pbrazos001: /
# ksysmgr query storage_agent
Name:            sa_Poughkeepsie_508
Serial:          196800508
Storagetype:     SRDF
Site:            Poughkeepsie
Ip:              10.40.0.30
Login:           default

Name:            sa_Austin_573
Serial:          196800573
Storagetype:     SRDF
Site:            Austin
Ip:              10.40.0.31
Login:           default
```

During this action, the resource class IBM.VMR_SA is populated with the storage agent information (Example 4-39).

Example 4-39 Resource class IBM.VMR_SA populated with storage agent information

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_SA
Resource Persistent Attributes for IBM.VMR_SA
resource 1:
        SAname          = "sa_Poughkeepsie_508"
        SA_serial       = "196800508"
        storageType     = 227
```

```
        siteID          = 1
        ipAddr          = "10.40.0.30"
        userID          = "default"
        password        = "default"
        StgInfVendor    = "EMC"
        StgInfProductID = "SYMMETRIX"
        StgInfRevision  = "5977"
        Phase           = "READY"
        PhaseDetail     = 0
        ActivePeerDomain = "itsocluster"
resource 2:
        SAname          = "sa_Austin_573"
        SA_serial       = "196800573"
        storageType     = 227
        siteID          = 2
        ipAddr          = "10.40.0.31"
        userID          = "default"
        password        = "default"
        StgInfVendor    = "EMC"
        StgInfProductID = "SYMMETRIX"
        StgInfRevision  = "5977"
        Phase           = "READY"
        PhaseDetail     = 0
        ActivePeerDomain = "itsocluster"
```

4.6.8 Setting up contacts for events notification

You can optionally add mechanisms for the KSYS node to contact you in case of events. Although this step is optional (because the IBM Geographically Dispersed Resiliency for Power Systems solution still works correctly without this configuration), it is preferred so that you can receive a notification as soon as a problem occurs in the environment, giving you time to review the problem and decide what action to take.

The KSYS node tracks the environment and uses these contacts to notify you. The following types of contacts can be added for each user:

- Email address
- Phone number with phone carrier email address
- Pager email address

You can add information for multiple contacts per user, but information for only one contact per command can be added. If you want to add more than one contact information per user, run multiple commands.

To add an address for text messages (SMS) or pager number, you must provide your address in the format of an email. The phone carriers usually offer a way to receive an email and transform the email in an SMS or pager message. To obtain your phone carrier email address, contact your phone service provider. A list of several phone service providers and their email addresses are at the email text messages website.

> **Important:** Your KSYS node must have a public address in your network so that it can send email successfully.

To add the notification methods, use the **ksysmgr add notify** command with the following syntax:

```
# ksysmgr add notify -h

ksysmgr add notify
            user=<username>
            contact=<contact>
```

Example 4-40 shows an email address added for notification.

Example 4-40 Adding email address for event notification

```
(0) root @ pbrazos001: /
# ksysmgr add notify user=Fabio contact=fabiomm@br.ibm.com
successfully added user info
```

Example 4-41 shows an SMS address that is added for event notification.

Example 4-41 Adding SMS address for event notification

```
(0) root @ pbrazos001: /
# ksysmgr add notify user=Fabio contact=5129340790@txt.att.net
successfully added user info
```

Example 4-42 shows a pager address added for event notification.

Example 4-42 Adding pager address for event notification

```
(0) root @ pbrazos001: /
# ksysmgr add notify user=Fabio contact=5129340790@skytel.com
successfully added user info
```

Example 4-43 shows how you can check whether the addresses are added properly.

Example 4-43 Checking the notification contact information

```
(0) root @ pbrazos001: /
# ksysmgr query notify contact
User:           Fabio
Contact:        fabiomm@br.ibm.com

User:           Fabio
Contact:        5129340790@txt.att.net

User:           Fabio
Contact:        5129340790@skytel.com
```

Tip: The user name that is provided in the **ksysmgr add notify** command does not need to exist in the AIX server. This is just the information of the user who will receive notification by the KSYS node.

4.6.9 Running the discovery operation

After all components of the IBM Geographically Dispersed Resiliency for Power Systems environment are added to the KSYS node, including sites, HMCs, hosts, host pairs, virtual machines, and storage agents, you must run a discovery operation in your KSYS node.

The KSYS node uses the configuration that you added to it to communicate with the involved components and discover the resources that are related to the IBM Geographically Dispersed Resiliency for Power Systems environment. The KSYS node captures the configuration from the active and backup sites and prepares the environment for disaster recovery purposes. Only information collection is performed at this point; no modification to you currently running environment is performed.

During the first discovery operation, the KSYS node uses the list of virtual machines you previously provided (during the **`ksysmgr manage vm`** or the **`ksysmgr unmanage vm`** command operations). In the following discovery operations that you run, the KSYS node scans the hosts looking for new virtual machines that might have been created or moved to the hosts using Live Partition Mobility (LPM), and then it updates the list of virtual machines it is able to manage (see the **`ksysmgr query vm`** command output).

During the discovery phase, this is what happens:

1. The KSYS node obtains the list of virtual machines it manages. It already knows the hosts where the virtual machines are and which Virtual I/O Servers the hosts have. The KSYS node is also aware of the HMCs that manage these hosts.
2. The KSYS node then contacts the HMCs and performs query commands that interact with the Virtual I/O Servers and obtains a list of resources that are used by the virtual machines.
3. The LPAR Control Block information (LCB, which contains all the details of the profiles of the virtual machines) is obtained by the HMCs and stored in the `IBM.VMR_LPAR` resource class.
4. Also, during the discovery phase, the KSYS node obtains from the HMCs (and from the Virtual I/O Servers) the list of disks that are used by each virtual machine (disks can be available using NPIV, VSCSI, or a combination of these modes).
5. The KSYS node then contacts the storage agents to determine whether these disks are properly set up for storage replication. If a disk is not configured for replication, the command produces an error and notifies you about which volume is not properly set up.

Still, during the discovery phase, the *Disk Groups* are created in the KSYS node. The disk group is basically a group of all volumes from a site (this group might include volumes from more than one storage subsystem from the same site, in case you have more than one storage that is involved in the IBM Geographically Dispersed Resiliency for Power Systems solution). The KSYS node also uses the storage agent to contact the storage subsystem and create the consistency group within the storage. One consistency group at each site is created, containing all the volumes from all the storage subsystems from that site. All the KSYS node further operations are performed at the disk group level.

Note: For Dell EMC VMAX storage systems, one composite group (CG) at each site is created, containing the volumes from all storage from that site. From the KSYS node perspective, *disk group*, *consistency group*, and *composite group* have the same meaning. For more information about these definitions, see 3.3.2, "Management of the volume pairs by using a composite group" on page 31.

Important: For Dell EMC Storage using SRDF/A replication, all volume pairs in an RDF group must belong to virtual machines that are managed by the IBM Geographically Dispersed Resiliency for Power Systems solution. You cannot have some volume pairs that are managed by the KSYS node and other volume pairs that are not managed by the KSYS node in the same RDF group.

For example, if volumes used by VMs pbrazos007 and pbrazos008 are in the same RDF group, both VMs should be managed by the KSYS node. If, for example, pbrazos008 is not managed by the KSYS node, then the discovery operation fails with a disk mismatch count failure.

For more information about RDF groups and Dell EMC Storage setup, see Chapter 3, "Storage and SAN setup for the IBM Geographically Dispersed Resilience environment" on page 25.

If the environment is modified, for example, by moving a virtual machine between hosts at the home site, or if a new volume is added to an existing virtual machine, the discovery operation identifies such changes, adds to the configuration, and starts monitoring the modified environment for disaster recovery purposes.

Use the following command to perform the discovery operation:

```
# ksysmgr discover site -h

ksysmgr discover site <sitename>
      verify=<yes|no>
    discover => di*
    site => sit*
```

The following steps show how the discovery operation is performed in this environment. Step 5 on page 186 shows the discovery operation correctly being run, and it is the only required step for this topic. The remaining steps are documented to explain what actions are performed during the discovery operation:

1. Use the **ksysmgr query vm** command to ensure that only the VMs you want to add to the IBM Geographically Dispersed Resiliency for Power Systems environment are managed (Example 4-44).

Example 4-44 Check whether only the desired VMs are managed by KSYS

```
(0) root @ pbrazos001: /
# ksysmgr query vm state=manage | grep -p Managed
Managed VMs:
        pbrazos007
        pbrazos008
        pbrazos030
```

2. Check that the volume pairs of these virtual machines are properly set up for replication (Example 4-45). The volumes `0324F`, `03250`, `03251`, `03254`, `03255` are used by the virtual machines `pbrazos007`, `pbrazos008`, and `pbrazos030`, which are the ones that are currently managed by this IBM Geographically Dispersed Resiliency for Power Systems solution.

Example 4-45 Volume pairs of managed VMs setup for SRDF/A replication

```
(0) root @ pbrazos001: /
# symcli -def


Symmetrix Command Line Interface (SYMCLI) Version V8.1.0.0 (Edit Level: 2054)
built with SYMAPI Version V8.1.0.0 (Edit Level: 2054)


Current settings of the SYMCLI environmental variables:

  SYMCLI_CONNECT              : SYMAPI_SITE_508
  SYMCLI_CONNECT_TYPE         : REMOTE


(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
0324F 02414   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03250 02415   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03251 02416   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03254 0241E   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03255 0241F   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
```

3. Check whether the RDF group that is used for replication contains only the volume pairs of the managed VMs (no volume pairs from unmanaged VMs should be part of the RDF group), as shown in Example 4-46.

Example 4-46 All volumes in RDF group belong to managed VMs

```
(0) root @ pbrazos001: /
# symrdf list | grep -w "R1\:67"
0324F 02414   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03250 02415   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03251 02416   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03254 0241E   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
03255 0241F   R1:67  RW RW RW  A..1.      0       0 RW  WD   Consistent
```

Example 4-46 checks the volume pairs belonging to the RDF Group 67. As shown, it contains only the same volumes of the virtual machines `pbrazos007`, `pbrazos008`, and `pbrazos030` that are being managed by the KSYS node. If additional volumes are displayed here, then the discovery operation can fail because of a disk-count mismatch.

In the IBM Geographically Dispersed Resiliency for Power Systems solution, you can have multiple RDF groups being used by your virtual machines; repeat the same steps for each of the RDF groups that are used in the IBM Geographically Dispersed Resiliency for Power Systems environment.

For more information about RDF groups and the setup of the SRDF replication, see Chapter 3, "Storage and SAN setup for the IBM Geographically Dispersed Resilience environment" on page 25.

4. Currently, no CG is created for this cluster in any storage (the cluster name here is `itsocluster`, so the CG name is `VMRDG_itsocluster_<sitename>`), as shown in Example 4-47.

Example 4-47 No composite group exists for this environment

```
(0) root @ pbrazos001: /var/symapi/log
# export SYMCLI_CONNECT=SYMAPI_SITE_508

(0) root @ pbrazos001: /var/symapi/log
# symcg list

                      C O M P O S I T E   G R O U P S

                                         Number of          Number of
  Name                   Type   Valid  Symms RAGs  DGs Devs  BCVs  VDEVs  TGTs

  VMRDG_itso3_cluster_S* RDF2    Yes      1     2    0    9     0      0     0
  VMRDG_itso4_cluster_I* RDF2    Yes      1     1    0    7     0      0     0
  VMRDG_itsocluster2_IT* RDF2    Yes      0     0    0    0     0      0     0


(0) root @ pbrazos001: /var/symapi/log
# export SYMCLI_CONNECT=SYMAPI_SITE_573

(130) root @ pbrazos001: /var/symapi/log
# symcg list

                      C O M P O S I T E   G R O U P S

                                         Number of          Number of
  Name                   Type   Valid  Symms RAGs  DGs Devs  BCVs  VDEVs  TGTs

  VMRDG_itso3_cluster_S* RDF1    Yes      1     2    0    9     0      0     0
  VMRDG_itso4_cluster_I* RDF1    Yes      1     1    0    7     0      0     0
  VMRDG_itsocluster2_IT* RDF1    Yes      0     0    0    0     0      0     0
```

5. Run the **`ksysmgr discover site <sitename>`** operation (Example 4-48). The command output shows that all VMs are discovered, the configuration is retrieved for each of the managed VMs, including storage information, and the disk group is created at both sites.

Example 4-48 Output of the discover operation

```
(0) root @ pbrazos001: /
# ksysmgr discover site Poughkeepsie
Running discovery on entire site, this may take few minutes...
        Storage state synchronization has started for Site Poughkeepsie
        Storage state synchronization has completed for Site Poughkeepsie
        Discovery has started for VM pbrazos008
        Configuration information retrieval started for VM pbrazos008
        Discovery has started for VM pbrazos030
        Configuration information retrieval started for VM pbrazos030
        Discovery has started for VM pbrazos007
        Configuration information retrieval started for VM pbrazos007
        Configuration information retrieval completed for VM pbrazos008
        Configuration information retrieval completed for VM pbrazos030
        Configuration information retrieval completed for VM pbrazos007
        Storage information retrieval from VIOS started for VM pbrazos008
        Storage information retrieval from VIOS started for VM pbrazos030
```

```
        Storage information retrieval from VIOS started for VM pbrazos007
        Storage information retrieval from VIOS completed for VM pbrazos008
        Discovery for VM pbrazos008 is complete
        Storage information retrieval from VIOS completed for VM pbrazos030
        Discovery for VM pbrazos030 is complete
        Storage information retrieval from VIOS completed for VM pbrazos007
        Discovery for VM pbrazos007 is complete
        Disk Group creation on storage subsystem started for Site Poughkeepsie
        Disk Group creation on storage subsystem started for Site Austin
        Disk Group creation on storage subsystem completed for Site Poughkeepsie
        Disk Group creation on storage subsystem completed for Site Austin
Discovery has finished for Poughkeepsie
3 out of 3 managed VMs have been successfully discovered
```

Note: Run the discover operation only for the home site. Running the discover operation for the backup site results in the following error message:

```
(0) root @ pbrazos001: /
# ksysmgr discover site Austin
ERROR: Austin is not the active site. Run "ksysmgr [-v] report system" to
view the current configuration
```

6. After discovery is completed, the state of the virtual machines is `READY` (Example 4-49). This state changes to `READY_TO_MOVE` only after a successful verify operation.

Example 4-49 State of the VMs set to READY after the discover operation

```
(0) root @ pbrazos001: /
# ksysmgr query ksyscluster
Name:           itsocluster
State:          Online

(0) root @ pbrazos001: /
# ksysmgr query vm
Unmanaged VMs:
        pbrazos004
        pbrazos006
        pbrazos003
        pbrazos031

Managed VMs:
        pbrazos007
        pbrazos008
        pbrazos030


All VMs:
Name:           pbrazos004
UUID:           42BF8AE3-83BF-4DBD-A51C-645352B88EE5
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED

Name:           pbrazos007
UUID:           6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C
host:           pbrazos_9119-MME-21BBC47
State:          READY
```

```
Name:           pbrazos006
UUID:           00D26E0E-BE4B-4D33-804F-3B6CC2AD593A
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED

Name:           pbrazos008
UUID:           3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos030
UUID:           4685C72C-26FA-41A7-AB4C-B65C92217F75
host:           pbrazos_9119-MME-21BBC47
State:          READY

Name:           pbrazos003
UUID:           7CE3B71A-2F50-46C8-BD1E-28AB9243E2F7
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED

Name:           pbrazos031
UUID:           467D7430-618B-494E-A094-66373135B272
host:           pbrazos_9119-MME-21BBC47
State:          UNMANAGED
```

7. Check the resource class `IBM.VMR_LPAR` and verify that the managed VMs are updated with the LCB information. As explained previously, LCB is the LPAR Control Block and is basically a set of binary data that contains the profile information of the LPAR, which allows the HMC from the backup site to deploy the VM at the destination host in a disaster. Example 4-50 shows the output of an updated VM resource, but several pieces of the LCB are removed to simplify this page.

Example 4-50 Output of the IBM.VMR_LPAR resource class after the discover operation

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_LPAR
Resource Persistent Attributes for IBM.VMR_LPAR
.
. <Several lines were omitted>
.
resource 8:
        Name               = "pbrazos007"
        LparUuid           = "6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C"
        LparIPList         = {}
        SiteCleanupTastList = {}
        ActiveSiteID       = 0
        LCB                = "0x3c3f786d 0x6c207665 0x7273696f 0x6e3d2231 0x2e302220 0x656e636f
0x64696e67 ... 0x6174696f 0x6e3e"
        BootDiskList       = {}
        CecUuid            = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg             = ""
        Phase              = "READY"
        PhaseDetail        = 0
        Memory             = "4096"
        Processors         = "0.1"
        ActivePeerDomain   = "itsocluster"
.
. <Several lines were omitted>
.
```

8. The IBM.VMR_DG resource class, which stores the disk group information, is also updated with the information regarding the disk groups that are created at both sites. In this case, the disk groups are the names of the CGs created at the Dell EMC Storages from each site. The disk group is always named as VMRDG_<clustername>_<sitename>.

   Example 4-51 shows the disk groups that are created at the storage systems from the environment setup for this publication.

   Example 4-51 Disk groups that are created in the Dell EMC Storages

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_DG
Resource Persistent Attributes for IBM.VMR_DG
resource 1:
        Name             = "VMRDG_itsocluster_Poughkeepsie"
        SiteID           = 1
        StorageIDs       = {"196800508"}
        hostUuidList     = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        VmGroupID        = 1
        MirrorGroup      = {["VMRDG_itsocluster_Poughkeepsie",0,{""}]}
        ActivePeerDomain = "itsocluster"
resource 2:
        Name             = "VMRDG_itsocluster_Austin"
        SiteID           = 2
        StorageIDs       = {"196800573"}
        hostUuidList     = {"8405b4db-629d-3f8d-907e-201d1ffd8f13"}
        VmGroupID        = 1
        MirrorGroup      = {["VMRDG_itsocluster_Austin",0,{""}]}
        ActivePeerDomain = "itsocluster"
```

9. You can also use the SYMAPI commands to determine whether CGs are properly created in both storages using the same names that are stored in the IBM.VMR_DG resource class. Example 4-52 shows the CGs created in the storages from both sites.

   Example 4-52 Check whether the composite groups are properly created

```
(130) root @ pbrazos001: /
# SYMCLI_CONNECT=SYMAPI_SITE_508 SYMCLI_FULL_NAME=1 SYMCLI_CONNECT_TYPE=REMOTE
symcg list

                      C O M P O S I T E   G R O U P S

                                     Number of          Number of
Name                              Type Valid Symms RAGs DGs Devs BCVs VDEVs TGTs

VMRDG_itso3_cluster_Site_BeiJing  RDF2  Yes    1   2  0    9    0     0    0
VMRDG_itso4_cluster_ITSO4_NewYork RDF2  Yes    1   1  0    7    0     0    0
VMRDG_itsocluster2_ITSO2_active   RDF2  Yes    0   0  0    0    0     0    0
VMRDG_itsocluster_Poughkeepsie    RDF1  Yes    1   1  0    5    0     0    0

(1) root @ pbrazos001: /
# SYMCLI_CONNECT=SYMAPI_SITE_573 SYMCLI_FULL_NAME=1 SYMCLI_CONNECT_TYPE=REMOTE
symcg list

                      C O M P O S I T E   G R O U P S

                                       Number of        Number of
```

```
Name                               Type Valid Symms RAGs DGs Devs BCVs VDEVs TGTs

VMRDG_itso3_cluster_Site_ShangHai  RDF1  Yes    1     2  0    9     0     0    0
VMRDG_itso4_cluster_ITSO4_Austin   RDF1  Yes    1     1  0    7     0     0    0
VMRDG_itsocluster2_ITSO2_backup    RDF1  Yes    0     0  0    0     0     0    0
VMRDG_itsocluster_Austin           RDF2  Yes    1     1  0    5     0     0    0
```

10. The IBM.VMR_DP resource class is also populated with the disk pairs (or volume pairs), which are the volumes that are used by the managed VMs, and correctly configured for replication (Example 4-53).

Example 4-53 Disk pairs that are configured in the IBM Geographically Dispersed Resiliency for Power Systems environment

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_DP
Resource Persistent Attributes for IBM.VMR_DP
resource 1:
        Name             = "196800508:60000970000196800508533033323530"
        hostGroupList    = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        VmGroupID        = 1
        StorageID        = {"196800508","196800573"}
        VolumeID         =
{"60000970000196800508533033323530","60000970000196800573533032343135"}
        ActivePeerDomain = "itsocluster"
resource 2:
        Name             = "196800508:60000970000196800508533033323446"
        hostGroupList    = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        VmGroupID        = 1
        StorageID        = {"196800508","196800573"}
        VolumeID         =
{"60000970000196800508533033323446","60000970000196800573533032343134"}
        ActivePeerDomain = "itsocluster"
resource 3:
        Name             = "196800508:60000970000196800508533033323531"
        hostGroupList    = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        VmGroupID        = 1
        StorageID        = {"196800508","196800573"}
        VolumeID         =
{"60000970000196800508533033323531","60000970000196800573533032343136"}
        ActivePeerDomain = "itsocluster"
resource 4:
        Name             = "196800508:60000970000196800508533033323535"
        hostGroupList    = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        VmGroupID        = 1
        StorageID        = {"196800508","196800573"}
        VolumeID         =
{"60000970000196800508533033323535","60000970000196800573533032343146"}
        ActivePeerDomain = "itsocluster"
resource 5:
        Name             = "196800508:60000970000196800508533033323534"
        hostGroupList    = {"6ce366c5-f05d-3a12-94f8-94a3fdfc1319"}
        VmGroupID        = 1
        StorageID        = {"196800508","196800573"}
        VolumeID         =
{"60000970000196800508533033323534","60000970000196800573533032343145"}
        ActivePeerDomain = "itsocluster"
```

Tip: The output in Example 4-53 on page 190 shows that the KSYS node saves the volume information based on the WWN of each volume. If you need to relate the WWN of the volumes with its Volume ID (used to set up and control SRDF replication of the volumes), you can use the **symdev** command as shown in the following example:

```
(130) root @ pbrazos001: /tmp/ibmsupt
# symdev list -wwn -sid 000196800508 | egrep "0324F|03250|03251|03254|03255"
0324F Not Visible RDF1+TDEV 60000970000196800508533033323446
03250 Not Visible RDF1+TDEV 60000970000196800508533033323530
03251 Not Visible RDF1+TDEV 60000970000196800508533033323531
03254 Not Visible RDF1+TDEV 60000970000196800508533033323534
03255 Not Visible RDF1+TDEV 60000970000196800508533033323535
```

The KSYS node automatically rediscovers your environment every 24 hours. This period can be modified by changing the `auto_discovery_time` parameter. To check this parameter, use the **ksysmgr query system** command (Example 4-54).

Example 4-54 Checking system-wide attributes

```
(0) root @ pbrazos001: /
# ksysmgr query system
System-Wide Persistent Attributes
auto_discovery_time  ="00:00" hours
lose_vios_redundancy ="no"
auto_reverse_mirror  ="yes"
notification_level   ="low"
dup_event_processing ="yes"
```

To modify this parameter, use the **ksysmgr modify system** command as in the following syntax:

```
# ksysmgr modify system -h

 ksysmgr modify system
       [auto_discovery_time=<hh:mm>]
               hh - hour:   00 to 23
               mm - minute: 00 to 59
       [lose_vios_redundancy=<yes | no>]
       [auto_reverse_mirror=<yes | no>]
       [notification_level=<low | medium | high | disable>]
       [dup_event_processing=<yes | no>]
     modify => ch*, sets
     system => sys*
```

However, you do not need to wait for the automatic discovery in case changes are made to your environment. You can run the **ksysmgr discover site <sitename>** command to discover the modification immediately.

Only one discovery operation can be run at a time. Running multiple **discover** commands gives an error message. Example 4-55 shows the error if you try to run a **discover** command while the daily scheduled discovery is in progress in the background.

Example 4-55 Error trying to run multiple discover operations

```
(130) root @ pbrazos001: /
# ksysmgr discover site Poughkeepsie
ERROR: Site Poughkeepsie failed to discover
        0000-164 Error - Operation failed. Scheduler initiated DiscoverOnly
(Quick) is running in background.
```

To determine whether a discovery operation is in progress and to monitor its status, use the command that is shown in Example 4-56.

Example 4-56 Checking whether there is a discover operation in progress

```
(0) root @ pbrazos001: /
# ksysmgr query system status monitor=yes
Discovery is in progress for Site Poughkeepsie. Please use "ksysmgr query system
status monitor=yes " to track the progress of the operation.
Discovery is in progress for Site Austin. Please use "ksysmgr query system status
monitor=yes " to track the progress of the operation.
Monitoring status...
Running discovery on entire site, this may take few minutes...
```

All the configuration on the KSYS node has been performed. The only remaining task is a verify operation. Then, the environment is set up and ready to monitor for disaster situations and move the VMs to the backup site when the move operation is triggered by the administrator.

Important snapshot: Be sure to back up the configuration of your KSYS node by creating a snapshot. For more information about how to create a snapshot of the KSYS node, see Section 5.1, “Backing up and restoring the configuration data of KSYS” on page 214.

4.6.10 Verifying the IBM Geographically Dispersed Resiliency for Power Systems environment

After completing the discovery operation, perform the verify operation in the KSYS node. At this time, the KSYS node determines whether the backup site has enough resources to receive the virtual machines from the home site in case of a disaster situation. The volume pairs are also verified to guarantee that replication is set up correctly.

Use the following command to perform the verify operation:

```
# ksysmgr verify site -h

ksysmgr verify site <sitename>
    verify => ver*
    site => sit*
```

Tip: As with the discovery operation, the verify operation must be performed only on the active or home site.

You can optionally run the **discover** and **verify** commands in the same command line:

```
# ksysmgr discover site Poughkeepsie verify=yes
```

Example 4-57 shows the verify operation that is performed in the environment setup for this book.

Example 4-57 Output of the verify operation

```
(0) root @ pbrazos001: /
# ksysmgr verify site Poughkeepsie
Site verification started for Poughkeepsie
        HAM-9179-MHD-SN106DBEP verification has started
        HAM-9179-MHD-SN106DBEP verification has completed
        pbrazos007 verification has started
        pbrazos008 verification has started
        pbrazos030 verification has started
        pbrazos007 verification has completed
        pbrazos008 verification has completed
        pbrazos030 verification has completed
        Disk Group verification on storage subsystem started for Site Poughkeepsie
        Disk Group verification on storage subsystem completed for Site
Poughkeepsie
Verification has finished for Poughkeepsie
3 out of 3 VMs have been successfully verified
```

After a successful verify operation, run the **ksysmgr query vm** command again; the virtual machines state changes to READY_TO_MOVE (Example 4-58).

Example 4-58 Checking the ksysmgr query vm output and ensure VMs are READY_TO_MOVE

```
(0) root @ pbrazos001: /
# ksysmgr query vm | egrep -w -p "pbrazos007|pbrazos008|pbrazos030"
Managed VMs:
        pbrazos007
        pbrazos008
        pbrazos030

Name:            pbrazos007
UUID:            6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C
host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos008
UUID:            3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606
host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos030
UUID:            4685C72C-26FA-41A7-AB4C-B65C92217F75
host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE
```

The same information is updated in the IBM.VMR_LPAR resource class (Example 4-59).

Example 4-59 State of the VMs updated in the IBM.VMR_LPAR resource class

```
(0) root @ pbrazos001: /
# lsrsrc IBM.VMR_LPAR
Resource Persistent Attributes for IBM.VMR_LPAR
.
. <Some lines were omitted>
.
resource 8:
        Name                = "pbrazos007"
        LparUuid            = "6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 0
        LCB                 = "0x3c3f786d 0x6c207665 ... 0x6174696f 0x6e3e"
        BootDiskList        = {}
        CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfc1319"
        ErrMsg              = ""
        Phase               = "READY_TO_MOVE"
        PhaseDetail         = 3145728
        Memory              = "4096"
        Processors          = "0.1"
        ActivePeerDomain    = "itsocluster"
.
. <Some lines were omitted>
.
```

Now your IBM Geographically Dispersed Resiliency for Power Systems environment is set up, ready to monitor the VMs and move them to the backup site in case of a disaster situation.

Important: The KSYS node will never trigger a move operation automatically. It monitors the environment and notifies the administrators if a problem occurs. The administrators should review the notification, evaluate the situation, and initiate a move operation by running the **ksysmgr move** command.

You can optionally use the **ksysmgr -v report system** command to obtain a current summary of all the configuration (Example 4-60).

Example 4-60 Using the report system to obtain information about current configuration

```
(1) root @ pbrazos001: /
# ksysmgr -v report system
This is the latest KSYS configurations, please run discover to capture any changes

Status: KSYS is ready to be issued a command
Ksysmgr version: 1.1.0.0
Ksys version: 1.1.0.0

Current environment:
====================

Active Site: Poughkeepsie

    host: pbrazos_9119-MME-21BBC47
```

```
          HMC:
               vhmc1_Poughkeepsie
               vhmc3_Poughkeepsie
          VIOS:
               pbrazosv1
          Paired host:
               HAM-9179-MHD-SN106DBEP
          Number of Managed VMs: 3
          Managed Processors: Unable to determine, please run discover
          Managed Memory: Unable to determine, please run discover

     storage agent:
               sa_Poughkeepsie_508

     Total Managed Processors: 0
     Total Managed Memory: 0

Back up Site: Austin

     host: HAM-9179-MHD-SN106DBEP
          HMC:
               vhmc2_Austin
               vhmc4_Austin
          VIOS:
               hamv2
               hamv1
          Paired host:
               pbrazos_9119-MME-21BBC47
          Number of Managed VMs: 0
          Configurable Processors: 48
          Configurable Memory: 524288

     storage agent:
               sa_Austin_573

     Total configurable Processors: 48
     Total configurable Memory: 524288
```

4.7 Moving virtual machines between sites

Now that the IBM Geographically Dispersed Resiliency for Power Systems solution is properly configured, you can move the virtual machines between sites when required. In case of a disaster situation, you are notified, able to analyze the situation, and decide whether the move should be performed. You can also use the KSYS node to move the VMs between sites during planned activities, for example, maintenance at the home site. You are also encouraged to move the VMs to the backup site at a maintenance window to test the disaster recovery solution.

To do the move, use the **ksysmgr move** command. Two types of move operations are available:

- Planned move

  In this situation, the communication between the backup site (where the KSYS node resides) and the home site (where your virtual machines are running) is working properly. In this case, the expectation is that the KSYS node is able to contact your HMCs and storage controllers at the home site. The KSYS node initiates a shutdown of the virtual machines, the storage replication is reversed, and the virtual machines are created at the backup site and then activated. After completing the activation of the VMs at the backup site, the KSYS node also contacts the HMCs from the home site to clean up the configuration of the VMs.

- Unplanned move

  This operation is expected to occur during a disaster situation. In this case, the communication between backup site (where KSYS node is located) and the home site (where the VMs are running) might be compromised. During the unplanned move operation, the KSYS node still tries to contact the HMCs and storage controllers at the home site to shut down the virtual machines, and also change the volumes to write-disable. Because the communication might be compromised, this attempt can fail; therefore, although the KSYS tries to perform the operation, it does not wait for its return (in case KSYS is not able to contact the home site, it continues the move operation anyway). In the unplanned move, the replication is failed over, which promotes the target volumes to write enable, then the virtual machines are created at the backup site and started. After the communication between sites is reestablished, you should manually reverse the replication direction of the volumes and also perform the cleanup operation at the home site because the KSYS node might not be able to contact the HMCs from the home site during the disaster situation (the cleanup operation does not need to be manually performed, you can use the **ksysmgr cleanup** command).

For more information about the operations that are performed on the storage subsystems during a planned or unplanned move, see “Dell EMC SRDF status and operations” on page 125.

The move operation is initiated by the **ksysmgr** command with the following syntax:

```
# ksysmgr move site -h
ksysmgr move site
      <from=sitename>
      <to=sitename>
      [force=true|false]
      [lose_vios_redundancy=[yes|no]
      [dr_type=planned|unplanned]
    move => mov*, mv, swi*
    site => sit*
```

The `lose_vios_redundancy` option allows you to move your VMs from a host with dual Virtual I/O Servers to a host with a single Virtual I/O Server. For more information and instructions about this option, see Chapter 6, “Testing scenarios” on page 287.

> **Note:** The KSYS node does not communicate with the virtual machine directly. All the operations are performed at the Hardware Management Console (HMC), so the KSYS does not automatically start any application within the virtual machine. Only the virtual machine is started automatically at the target or backup host after a move operation. In case the applications are automatically started during the boot the VM (for example, using the `/etc/inittab`), then the application is also started automatically after the VM is brought online.

4.7.1 Initiating a planned move between sites

This section shows an example of a planned move, performed in the residency environment. The virtual machines pbrazos007 (NPIV), pbrazos008 (NPIV), and pbrazos030 (VSCSI) are moved from host pbrazos at site Poughkeepsie to host HAM at site Austin. This move operation shows the actions that are performed by the KSYS node on the HMCs, Virtual I/O Servers, and storage controllers:

1. Before starting the move operation, see that the `ACTIVE` site is Poughkeepsie (Example 4-61).

   Example 4-61 Currently ACTIVE site is Poughkeepsie

   ```
   (130) root @ pbrazos001: /
   # ksysmgr query site
   Name:            Poughkeepsie
   Sitetype:        ACTIVE

   Name:            Austin
   Sitetype:        backup
   ```

2. Before starting the move, use a **`discover`** command, followed by a **`verify`** command to ensure that no error messages are displayed, which means that the environment is prepared for the move, as shown in Example 4-62 (because all of these operations were run before, those steps are not required).

   Example 4-62 Performing the discover and verify operations before moving

   ```
   (0) root @ pbrazos001: /
   # ksysmgr discover site Poughkeepsie
   Running discovery on entire site, this may take few minutes...
           Storage state synchronization has started for Site Poughkeepsie
           Storage state synchronization has completed for Site Poughkeepsie
           Discovery has started for VM pbrazos008
           Configuration information retrieval started for VM pbrazos008
           Discovery has started for VM pbrazos030
           Configuration information retrieval started for VM pbrazos030
           Discovery has started for VM pbrazos007
           Configuration information retrieval started for VM pbrazos007
           Configuration information retrieval completed for VM pbrazos008
           Configuration information retrieval completed for VM pbrazos030
           Configuration information retrieval completed for VM pbrazos007
           Storage information retrieval from VIOS started for VM pbrazos008
           Storage information retrieval from VIOS started for VM pbrazos030
   ```

```
        Storage information retrieval from VIOS started for VM pbrazos007
        Storage information retrieval from VIOS completed for VM pbrazos008
        Discovery for VM pbrazos008 is complete
        Storage information retrieval from VIOS completed for VM pbrazos030
        Discovery for VM pbrazos030 is complete
        Storage information retrieval from VIOS completed for VM pbrazos007
        Discovery for VM pbrazos007 is complete
        Disk Group creation on storage subsystem started for Site Austin
        Disk Group creation on storage subsystem completed for Site Austin
Discovery has finished for Poughkeepsie
3 out of 3 managed VMs have been successfully discovered

(0) root @ pbrazos001: /
# ksysmgr verify site Poughkeepsie
Site verification started for Poughkeepsie
        HAM-9179-MHD-SN106DBEP verification has started
        HAM-9179-MHD-SN106DBEP verification has completed
        pbrazos007 verification has started
        pbrazos008 verification has started
        pbrazos030 verification has started
        pbrazos007 verification has completed
        pbrazos008 verification has completed
        pbrazos030 verification has completed
        Disk Group verification on storage subsystem started for Site
Poughkeepsie
        Disk Group verification on storage subsystem completed for Site
Poughkeepsie
Verification has finished for Poughkeepsie
3 out of 3 VMs have been successfully verified
```

3. Check that the only currently managed VMs are the correct ones, which are properly set up for the IBM Geographically Dispersed Resiliency for Power Systems solution. The state of the VMs is `READY_TO_MOVE` (Example 4-63).

Example 4-63 Checking the managed virtual machines

```
(0) root @ pbrazos001: /
# ksysmgr query vm state=manage | grep -p Managed
Managed VMs:
        pbrazos008
        pbrazos007
        pbrazos030

(0) root @ pbrazos001: /
# ksysmgr query vm state=manage | grep -p Managed | egrep -p
"pbrazos007|pbrazos008|pbrazos030"

Managed VMs:
        pbrazos008
        pbrazos007
        pbrazos030

All VMs:
Name:            pbrazos008
UUID:            3697D9B6-5D90-40F2-BEBE-D2C6F7E5E606
host:            pbrazos_9119-MME-21BBC47
```

```
State:          READY_TO_MOVE

Name:           pbrazos007
UUID:           6F1A0B4B-C2BE-4B3E-87AE-DEE1219F262C
host:           pbrazos_9119-MME-21BBC47
State:          READY_TO_MOVE

Name:           pbrazos030
UUID:           4685C72C-26FA-41A7-AB4C-B65C92217F75
host:           pbrazos_9119-MME-21BBC47
State:          READY_TO_MOVE
```

4. Before starting the move, see that the VMs are running on the host pbrazos, which is at the Poughkeepsie site (Figure 4-8).

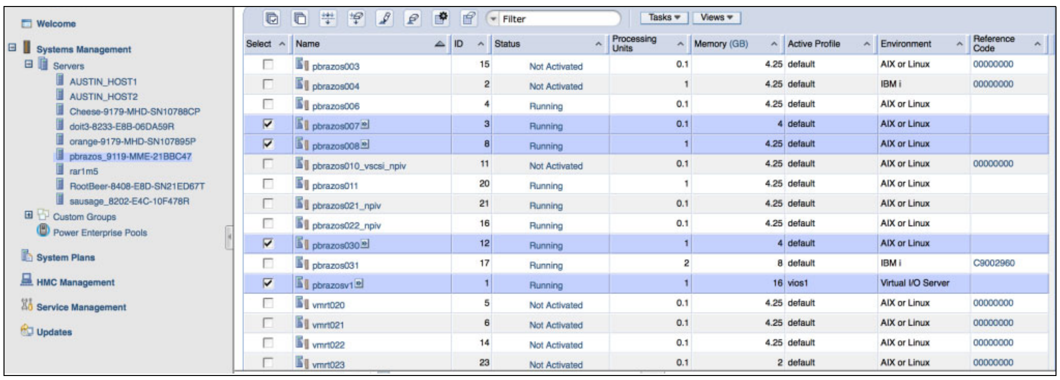


Figure 4-8 Virtual machines running in host pbrazos

5. Also see, in the source Virtual I/O Server (pbrazosv1), that the NPIV adapters from `pbrazos007` and `pbrazos008`, and the VSCSI adapter from `pbrazos030` are properly mapped (Example 4-64).

Example 4-64 Virtual adapters that are mapped for the virtual machines

```
(0) padmin @ pbrazosv1: /home/padmin
$ lsmap -vadapter vfchost28 -npiv
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost28     U9119.MME.21BBC47-V1-C104               3 pbrazos007     AIX

Status:LOGGED_IN
FC name:fcs1                      FC loc code:U78CD.001.FZH1401-P1-C6-T2
Ports logged in:2
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs0              VFC client DRC:U9119.MME.21BBC47-V3-C104


(0) padmin @ pbrazosv1: /home/padmin
$ lsmap -vadapter vfchost10 -npiv
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost10     U9119.MME.21BBC47-V1-C108               8 pbrazos008     AIX

Status:LOGGED_IN
FC name:fcs1                      FC loc code:U78CD.001.FZH1401-P1-C6-T2
```

```
Ports logged in:2
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs0           VFC client DRC:U9119.MME.21BBC47-V8-C108


(0) padmin @ pbrazosv1: /home/padmin
$ lsmap -vadapter vhost9
SVSA            Physloc                                      Client Partition
ID
--------------- -------------------------------------------- ------------------
vhost9          U9119.MME.21BBC47-V1-C105                    0x0000000c

VTD                   vtscsi2
Status                Available
LUN                   0x8100000000000000
Backing device        hdisk195
Physloc
U78CD.001.FZH1401-P1-C6-T1-W500009735807F004-L1000000000000
Mirrored              false

VTD                   vtscsi4
Status                Available
LUN                   0x8200000000000000
Backing device        hdisk196
Physloc
U78CD.001.FZH1401-P1-C6-T1-W500009735807F004-L2000000000000
Mirrored              false
```

6. Before the move operation, the Dell EMC Storage `000196800508`, which is in the Poughkeepsie site, has the `R1` relationship of the storage replication, which means it is the source of the replication (Example 4-65).

Example 4-65 Storage 000196800508 is the source storage

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_508

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
0324F 02414   R1:67  RW RW RW  S..1.       0       0 RW  WD   Consistent
03250 02415   R1:67  RW RW RW  S..1.       0       0 RW  WD   Consistent
03251 02416   R1:67  RW RW RW  S..1.       0       0 RW  WD   Consistent
03254 0241E   R1:67  RW RW RW  S..1.       0       0 RW  WD   Consistent
03255 0241F   R1:67  RW RW RW  S..1.       0       0 RW  WD   Consistent
```

7. Perform the move operation. As you see, it is successful (Example 4-66 on page 201).

> **Tip:** If you do not specify the `type` or `dr_type` in the **`ksysmgr move`** command, the planned move is initiated, so the following commands have the same effect:
>
> ```
> # ksysmgr move site from=Poughkeepsie to=Austin dr_type=planned
> # ksysmgr move site from=Poughkeepsie to=Austin
> ```

Example 4-66 Performing the move operation from site Poughkeepsie to Austin

```
(0) root @ pbrazos001: /
# ksysmgr move site from=Poughkeepsie to=Austin
Site move started for Poughkeepsie to Austin
        Shutdown on Poughkeepsie site has started for VM pbrazos008
        Shutdown on Poughkeepsie site has started for VM pbrazos030
        Shutdown on Poughkeepsie site has started for VM pbrazos007
        Shutdown on Poughkeepsie site has completed for VM pbrazos008
        Shutdown on Poughkeepsie site has completed for VM pbrazos030
        Shutdown on Poughkeepsie site has completed for VM pbrazos007
        Storage mirror reversal has started
        Mirroring will be set up from Austin to Poughkeepsie
        Storage mirror reversal has completed
        Restart on Austin site has started for VM pbrazos008
        Restart on Austin site has started for VM pbrazos030
        Restart on Austin site has started for VM pbrazos007
        Restart on Austin site has completed for VM pbrazos008
        Move has completed for VM pbrazos008
        Configuration cleanup on Poughkeepsie site for VM pbrazos008
        Restart on Austin site has completed for VM pbrazos030
        Move has completed for VM pbrazos030
        Configuration cleanup on Poughkeepsie site for VM pbrazos030
        Restart on Austin site has completed for VM pbrazos007
        Move has completed for VM pbrazos007
        Configuration cleanup on Poughkeepsie site for VM pbrazos007
        Rediscovering configuration for VM pbrazos007 on site Austin
        Rediscovering configuration for VM pbrazos008 on site Austin
        Done rediscovering configuration for VM pbrazos007 on site Austin
        Done rediscovering configuration for VM pbrazos008 on site Austin
        Rediscovering configuration for VM pbrazos030 on site Austin
        Done rediscovering configuration for VM pbrazos030 on site Austin
Site move completed from Poughkeepsie to Austin
3 out of 3 VMs have been successfully moved from Poughkeepsie to Austin
Austin is now the active site
```

From the output of the move operation, you can see that the following activities are performed by the KSYS node:

a. Shut down all managed virtual machines on the host pbrazos, which resides in site Poughkeepsie.

b. Reverse the direction of the storage replication, so that storage 000196800573 (from site Austin) is the new source or R1, and that storage 000196800508 is the new target or R2 for the volume pairs that are used by the managed VMs.

c. Create and start the virtual machines at the host HAM, which is at site Austin.

d. Clean up the configuration at site Poughkeepsie, removing the VMs from the host pbrazos.

e. Perform a new discover operation.

During the next steps, this section shows evidence that is collected from the HMCs, storage systems, and virtual I/Os during the move operation (while step 7 on page 200 is still in progress). This evidence illustrates the actions that are performed by the KSYS node.

Note: The following link takes you to a demonstration of the IBM Geographically Dispersed Resilience for IBM Power Systems:

https://youtu.be/kTeOTzpOghs

8. During the initial steps of the move operation, you can see the virtual machines being shut down at the pbrazos host, in the Poughkeepsie site (Figure 4-9).

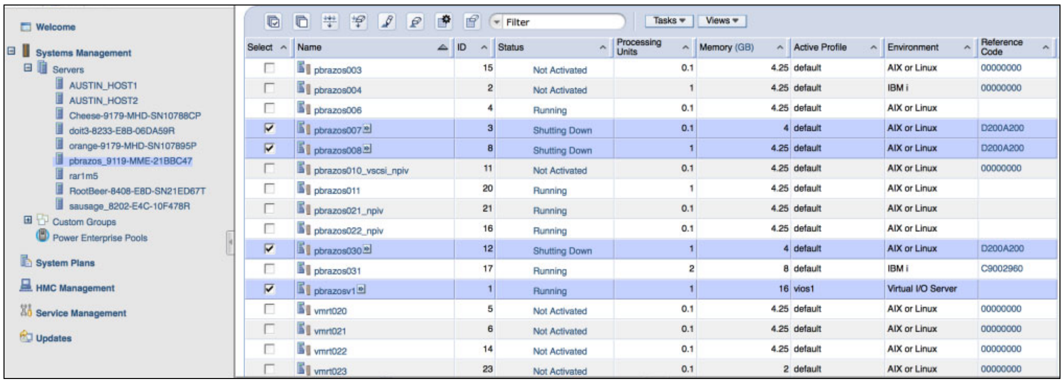


Figure 4-9 Virtual machines being shut down at the pbrazos host in the Poughkeepsie site

9. By monitoring the storage 000196800573, from site Austin, you can see the KSYS node acting to reverse the direction of the replication. The CG has its consistency disabled, followed by a swap of the personalities (making the volumes now R1, or source of the replication), and then the replication is reestablished, now having the volumes from storage 000196800573 at site Austin as the source (R1), as shown in Example 4-67.

Example 4-67 Volume pairs replication being reversed by the KSYS node

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_573

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
02414 0324F    R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
02415 03250    R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
02416 03251    R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
0241E 03254    R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
0241F 03255    R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
02414 0324F    R2:67  WD WD RW  C.D2.       0       0 WD  WD   Invalid
02415 03250    R2:67  WD WD RW  C.D2.       0       0 WD  WD   Invalid
02416 03251    R2:67  WD WD RW  C.D2.       0       0 WD  WD   Invalid
0241E 03254    R2:67  WD WD RW  C.D2.       0       0 WD  WD   Invalid
0241F 03255    R2:67  WD WD RW  C.D2.       0       0 WD  WD   Invalid

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
02414 0324F    R1:67  RW RW NR  C.D1.       0       0 RW  WD   Suspended
02415 03250    R1:67  RW RW NR  C.D1.       0       0 RW  WD   Suspended
02416 03251    R1:67  RW RW NR  C.D1.       0       0 RW  WD   Suspended
0241E 03254    R1:67  RW RW NR  C.D1.       0       0 RW  WD   Suspended
```

```
0241F 03255   R1:67  RW RW NR  C.D1.       0       0 RW  WD   Suspended

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
02414 0324F   R1:67  RW RW RW  A..1.       0       0 RW  WD   Consistent
02415 03250   R1:67  RW RW RW  A..1.       0       0 RW  WD   Consistent
02416 03251   R1:67  RW RW RW  A..1.       0       0 RW  WD   Consistent
0241E 03254   R1:67  RW RW RW  A..1.       0       0 RW  WD   Consistent
0241F 03255   R1:67  RW RW RW  A..1.       0       0 RW  WD   Consistent
```

10. Looking at the storage `000196800508`, from site Poughkeepsie, you can see that its volumes became `R2`, or target (Example 4-68).

Example 4-68 Volume pairs from storage in site Poughkeepsie became the target

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_508

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
0324F 02414   R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
03250 02415   R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
03251 02416   R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
03254 0241E   R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
03255 0241F   R2:67  WD WD RW  A..2.       0       0 WD  RW   Consistent
```

11. The virtual machines are also created on the host HAM, which resides in site Austin, and these are started as shown in Figure 4-10.

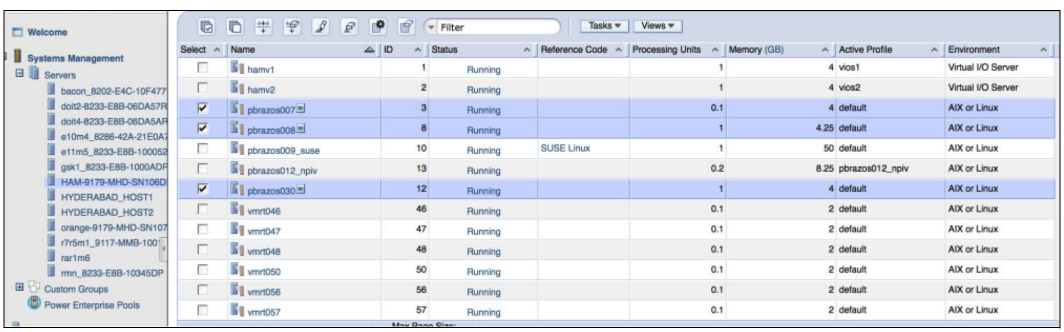


Figure 4-10 VMs starting in host HAM

12. After the move operation (performed in step 7 on page 200) is completed, you can see that now the `ACTIVE` site is Austin (Example 4-69).

Example 4-69 Austin is now the ACTIVE site

```
(0) root @ pbrazos001: /
# ksysmgr query site
Name:            Poughkeepsie
Sitetype:        backup

Name:            Austin
Sitetype:        ACTIVE
```

13. You can see that the adapters are now mapped in the Virtual I/O Server hamv1, which resides in host HAM, at the Austin site (Example 4-70).

Example 4-70 Virtual adapters that are mapped in host HAM

```
(0) padmin @ hamv1: /home/padmin
$ lsmap -vadapter vfchost10 -npiv
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost10     U9179.MHD.106DBEP-V1-C104               3 pbrazos007     AIX

Status:LOGGED_IN
FC name:fcs1                    FC loc code:U2C4E.001.DBJC633-P2-C1-T2
Ports logged in:5
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs0            VFC client DRC:U9179.MHD.106DBEP-V3-C104


(0) padmin @ hamv1: /home/padmin
$ lsmap -vadapter vfchost11 -npiv
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost11     U9179.MHD.106DBEP-V1-C108               8 pbrazos008     AIX

Status:LOGGED_IN
FC name:fcs1                    FC loc code:U2C4E.001.DBJC633-P2-C1-T2
Ports logged in:5
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs0            VFC client DRC:U9179.MHD.106DBEP-V8-C108


(0) padmin @ hamv1: /home/padmin
$ lsmap -vadapter vhost9
SVSA            Physloc                                      Client Partition
ID
--------------- -------------------------------------------- ------------------
vhost9          U9179.MHD.106DBEP-V1-C105                    0x0000000c

VTD                   vtscsi8
Status                Available
LUN                   0x8100000000000000
Backing device        hdisk125
Physloc
U2C4E.001.DBJC633-P2-C1-T1-W500009735808F409-L6E000000000000
Mirrored              false

VTD                   vtscsi9
Status                Available
LUN                   0x8200000000000000
Backing device        hdisk126
Physloc
U2C4E.001.DBJC633-P2-C1-T1-W500009735808F409-L6F000000000000
Mirrored              false
```

14. The host HAM at site Austin has dual Virtual I/O Servers (hamv1 and hamv2). Because, in the Poughkeepsie site for host pbrazos, there is only one Virtual I/O Server, the VMs do not have dual virtual adapters, hence in the VIOS hamv2 no virtual adapter is mapped as part of this operation (Example 4-71).

Example 4-71 No virtual adapters are created in virtual I/O server hamv2

```
(0) padmin @ hamv2: /home/padmin
$ lsmap -all
SVSA            Physloc                                        Client Partition
ID
--------------- -------------------------------------------- ------------------
vhost0          U9179.MHD.106DBEP-V2-C2                        0x00000000

VTD                   NO VIRTUAL TARGET DEVICE FOUND


(0) padmin @ hamv2: /home/padmin
$ lsmap -all -npiv

(0) padmin @ hamv2: /home/padmin
$ lsmap -all
SVSA            Physloc                                        Client Partition
ID
--------------- -------------------------------------------- ------------------
vhost0          U9179.MHD.106DBEP-V2-C2                        0x00000000

VTD                   NO VIRTUAL TARGET DEVICE FOUND
```

> **Tip:** If the operation is performed from a host with dual Virtual I/O Servers to a host with a single Virtual I/O Server, you can use the option `lose_vios_redundancy` to perform the move. Details about this option are in Chapter 6, "Testing scenarios" on page 287.

The move operation is now complete. The same move operation can be performed to move the virtual machines back to the Poughkeepsie site (Example 4-72).

Example 4-72 Moving VMs from Austin to Poughkeepsie

```
(0) root @ pbrazos001: /
# ksysmgr move site from=Austin to=Poughkeepsie
Site move started for Austin to Poughkeepsie
        Shutdown on Austin site has started for VM pbrazos008
        Shutdown on Austin site has started for VM pbrazos030
        Shutdown on Austin site has started for VM pbrazos007
        Shutdown on Austin site has completed for VM pbrazos008
        Shutdown on Austin site has completed for VM pbrazos030
        Shutdown on Austin site has completed for VM pbrazos007
        Storage mirror reversal has started
        Mirroring will be set up from Poughkeepsie to Austin
        Storage mirror reversal has completed
        Restart on Poughkeepsie site has started for VM pbrazos008
        Restart on Poughkeepsie site has started for VM pbrazos030
        Restart on Poughkeepsie site has started for VM pbrazos007
        Restart on Poughkeepsie site has completed for VM pbrazos008
        Move has completed for VM pbrazos008
        Configuration cleanup on Austin site for VM pbrazos008
        Rediscovering configuration for VM pbrazos008 on site Poughkeepsie
        Restart on Poughkeepsie site has completed for VM pbrazos030
        Move has completed for VM pbrazos030
        Configuration cleanup on Austin site for VM pbrazos030
        Restart on Poughkeepsie site has completed for VM pbrazos007
```

```
        Move has completed for VM pbrazos007
        Configuration cleanup on Austin site for VM pbrazos007
        Done rediscovering configuration for VM pbrazos008 on site Poughkeepsie
        Rediscovering configuration for VM pbrazos030 on site Poughkeepsie
        Done rediscovering configuration for VM pbrazos030 on site Poughkeepsie
        Rediscovering configuration for VM pbrazos007 on site Poughkeepsie
        Done rediscovering configuration for VM pbrazos007 on site Poughkeepsie
Site move completed from Austin to Poughkeepsie
3 out of 3 VMs have been successfully moved from Austin to Poughkeepsie
Poughkeepsie is now the active site
```

The VMs are now moved to the Poughkeepsie site (Figure 4-11).

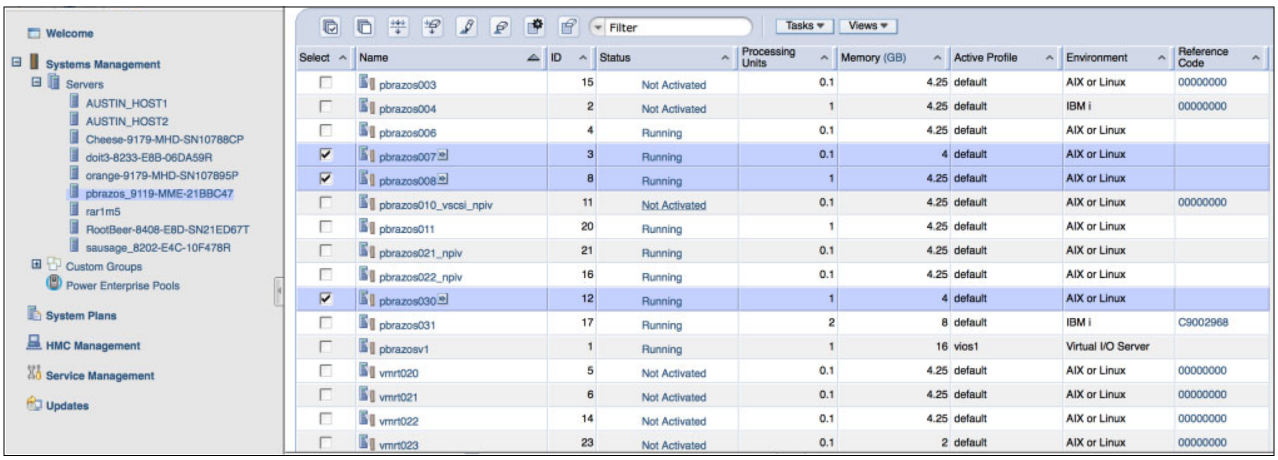


Figure 4-11 VMs started in Poughkeepsie site

Example 4-73 shows that in this situation, storage `000196800508` becomes the source (`R1`) and `000196800573` becomes the target (`R2`).

Example 4-73 Storage replication was reversed

```
(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_508

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
0324F 02414   R1:67   RW RW RW   A..1.       0       0 RW  WD   Consistent
03250 02415   R1:67   RW RW RW   A..1.       0       0 RW  WD   Consistent
03251 02416   R1:67   RW RW RW   A..1.       0       0 RW  WD   Consistent
03254 0241E   R1:67   RW RW RW   A..1.       0       0 RW  WD   Consistent
03255 0241F   R1:67   RW RW RW   A..1.       0       0 RW  WD   Consistent

(0) root @ pbrazos001: /
# export SYMCLI_CONNECT=SYMAPI_SITE_573

(0) root @ pbrazos001: /
# symrdf list | egrep "0324F|03250|03251|03254|03255"
02414 0324F   R2:67   WD WD RW   A..2.       0       0 WD  RW   Consistent
02415 03250   R2:67   WD WD RW   A..2.       0       0 WD  RW   Consistent
02416 03251   R2:67   WD WD RW   A..2.       0       0 WD  RW   Consistent
0241E 03254   R2:67   WD WD RW   A..2.       0       0 WD  RW   Consistent
```

```
0241F 03255    R2:67   WD  WD  RW   A..2.        0         0  WD   RW   Consistent
```

The virtual machines are now cleaned up from host HAM (Figure 4-12).

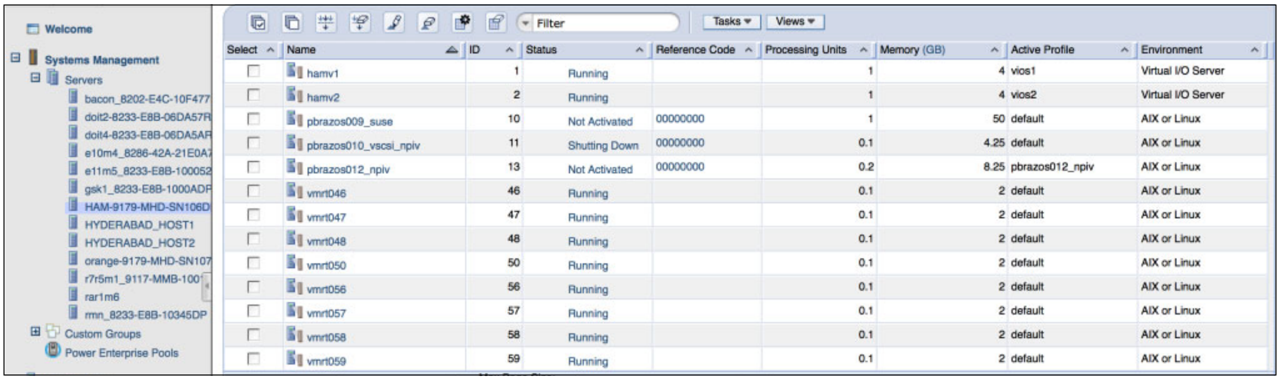


Figure 4-12 VMs are cleaned up from HAM

4.7.2 Initiating an unplanned move between sites

The unplanned move can be triggered by specifying the `dr_type=unplanned` during the execution of the **`ksysmgr move`** command. This type of move operation should be used during an unplanned situation, where a disaster occurred and the KSYS node is probably unable to communicate with the home site. In this situation, the priority is to bring the virtual machines up and running at the backup site, without waiting for synchronization to complete between storages, and without waiting from responses from the home HMCs and storages.

For more information about the actions that are performed by the unplanned move from a storage point of view, see Section “Dell EMC SRDF status and operations” on page 125.

Use the following command to trigger an unplanned move operation:

```
# ksysmgr move site from=Poughkeepsie to=Austin dr_type=planned
```

The following sections direct you to several examples of unplanned move operations, illustrating all actions that are performed by the KSYS node at the components that are involved in the IBM Geographically Dispersed Resiliency for Power Systems solution during the move operation. The sections also show the actions that should be performed when moving the VMs back to the home site, and after fixing the disaster situation.

4.7.3 Recovering failed virtual machines

If, for some reason, one or more virtual machines failed to move to the backup site during the **`ksysmgr move`** operation, you can use the **`ksysmgr`** command to recover this virtual machine.

Before initiating a recovery operation, review the KSYS logs and traces to identify the root cause of the failure. After solving the source of the problem, you can run the **`ksysmgr recover`** command to recover the failed virtual machine.

The recovery operation can be performed at the VM level or at the site level. When you run the **`recover`** command, the KSYS node attempts to move the specified VM to the backup site. When the command is run at the site level, the KSYS node attempts to move all failed VMs to the backup site.

Note: Use the **ksysmgr recover** command only in planned moves and only when the reverse replication of the storage is successful.

After the original move operation (before the recovery), the KSYS node reverses the direction of the storage replication. If the storage replication is successfully reversed, but the virtual machine fails to start at the backup site, for some reason, the VM at the home site is also not able to start because its disk now becomes the target of the storage replication and these are now write-disabled. Therefore, the recovery operation moves the failed VM to the backup site without affecting the storage, because the replication was already reversed.

Use the following **recover** command to recover a failed virtual machine:

```
# ksysmgr recover vm <vmname>
```

Use the following **recover** command to perform the recovery operation at the site level, and try to recover all failed virtual machines from that site:

```
# ksysmgr recover site <sitename>
```

Example

An example of how to recover a failed virtual machine is described in 6.2, "Planned recovery of a failed virtual machine" on page 289.

4.7.4 Cleaning up VMs from a failed server after an unplanned move

During an unplanned move operation, the virtual machines are not cleaned up at the home site after the move is complete. The reason for not cleaning up is that the unplanned operation is meant to be performed during a disaster situation, where the KSYS node is probably unable to communicate with the home site. In this case, the KSYS node prioritizes the move of the VMs and does not try to clean them after the move.

In this situation, after the move is complete, the host at the home site still has the VMs created, so you cannot move the VMs back (after the disaster situation is solved), unless you clean the host, removing the virtual machines and their virtual adapters.

This cleanup operation can be performed by the KSYS node by using the **ksysmgr cleanup** command, which can be done at the VM level (for a specific VM) or at the site level (for all managed VMs from that site).

To start the cleanup operation at the VM level, use the following command:

```
# ksysmgr cleanup vm <vmname>
```

To start the cleanup operation at the site level, use the following command:

```
# ksysmgr cleanup site <sitename>
```

Example

Several examples of an unplanned move are in Chapter 6, "Testing scenarios" on page 287. In each of these cases, the cleanup operation of performed after the move.

4.8 Daily checks that are performed by the KSYS node

The KSYS node has scheduled tasks to perform daily checks in your environment. Daily discover and verify operations are performed to guarantee that the environment is always ready to be moved to the backup site in case of a disaster situation.

Table 4-3 lists the scheduled daily checks that the KSYS node performs.

Table 4-3 Daily checks that are performed by the KSYS node

Check type	Description
Check the capacity of the backup site to host a disaster recovery failover	In the IBM Geographically Dispersed Resiliency for Power Systems solution, the hosts in the backup site work in standby mode. They must have enough resources (CPU and memory) to receive the virtual machines from the home site in case of a disaster situation. The KSYS node sums the resources that are allocated to the virtual machines at the home site and determines whether the backup site has enough resources to host the virtual machines. If the resources are not enough, the KSYS node generates a `host_CAPACITY_CHECK` event notification.
Pre-verification and post-verification scripts	You can optionally configure pre-verify and post-verify scripts. These scripts are run during daily validation by the KSYS node. The configuration of these scripts can be accomplished by using the following commands: ► `# ksysmgr add script pre_verify=script_path` ► `# ksysmgr add script post_verify=script_path` These scripts are run before and after the daily verification process.
Disk space check for `/tmp` and `/var` directories	The `/var` file system is important for the KSYS node because logs from KSYS and storage operations are saved in this directory. The `/tmp` is also important because during KSYS node operations, temporary files are created under this directory. The KSYS node determines whether the space in these file systems have reached or exceeded 90%, which in this case, a `TMP_USAGE_CROSSED_90PERCENT` or `VAR_USAGE_CROSSED_90PERCENT` event is issued.
Dell EMC Storage validation	During the storage agent verification, the KSYS node communicates with Dell EMC Storage systems from both sites and checks the CGs and their associated disks. Several checks are performed, including checking whether CGs exists, which disks belong to the CGs, which disks belong to RDF groups from the CGs, and the replication of the volumes. If any problem is detected during this check, a `STORE_UNREACHABLE` event notification is triggered.
Disaster recovery verification	The KSYS node perform this verification daily to check the overall health of both sites, making sure that the solution is ready to act in case of a disaster event. The following checks are performed during this verification: ► Virtual machine validation to check whether the host from the backup site is able to host the VMs from the active site. ► CPU and memory resources validation to check whether the host in the backup site has enough resources to receive the workload from the home site. ► Storage validations. ► Network validations.

During these checks and other operations, the KSYS node constantly tracks the various events that occur in the IBM Geographically Dispersed Resiliency for Power Systems environment. The event information is saved to log files, and sends email and text messages to the administrators. By notifying administrators of failure, the administrators can review the problem and decide whether an action is required.

> **Note:** To receive the event notifications, add notify methods to the KSYS node by using the **ksysmgr add notify** command, as explained in 4.6.8, “Setting up contacts for events notification” on page 181.

4.9 Uninstalling IBM Geographically Dispersed Resiliency for Power Systems

If for some reason you need to uninstall the KSYS file sets from the KSYS node, remove the cluster before uninstalling the file sets. Otherwise, the RSCT Peer Domain remains created at the node. Example 4-74 shows the command that is used to perform the cluster removal.

Example 4-74 Removing the KSYS cluster prior to uninstalling the KSYS file sets

```
(0) root @ pbrazos001: /
# ksysmgr remove ksyscluster itsocluster
WARNING: This action will remove all configuration and destroy the KSYS setup, its
recommended to create a backup "ksysmgr add snapshot -h"
Do you wish to proceed? [y|n]
y
Do you want to a backup to be created now ? [y|n]
n
Consistency group cleaunup successful
IBM.VMR process stopped successfully
Peer domain stopped successfully
Peer domain was removed successfully
```

> **Tip:** If you reinstall the file sets and re-create the environment at a later time, consider creating a snapshot before removing the cluster, so you can restore the snapshot after reinstalling the file sets. To create and restore a snapshot, see 5.1, “Backing up and restoring the configuration data of KSYS” on page 214.

After removing the cluster, you can uninstall the `ksys.*` file sets by using the **smit remove** command (Example 4-75).

Example 4-75 Using smit to remove the ksys. file sets*

```
# smit remove

Remove Installed Software

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                        [Entry Fields]
* SOFTWARE name                                      [ksys.*]          +
  PREVIEW only? (remove operation will NOT occur)     no               +
  REMOVE dependent software?                          yes              +
  EXTEND file systems if space needed?                yes              +
  DETAILED output?                                    yes              +
```

```
WPAR Management
    Perform Operation in Global Environment         yes               +
    Perform Operation on Detached WPARs            no                +
        Detached WPAR Names                       [_all_wpars]       +
```

5

Managing and administering

This chapter describes how to manage and administer the IBM Geographically Dispersed Resiliency for Power Systems. It provides a list of tasks to maintain and monitor the resources in the IBM Geographically Dispersed Resiliency for Power Systems solution.

The following topics are described in this chapter:

- Backing up and restoring the configuration data of KSYS
- Image backup for the KSYS LPAR
- Administration of the IBM Geographically Dispersed Resiliency for Power Systems
- IBM Enterprise Pool Capacity on Demand with IBM Geographically Dispersed Resiliency for Power Systems
- Cleaning ghost disks in AIX (ghostdev parameter)
- Site-specific network configuration
- Troubleshooting in an IBM Geographically Dispersed Resiliency for Power Systems environment

5.1 Backing up and restoring the configuration data of KSYS

You can back up all the current KSYS configuration data as a snapshot. A snapshot stores the configuration details such as the information of existing sites, managed HMCs, and the managed hosts in a specific site. The snapshot file is saved in XML format and is compressed with default path `/var/ksys/snapshots` and default type `basic`.

After configuring the sites, HMCs, hosts, storage devices, and virtual machines (VMs), run the **snapshot** command.

Consider the following information about snapshots:

- Be sure that the `/var` file system has enough space for the snapshot files before running the **snapshot** command.
- The snapshot files cannot be restored on a different site. The snapshot configuration must be restored in the same site.
- If the KSYS node needs to be reinstalled, you must save or copy the snapshots files to a different path from the default path.

To create and verify a snapshot, use the following command syntax:

```
ksysmgr add snapshot
      filepath=<full file prefix path> | <file prefix>
      type=<CLUSTER|BASIC|DETAILED>
    add => create, make
    snapshot => snap*
```

Because the snapshot is a specific point-in-time backup configuration, you should run a discover and verify operation so that the KSYS configuration is updated. Table 5-1 lists the available snapshot types.

Table 5-1 Options for the snapshot command

Type of snapshot	Description
CLUSTER	The CLUSTER snapshot backs up the core KSYS deployment data that is used to create the KSYS cluster. The CLUSTER type contains the following information: ► Cluster name ► KSYS node name
BASIC	The BASIC snapshot backs up the cluster configuration with the data of configured sites, hosts, HMCs, and storage agents. The BASIC does not include the detailed information of disk pairs and VM configurations. The BASIC snapshot contains the following information: ► Sites: Site name, site type ► Host: Name, UUID, FSP ID, FSP host name, host partner’s UUID ► HMCs user name, password, IP address, logical name, site ID, site name ► Storage agent: Name, IP address, storage host name, user name, password, site name, site ID, storage type, serial number
DETAILED	The DETAILED snapshot backs up all the basic configuration data including detailed LPAR data that is found by discovering resources in a site such as disk pairs and disk groups.

Important: Remember to back up your KSYS configuration often.

Example 5-1 shows the creation of a snapshot of the KSYS01 configuration.

Example 5-1 Create snapshot

```
# ksysmgr add snapshot
Taking basic snapshot...
Created: /var/ksys/snapshots/snap.xml_2016-10-31_14:26:01.xml.tar.gz
Successfully added
snapshot:/var/ksys/snapshots/snap.xml_2016-10-31_14:26:01.xml.tar.gz
```

As the command in Example 5-1 shows, the default file name prefix and path of the snapshot are `snap.xml` and `/var/ksys/snapshots`, also the default type of the backup is `basic`.

You can change the output of the snapshot files and the type of snapshot (Example 5-2).

Example 5-2 Create the snapshot with filepath and type option

```
# ksysmgr add snapshot filepath=/tmp/KSYS01 type=detailed
Created: /tmp/KSYS01_2016-10-31_15:19:28.xml.tar.gz
Successfully added snapshot:/tmp/KSYS01_2016-10-31_15:19:28.xml.tar.gz
```

After creating a snapshot is completed, verify the snapshot with the following command:

```
# ksysmgr query snapshot filepath=<full file prefix path>
```

Example 5-3 shows the result of the query snapshot file.

Example 5-3 To query snapshot file after created

```
# ksysmgr query snapshot filepath=/tmp/KSYS01_2016-10-31_15:42:38.xml.tar.gz|more
---- Snapshot Contents ----
File:       /tmp/KSYS01_2016-10-31_15:42:38.xml
Type:       BASIC
Version:    1.00
Date:       2016-10-31
Time:       15:42:38
---------------------------

Cluster:
--------
Name:       itso2cluster
Node:       pvcnet2
---------------------------

Site:1
-------
Name:       ITSO2_active
Type:       HOME
ID:         1
Active:     yes
---------------------------

Site:2
-------
Name:       ITSO2_backup
Type:       BACKUP
ID:         2
---------------------------
```

```
SA:1
-------
Name:        sa_ITSO2_active_573
Serial Num:  196800573
IP:          10.40.0.31
storage Type:227
user ID:     default
password:    default
site ID:     1
---------------------------

SA:2
-------
Name:        sa_ITSO2_backup_508
Serial Num:  196800508
IP:          10.40.0.30
storage Type:227
user ID:     default
password:    default
site ID:     2
---------------------------

HMC:1
-------
Name:        vhmc1
IP:          9.3.18.34
username:    hscroot
password:    {#####}CE5A 2443588502DFAFA9DC3E7AEACE5
site ID:     2
---------------------------

HMC:2
-------
Name:        vhmc2
IP:          9.3.18.35
username:    hscroot
password:    {#####}374C89AE3B85C51C 8D099E5D54CDB17
site ID:     1
---------------------------

HMC:3
-------
Name:        vhmc3
IP:          9.3.18.36
username:    hscroot
password:    {#####}262AC1B6C52B5619E4F016F73C53D18A
site ID:     2
---------------------------

HOST:1
-------
Name:        HAM-9179-MHD-SN106DBEP
UUID:        8405b4db-629d-3f8d-907e-201d1ffd8f13
partner UUID:{6ce366c5-f05d-3a12-94f8-94a3fdfc1319}
FSP IP:      10.40.0.131
---------------------------
```

```
HOST:2
-------
Name:        pbrazos_9119-MME-21BBC47
UUID:        6ce366c5-f05d-3a12-94f8-94a3fdfc1319
partner UUID:{8405b4db-629d-3f8d-907e-201d1ffd8f13}
FSP IP:      10.40.1.159
---------------------------

LPAR:1
-------
Name:        pbrazos022_npiv
UUID:        7B42CD08-D003-4AA8-8CFC-E4A88D9A911B
State:       UNMANAGED
---------------------------

LPAR:2
-------
Name:        pbrazos021_npiv
UUID:        27841FE1-F0B7-4C38-B7E1-A4B563550B9C
State:       UNMANAGED
---------------------------

LPAR:3
-------
Name:        pbrazos009_suse
UUID:        0647FBE2-B8B5-4A2E-86ED-4242702F036C
State:       UNMANAGED
---------------------------

LPAR:4
-------
Name:        pbrazos015_RedHat
UUID:        5BA0080B-0DC2-417A-9D21-70B489462676
State:       UNMANAGED
---------------------------

LPAR:5
-------
Name:        pbrazos016_PHA1
UUID:        616D4AF1-8BE0-4A4C-8253-5CB7F45F8658
State:       UNMANAGED
---------------------------

LPAR:6
-------
Name:        pbrazos017_PHA2
UUID:        1B10A101-E3A4-418A-8DF2-07A391960C56
State:       READY
---------------------------

LPAR:7
-------
Name:        pbrazos024_ha2
UUID:        5FBA11F2-CAD6-4C0D-8F5D-D2622DD0745B
State:       UNMANAGED
---------------------------

LPAR:8
```

```
-------
Name:       pbrazos023_ha1
UUID:       7C9C8323-47DB-435E-91FB-7105625A5386
State:      UNMANAGED
---------------------------

LPAR:9
-------
Name:       pbrazos026_npiv
UUID:       034685A8-01D2-44F8-B698-ECE28DCCEF11
State:      READY_TO_MOVE
---------------------------

LPAR:10
-------
Name:       pbrazos027_npiv
UUID:       612EEF68-95C5-48DC-994D-C46597E2125D
State:      UNMANAGED
---------------------------

Site Tunables:
--------------
version=1.1
DupEventProcessing="yes"
EventData={}
Redundancy=0
NotificationLevel="low"
AutoReverseMirror="yes"
LoseViosRedundancy="yes"
AutoDiscoveryTime="00:00"
AutoResync="no"
Preserve10= ""
Preserve9= ""
Preserve8= ""
Preserve7= ""
Preserve6= ""
Preserve5= ""
Preserve4= ""
Preserve3= ""
Preserve2= ""
Preserve1= ""
EventScript={}
UserInfo={}
PostVerifyScript= ""
PreVerifyScript= ""
PostSiteOnline= ""
PostSiteOffline= ""
PreSiteOnline= ""
PreSiteOffline= ""
ReplicationType="Async"
ActiveSiteID=1
QuickChkIntvl=1
CompCollectDur=24
CompCollectFreq=1

SA Tunables:
------------
Excluded={}
```

```
HMC Tunables:
-------------
PingCycle=0

HOST Tunables:
--------------
PostServerOnline= ""
PostServerOffline= ""
PreServerOnline= ""
PreServerOffline= ""
Excluded={}
```

To restore the KSYS configuration data, use the following command syntax:

```
# ksysmgr restore snapshot filepath=<full file prefix path>
```

The restore snapshot command decompresses and unarchives the snapshot file, then applies the configuration to the KSYS (Example 5-4).

Example 5-4 Restore KSYS configuration from snapshot

```
#ksysmgr restore snapshot filepath=/tmp/KSYS01_2016-10-31_15:42:38.xml.tar.gz
Cleaning up old configuration...!
Restoring configuration...
Creating cluster...
Updating registry...
Successfully restored registry files!
Starting VMR daemon...
Restore done successfully!
Successfully restored snapshot:/tmp/KSYS01_2016-10-31_15:42:38.xml.tar.gz!
```

5.2 Image backup for the KSYS LPAR

Additionally, you can back up the KSYS configuration by using the **mksysb** command for AIX image backup to store the configuration.

For configuration safety, perform this backup regularly:

1. Create the snapshot of KSYS with type `basic` or `detailed`.
2. Verify the snapshot results by running **ksysmgr query snapshot**.
3. Perform the backup system by using **mksysb** command.

IBM Knowledge Center has more information about the **mksysb** command.

5.3 Administration of the IBM Geographically Dispersed Resiliency for Power Systems

You can maintain and monitor the resources in the IBM Geographically Dispersed Resiliency for Power Systems by using the methods that are described in this section.

5.3.1 Adding resources to the IBM Geographically Dispersed Resiliency for Power Systems configuration

Because of growing business requirements, you might need to modify the current configuration, such as by adding a VM or an entire host to the environment. KSYS continues to monitor any changes in the KSYS configuration. If you want to modify the current configuration in your environment, use the **discover** command to check the change in the KSYS configuration immediately.

You can add more resources to the IBM Geographically Dispersed Resiliency for Power Systems configuration coming from the expansion of the resources to support business growth. The following example adds a specific VM to the KSYS configuration after the initial KSYS setup:

1. Add the managing HMC and managed host that contains VM in the active site (Example 5-5).

   Example 5-5 Adding managing HMC and managed host of VMs at active site

   ```
   # ksysmgr add hmc vhmc2 login=hscroot password=abc123 ip=9.3.18.35
   site=ITSO4_BeiJing
   HMC vhmc2 was added
   # ksysmgr add host HAM-9179-MHD-SN106DBEP site=ITSO4_BeiJing
   Host HAM-9179-MHD-SN106DBEP was added
   ```

2. Add the managing HMC and managed host that contains VM in the backup site (Example 5-6).

   Example 5-6 Adding managing HMC and managed host of VMs at backup site

   ```
   # ksysmgr add hmc vhmc3 login=hscroot password=abc123 ip=9.3.18.36
   site=ITSO4_ShangHai
   HMC vhmc3 was added
   # ksysmgr add host pbrazos_9119-MME-21BBC47 site=ITSO4_ShangHai
   Host pbrazos_9119-MME-21BBC47 was added
   ```

   You can add any extra HMCs to the KSYS.

3. Create a host pair between the host of an active site and a backup site (Example 5-7).

   Example 5-7 Create a host pair

   ```
   # ksysmgr pair host HAM-9179-MHD-SN106DBEP pair=pbrazos_9119-MME-21BBC47
   Host HAM-9179-MHD-SN106DBEP was paired with pbrazos_9119-MME-21BBC47
   ```

   You can exclude some VMs during a recovery operation. Run the following command for each VM that you want to exclude:

   ```
   # ksysmgr unmanage VM_name
   ```

4. Create the SRDF group and volume pair in the storage between the active site and the backup site.

   Note: You must add a corresponding disk in the backup site so that the KSYS can create a disk pair across sites for replication during the discovery operation. See Chapter 3, "Storage and SAN setup for the IBM Geographically Dispersed Resilience environment" on page 25.

5. Add a storage agent (Example 5-8).

   Example 5-8 Adding a storage agent

```
# ksysmgr add storage_agent sa_ITSO4_active_573 site=ITSO4_BeiJing
serialnumber=000196800573 storagetype=emc ip=10.40.0.30
#ksysmgr add storage_agent sa_ITSO4_backup_508 site=ITSO4_ShangHai
serialnumber=000196800508 storagetype=emc ip=10.40.0.31
```

6. Discover and verify these added resources by running the following command:

```
# ksysmgr discover site ITSO4_BeiJing verify=yes
```

More scenarios for adding the extra resource are described in 6.3, "Adding a new virtual machine to an IBM Geographically Dispersed Resilience cluster dynamically" on page 301.

5.3.2 Removing the resource in the IBM Geographically Dispersed Resiliency for Power Systems configuration

You can remove the resource that is not required such as VMs, host, or HMCs from the KSYS configuration.

Excluding VMs from KSYS

If you need to exclude VMs from the KSYS configuration, use the VM name or the UUID, as shown in Example 5-9.

Example 5-9 Exclude VM from the KSYS

```
# ksysmgr unmanage vm name=pbrazos024_ha2 host=HAM-9179-MHD-SN106DBEP
VM pbrazos024_ha2 was successfully unmanaged

or

# ksysmgr unmanage vm uuid=5FBA11F2-CAD6-4C0D-8F5D-D2622DD0745B
ksysmgr VM 5FBA11F2-CAD6-4C0D-8F5D-D2622DD0745B was successfully unmanaged
```

Removing a managed host

To remove a managed host, you must break the associated host pair by using the following command:

```
# ksysmgr pair host=host_name pair=none
```

After you unpair the host, use the following command to delete a managed host:

```
# ksysmgr delete host host_name
```

Removing an HMC

If the HMC is not managing any host, use the following command to delete the HMC:

```
# ksysmgr delete hmc HMC_name
```

Removing a storage agent

When you want to remove a storage agent from the active site, check that the storage disk from the backup site that is paired with the active site is also removed. Otherwise, the disk pair can cause discovery errors. Use the following command to delete the storage agent:

```
# ksysmgr delete storage_agent Storage_Agent_Name
```

5.3.3 Managing the system attributes

The KSYS uses the system-wide persistent attributes for activities such as automatic rediscovery of the resources, and removal of duplicate notification.

By default, the KSYS sets up the following system attributes:

- auto_discovery_time
- lose_vios_redundancy
- notification_level
- dup_event_processing

auto_discovery_time

This attribute specifies the time interval in hours that the KSYS rediscovers the environment automatically for any new or modified resources. The default value of the auto_discovery_time attribute is set to 24 hours, which the KSYS uses to discover the resources and update its database.

The HMC and VIOS are also involved in the rediscovery process to update information about the VMs and storage-disk paired configuration. If your environment is large (for example, hundreds of LPARs), you might want to increase this period to reduce the load on the HMC, VIOS, and the underlying I/O subsystems. This attribute also specifies the span of time during which any changes in the configuration can be lost if a disaster occurs before the rediscovery.

lose_vios_redundancy

This attribute allows the VMs that have dual VIOS set up from the source site to recover the VMs that have only one VIOS on the target site. By default, this attribute is set to **no,** which means that the dual VIOS setup is maintained during disaster recovery to the backup site.

If your currently active site that has a dual VIOS configuration fails, and a VIOS in the target host at the backup site is not functioning, you might want to recover the VMs with only one VIOS on the backup site. In this case, you can set this attribute to **yes**. However, if the virtual machines are started with single VIOS configuration on the backup site, and later you want to move the VMs back to the previous site that has a dual VIOS configuration, you must manually add the second VIOS into the configuration. For more examples, see Chapter 6, “Testing scenarios” on page 287.

notification_level

To enable or disable the notification for different types of events, this attribute supports the following values:

Low This is the default. Only critical error events are notified.

Medium Critical and warning error events are notified.

High All events that include information events are notified.

Disable None of the events are notified.

dup_event_processing

This attribute reduces the duplicate event notification. The email and script notifications that are related to the duplicate events are also disabled. This parameter has the following values:

Yes This is the default. Notifies about only those events that are not repeated in the last 24 hours.

No Notifies all the events.

Querying the system-wide attributes

To view the current system-wide attributes, use the **query system** command (Example 5-10).

Example 5-10 Query the system-wide attributes

```
# ksysmgr query system
System-Wide Persistent Attributes
auto_discovery_time  ="00:00" hours
lose_vios_redundancy ="no"
notification_level   ="low"
dup_event_processing ="yes"
```

These examples show how to modify the system-wide attributes:

- To enable KSYS to automatically rediscover the resources once in every 12 hours, run the following command:

  ```
  ksysmgr modify system auto_discover_time=12:00
  ```

- To enable the KSYS to allow the VMs to verify and move from dual VIOS configuration to single VIOS configuration, run the following command:

  ```
  ksysmgr modify system lose_vios_redundancy=yes
  ```

5.3.4 Modifying the KSYS notification

To modify an email address, pager email address, or the SMS number for a specific user, use the following command syntax:

```
#ksysmgr modify notify oldcontact=old_username newcontact=new_username
#ksysmgr modify notify oldcontact=old_email_address newcontact=new_email_address
```

To query all registered contact details, run the following command:

```
#ksysmgr query notify contact
```

To delete all contact information for a specific user, run the following command:

```
#ksysmgr delete notify user=username
```

Notification message

The notification messages are logged in to the /var/ksys/events.log notification log file. An example of the notification message is shown in Example 5-11.

Example 5-11 Notification message from /var/ksys/events.log

```
---------EVENT START--------
HMC_UNREACHABLE event has occurred. Details are as follows:
Event:              HMC_UNREACHABLE
Type:               Critical Error Event
Time:               Wed Oct  5 15:47:29 CDT 2016
Entity Affected:    HMC
Resource Affected:  Site Name: Austin
Description:        0000-131 Error - HMC 9.3.18.34  is unreachable.

sending notification succeeded
no event script exists. Please add event script first
---------EVENT END--------
```

5.4 IBM Enterprise Pool Capacity on Demand with IBM Geographically Dispersed Resiliency for Power Systems

The IBM Geographically Dispersed Resiliency for Power Systems solution relies on having a backup host at the backup site, which receives the workload from your home site in a disaster situation. The host at the backup site should have enough resources (CPU and memory) to be able to handle the workload of your managed virtual machines from the home site.

Depending on the design of your sites, buying a standby host with the same CPU and memory capacity as the home site, and placing this host at the backup site to wait for a disaster event might be too expensive. To avoid this problem, you can benefit from the use of capacity on demand (CoD) on your backup hosts, so you do not need to afford a system with the same amount of CPU and memory resources for the standby host.

With CoD, you can activate dormant CPU and memory resources at your standby system when you need to. In this way, you can add these resources to the backup host only when a disaster situation occurs and you need to move your virtual machines to the backup site.

The Power System Capacity on Demand feature has several offerings:

- Capacity Upgrade on Demand (static)

  Use this offering to permanently enable more memory and CPU resources to your managed system by activating dormant resources. This offering does not require any hardware to be sent or to be installed. An IBM sales representative can assist you in acquiring an electronically encrypted activation core over the web, which allows you to enable the additional resources.

- Elastic Capacity on Demand (temporary)

  This offering is also known as On/Off Capacity on Demand. This offering provides temporary or short-term additional resources to your host. When this type of offering is ordered, you receive an enablement code that allows you to enable a certain amount of CPU and memory for a limited period in your system. The system monitors the amount of resources and duration of the activation to determine the cost of such activation.

- Utility Capacity on Demand

  This offering provides automated usage of additional CPU-only resources for a short-term period, allowing you to add on demand processors to your shared processor pool, which are used by the virtual machines when necessary.

- Trial Capacity on Demand

  This offering provides a one-time request that can be placed to enable a certain amount of resources for a limited time for testing purposes.

- Power Enterprise Pools

  With this offering, you can create a group of Power Systems servers that can share a certain number of processors and memory on demand, which are considered mobile CoD resources. You can activate those resources at either of the Power Systems servers that are part of the pool, depending where you want to run the workload.

For more information about the Capacity on Demand offerings, see the Power Systems Capacity on Demand web page.

> **Note:** The **ksysrppmgr** command, provided by the IBM Geographically Dispersed Resiliency for Power Systems solution handles Power Enterprise Pools and Elastic Capacity on Demand offerings.

In an environment that is designed for the IBM Geographically Dispersed Resiliency for Power Systems solution (or a regular disaster recovery scenario), consider using two sites (home and backup). As your production runs in the home site, the hosts from that site should have the majority of the CPU and memory resources to attend to the VMs, and the hosts from the backup site must have a minimum number of resources, allowing it to operate in standby (maintaining the Virtual I/O Servers running) and staying in standby (waiting for a disaster situation or any need to move the VMs between sites). Having hosts with minimal resources at your backup site results in considerable savings in terms of hardware costs.

In case of a disaster situation, you need to be able to move all the workload from the home site to the backup site, keeping your production environment operational. Power Enterprise Pools provide flexibility to move your CPU and memory resources between sites when required. In this case, you can provide the majority of CPU and memory resources to a resource pool, and have the flexibility to enable these resources at the home or backup sites, depending on your requirements.

In the IBM Geographically Dispersed Resiliency for Power Systems solution, the KSYS node is responsible for coordinating the disaster recovery situation, by communicating with the HMC and storage subsystems to reverse the direction of the storage replication and create and activate the virtual machines at the backup host.

The KSYS node provides the **ksysrppmgr** command, which also communicates with the HMC to manage resource allocations in a disaster recovery environment.

5.4.1 The ksysrppmgr command

The **ksysrppmgr** command is a resource pool provisioning (RPP) tool that is provided by the ksys.main.cmds file sets in the IBM Geographically Dispersed Resiliency for Power Systems solution, as shown in Example 5-12. It adjusts available resources on the managed hosts, providing a simple interface for Enterprise Pools and Elastic Capacity on Demand management.

Example 5-12 Fileset ksys.main.cmds provides the ksysrppmgr command

```
(0) root @ pbrazos001: /
# whence ksysrppmgr
/opt/IBM/ksys/ksysrppmgr

(0) root @ pbrazos001: /
# lslpp -w /opt/IBM/ksys/ksysrppmgr
  File                                        Fileset               Type
  ----------------------------------------------------------------------------
  /opt/IBM/ksys/ksysrppmgr                    ksys.main.cmds        File
```

The **ksysrppmgr** command manages Power Enterprise Pool and Elastic Capacity on Demand resources at a single command line. It adjusts the amount of resources on a certain host, so you do not need to check current available resources and calculate the amount of resources that should be manually added.

Note: You must know the resource amount that is used by your virtual machines, which should be part of the Enterprise Pool, and then you tell the **ksysrppmgr** command the resource amount to set to both home and backup systems. If you are moving the VMs from home to backup, setting the home host with minimal resources removes existing resources from it, making it available to the Enterprise Pool, which by setting the backup host with additional flexible resources (enough to run your VMs) adds CPU and memory from the Enterprise Pool to the backup host, ultimately increasing its capacity and allowing you to move your VMs over to the backup site.

The **ksysrppmgr** command also minimizes cost by optimizing the type of on demand resource to add to your host. For example, if you specify a certain resource amount to add, the command checks whether you have those resources available to use from the Enterprise Pool before trying to use the Elastic Capacity on Demand (which can generate extra costs).

Using the **ksysrppmgr** command is an optional feature. You can still do the same adjustment of resources by using the HMC graphical or command-line interfaces (GUI or CLI) to adjust the capacity on demand features in your environment, including Power Enterprise Pools. In this case, all operations must be manually performed on the HMC, adjusting the resources on the target system before moving the VMs to the backup Site.

For more information about Power Enterprise Pools, see the *Power Enterprise Pools on IBM Power Systems*, REDP-5101.

Note: At the time of writing this publication, the **ksysrppmgr** command is a management tool that must be manually operated by the administrator. Currently, there is no automation of the allocation of resources during the move operation. The administrator must manually run the **ksysrppmgr** command (or perform the adjustments by using the HMC) before moving the VMs to the backup site. The **ksysrppmgr** command offers an alternative to the HMC GUI and CLI, but does not perform the adjustments automatically. IBM intends to deliver enhancements for automating this process.

The syntax of the **ksysrppmgr** command is shown in Example 5-13.

Example 5-13 Syntax of the ksysrppmgr command

```
# ksysrppmgr
ksysrppmgr -o action
           (-h [hmc_name]:hmc_uri:hmc_user)+
           [-m
ms_name:ms_action:[onoff_use(n|y[nb_days])]:[mem_amount]:[proc_amount]]*
           [-M
ms_uuid:ms_action:[onoff_use(n|y[nb_days])]:[mem_amount]:[proc_amount]]*
           [-e enterprisepool_name]*
           [-E enterprisepool_uuid]*
           [-v] [-r] [-l "none"|logfile_path] [-p logfile_prefix]

   Call without parameter to display this help

   -o      action can be "e" / "execute" to execute the resources requests
           or "c" / "check" to simulate if the resources requests would be satisfied

   -h      HMC input. uri and user are required. Name is optionnal. The name won't be
taken into account, unless the HMC REST API page about HMC information returns
information about more than self, which is unlikely to happen. All ":" are required,
even if optionnal parameters are not filled. This option can be specified multiple
times.

   -m      ManagedSystem input by name. Name and action are required. OnOff usage and
resource requests are optionnal. Action can be "s" / "set" to match the resource
requests amounts of available resources. No other action currently supported. All ":"
are required, even if optionnal parameters are not filled. Memory resource request
unit is MB. This option can be specified multiple times.

   -M      ManagedSystem input by Rest UUID. Same as -m for details.

   -e      EnterprisePool input by name. If neither -e nor -E is used, all enterprise
pools will be monitored. This option can be specified multiple times.

   -E      EnterprisePool input by Rest UUID. Same as -e for details.

   -v      Verbose. Ouput all ManagedSystem:RC, one per line at the end of the
execution.

   -r      Report. Enable more logging, including overall status of topology and
resources before and after execution. It also includes a timing analysis on overall
execution. Enabling this option might trigger more REST operation and then require
more time to complete.
```

```
   -l      Logfile to be used. default is /var/ksys/log/capmgr.log . Can use keyword
"none" to remove all logging. Libhmc logs are stored in file :
[LOGFILE].librpp_last_rest.log or in [LOGFILE].[LOGPREFIX].librpp_last_rest.log if
logprefix is provided. Libhmc logs does overwrite previous logs, if same (or no)
prefix was already used.

   -p      Log prefix. Prefix string found at the start of each log string, along with
other prefix information. Can also be used to avoid overwritting libhmc logs.

   RC: SUCCESS(0)  ERROR(1)  CMDLINE_PARSING_ERROR(2)
```

Consider the following rules when running the command:

- The **-o** option allows you to choose between check (c) or execute (e) mode. The check mode simulates whether the resource request is satisfied; the execute mode runs the resource requests.
- The **-e** option specifies which CoD or Enterprise Pools to use. By default all Enterprise Pools are monitored by the **ksysrppmgr** command.
- The **-r** option enables more logging.
- All memory amounts are provided in megabytes (MB).
- Amounts that are provided in the command line are absolute values.
- Colons (**:**) are required, even if the value specified by the colon is left blank.

The following examples clarify the syntax of the **ksysrppmgr** command:

- Check whether the Enterprise Pool can allocate three CPUs to the host_1 host, and 2 GB of memory to the host_2 host. This command prevents usage of Elastic Capacity on Demand, restricting the usage only to resources of the Enterprise Pool:

  ```
  # ksysrppmgr -o c -h :hmc1:hmcuser -h :hmc2:hmcuser -m host_1:s:n::3 -m
  host_2:s:n:2048: -r
  ```

- Request three CPUs to be added to host_1 and 2 GB of memory to be added to host_2. This command prevents usage of the Elastic Capacity on Demand and printing additional information (-v):

  ```
  # ksysrppmgr -o e -h :hmc1:hmcuser -h :hmc2:hmcuser -m host_1:s:n::3 -m
  host_2:s:n:2048: -r -v
  ```

- Add 2.5 CPUs and 10500 MB to host_1 and also allow usage of the Elastic Capacity on Demand for 5 days:

  ```
  # ksysrppmgr -o e -h :hmc1:hmcuser -m host_1:s:y5:10500:2.5 -r
  ```

- Release all Capacity on Demand resources from host_1:

  ```
  # ksysrppmgr -o e -h :hmc1:hmcuser -m host_1:s:y5:0:0
  ```

Tip: The operations run by the **ksysrppmgr** command are logged to the following file:

/var/ksys/log/capmgr.log

5.4.2 Sample scenarios of capacity on demand usage with IBM Geographically Dispersed Resiliency for Power Systems

While deploying IBM Geographically Dispersed Resiliency for Power Systems solutions with Power Enterprise Pools, the resource pools can be spread between home and backup sites or restricted to several hosts in the backup site. This section provides examples of scenarios that use Enterprise Pools and a summary of the actions that the system administrator must perform to add resources to the host that receives the workload from your production site. A sample of the Elastic Capacity on Demand is also provided.

Cross-site Enterprise Pool deployments

The Power Enterprise Pool can be created and enabled between hosts from your home and backup sites. One possibility is having a single host at each site with the resources pool enabled between them, as shown in Figure 5-1.

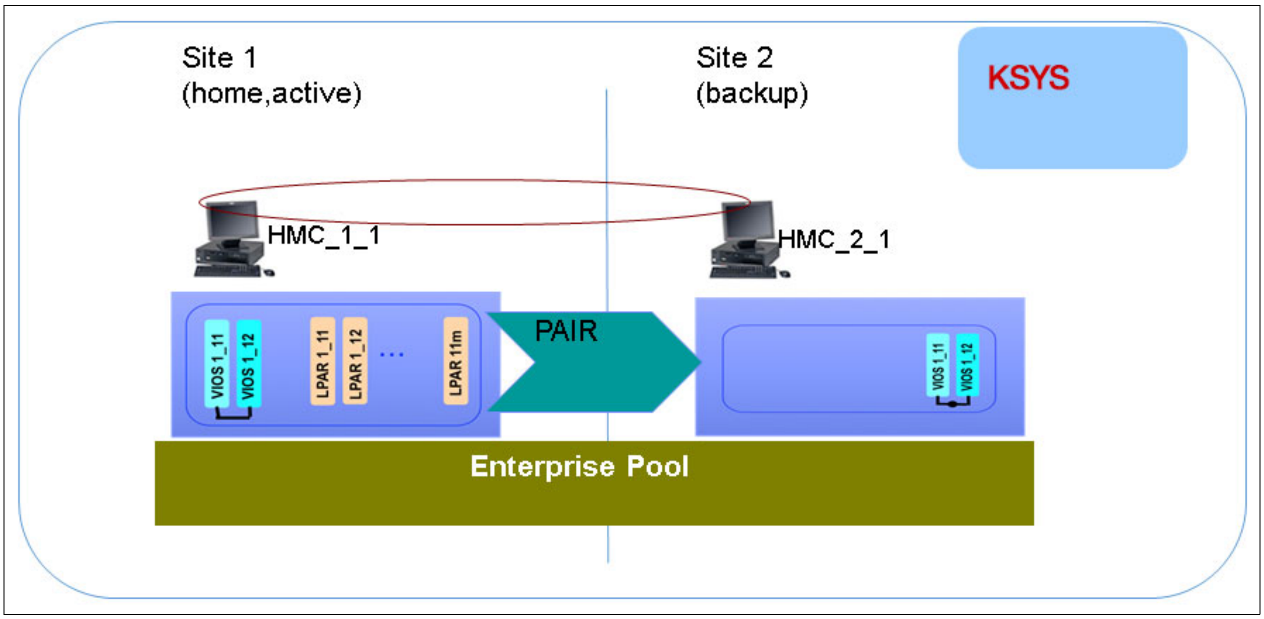


Figure 5-1 Two hosts Enterprise Pool across sites

Also, some situations might involve two or more hosts at each site; the Enterprise Pool can be set up across all hosts, providing a significant flexibility of resources between them, as shown in Figure 5-2.

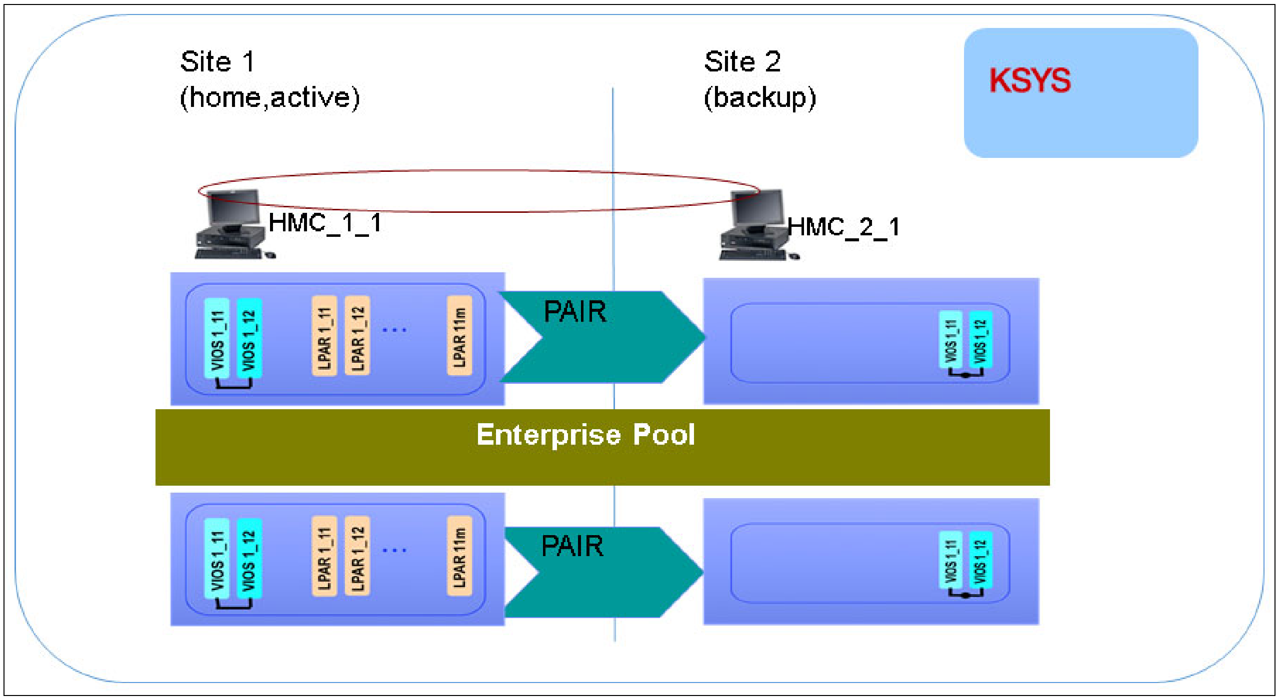


Figure 5-2 Four hosts Enterprise Pool across sites

In both situations, the system administrator must perform the actions that are shown in the next two sections when you must move the VMs from home to backup sites.

Planned move

During the planned move, the expectation is that the KSYS node should be able to communicate normally with the HMCs and hosts from the home site and backup site. Therefore, it is possible to reduce the resources from the home site prior, then add the resources to the backup site, and only after that, move the virtual machines to the backup site. The following steps describe the actions that the system administrator must perform:

1. Shut down the virtual machines (VMs) at the active site.
2. Use the HMC from the active site and reduce the resources amounts that are allocated to the VMs.
3. Use the KSYS node and run the **ksysrppmgr** command to return the resources that are used by the host from the active site to the Enterprise Pool.
4. Use the KSYS node and run the **ksysrppmgr** command to add the resources to the host from backup site.
5. Use the KSYS node and run the **ksysmgr** command to move the VMs to the backup site.

Unplanned move

During the unplanned move, the communication between sites might be compromised, so the KSYS node might be unable to contact the HMCs from the home site to reduce the amount of resources from the Enterprise Pool before adding such resources to hosts in the backup site. In this case, adding the resources to the hosts in the backup site is still possible, even without removing the resources from the hosts in the home site. In this situation, the Enterprise Pool is considered overcommitted, but you can still use the KSYS node to perform the move operation and activate the VMs at the backup site. When the communication with the home site is reestablished, you can use the KSYS node to remove the resources from the home host and return its capacity to the pool, which is no longer overcommitted.

In that situation, the system administrator should do the following steps:

1. Allocate the resources to the host in the backup site. the pool is considered overcommitted. The resources must be removed from the host in the home site and returned back to the pool after communication with the home site is reestablished.
2. Use the **ksysmgr** command to perform the move operation and start the VMs at the backup site.

> **Tip:** To manipulate the Enterprise Pool by using the **ksysrppmgr** command in both situations, use the following commands:
>
> - Use the **hmcauth** command to allow the KSYS node to authenticate at the HMC and then start using APIs to perform actions at the HMC:
>
> ```
> # hmcauth -u <username> -p <password> -a <hmc_name>
> ```
>
> - Use the **ksysrppmgr** command to manipulate the Enterprise Pool:
>
> ```
> # ksysrppmgr -o e -h :<hmc_name>:<hmc_user> -m <CEC_name>
> :s:y<number_of_days>:<mem_amount>:<proc_amount> -e <enterprise_pool_name>
> ```
>
> As the system administrator, you can optionally use the HMC GUI, instead of the **ksysrppmgr** command. In this case, log in to the HMC, select the managed system and then click **Power Enterprise Pools** → **Pools** → **<Pool_name>** → **Processor / Memory Resources**.

Backup site Enterprise Pool capacity management

Instead of deploying the Enterprise Pool across sites, you can optionally have the Enterprise Pool that is deployed at a single site. For example, you can have multiple hosts at your backup site running low-priority VMs such as development and test. During a disaster situation, you can shut down or reduce the capacity of such VMs and return their resources to an Enterprise Pool. These resources can be relocated to the host, which receives the VMs from your production site, assigning additional CPU and memory capacity to allow it to receive the workload during a move operation (Figure 5-3).

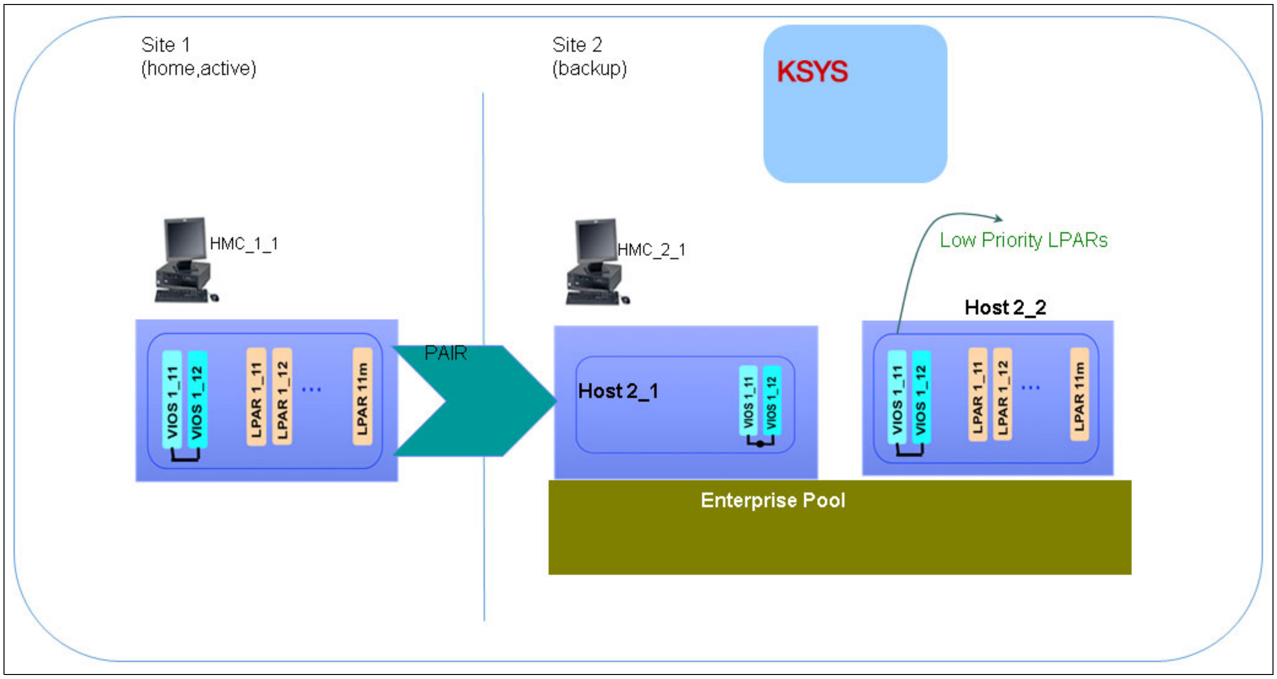


Figure 5-3 Enterprise Pool within a single site

In this situation, if the move operation is necessary to migrate the VMs from the home to the backup site, perform the following tasks *before* initiating the move:

1. Shut down low-priority VMs or reduce their capacity (from host2_2).
2. In the KSYS node, run the **ksysrppmgr** command to return the resources that are used by host2_2 to the Enterprise Pool.
3. Use the **ksysrppmgr** command to add the resources to host2_1 (which receives the workload from the production site).
4. Use the **ksysmgr** command to perform the move operation.

Recovery site Elastic Capacity on Demand management

Instead of using the Enterprise Pool, you can optionally use only the Elastic Capacity on Demand at your host in the backup site to provide additional capacity to receive the VMs from the home site.

> **Tip:** Also, a combination of resources can be used from both the Enterprise Pools and Elastic Capacity on Demand.

Figure 5-4 shows an environment illustrating that possibility.

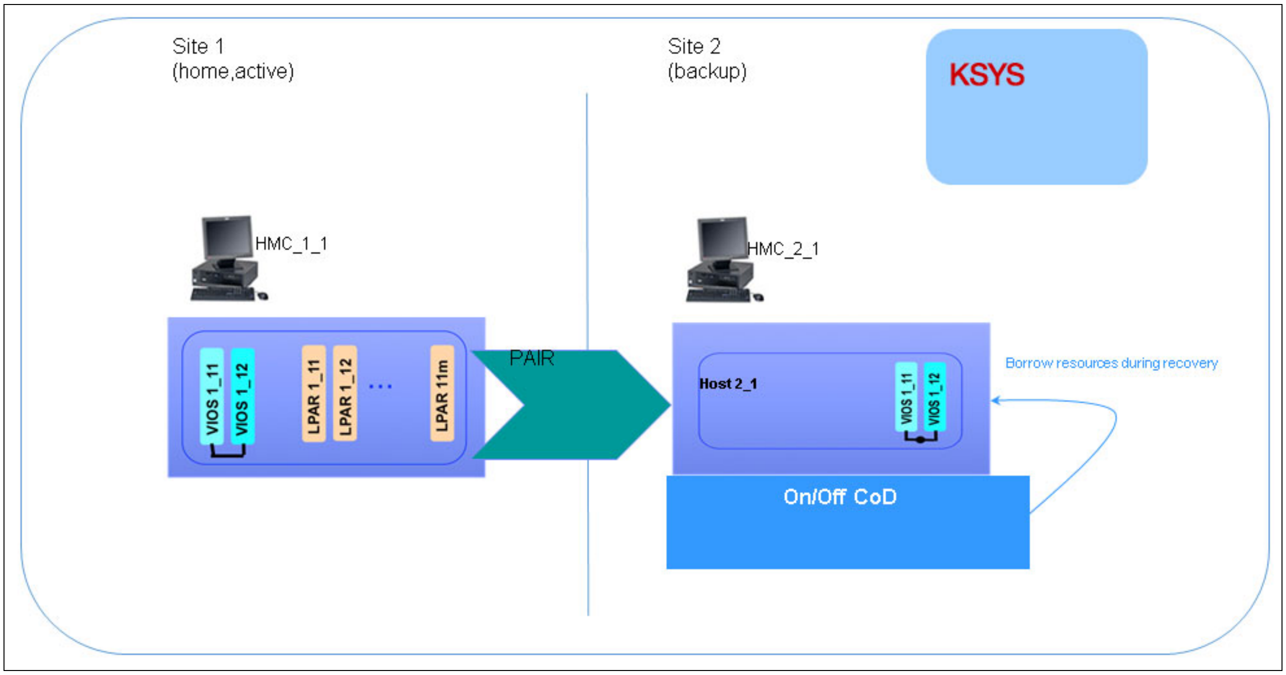


Figure 5-4 Elastic Capacity on Demand (On/Off) usage on recovery site

In this scenario, if you need to move the VMs to the backup site, use the following actions before the move:

1. Use the KSYS node to run the **ksysrppmgr** command to borrow resources from the Elastic Capacity on Demand pool and assign them to the host in the backup site.
2. Use the **ksysmgr** command to move the VMs to the backup site.

5.4.3 Capacity check failures use cases

Important information that you must consider about IBM Geographically Dispersed Resiliency for Power Systems environments with Capacity on Demand resources is that at the moment of the *verify* operation (**ksysmgr verify site <sitename>**), which is usually run during normal operation of the sites (out of any disaster situation), the host from the backup site does not have enough resources to host the VMs from the home site. This is one of the basic verifications that are performed by the KSYS node during the verify operation, so the *verify* operation fails. It is expected in this type of scenario because characteristics indicate that the backup site does not have enough resources, you know you can provide resources in a disaster situation by using the IBM Enterprise Pool Capacity on Demand (EPCoD) or Elastic Capacity on Demand.

The capacity check failure can occur at the VM level, at the host (CEC) level, or at both levels, depending on the configuration of each VM and also the target host.

Table 5-2 lists two sample scenarios to help you understand the possible capacity check failures.

Table 5-2 Capacity check failures scenarios

Scenario	Home host VMs (source)	Backup host (target CEC)
Case 1	**LPAR1_11:** ► CPU: 10 ► Memory: 5 GB	**Host_2_1:** ► Total CPUs in system: 10 ► Total memory in system: 10 GB
	LPAR1_12: ► CPU: 10 ► Memory: 5 GB	
Case 2	**LPAR1_11:** ► CPU: 15 ► Memory: 5 GB	**Host_2_1:** ► Total CPUs in system: 10 ► Total memory in system: 10 GB
	LPAR1_12: ► CPU: 10 ► Memory: 5 GB	

Case 1 has two VMs with 10 CPUs and 5 GB of memory each. The host at the backup site has only 10 CPUs and 10 GB of memory. During the verify operation (**ksysmgr verify site <sitename>**), the KSYS node verifies one VM at a time. The verification of both virtual machines succeeds because Host_2_1 (target host) has enough resources to host each VM individually. After the verification of the VMs, the KSYS node verifies whether the target host has enough resources to host all the managed virtual machines, so this verification fails. In this situation, both virtual machines are left in the READY_TO_MOVE state, but the failure is at the CEC level, so in the target host, an error bit is set (which means number differs from 0 in the PhaseDetail field of the "lsrsrc IBM.VMR_CEC" output).

Case 2 has two virtual machines. VM LPAR1_11 has 15 CPUs and 5 GB of memory, and VM LPAR1_12 has 10 CPUs and 5 GB of memory. In this situation, the verify operation fails at the VM Level for LPAR1_11 because Host_2_1 does not have 15 CPUs to host this VM. The verify operation succeeds for LPAR1_12. Finally, the verify operation fails at the CEC level because Host_2_1 does not have enough CPU or memory to host both VMs. In this case, the error bit is set at the CEC level, LPAR1_11 remains in the VERIFY state, and LPAR1_12 remains in the READY_TO_MOVE state.

In both situations, you have to use Capacity on Demand to provide enough resources to Host_2_1 in case you need to move the VMs. To understand the action and what must be done to provide resources to the target host, which depends on the Capacity on Demand offering that you chose, see 5.4.2, "Sample scenarios of capacity on demand usage with IBM Geographically Dispersed Resiliency for Power Systems" on page 229.

After providing resources to the target host, a regular *move* operation (**ksysmgr move site from=<source_site> to=<target_site> type=planned|unplanned**) will still fail because the VMs might not be in the READY_TO_MOVE state (as in Case 2), and in both cases the CEC level has an error bit turned on. To solve this problem in both cases, perform a new *verify* operation after providing resources to the target host, which places the VMs in a READY_TO_MOVE state, and unset the error bit for CEC level failure (PhaseDetail). Considering that the verify operation takes some time, which you might not have during a disaster situation, you can optionally move the VMs with the **-f** (force) option, which does not require a verify operation for either of the cases:

```
# ksysmgr move -f from=site1 to=site2 force=true
```

Example 5-14 shows a sample output of the verify operation where it fails in both VM and CEC levels.

Example 5-14 Verification failing at VM and CEC level

```
(0) root @ r7r3m107: /usr/symcli/bin
# ksysmgr verify site India
Site verification started for India
        vmsvt006 verification has started
        vmsvt007 verification has started
        vmsvt007 verification has completed
        ERROR: Verify has encountered an error for site India please investigate
        ERROR: Verify has encountered an error for VM vmsvt006 please investigate
Verification has finished for India
1 out of 2 VMs have been successfully verified
Unverified VMs:
        vmsvt006

Please review the error(s) and take any corrective actions
```

After verification, the VM that succeeds in the verify operation remains in the `READY_TO_MOVE` state, and the VM that fails verification remains in the `VERIFY` state (Example 5-15).

Example 5-15 VM left in VERIFY state after verification failure

```
# lsrsrc IBM.VMR_LPAR
Resource Persistent Attributes for IBM.VMR_LPAR
resource 1:
        Name                = "vmsvt006"
        LparUuid            = "1CF267D6-5922-4334-A0DD-2DB8FA9AC49A"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 807678576
        LCB                 = "0x3c3f786d 0x6c207665 0x7273696f 0x6e3d2231 0x2e302220
0x656e636f 0x64696e67 0x3d225554 0x462d3822 0x3f3e3c4d 0x69677261 0x74696f6e
0x3e3c4d65 0x73736167 0x65732f3e 0x3c536f75 0x72636549 0x6e666f20 0x73746174
0x653d226e 0x6f6e6578 07469 0x62696c74 0x792c7072 0x6f635f63 0x6f6d7061 0x745f6d6f
0x6465732c 0x6c706172 0x5f757569 0x64222073 0x74617274 0x5f66726f 0x6d5f636c
0x693d2266 0x616c7365 0x22207374 0x7265616d 0x5f69645f 0x70757368 0x65643d22
0x66616c73 0x65222075 0x73655f72 0x6564756e 0x64616e74 0x5f6d7370 0x733d2232
0x222f3e3c 0x2f4d6967 0x72617469 0x6f6e3e"
        BootDiskList        = {}
        CecUuid             = "9f5fd671-0597-31b8-a950-f2d043c864f8"
        ErrMsg              = ""
        Phase               = "VERIFY"
        PhaseDetail         = 1048577
        Memory              = "2048"
        Processors          = "17"
        ActivePeerDomain    = "vmdr"
resource 2:
        Name                = "vmsvt007"
        LparUuid            = "39813612-1F47-41E5-BD4B-B73E15B28FE8"
        LparIPList          = {}
        SiteCleanupTastList = {}
        ActiveSiteID        = 807678576
        LCB                 = "0x3c3f786d 0x6c207665 0x7273696f 0x6e3d2231 0x2e302220
0x656e636f 0x64696e67 0x3d225554 0x462d3822 0x3f3e3c4d 0x69677261 0x74696f6e
0x3e3c4d65 0x73736167 0x65732f3e 0x3c536f75 0x72636549 0x6e666f20 0x73746174
```

```
0x653d226e 0x6f6e6578 0x69746f66 0x726f6d5f 0x636c693d 0x2266616c 0x73652220
0x73747265 0x616d5f69 0x645f7075 0x73686564 0x3d226661 0x6c736522 0x20757365
0x5f726564 0x756e6461 0x6e745f6d 0x7370733d 0x2232222f 0x3e3c2f4d 0x69677261
0x74696f6e 0x3e"
        BootDiskList        = {}
        CecUuid             = "9f5fd671-0597-31b8-a950-f2d043c864f8"
        ErrMsg              = ""
        Phase               = "READY_TO_MOVE"
        PhaseDetail         = 3145728
        Memory              = "2048"
        Processors          = "0.1"
        ActivePeerDomain    = "vmdr"
```

Example 5-16 shows that an error bit was set at the CEC level (`PhaseDetail`) for host `doit3-8233-E8B-06DA59R`.

Example 5-16 CEC with error bit set after verification failure

```
(0) root @ r7r3m107: /
# lsrsrc "IBM.VMR_CEC"
Resource Persistent Attributes for IBM.VMR_CEC
resource 1:
        CecUuid               = "9f5fd671-0597-31b8-a950-f2d043c864f8"
        Name                  = "doit4-8233-E8B-06DA5AR"
        FspIP                 = "10.40.1.91"
        SiteID                = 2
        DR_PartnerCecUuidList = {"b6966940-52f1-306b-9b2b-2d8447acc14f"}
        MachineType           = "8233"
        MachineModel          = "E8B"
        MachineSerial         = "06DA5AR"
        PhypVersion           = "AL730_146"
        ConfigStatus          = 0
        ConfigValues          = {}
        ProcValues            = {}
        MemValues             = {}
        Vios                  =
{"213835C9-7B48-43D3-8D90-EE4E363CE44E","2B6C519E-C67A-4A37-B1EC-68FF17A5D650"}
        HMCs                  = {"vmhmc6"}
        LPARs                 =
{"1E35152F-99B8-47CB-BD05-923577F491E9","29801617-04C1-42C9-85F5-E6A44FBD1E8A","0FC0523A-21
07-4F4F-BD2A-E5B9B65E0DE2","0D082149-84D1-493A-870A-6859E02456A8","191811D9-9BF4-4B8A-B4EC-
9ADD7A09EB24","567A48BB-504B-41BC-BBC8-2371CDA94F8D","4B63E27F-A562-4EC0-A65D-4EA464C6F9F6"
,"172D09F4-4AA0-4790-A2D8-24F4D7CAD812","0DA3E235-D943-4CD2-9A3B-75D5353F1BF3","45611946-11
43-4F95-9543-B514A73EEA12","773365D9-43A9-403B-A57A-88CA99CEA510","6BAE40B6-B893-4D14-B1BC-
C3CA3DCC636F","7A75B64D-E5E5-4ACA-982C-F4EB329C666E","536761D3-0166-40EA-987D-536E67666BE2"
,"15011998-8390-42AF-BFAB-C29A9E46B704","5E624EC7-A107-4416-9EBA-7E531D836CC1","03C10DE5-72
4A-4D22-B723-4AD3D7182E79","2B73BC81-A2A4-447D-B9EA-FFCC673AD44C","220D40FD-2E68-43D8-BAC3-
4B239DC14D0A","4BC890B6-28D6-4C14-AA7B-9CE5534009BF","5B2CB358-B4F7-4BAB-A5C3-7EFBC1AE3F4C"
,"2D5A37C5-53AB-4F72-8566-787319710944","01130D0F-88D6-4F42-9505-6F92076C64CF","448D2960-13
88-41E3-96A8-273C75538238","448A000C-8DE0-48DB-83B4-466C761D64D2","15016688-306A-46DC-8350-
D5131A1B7C50","289EBD09-7C1E-4D5F-A75F-931AF4F3E4C3","1E6711ED-625B-4AA7-AC06-98A4AF0F5E13"
,"7236B261-61D6-479D-A7DB-84772A2F0998","0B42E35C-F0DE-406C-AB9C-F6E5842679E9","674D7F0A-A6
3A-4192-A0D9-287C9183C05B","2E91F9BB-98A5-4E78-8104-D880639C9663","44374F1C-0B97-446B-AEC3-
2C4C45FE2FD5","14A1F3B6-B50F-40FB-9F12-CE1001001B6B","5872AC8E-08E2-439D-8A7B-F7F863B575ED"
,"51621486-337A-4C36-A366-0052D81A237B","10E862A0-4474-4D93-9004-8411DA775CA0","69FC7140-8C
2B-4C44-A69A-764347331C55","51E2190E-D0EC-40B0-A582-B8CA8C3FAB1D","21A6E76C-505B-403D-8D9E-
D4E15E5D0406","69B280B4-8EFC-4A31-A30B-98989A3CE945","5A2F7C1C-5A22-4B82-BB4F-4D61A229FA29"
,"76D31108-F3FD-44A2-A6F9-F8145799E61F","4EA33FF7-395C-4C0C-B5FB-C813BDDC62A3","58BAB2E9-6C
30-4525-860E-4B16C3FA6776","5154ADAE-BB68-4F11-B9AE-88018FFCE65B","7B2AD234-1833-4410-869A-
6F63015DF568","4D6866C4-E08B-45A9-9A5F-08D071843536","4C6F48F3-E78A-4392-A33D-1927DB2041D6"
```

```
,"6240F04E-F724-474E-9C5C-D598CD8E83A4","78E53C9E-1D19-466C-966E-34C8867AD274","278B2327-00
31-42A3-A94F-F45A7A866C89","1D2D7C38-357D-4671-A767-A13037885626","0D7F3445-08E3-4E37-9DD5-
94B1A8576024","2A8A253F-CA2D-4A7E-A706-B2A9FA3DB224","076B3CB4-0524-444A-BCDB-AA716DF62B22"
,"564CE084-6B61-43EF-BDA2-B4ADF764B848","559A28FE-2156-4EE8-ACAF-E79B8E5F3F05","0DC83E75-75
A0-491C-BBE7-3E5EEE863781","66332CD0-38BB-4D01-9849-9F97D278AFCD","660345E1-7828-4778-9857-
E5290DB4ED69","381E5256-7934-4EB0-895A-8DFD113E90B9","6D333997-F5AC-4FD3-8282-49DB2C4D31B0"
,"6D5A8480-2CF7-4F7C-9110-C6C72E612F5D","7C7E7FAC-E829-46B8-99CC-356D92D6050F","14BD8A88-34
5D-4644-86CF-0DF5C90BCC39","4E44F628-B552-4068-8E5A-A5BE35D96D07","459D5C45-2C48-48DB-B2BE-
E01BAF618DCC","78944AC6-E046-4755-836C-40F6F2D57DAF","68D4A3CC-F911-4402-8C11-801542CB898F"
,"34E4F505-71EB-4BA1-B1BD-1300E3D84F9D","6021937A-10B4-4673-96E7-BDE4E64BEF93","175BB184-9A
BB-4A44-AA9E-1E30D4541650","30003135-C731-4B51-A9E8-B813F8BA18D1","1FDB913B-87CB-488C-8318-
C98FBEB4937B","5ECADC06-66C4-4EF0-BD7E-98156891EBF3","33A22974-4600-4B1C-98A7-1CBF94A2E335"
,"1CF267D6-5922-4334-A0DD-2DB8FA9AC49A","39813612-1F47-41E5-BD4B-B73E15B28FE8"}
        Phase                = "READY"
        PhaseDetail          = 0
        ErrMsg               = ""
        Memory               = "524288"
        Processors           = "32"
        ActivePeerDomain     = "vmdr"
resource 2:
        CecUuid              = "b6966940-52f1-306b-9b2b-2d8447acc14f"
        Name                 = "doit3-8233-E8B-06DA59R"
        FspIP                = "10.40.1.90"
        SiteID               = 1
        DR_PartnerCecUuidList = {"9f5fd671-0597-31b8-a950-f2d043c864f8"}
        MachineType          = "8233"
        MachineModel         = "E8B"
        MachineSerial        = "06DA59R"
        PhypVersion          = "AL730_146"
        ConfigStatus         = 0
        ConfigValues         = {}
        ProcValues           = {}
        MemValues            = {}
        Vios                 =
{"64B120F0-11AA-4856-B8E9-411448B28FF6","4D44B3DE-3F42-458C-8227-18DA5E0F945D","4E9C2AE5-BC
2F-482F-A830-98B2606291D5","48395DBE-D1E3-469D-B95C-5CFDDD59F9F7"}
        HMCs                 = {"vmhmc5"}
        LPARs                = {}
        Phase                = "READY"
        PhaseDetail          = 142
        ErrMsg               = ""
        Memory               = "524288"
        Processors           = "32"
        ActivePeerDomain     = "vmdr"
```

In both situations, provide the resources to the target host and either perform a new verify operation or move the VMs with the **force** option.

> **Important:** Because daily checks in the KSYS node automatically perform a verify activity, such checks also fail if you use capacity on demand resources. See section 5.4.5, “Automation of the Enterprise Pool Capacity on Demand management” on page 246 for information about how to avoid such failures.

5.4.4 IBM Geographically Dispersed Resiliency for Power Systems with capacity on demand

This section explains how to configure a Power Enterprise Pool Capacity on Demand (EPCoD) and shows how to use the KSYS **ksysrppmgr** command to handle the EPCoD for disaster recovery purposes. The explanation is provided based on a sample environment, which is represented in Figure 5-5.

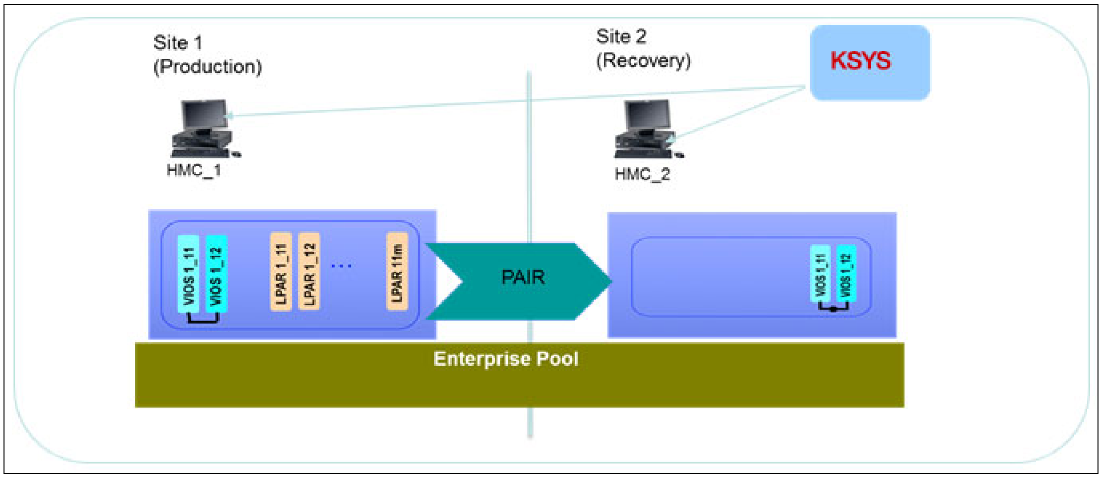


Figure 5-5 Sample environment that is used to show the steps for EPCoD configuration and IBM Geographically Dispersed Resiliency for Power Systems

In this scenario, Site 1 is the production site, where several virtual machines are currently running. HMC_1 represented in Figure 5-5 has the host name `vmhmc1`, and it is the HMC used to manage the hosts (managed systems) from this site. Host_1 is the managed system `kumquat_9179-MHD-105E67P`, which is the server (CEC) from the production site where the workload (VMs or LPARs) are currently running.

In the same environment, Site 2 is the backup site, which is available for disaster recovery purposes in case of problems with Site 1. This site has the HMC_2, named `vmhmc3`, which is the HMC that manages the servers from this site. Host_2 is the managed system that is named `orange-9179-MHD-SN107895P`, which is for receiving VMs from Host_1 in case of a failure in Site 1.

In this scenario, an Enterprise Pool Capacity on Demand is set up between servers `kumquat` and `orange`. In this situation, both hosts are prepared with minimal CPU and memory resources, and the majority of the resources are assigned to the resource pool. During a normal situation, where the workload is running in Site 1, the resources are assigned from the Enterprise Pool to host `kumquat`. In case of failure in Site 1, the Enterprise Pool memory and CPU resources are moved to the host `orange` at Site 2, so you can receive the workload from Site 1.

Setup of the Enterprise Pool Capacity on Demand

Before starting to use the Enterprise Pool with IBM Geographically Dispersed Resiliency for Power Systems, the environment must be configured in a pool. You must contact an IBM sales representative to order a Power Enterprise Pool. After the order is complete, you receive an XML configuration file, which contains a Power Enterprise Pool membership activation code for each of the systems to be added in the pool. The file also contains codes to activate the desired amount of CPU and memory for the hardware and for the pool.

IBM Knowledge Center has information about Ordering Power Enterprise Pools.

When you receive the XML configuration file, create and configure your Enterprise Pool by following the instructions that are provided in *Power Enterprise Pools on IBM Power Systems*, REDP-5101.

In this environment, an Enterprise Pool is set up between the `kumquat` and `orange` managed systems, being managed by HMCs `vhmc1` and `vhmc3`, as shown in Figure 5-6.

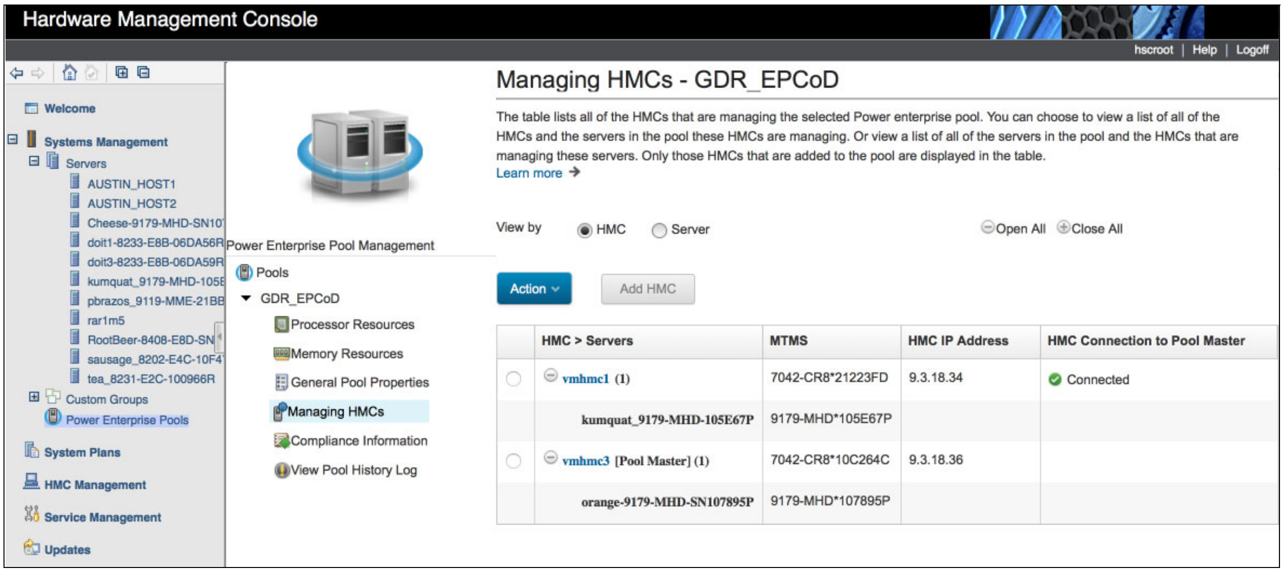


Figure 5-6 GDR_EPCoD management and hosts

This Enterprise Pool has 10 mobile processors (Figure 5-7).

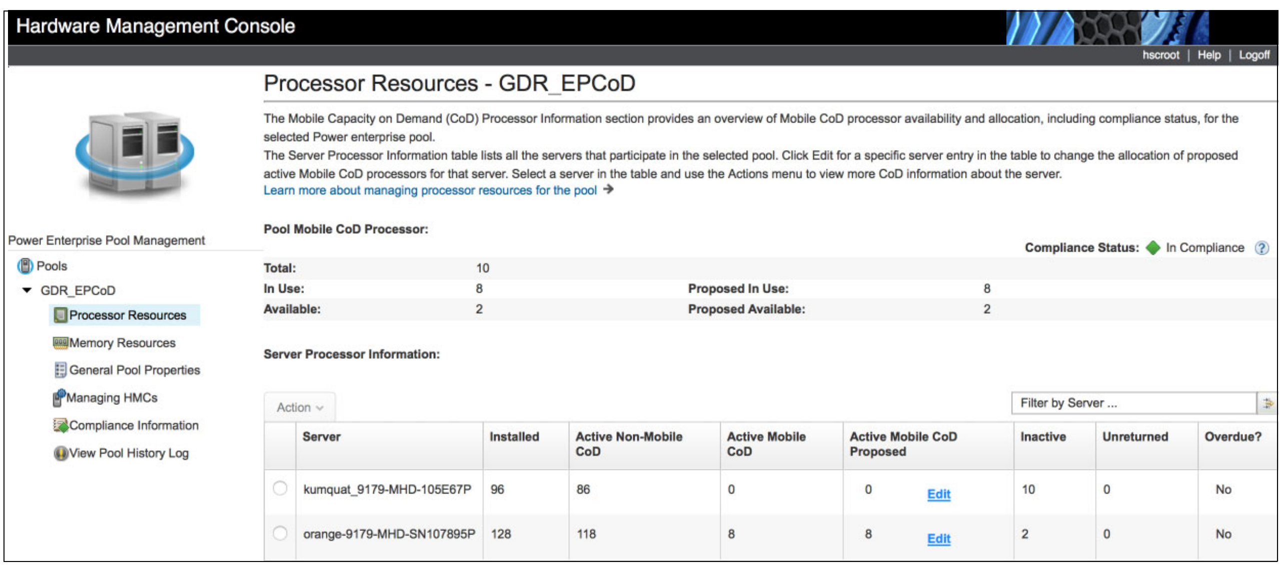


Figure 5-7 Mobile processors available in the Enterprise Pool

The Enterprise Pool also has 100 GB of mobile memory available in the pool (Figure 5-8).

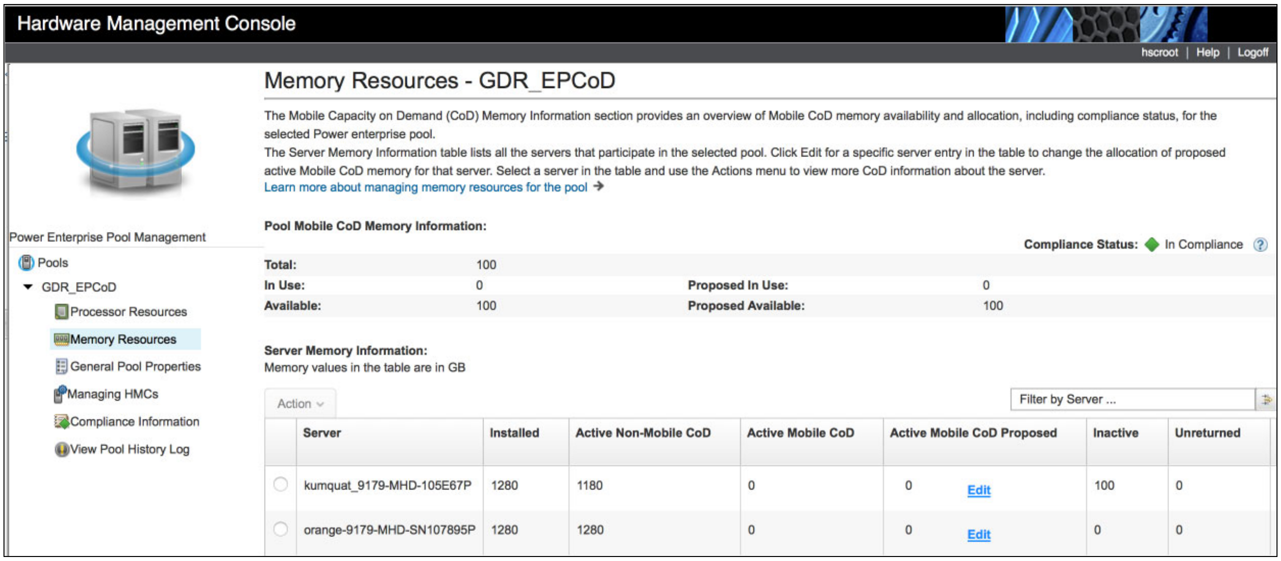


Figure 5-8 Mobile memory available in the Enterprise Pool

Such resources can be moved between hosts `kumquat` and `orange` as required.

Example 5-17 shows the same details of the Enterprise Pool by using the command-line interface (CLI).

Example 5-17 Mobile resources in the Enterprise Pool

```
hscroot@vmhmc1:~> lscodpool -p GDR_EPCoD --level sys
name=kumquat_9179-MHD-105E67P,mtms=9179-MHD*105E67P,state=Operating,mobile_procs=0,non
_mobile_procs=86,unreturned_mobile_procs=0,inactive_procs=10,installed_procs=96,mobile
_mem=0,non_mobile_mem=1208320,unreturned_mobile_mem=0,inactive_mem=102400,installed_me
m=1310720
name=orange-9179-MHD-SN107895P,mtms=9179-MHD*107895P,state=Operating,mobile_procs=8,no
n_mobile_procs=118,unreturned_mobile_procs=0,inactive_procs=2,installed_procs=128,mobi
le_mem=0,non_mobile_mem=1310720,unreturned_mobile_mem=0,inactive_mem=0,installed_mem=1
310720

hscroot@vmhmc1:~> lscodpool -p GDR_EPCoD --level pool
name=GDR_EPCoD,id=0435,state=In
compliance,sequence_num=40,master_mc_name=vmhmc3,master_mc_mtms=7042-CR8*10C264C,maste
r_mc_ipaddr=9.3.18.36,mobile_procs=10,avail_mobile_procs=2,unreturned_mobile_procs=0,m
obile_mem=102400,avail_mobile_mem=102400,unreturned_mobile_mem=0

hscroot@vmhmc1:~> lscodpool -p GDR_EPCoD --level mc
name=vmhmc3,mtms=7042-CR8*10C264C,ipaddr=9.3.18.36,is_master=1,pool_sys_names=orange-9
179-MHD-SN107895P,pool_sys_mtms=9179-MHD*107895P
name=vmhmc1,mtms=7042-CR8*21223FD,ipaddr=9.3.18.34,is_master=0,pool_sys_names=kumquat_
9179-MHD-105E67P,pool_sys_mtms=9179-MHD*105E67P
```

Using Enterprise Pools Capacity on Demand in the IBM Geographically Dispersed Resiliency for Power Systems environment

The Enterprise Pools Capacity on Demand can be used in both planned and unplanned move situations by the KSYS node:

- Planned

  A planned move is initiated by the system administrator in a non-disaster situation. In this case, both home and backup sites are operational, so the VMs at the home site can be shut down gracefully before moving them to the backup site. This type of move operation is usually initiated for DR test purposes, or when some maintenance needs to be performed at the home site.

- Unplanned

  An unplanned move is usually initiated during a disaster situation. In this situation, a problem might cause the home site to be down or cause communication to be unavailable between sites, so the components from home site are no longer reachable from the backup site. In this situation, the priority is to get the VMs online at the backup site and resume business operations. Because communication between sites might be compromised, the resources from the home site are not reachable and cannot be automatically released back to the Enterprise Pool by the KSYS node (in this situation the pool is overcommitted). When the problem in the home site is resolved and communication is restored, the system administrator can use the KSYS node to manually clean up the VMs on the active site and return the CPU and memory resources to the Enterprise Pool.

The following list summarizes the actions that the system administrator should use in situations where a move operation must be performed in an environment of Enterprise Pools:

1. Return resources from the home site hosts to the Enterprise Pool Capacity on Demand if possible (if the communication with the home site is still available).
2. Allocate the necessary resources to start the managed virtual machines to the backup site hosts.

3. Initiate the move operation from the home to the backup site.
4. If this is an unplanned move, after the communication with the home site is reestablished (when the original problem that led to the disaster situation is solved), clean up the resources from the home site hosts (clean up the virtual machines) and return the EPCoD resources to the pool.

The next steps demonstrate the use of the EPCoD in an IBM Geographically Dispersed Resiliency for Power Systems environment during a move situation. For this example, only mobile processors are used, but the same steps should apply for memory resources:

1. Reduce the resources from the active site and return them to the Enterprise Pool.

   This example assumes that the move operation is being performed from host `kumquat` (`kumquat_9179-MHD-105E67P`), which is the home site, to host `orange` (`orange-9179-MHD-SN107895P`), which is the backup site), and considers that the host orange need to receive eight processors to be able to handle the workload (VMs) that it receives. In this case, the first action that needs to be performed is to reduce eight processor units from the host `kumquat`.

   > **Note:** You can reduce the resources directly in the Enterprise Pool. There is no need to reduce the resources from the VMs before reducing the pool. When you reduce the resources from the pool, these are considered *unreturned resources* while the VMs are running. These are automatically returned to the pool after the VMs are shut down (which is automatically performed by the KSYS node during the move operation).

   To reduce resources, either use the HMC GUI or use the **`ksysrppmgr`** command in the KSYS command line:

   – Using the HMC GUI to reduce the resources

     Log in to the HMC and click **Systems Management** → **Power Enterprise Pools** → **Pools** → **Processor Resources**. Notice that the eight mobile processors are currently being used by host `kumquat` (Figure 5-9).

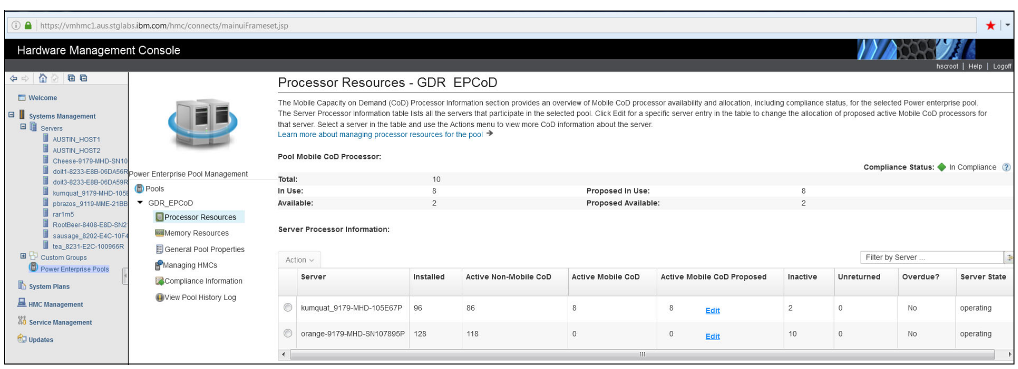


Figure 5-9 Processors currently being used by host kumquat

To modify this configuration, remove the host `kumquat` by clicking **Edit** (in the `Active Mobile CoD Proposed` column). Because the VMs are still using the resources, you notice that the mobile processors are now referred to as `Unreturned` resources for host `kumquat` (Figure 5-10).

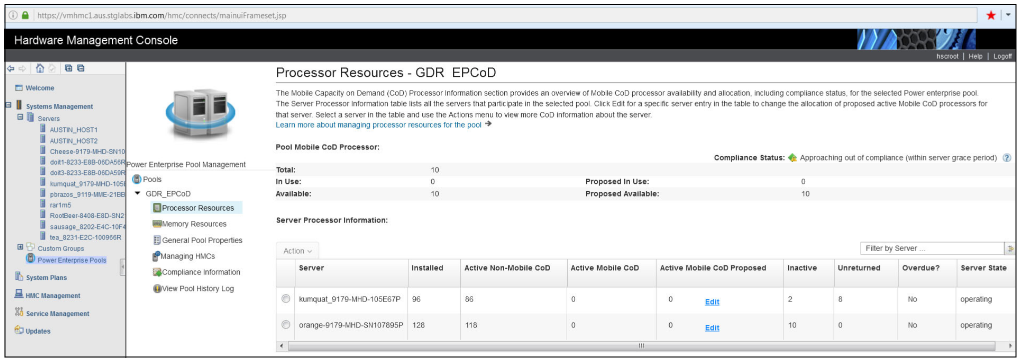


Figure 5-10 Unreturned processors in host kumquat

This action completes the task of returning the resources to the Enterprise Pool. Although the processors are still listed as unreturned, they are returned to the pool after they are freed, which means when the VMs are automatically shut down by the KSYS node during the move operation.

– Using the **ksysrppmgr** command to reduce the resources

This command can be used both to add resources to a host and to remove resources from a host, returning it to the pool. Example 5-18 shows how to use the command in the KSYS node.

Example 5-18 Syntax of the ksysrppmgr command

```
# ksysrppmgr
ksysrppmgr -o action
(-h [hmc_name]:hmc_uri:hmc_user)+
[-m ms_name:ms_action:[onoff_use(n|y[nb_days])]:[mem_amount]:[proc_amount]]*
[-M ms_uuid:ms_action:[onoff_use(n|y[nb_days])]:[mem_amount]:[proc_amount]]*
[-e enterprisepool_name]*
[-E enterprisepool_uuid]*
[-v] [-r] [-l "none"|logfile_path] [-p logfile_prefix]
```

Before using the **ksysrppmgr** command, run the **hmcauth** command to authenticate with the HMC, which receives the commands (**ksysrppmgr** uses the APIs that require authentication prior to use). The **hmcauth** command is provided by the file set `bos.sysmgt.hmc`. Example 5-19 shows how to use the **hmcauth** command.

Example 5-19 Use the hmcauth command to authenticate with the HMC

```
# whence hmcauth
/usr/sbin/hmcauth

# lslpp -w /usr/sbin/hmcauth
  File                                        Fileset               Type
  ----------------------------------------------------------------------------
  /usr/sbin/hmcauth                           bos.sysmgt.hmc        File

# hmcauth -u hscroot -p abc123 -a vhmc1
```

Now you can use the **ksysrppmgr** command to set to 0 the number of processors from the pool that is used by the kumquat host. The syntax of the command is as follows:

```
# ksysrppmgr -o c|e -h [<HMCname>]:<hmcuri>:<username> -m
<managedsystem>:<action>:<memory_amount>:<proc amount> -e <poolname> -v -r
```

Example 5-20 shows the command being used to set the number of processors from the EPCoD to 0 for host kumquat. The first command just checks whether it works (simulating) and the second command properly executes the action.

Example 5-20 Using the ksysrppmgr command to reduce the amount of resources

```
# ksysrppmgr -o c -h :vhmc1:hscroot -m kumquat_9179-MHD-105E67P:s:y::0 -e
GDR_EPCoD -v -r
kumquat_9179-MHD-105E67P:0

# ksysrppmgr -o c -h :vhmc1:hscroot -m kumquat_9179-MHD-105E67P:s:y::0 -e
GDR_EPCoD -v -r
kumquat_9179-MHD-105E67P:0
```

2. Now you need to allocate the steps to the host orange-9179-MHD-SN107895P at the backup site. These are the resources that were freed in step 1 on page 242. After adding the resources to host orange, these are considered overcommitted licensed resources because the VMs are still running at host kumquat and the resources are currently considered unreturned. This situation is automatically corrected after the VMs from kumquat are shut down and removed, then the resources are returned to the pool. You can perform this operation by either using the HMC GUI or by using the **ksysrppmgr** command.

   – Using the HMC GUI to add resources to host orange

     In the HMC, click **Systems Management** → **Power Enterprise Pools** → **Pools** → **Processor Resources** and click **Edit** to add the eight processor units to host orange (Figure 5-11).

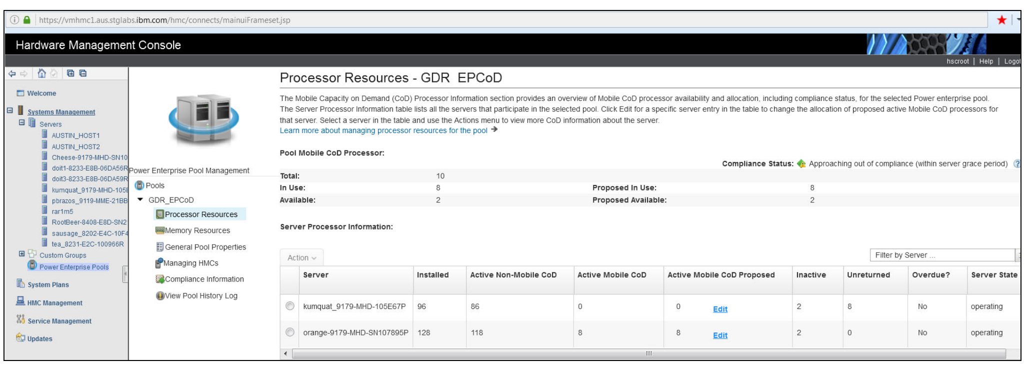


Figure 5-11 Adding processor units to host orange

   – Using the **ksysrppmgr** command to add the resources to host orange

     Use the **hmcauth** command to authenticate with the HMC that manages the orange host, optionally simulate the execution of the **ksysrppmgr** command, and then execute the change, adding eight processor units to the orange host (Example 5-21).

Example 5-21 Adding eight processor units to host orange by using ksysrppmgr

```
# hmcauth -u hscroot -p abc123 -a vhmc3

# ksysrppmgr -o c -h :vhmc3:hscroot -m orange-9179-MHD-SN107895P:s:y::8 -e
GDR_EPCoD -v -r
```

```
orange-9179-MHD-SN107895P:0

# ksysrppmgr -o e -h :vhmc3:hscroot -m orange-9179-MHD-SN107895P:s:y::8 -e
GDR_EPCoD -v -r
orange-9179-MHD-SN107895P:0
```

3. Initiate the move operation from the home to the backup site.

   The resources are provided to the target host, which receives the workload from the home site, so it is ready to receive the VMs.

   Keep in mind that the verify operation would have failed before because not enough resources are available, so the VMs are in the `VERIFY` state or the CEC has an error bit turned on. In this situation, the move operation fails if initiated normally. You can either run a verify operation or perform the move by using the **force** option.

   Example 5-22 shows the syntax of the **verify** command that can be used at this moment. After the verify operation completes successfully, the state of the VMs is changed to `READY_TO_MOVE` and the error bit is unset from the CEC level, therefore a normal move operation can be executed (no need to use the force option in this case).

   Example 5-22 Running the verify operation

   ```
   # ksysmgr verify site <sitename>
   ```

   If you cannot wait the time that is spent by the verify operation, you can move the VMs with the **force** option as shown in Example 5-23.

   Example 5-23 Moving the virtual machines with force option

   ```
   # ksysmgr move site from=<home_site> to=<backup_site> dr_type=planned|unplanned
   force=true
   ```

   After the move operation is initiated from the home to the backup site, the VMs are started on host `orange`. If it is a *planned* move, the VMs are automatically cleaned up from host `kumquat`, and the resources that are considered `unreturned` will automatically return to the pool (so the pool is no longer be overcommitted). If it is an *unplanned* move, the VMs are started on host `orange` and remain created also on host `kumquat`, leaving the pool overcommitted. In this case, after the communication between sites is reestablished, you must manually perform a *cleanup* operation by using the KSYS node, so the KSYS contacts the HMCs from the home site and cleans up the VMs, therefore the resources are returned to the pool.

   Example 5-24 shows the syntax of the cleanup operation that must be run after communication between sites is reestablished, in case of an unplanned move.

   Example 5-24 Syntax of the cleanup operation

   ```
   # ksysmgr cleanup site <sitename>
   ```

Figure 5-12 shows the Enterprise Pool Capacity on Demand after the VMs are cleaned up from the home site, which demonstrates that the processor units are no longer unreturned.

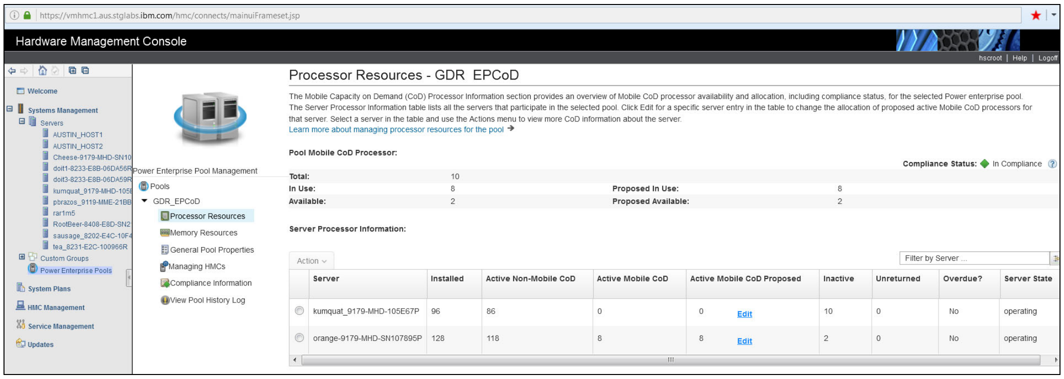


Figure 5-12 Resources returned to the pool after VMs are cleaned up

This solution allows IBM Geographically Dispersed Resiliency for Power Systems and EPCoD to work together, optimizing hardware resources between sites and minimizing the costs that are involved with the backup site, while it still provides a robust disaster recovery solution for your virtual machines.

5.4.5 Automation of the Enterprise Pool Capacity on Demand management

Currently, the KSYS node does not manage the Capacity on Demand resources automatically. IBM intends to deliver enhancements to integrate the **ksysrppmgr** command with KSYS activities, automating the management of CoD resources, including Enterprise Pool Capacity on Demand (EPCoD).

Because automation is not currently available, and considering that verify fails if not enough resources are available in the target system (explained in 5.4.3, “Capacity check failures use cases” on page 233), and also considering that KSYS nodes automatically performs daily verifications (explained in 4.8, “Daily checks that are performed by the KSYS node” on page 209), these automatic verify activities also fail if not enough resources are on the target host, leaving the VMs in a state other than `READY_TO_MOVE`.

IBM intends to deliver enhancements in order for the KSYS node to address this automation issue, but currently, the only way to avoid the issue, if you use Capacity on Demand resources, is to set up an automation script to run before the verify activity and add resources to the target host, and then verify the IBM Geographically Dispersed Resiliency for Power Systems environment and remove such resources from the target host. This approach was validated by the HMC Enterprise Pool Team so no problem should exist in performing such tasks. The Enterprise Pool does not flag any issue unless the resources are held for more than 48 hours, which is not the case here, because they are freed when verify is completed. Also, it is a good way of checking that the EPCoD is working properly because if the verify operation fails, you are notified and know that some problem has happened to the allocation of resources.

Example 5-25 shows a script that releases resources from home site and assign the resources to the backup site. In this situation, because the VMs are currently running in the home site, the resources become *unreturned resources* in the Enterprise Pool. This script can be registered as a `pre_verify` script to avoid a verify failure.

Example 5-25 Example of resource_allocation script

```
# cat resource_allocation.sh
SOURCEHMCUSER="hscroot"
TARGETHMCUSER="hscroot"
SOURCEPASSWD="abc123"
TARGETPASSWD="abc123"
/opt/IBM/ksys/ksysmgr q vm | grep -e "Name:" -e "Host:" -e "UUID:" -e "State" | awk
'{print $2}' | while read -r vm; do read -r uuid; read -r host; read -r state ; echo
"$vm:$uuid:$host:$state"; done  | grep -v "UNMANAGED" >/tmp/VMLIST
/opt/IBM/ksys/ksysmgr q cec | grep -e "Name:" -e "UUID:" -e "Pair:"  -e "Site:"  -e
"HMCs:" | awk '{print $2}' | while read -r cec; do read -r uuid ; read -r pair;  read
-r site; read -r hmc  ;  echo "$cec:$uuid:$pair:$site:$hmc"; done >/tmp/CECPAIR
 /opt/IBM/ksys/ksysmgr q site | grep -e "Name:" -e "Sitetype:" | awk '{print $2}' |
while read -r name ; do read -r type ;  echo "$name:$type"; done >/tmp/SITE

SOURCESITE=`cat /tmp/SITE | grep ACTIVE | awk -F ":" ' { print $1 } '`
TARGETSITE=`cat /tmp/SITE | grep BACKUP | awk -F ":" ' { print $1 } '`
for CEC in `cat /tmp/CECPAIR | grep $SOURCESITE |  awk -F ":" ' { print $1 } '`
do
source_currentprocessors=0
source_currentmemory=0
for VM in ` cat /tmp/VMLIST | grep $CEC | awk -F ":" ' { print $2 }'`
do
SOURCECEC=`cat /tmp/VMLIST | grep $VM | awk -F ":" ' { print $3 } '`
SOURCEUUID=`cat /tmp/CECPAIR | grep "^$SOURCECEC" | awk -F ":" ' { print $2 } '`
TARGETCEC=`cat /tmp/CECPAIR | grep "^$SOURCECEC" | awk -F ":" ' { print $3 } '`
TARGETUUID=`cat /tmp/CECPAIR | grep "^$TARGETCEC" | awk -F ":" ' { print $2 } '`
SOURCEHMC=`cat /tmp/CECPAIR | grep "^$SOURCECEC" | awk -F ":" ' { print $4 } '`
TARGETHMC=`cat /tmp/CECPAIR | grep "^$TARGETCEC" | awk -F ":" ' { print $4 } '`
VMNAME=`cat /tmp/VMLIST | grep $VM | awk -F ":" ' { print $1 } '`
mkdir -p /tmp/krest 2>/dev/null 1>/dev/null
#currentprocessors=`$location/krest_get_vminfo -H $SOURCEHMC -u $SOURCEHMCUSER -p
$SOURCEPASSWD -l $VM | grep currentprocessors | awk -F ":" ' { print $2 } '`
#currentmemory=`$location/krest_get_vminfo -H $SOURCEHMC -u $SOURCEHMCUSER -p
$SOURCEPASSWD -l $VM | grep currentmemory | awk -F ":" ' { print $2 } '`

currentprocessors=`ssh hscroot@$SOURCEHMC lshwres -m $SOURCECEC -r   proc --level
lpar --filter "lpar_names=$VMNAME" -F curr_proc_units`
currentmemory=`ssh hscroot@$SOURCEHMC lshwres -m $SOURCECEC -r  mem --level  lpar
--filter "lpar_names=$VMNAME" -F curr_mem`

source_currentprocessors=`echo "scale=3; $source_currentprocessors +
$currentprocessors" | bc`
source_currentmemory=`expr $source_currentmemory  + $currentmemory`
done
echo Source Current Processors : "$source_currentprocessors"
echo Source Current Memory :  "$source_currentmemory"
memory=`ssh hscroot@$TARGETHMC lshwres -m  $TARGETCEC -r mem  --level  sys -F
installed_sys_mem`
processors=`ssh hscroot@$TARGETHMC lshwres -m  $TARGETCEC -r proc  --level  sys -F
installed_sys_proc_units`
```

```
#processors=`$location/krest_get_hostinfo -H $TARGETHMC -u $TARGETHMCUSER -p
$TARGETPASSWD -m $TARGETUUID | grep processors | awk -F ":" ' { print $2 } '`
#memory=`$location/krest_get_hostinfo -H $TARGETHMC -u $TARGETHMCUSER -p $TARGETPASSWD
-m $TARGETUUID | grep memory | awk -F ":" ' { print $2 } '`

echo Target Current Processors : "$processors"
echo Target Current Memory : "$memory"
if [ $processors -ge $source_currentprocessors ]
then
    echo "We have enough processor on target "
else


Require_processors=`echo "scale=2; $source_currentprocessors - $processors" | bc`

for POOL in `ssh hscroot@$SOURCEHMC lscodpool  --level pool | awk -F "," ' { print $1
} ' | awk -F "=" ' { print $2 } '`
do

for POOLCEC in `ssh hscroot@$SOURCEHMC lscodpool -p $POOL --level sys | awk -F "," ' {
print $1  } ' | awk -F "=" ' { print $2 } '
do
echo POOLCEC | grep $SOURCECEC 2>/dev/null 1>/dev/null
X=$?
echo $POOLCEC | grep $TARGETCEC 2>/dev/null 1>/dev/null
Y=$?
if [ $X = 0 -a $Y = 0 ]
then
   echo POOL NAME : $POOL
   break
fi
done

if [ $X = 0 -a $Y = 0 ]
then
   echo "POOL NOT CONFIGURED between $SOURCECEC and $TARGETCEC "
   break
fi

done
source_inactive_processor=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys |
grep $SOURCECEC | awk -F "," ' { print $7 } ' | awk -F "=" ' { print $2 } '`

unavailable_processor=`expr $Require_processors - $source_inactive_processor`

source_active_processor=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys | grep
$SOURCECEC | awk -F "," ' { print $4 } ' | awk -F "=" ' { print $2 } '`

diffeenc_processor=`expr $source_active_processor - $unavailable_processor`
echo ksysrppmgr -o c -h $TARGETHMC:$TARGETHMC:hscroot -m
$SOURCECEC:s:y::$diffeenc_processor -e $POOL -v -r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m
$SOURCECEC:s:y::$diffeenc_processor -e $POOL -v -r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m
$TARGETCEC:s:y::$Require_processors -e $POOL -v -r
fi

if [ $memory -ge $source_currentmemory ]
```

```
then
    echo "We have enough memory on target "
else

Require_memory=`echo "scale=2; $source_currentmemory  - $memory" | bc`

source_inactive_memory=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys | grep
$SOURCECEC | awk -F "," ' { print $12 } ' | awk -F "=" ' { print $2 } '`

unavailable_memory=`expr $Require_memory - $source_inactive_memory`

source_active_memory=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys | grep
$SOURCECEC | awk -F "," ' { print $9 } ' | awk -F "=" ' { print $2 } '`

diffeenc_memory=`expr $source_active_memory - $unavailable_memory`

echo ksysrppmgr -o c -h $TARGETHMC:$TARGETHMC:hscroot -m
$TARGETCEC:s:y:$Require_memory: -e $POOL -v -r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m
$SOURCECEC:s:y:$diffeenc_processor: -e $POOL -v -r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m $TARGETCEC:s:y:$Require_memory: -e
$POOL -v -r
fi
done
```

Example 5-26 shows a script that reduces unreturned resources from the backup host and assigns them back to the home site host. This script can be used as a `post_verify` event to return the resources to the host where VMs are running.

Example 5-26 Sample resource_reallocation script

```
# cat resource_reallocation.sh
SOURCEHMCUSER="hscroot"
TARGETHMCUSER="hscroot"
SOURCEPASSWD="abc123"
TARGETPASSWD="abc123"

/opt/IBM/ksys/ksysmgr q cec | grep -e "Name:" -e "UUID:" -e "Pair:"  -e "Site:"  -e "HMCs:" |
awk '{print $2}' | while read -r cec; do read -r uuid ; read -r pair;  read -r site; read -r hmc
;  echo "$cec:$uuid:$pair:$site:$hmc"; done >/tmp/CECPAIR
/opt/IBM/ksys/ksysmgr q site | grep -e "Name:" -e "Sitetype:" | awk '{print $2}' | while read -r
name ; do read -r type ;  echo "$name:$type"; done >/tmp/SITE

SOURCESITE=`cat /tmp/SITE | grep ACTIVE | awk -F ":" ' { print $1 } '`
TARGETSITE=`cat /tmp/SITE | grep BACKUP | awk -F ":" ' { print $1 } '`

for SOURCECEC in `cat /tmp/CECPAIR | grep $SOURCESITE |  awk -F ":" ' { print $1 } '`
do

SOURCEUUID=`cat /tmp/CECPAIR | grep "^$SOURCECEC" | awk -F ":" ' { print $2 } '`
TARGETCEC=`cat /tmp/CECPAIR | grep "^$SOURCECEC" | awk -F ":" ' { print $3 } '`
TARGETUUID=`cat /tmp/CECPAIR | grep "^$TARGETCEC" | awk -F ":" ' { print $2 } '`
SOURCEHMC=`cat /tmp/CECPAIR | grep "^$SOURCECEC" | awk -F ":" ' { print $4 } '`
TARGETHMC=`cat /tmp/CECPAIR | grep "^$TARGETCEC" | awk -F ":" ' { print $4 } '`


for POOL in `ssh hscroot@$SOURCEHMC lscodpool  --level pool | awk -F "," ' { print $1  } ' | awk
-F "=" ' { print $2 } '`
do
```

```
for POOLCEC in `ssh hscroot@$SOURCEHMC lscodpool -p $POOL --level sys | awk -F "," ' { print $1
} ' | awk -F "=" ' { print $2 } '
do
echo POOLCEC | grep $SOURCECEC 2>/dev/null 1>/dev/null
X=$?
echo $POOLCEC | grep $TARGETCEC 2>/dev/null 1>/dev/null
Y=$?
if [ $X = 0 -a $Y = 0 ]
then
   echo POOL NAME : $POOL
   break
fi
done

if [ $X = 0 -a $Y = 0 ]
then
   echo "POOL NOT CONFIGURED between $SOURCECEC and $TARGETCEC "
   break
fi

done

unreturned_mobile_procs=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys | grep $SOURCECEC
| awk -F "," ' { print $6 } ' | awk -F "=" ' { print $2 } '`

target_active_processor=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys | grep $TARGETCEC
| awk -F "," ' { print $4 } ' | awk -F "=" ' { print $2 } '`

if [ $unreturned_mobile_procs != 0 ]
diffeenc_processor=`expr $target_active_processor - $unreturned_mobile_procs`
echo ksysrppmgr -o c -h $TARGETHMC:$TARGETHMC:hscroot -m $TARGETCEC:s:y::$diffeenc_processor -e
$POOL -v -r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m $TARGETCEC:s:y::$diffeenc_processor -e $POOL
-v -r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m $SOURCECEC:s:y::$unreturned_mobile_procs -e
$POOL -v -r
fi


unreturned_mobile_memory=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys | grep
$SOURCECEC | awk -F "," ' { print $11 } ' | awk -F "=" ' { print $2 } '`

target_active_memory=`ssh hscroot@$TARGETHMC lscodpool -p $POOL --level sys | grep $TARGETCEC |
awk -F "," ' { print $9 } ' | awk -F "=" ' { print $2 } '`

if [ $unreturned_mobile_memory != 0 ]
diffeenc_memory=`expr $target_active_memory - $unreturned_mobile_memory`
echo ksysrppmgr -o c -h $TARGETHMC:$TARGETHMC:hscroot -m $TARGETCEC:s:y::$diffeenc_memory -e
$POOL -v -r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m $TARGETCEC:s:y::$diffeenc_memory -e $POOL -v
-r
ksysrppmgr -o e -h $TARGETHMC:$TARGETHMC:hscroot -m $SOURCECEC:s:y::$unreturned_mobile_memory -e
$POOL -v -r
fi

done
```

Note: These scripts are provided as-is and are not officially supported. These scripts can require additional customization for running in your environment. If you need help to customize these scripts, contact your IBM representative.

After preparing and testing the scripts in your environment, you can register them as `pre_verify` and `post_verify` events as shown in Example 5-27.

Example 5-27 Registering the scripts as pre_verify and post_verify events

```
# ksysmgr add script entity=site
pre_verify="/opt/IBM/ksys/samples/resource_allocation.sh”

# ksysmgr add script entity=site
post_verify="/opt/IBM/ksys/samples/resource_reallocation.sh”
```

You can also use the `resource_reallocation.sh` script and register it as a `pre_offline` event. In this case, it is executed before a move event, adding resources to the backup host, and then the cleanup operation automatically releases the unreturned resources from the home site. Example 5-28 shows how to register the script as a `pre_offline` event.

Example 5-28 Registering script as a pre_offline event

```
# ksysmgr add script entity=site
pre_offline="/opt/IBM/ksys/samples/resouce_allocation.sh”
```

Note: The script queries the production and recovery site HMCs to retrieve resource information. The script needs the user name and password of the production and recovery site HMCs. These can be set as variables in the beginning of the script (`SOURCEHMCUSER`, `TARGETHMCUSER`, `SOURCEPASSWD`, `TARGETPASSWD`).

5.5 Cleaning ghost disks in AIX (ghostdev parameter)

If you use the AIX operating system in the virtual machines (LPARs) managed by the IBM Geographically Dispersed Resiliency for Power Systems solution, you notice that when the VM is moved to the backup site, ghost disks are in the ODM when the VM boots, as shown in Example 5-29.

Example 5-29 Ghost disks in AIX VM

```
# lsdev -Cc disk
hdisk0 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk2 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk3 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
```

The reason for this behavior is that, although the disks are replicated, and therefore have the exact same content, the UUID or unique ID of the disks are different, so they are handled by the operating system as different disks. Example 5-30 shows the disks from one of the VMs from the environment, setup for this publication, called `pbrazos041`. At this time, the VM is running in frame `pbrazos`, which receives disks from the Dell EMC Storage `000196800508` (SID).

Example 5-30 VM pbrazos041 booting from home site

```
# lsattr -El hdisk0 | egrep "pvid|unique_id|ww_name"
pvid            00f66dbe9356956e0000000000000000
unique_id       2009800508!z;09SYMMETRIX03EMCfcp
ww_name         0x500009735807f005
```

```
# lsattr -El hdisk1 | egrep "pvid|unique_id|ww_name"
pvid          00f66dbe95a51e730000000000000000
unique_id     2009800508!z<09SYMMETRIX03EMCfcp
ww_name       0x500009735807f005
```

The same virtual machine has different `unique_id` and `ww_name`, but the same `pvid` when booting from the other host, which in this case is `HAM`, which receives disks from Dell EMC Storage `000196800573`, as shown in Example 5-31.

Example 5-31 VM pbrazos041 booting from backup site

```
# lsattr -El hdisk2 | egrep "pvid|unique_id|ww_name"
pvid          00f66dbe9356956e0000000000000000
unique_id     2009800573!?@09SYMMETRIX03EMCfcp
ww_name       0x500009735808f409

# lsattr -El hdisk3 | egrep "pvid|unique_id|ww_name"
pvid          00f66dbe95a51e730000000000000000
unique_id     2009800573!?G09SYMMETRIX03EMCfcp
ww_name       0x500009735808f409
```

Although AIX continues to work normally with such ghost devices, depending on the number of disks that your VMs have, handling a large number of `Defined` devices might be difficult or annoying, so you might want to use the AIX parameters to perform an Object Data Manager (ODM) wipe or cleanup during boot time, when booting from a different server, and thus avoiding such a situation.

Two parameters are available in AIX, which perform similar functions: **`ghostdev`** and **`clouddev`**. Table 5-3 briefly explains these parameters to help you better understand their behavior in the examples in the next sections.

Value of 1: This section describes exclusively what is performed by such parameters when the value of `1` (one) is set. Other actions are performed by each of the parameters when a different value is set, but only the value of 1 is the objective of this explanation because it is the only value interesting for the IBM Geographically Dispersed Resiliency for Power Systems solution.

The default value for both parameters is `0` (zero), which means disabled, so nothing is performed by those parameters (no ODM wipe during boot time).

Optional: The configuration of the **`ghostdev`** parameter is optional, so it is not a requirement for the IBM Geographically Dispersed Resiliency for Power Systems solution.

Table 5-3 Description of ghostdev and clouddev parameters

Parameter	Value	Description
ghostdev	1	During boot time, AIX checks whether it is booting from the same server as before (based on ODM information). ► If it is booting from the same server, proceed with boot normally. ► If it is booting from another server (disks with different `unique_id` value), perform an ODM wipe before continuing with the operating system boot.

Parameter	Value	Description
clouddev	1	Performs a similar task as **ghostdev**, but also sets a flag in the NVRAM indicating when the wipe is performed, so the wipe is only performed during the first boot at each server. If you boot multiple times in multiple servers, only the first boot at each server performs the ODM wipe.

Important: You notice that only the **ghostdev** parameter is interesting for the IBM Geographically Dispersed Resiliency for Power Systems solution. The **clouddev** parameter performs a similar action only during the first move to each site, but the subsequent moves do not perform any ODM wipe, so moving your machines several times between sites (which is expected in an IBM Geographically Dispersed Resiliency for Power Systems solution) does not help and therefore does not help in solving the issue of ghost disks.

The next sections explain, through examples, what happens when parameters are set:

- Settings: ghostdev and clouddev are set to 0.
- Settings: ghostdev is set to 1 and clouddev is set to 0.
- Settings: clouddev is set to 1 and ghostdev is set to 0.

To provide these examples and explanations, a single virtual machine, `pbrazos041`, is being managed by the IBM Geographically Dispersed Resiliency for Power Systems solution. The virtual machine moves between these hosts:

- Host `pbrazos_9119-MME-21BBC47` (referred to as `pbrazos`)

  This host is served by Dell EMC Storage `000196800508`.
- Host `HAM-9179-MHD-SN106DBEP` (referred to as `HAM`)

  This host is served by Dell EMC Storage `000196800573`.

5.5.1 Settings: ghostdev and clouddev are set to 0

This is the default behavior. Because both parameters are set to 0, no ODM wipe is done. The following examples show what happens when the VM is moved between the hosts with the default parameters.

Example 5-32 shows that the pbrazos041 VM is initially running in host HAM (serial `106DBEP`). This is the initial status, so there is no ghost disk. As you can see, the VM has two Dell EMC disks: hdisk0 (rootvg) and hdisk1 (vg00). It also has one IP address that is configured in `en0`, and a single virtual FC adapter.

Example 5-32 VM pbrazos041 initially running in host HAM

```
# hostname
pbrazos041

# lsattr -El sys0 | egrep "ghost|cloud"
clouddev        0
ghostdev        0

# lsattr -El sys0 | grep sys
ghostdev        0
id_to_system    0X80000A3410100000
keylock         normal
systemid        IBM,02106DBEP
```

```
# lspv
hdisk0          00f66dbe9356956e            rootvg          active
hdisk1          00f66dbe95a51e73            vg00            active

# lsvg
rootvg
vg00

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   55%    17367    25% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3918     7% /var
/dev/hd3           0.12      0.12    3%       42     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# lsvg -l vg00
vg00:
LV NAME             TYPE       LPs     PPs     PVs  LV STATE      MOUNT POINT
loglv00             jfs2log    1       1       1    open/syncd    N/A
fslv00              jfs2       80      80      1    open/syncd    /vg00fs

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,CHECKSUM
_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESEND,CH
AIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs1   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter
vscsi0 Defined         Virtual SCSI Client Adapter

# lsdev -Cc if
en0 Available  Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface
```

After moving the VM to host pbrazos (serial `21BBC47`), you see that the entire configuration is maintained, but now the disks are called hdisk2 (rootvg) and hdisk3 (vg00), and the old disks (hdisk0 and hdisk1) are now showing as `Defined` (Example 5-33).

Example 5-33 VM pbrazos041 after moving to host pbrazos

```
# hostname
pbrazos041

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev       0
ghostdev       0
systemid       IBM,0221BBC47

# lspv
hdisk2         00f66dbe9356956e                    rootvg          active
hdisk3         00f66dbe95a51e73                    vg00            active

# lsvg
rootvg
vg00

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   55%    17317    25% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3920     7% /var
/dev/hd3           0.12      0.12    3%       42     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT
,CHECKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LAR
GESEND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsdev -Cc disk
hdisk0 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk2 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk3 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
```

```
fcs1   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter
vscsi0 Defined         Virtual SCSI Client Adapter

# lsdev -Cc if
en0 Available  Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface
```

If you move the VM back to host `HAM`, you notice that it goes back to use hdisk0 and hdisk1, but the hdisk2 and hdisk3 remain as `Defined` (Example 5-34).

Example 5-34 Description of the environment after the VM movement to host HAM

```
# hostname
pbrazos041

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev       0
ghostdev       0
systemid       IBM,02106DBEP

# lspv
hdisk0         00f66dbe9356956e                    rootvg          active
hdisk1         00f66dbe95a51e73                    vg00            active

# lsvg
rootvg
vg00

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   54%    17300    24% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3922     7% /var
/dev/hd3           0.12      0.12    3%       41     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT
,CHECKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LAR
GESEND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1
```

```
# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk2 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk3 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs1   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter
vscsi0 Defined         Virtual SCSI Client Adapter

# lsdev -Cc if
en0 Available  Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface
```

So, this situation (using both **ghostdev** and **clouddev** set to 0) shows what happens in the default behavior, where ghost disks remain because of the change in the UUID or `unique_id` value of the disks.

5.5.2 Settings: ghostdev is set to 1 and clouddev is set to 0

If the VM has many disks, the number of ghost devices might be annoying to handle or might cause problems (or false alarms) for the monitoring systems, so you might want to avoid this situation by changing the **ghostdev** value to `1` (Example 5-35).

Example 5-35 Changing ghostdev to 1

```
# chdev -l sys0 -a ghostdev=1
sys0 changed
```

> **Important:** Be sure that you understand what happens when you set ghostdev to 1, and what kind of ODM wipe is performed in this situation. Be sure to carefully read this section, where the examples show what happens after moving a VM with **ghostdev** set to 1.

The VM pbrazos041 is initially running in host HAM. After changing the ghostdev to 1, restart the VM in the same host. As Example 5-36 shows, no ODM wipe is performed and all configurations are kept. The example shows that the ghost disks (hdisk2 and hdisk3) are left by the tests (performed in 5.5.1, “Settings: ghostdev and clouddev are set to 0” on page 253), when the parameters are still set to the default value.

Example 5-36 No ODM wipe after rebooting VM in the same host with ghostdev set to 1

```
# hostname
pbrazos041

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev       0
ghostdev       1
systemid       IBM,02106DBEP

# lspv
```

```
hdisk0          00f66dbe9356956e                    rootvg          active
hdisk1          00f66dbe95a51e73                    vg00            active

# lsvg
rootvg
vg00

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   55%    17377    25% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3924     7% /var
/dev/hd3           0.12      0.12    3%       42     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -     - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT
,CHECKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LAR
GESEND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk2 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk3 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs1   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter
vscsi0 Defined         Virtual SCSI Client Adapter

# lsdev -Cc if
en0 Available  Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface
```

Now, with **ghostdev** set to 1, perform the move of the VM to host pbrazos. Example 5-37 shows that the ODM is wiped in this condition (**ghostdev** set to 1 and booting in a different server and disks), so there are no more ghost disks. Because the ODM is wiped, the IP address and user-created volume groups that were configuration are lost, so the IP must be reconfigured and the volume groups must be reimported.

> **Note:** Other ODM customizations might also be lost, including parameters set to disks and adapters or interfaces. Review those parameters and reconfigure them.

Example 5-37 Moving the VM to a different host with ghostdev set to 1

```
# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        0
ghostdev        1
systemid        IBM,0221BBC47

# hostname
localhost

# lspv
hdisk0          00f66dbe9356956e                    rootvg          active
hdisk1          00f66dbe95a51e73                    None

# lsvg
rootvg

# ifconfig -a
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESEND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter

# lsdev -Cc if
en0 Defined    Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface

# /usr/sbin/mktcpip -h'pbrazos041' -a'10.40.2.241' -m'255.255.254.0' -i'en0' -g'10.40.2.1'
-A'no' -t'N/A' '-s'
en0
pbrazos041
inet0 changed
en0 changed
inet0 changed
Checking for srcmstr active...complete
Starting tcpip daemons:
0513-029 The syslogd Subsystem is already active.
Multiple instances are not supported.
0513-029 The sendmail Subsystem is already active.
Multiple instances are not supported.
```

```
0513-029 The snmpd Subsystem is already active.
Multiple instances are not supported.
0513-029 The hostmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The snmpmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The inetd Subsystem is already active.
Multiple instances are not supported.
0513-029 The aixmibd Subsystem is already active.
Multiple instances are not supported.
Finished starting tcpip daemons.

# hostname
pbrazos041

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,CHECKSUM_OFFL
OAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESEND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# importvg -y vg00 hdisk1
vg00

# varyonvg vg00

# mount /vg00fs
Replaying log for /dev/fslv00.

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   55%    17382    25% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3928     7% /var
/dev/hd3           0.12      0.12    3%       40     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        0
ghostdev        1
systemid        IBM,0221BBC47
```

The same happens if you move the VM back to host HAM. Now that you are moving to a different host, the ODM is once more wiped, so you need to reconfigure the IP address and reimport the volume groups (and other possible customizations). Because the ODM is wiped, there are no more ghost disks (Example 5-38).

Example 5-38 Moving the VM to a different host with ghostdev set to 1

```
# hostname
localhost

# lspv
hdisk0          00f66dbe9356956e                    rootvg          active
hdisk1          00f66dbe95a51e73                    None

# lsvg
rootvg

# ifconfig -a
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LAR
GESEND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter

# lsdev -Cc if
en0 Defined    Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        0
ghostdev        1
systemid        IBM,02106DBEP

# /usr/sbin/mktcpip -h'pbrazos041' -a'10.40.2.241' -m'255.255.254.0' -i'en0' >
en0
pbrazos041
inet0 changed
en0 changed
inet0 changed
Checking for srcmstr active...complete
Starting tcpip daemons:
0513-029 The syslogd Subsystem is already active.
Multiple instances are not supported.
0513-029 The sendmail Subsystem is already active.
```

```
Multiple instances are not supported.
0513-029 The inetd Subsystem is already active.
Multiple instances are not supported.
0513-029 The snmpd Subsystem is already active.
Multiple instances are not supported.
0513-029 The snmpmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The aixmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The hostmibd Subsystem is already active.
Multiple instances are not supported.
Finished starting tcpip daemons.

# hostname
pbrazos041

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT
,CHECKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LAR
GESEND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# importvg -y vg00 hdisk1
vg00

# varyonvg vg00

# mount /vg00fs
Replaying log for /dev/fslv00.

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   55%    17384    25% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3931     7% /var
/dev/hd3           0.12      0.12    3%       40     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        0
ghostdev        1
systemid        IBM,02106DBEP
```

5.5.3 Settings: clouddev is set to 1 and ghostdev is set to 0

As explained in Table 5-3 on page 252, the **clouddev** parameter has a similar behavior to the **ghostdev** parameter, but the **clouddev** also communicates with the NVRAM to set a flag, so the LPAR knows whether or not the ODM wipe was done previously. The ODM wipe is done only once on each host. For this reason, considering that the virtual machine moves between hosts likely several times, the **clouddev** is not useful in the IBM Geographically Dispersed Resiliency for Power Systems solution. This section shows what happens when you set **clouddev** to 1 and why it is *not* useful for an IBM Geographically Dispersed Resiliency for Power Systems environment.

> **Tip:** The **clouddev** parameter is useful in a cloud environment, using cloud-init to perform multiple customizations when deploying a virtual machine based on an image.

Example 5-39 changes **ghostdev** back to 0 and sets **clouddev** to 1.

Example 5-39 Changing clouddev to 1 and ghostdev to 0

```
# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        0
ghostdev        1
systemid        IBM,02106DBEP

# chdev -l sys0 -a ghostdev=0
sys0 changed

# chdev -l sys0 -a clouddev=1
sys0 changed

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        1
ghostdev        0
systemid        IBM,02106DBEP
```

The pbrazos041 VM is initially running on host HAM. You changed **clouddev** to 1 and rebooted the VM in the same host HAM. Notice that this is the first time that the VM booted in host HAM with the **clouddev** parameter set to 1, so there is no flag set in NVRAM to tell the VM not to perform the ODM wipe. In this case, the ODM is wiped, so the IP must be reconfigured and the VGs reimported (Example 5-40).

Example 5-40 Rebooting the VM in the same host for the first time after changing clouddev to 1

```
# hostname
localhost

# ifconfig -a
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESE
ND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lspv
hdisk0          00f66dbe9356956e                    rootvg          active
hdisk1          00f66dbe95a51e73                    None
```

```
# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsvg
rootvg

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter

# lsdev -Cc if
en0 Defined    Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        1
ghostdev        0
systemid        IBM,02106DBEP

# /usr/sbin/mktcpip -h'pbrazos041' -a'10.40.2.241' -m'255.255.254.0' -i'en0' >
en0
pbrazos041
inet0 changed
en0 changed
inet0 changed
Checking for srcmstr active...complete
Starting tcpip daemons:
0513-029 The syslogd Subsystem is already active.
Multiple instances are not supported.
0513-029 The sendmail Subsystem is already active.
Multiple instances are not supported.
0513-029 The inetd Subsystem is already active.
Multiple instances are not supported.
0513-029 The snmpd Subsystem is already active.
Multiple instances are not supported.
0513-029 The hostmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The snmpmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The aixmibd Subsystem is already active.
Multiple instances are not supported.
Finished starting tcpip daemons.

# importvg -y vg00 hdisk1
vg00

# varyonvg vg00

# mount /vg00fs
Replaying log for /dev/fslv00.

# ifconfig -a
```

```
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,CHE
CKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESE
ND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsvg
rootvg
vg00

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   55%    17386    25% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3933     7% /var
/dev/hd3           0.12      0.12    3%       40     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        1
ghostdev        0
systemid        IBM,02106DBEP
```

To check how the **clouddev** parameter works, you again reboot the pbrazos041 VM in the same host, HAM. The NVRAM is already aware of this LPAR and the bit is already flagged, so no ODM wipe occurs in this situation (Example 5-41).

Example 5-41 Rebooting VM for the second time in the same host after changing clouddev to 1

```
# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,CHE
CKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESE
ND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# hostname
pbrazos041

# lsvg
rootvg
```

```
vg00

# lspv
hdisk0          00f66dbe9356956e                    rootvg          active
hdisk1          00f66dbe95a51e73                    vg00            active

# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter

# lsdev -Cc if
en0 Available  Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   54%    17313    24% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3935     7% /var
/dev/hd3           0.12      0.12    3%       41     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        1
ghostdev        0
systemid        IBM,02106DBEP
```

Now, move the VM to the other host, pbrazos. Because this is the first time that this VM is booting in host pbrazos, no flag is set in NVRAM, so the ODM is wiped (Example 5-42).

Example 5-42 Moving the VM for the first time after changing clouddev to 1

```
# hostname
localhost

# ifconfig -a
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESE
ND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lspv
hdisk0          00f66dbe9356956e                    rootvg          active
hdisk1          00f66dbe95a51e73                    None
```

```
# lsvg
rootvg

# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available          Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available          ACF/PKCS#11 Device
vsa0   Available          LPAR Virtual Serial Adapter

# lsdev -Cc if
en0 Defined    Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface

# lsvg
rootvg

# /usr/sbin/mktcpip -h'pbrazos041' -a'10.40.2.241' -m'255.255.254.0' -i'en0' >
en0
pbrazos041
inet0 changed
en0 changed
inet0 changed
Checking for srcmstr active...complete
Starting tcpip daemons:
0513-029 The syslogd Subsystem is already active.
Multiple instances are not supported.
0513-029 The sendmail Subsystem is already active.
Multiple instances are not supported.
0513-029 The inetd Subsystem is already active.
Multiple instances are not supported.
0513-029 The snmpd Subsystem is already active.
Multiple instances are not supported.
0513-029 The hostmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The snmpmibd Subsystem is already active.
Multiple instances are not supported.
0513-029 The aixmibd Subsystem is already active.
Multiple instances are not supported.
Finished starting tcpip daemons.

# importvg -y vg00 hdisk1
vg00

# varyonvg vg00

# mount /vg00fs
Replaying log for /dev/fslv00.

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   55%    17392    25% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
```

```
/dev/hd9var        0.50      0.26   49%     3939     7% /var
/dev/hd3           0.12      0.12    3%       40     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,CHE
CKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESE
ND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsvg
rootvg
vg00

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        1
ghostdev        0
systemid        IBM,0221BBC47
```

You then reboot the VM, still in host pbrazos. Because the ODM was already wiped in VM pbrazos041 while running in host pbrazos, the NVRAM flag is already set, so the ODM is not wiped at this time (Example 5-43).

Example 5-43 Rebooting VM in the same server for the second time after changing clouddev to 1

```
# hostname
pbrazos041

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,CHE
CKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESE
ND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lsvg
rootvg
vg00

# df -g
```

```
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   54%    17316    24% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3941     7% /var
/dev/hd3           0.12      0.12    3%       41     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# lsdev -Cc disk
hdisk0 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter

# lsdev -Cc if
en0 Available  Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        1
ghostdev        0
systemid        IBM,0221BBC47
```

Now you move back the VM to host HAM. Because this VM was previously booted in host HAM, the NVRAM flag is set, so no ODM wipe is performed in this situation. Because you are running in a different host now (but the VM previously ran in this host), the ghost disks situation returns (Example 5-44).

Example 5-44 Moving the VM back to the original host with clouddev set to 1

```
# hostname
pbrazos041

# ifconfig -a
en0:
flags=1e084863,480<UP,BROADCAST,NOTRAILERS,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,CHE
CKSUM_OFFLOAD(ACTIVE),CHAIN>
        inet 10.40.2.241 netmask 0xfffffe00 broadcast 10.40.3.255
         tcp_sendspace 262144 tcp_recvspace 262144 rfc1323 1
lo0:
flags=e08084b,c0<UP,BROADCAST,LOOPBACK,RUNNING,SIMPLEX,MULTICAST,GROUPRT,64BIT,LARGESE
ND,CHAIN>
        inet 127.0.0.1 netmask 0xff000000 broadcast 127.255.255.255
        inet6 ::1%1/0
         tcp_sendspace 131072 tcp_recvspace 131072 rfc1323 1

# lspv
hdisk2          00f66dbe9356956e                    rootvg          active
hdisk3          00f66dbe95a51e73                    vg00            active
```

```
# lsdev -Cc disk
hdisk0 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1 Defined   00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk2 Available 00-T1-01 MPIO Other FC SCSI Disk Drive
hdisk3 Available 00-T1-01 MPIO Other FC SCSI Disk Drive

# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 00-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter

# lsdev -Cc if
en0 Available  Standard Ethernet Network Interface
et0 Defined    IEEE 802.3 Ethernet Network Interface
lo0 Available  Loopback Network Interface

# lsvg
rootvg
vg00

# df -g
Filesystem    GB blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4           0.50      0.23   54%    17318    24% /
/dev/hd2           2.50      0.29   89%    43005    38% /usr
/dev/hd9var        0.50      0.26   49%     3944     7% /var
/dev/hd3           0.12      0.12    3%       41     1% /tmp
/dev/hd1           0.12      0.12    1%        7     1% /home
/dev/hd11admin      0.12      0.12    1%        5     1% /admin
/proc                 -         -    -         -      - /proc
/dev/hd10opt       0.38      0.31   18%     2218     3% /opt
/dev/livedump      0.25      0.25    1%        4     1% /var/adm/ras/livedump
/dev/fslv00       10.00     10.00    1%       21     1% /vg00fs

# lsattr -El sys0 | egrep "cloud|ghost|systemid"
clouddev        1
ghostdev        0
systemid        IBM,02106DBEP
```

This example explains why **clouddev** is not useful in an IBM Geographically Dispersed Resiliency for Power Systems environment. After the VM was already run on both hosts once, the ODM is no longer wiped in future move operations, leading back to the default behavior of ghost disks.

Summary

In summary, the **ghostdev** is the best parameter to use in an IBM Geographically Dispersed Resiliency for Power Systems environment. If you want to avoid these ghost disks, all ODM customizations are wiped out, so after the move, you need to rerun the customizations, including reconfiguring the IP addresses and reimporting of the volume groups.

5.6 Site-specific network configuration

In some situations, you might want to have a different network configuration for your virtual machines when they are running in the backup site. In some environments, the IP range that is used in the backup site differs from the IP range that is used in the home site, so the VMs have a different configuration. To address this situation, the KSYS provides sample scripts that can be used to automatically perform such customizations.

These scripts are also helpful when used with the **ghostdev** parameter. As explained in 5.5, "Cleaning ghost disks in AIX (ghostdev parameter)" on page 251, you can use the **ghostdev** parameter to avoid ghost disks (Defined disks) when the VMs move between sites, but this parameter brings other consequences, including a full ODM wipe, which means you then must reimport your volume groups and reconfigure the IP address (and also perform other customizations that you have in the home site, for example, the queue_depth of the disks). The scripts are run at the home site and capture the current configuration, so these can be reapplied to the VM when it moves to the backup site.

The disaster recovery scripts are custom scripts that are available along with the KSYS package. When the KSYS file sets are installed in your KSYS node, the scripts are available in a specific directory for you to optionally use them.

> **Note:** These scripts are provided "as is" and require extra customization to work in your environment. You can either customize them yourself or contact your IBM customer representative to help with customization.

Table 5-4 describes the scripts and the configuration file.

Table 5-4 The disaster recovery files (two scripts and one configuration file)

File	Description
`data_collection.ksh`	This script is manually run in the VM while it is still running in the home site. The script collects information about the source environment: ► System host name ► Network adapter information ► HBA configuration and parameters ► DNS Server information and domain ► LPAR attributes ► Volume group and physical volume attributes ► AIX kernel (sys0) attributes This script is available in the KSYS node, but should be copied to each of your VMs that you want to customize. Place the scripts under the `/usr/local/bin` directory and run this script regularly in the VM while running in the home site. The information that is collected by the `data_collection.ksh` script is placed in the following locations: ► `/usr/local/dr/data` directory: Contains system customized information. ► `/usr/local/dr/data_default` directory: Contains information about the default parameters for each device.

File	Description
setup_dr.ksh	Run this script in the VM after it has moved to the backup site. The script reads the information that is collected by the data_collection.ksh script, looks for specific customizations in the failover_config.cfg configuration file, and then performs the configuration in the VM where it is run. This script is available in the KSYS node as a sample. Copy it to each VM where you want to have this type of customization and automation. Place the script under the /usr/local/bin directory of the VMs. The script should be run while the VMs are still running in the home site, so you have the scripts available in the backup site when the VM is moved. After moving the VM to the backup site in the event of a disaster, run this script to perform the customization. This script calls other scripts automatically to perform the following customizations: ► Reconfigure the HBA adapters. ► Reconfigure the Ethernet adapter by reading the contents of the failover_config.cfg configuration file, and set the host name and IP addresses of the VM (here the failover_config.cfg can provide an IP different from the one used in the home site, if you have a site-specific network configuration). ► Import volume groups in the VM.
failover_config.cfg	This configuration file contains information about the VM. You can copy this file from the KSYS node and place it under the /usr/local/dr/data directory of each virtual machine, then manually edit this file and provide information about the configuration of your VM. In this file, you can provide a different configuration to be used depending on the site where the VM is running, for example, by using a site-specific IP address. Specify the following configuration in the failover_config.cfg file: ► IP address of VM at the home site. ► IP address of VM at the backup site. ► Network mask that is used at the backup site. ► DNS servers that are used at the backup site. ► Network domain that is used at the backup site. ► Default gateway IP address that is used at the backup site.

5.6.1 Initial configuration of disaster recovery scripts

To use the disaster recovery scripts, use the following *initial* configuration steps at each of your virtual machines while these are still running in the home site:

1. Copy the scripts and sample files from the KSYS node to the VMs. In the KSYS node, the scripts are available under the `/opt/IBM/ksys/samples` directory. Place these scripts under the `/usr/local/bin` directory in your VM, as shown in Example 5-45.

Example 5-45 Copy the disaster recovery scripts from the KSYS node to the VM

```
# mkdir -p /usr/local/bin
# cd /usr/local/bin
# pwd
/usr/local/bin
# scp -r root@<ksys_node>:/opt/IBM/ksys/samples/* .
root@pbrazos040's password:
postSiteOffline
100% 1005     1.0KB/s   00:00
postSiteOnline
100% 1000     1.0KB/s   00:00
postscript
100% 1634     1.6KB/s   00:00
preSiteOffline
100% 1002     1.0KB/s   00:00
preSiteOnline
100%  997     1.0KB/s   00:00
prescript
100% 1633     1.6KB/s   00:00
event_script_template
100% 1871     1.8KB/s   00:00
README
100%   20KB  19.8KB/s   00:00
data_collection
100%   12KB  11.6KB/s   00:00
failover_config.cfg
100% 1844     1.8KB/s   00:00
setup_dr
100% 4301     4.2KB/s   00:00
setup_dr_HBAs
100% 4274     4.2KB/s   00:00
setup_dr_ethernet
100% 2791     2.7KB/s   00:00
setup_dr_hadiskhbs
100% 6758     6.6KB/s   00:00
setup_dr_hostname_ip
100% 4351     4.3KB/s   00:00
setup_dr_hostname_ip_via_config_file
100% 6690     6.5KB/s   00:00
setup_dr_vgs
100% 2612     2.6KB/s   00:00
# pwd
/usr/local/bin
# ls -l
total 0
drwxr-xr-x    3 root     system          256 Nov 25 05:33 custom_validation
```

```
drwxr-xr-x    2 root     system          256 Nov 25 05:33 event_handler
drwxr-xr-x    3 root     system          256 Nov 25 05:33 site_specific_nw
```

2. Modify the `failover_config.cfg` configuration file with the appropriate information from your VM. Here is where you provide a site-specific IP address if you want to use one, as shown in Example 5-46.

Example 5-46 Configure the failover_config.cfg file

```
# vi site_specific_nw/AIX/failover_config.cfg

# IBM_PROLOG_BEGIN_TAG
# This is an automatically generated prolog.
#
# 61ksys110 src/ksys/usr/samples/failover_config.cfg 1.1
#
# Licensed Materials - Property of IBM
#
# Restricted Materials of IBM
#
# COPYRIGHT International Business Machines Corp. 2016
# All Rights Reserved
#
# US Government Users Restricted Rights - Use, duplication or
# disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
#
# IBM_PROLOG_END_TAG
#########################################
#
# This is a configuration file for the setup_dr scripts
# that configure the LPAR at the DR location.
#
# The configuration file contains the following variables
# that need to be defined so the LPAR can be properly
# configured when started at the DR location during
# a DR event:
#     IP_AT_DR_SITE
#         The IP address corresponding to the hostname
#         of the LPAR and which will be assigned to the adapter
#         defined by the ETHER_ADAPTER_AT_DR_SITE variable
#
#     NETMASK_AT_DR_SITE
#         The netmask of the network that the IP address
#         defined by the IP_AT_DR_SITE variable
#
#     NAMESERVER_AT_DR_SITE:
#         The IP address of the DNS name server used at
#         the DR location
#
#     DOMAIN_AT_DR_SITE: your_company.com
#         The DNS domain name used at the DR location
#
#     DEFAULT_ROUTE_AT_DR_SITE
#         The IP address of the default gateway at the DR site
#
# Example:
```

```
#    IP_AT_DR_SITE: 10.20.40.20
#    NETMASK_AT_DR_SITE: 255.255.255.0
#    NAMESERVER_AT_DR_SITE: 10.20.200.200
#    DOMAIN_AT_DR_SITE: your_company.com
#    DEFAULT_ROUTE_AT_DR_SITE: 10.20.40.1
#
#
#
ORIG_IP_AT_PRIMARY_SITE: 10.40.2.241
IP_AT_DR_SITE: 10.40.2.242
NETMASK_AT_DR_SITE: 255.255.254.0
NAMESERVER_AT_DR_SITE: 9.3.1.200
DOMAIN_AT_DR_SITE: dr.aus.stglabs.ibm.com
DEFAULT_ROUTE_AT_DR_SITE: 10.40.2.1
```

3. Place the `failover_config.cfg` file under the `/usr/local/dr/data` directory as shown in Example 5-47.

Example 5-47 Copy the failover_config.cfg file to the correct location

```
# mkdir -p /usr/local/dr/data
# cp site_specific_nw/AIX/failover_config.cfg /usr/local/dr/data
```

4. Run the `data_collection.ksh` script to collect the environment information. You can run the command manually, but the preferred way is to schedule this script to be executed in the crontab, so it is executed regularly. Example 5-48 shows the `data_collection.ksh` script being run and the data being collected in the appropriate directory.

Example 5-48 Running the data_collection script to capture environment information

```
# mkdir -p /usr/local/bin/datamine/data/
# mkdir -p /usr/local/bin/datamine/data_default/
# ./site_specific_nw/AIX/data_collection

# ls -lR
total 16
drwxr-xr-x 2 root system   4096 Nov 25 05:39 data
drwxr-xr-x 2 root system   4096 Nov 25 05:39 data_default
./data:
total 248
-rw-r--r-- 1 root system     11 Nov 25 05:39 local.hostname.m25.txt
-rw-r--r-- 1 root system      4 Nov 25 05:39 local.last_successful_run.txt
-rw-r--r-- 1 root system     80 Nov 25 05:39
pbrazos041.all_default_routes.m25.txt
-rw-r--r-- 1 root system     80 Nov 25 05:39
pbrazos041.default_routes.en0.m25.txt
-rw-r--r-- 1 root system   2451 Nov 25 05:39
pbrazos041.disk_attributes.hdisk0.m25.txt
-rw-r--r-- 1 root system   2451 Nov 25 05:39
pbrazos041.disk_attributes.hdisk1.m25.txt
-rw-r--r-- 1 root system   2451 Nov 25 05:39
pbrazos041.disk_attributes.hdisk2.m25.txt
-rw-r--r-- 1 root system   2451 Nov 25 05:39
pbrazos041.disk_attributes.hdisk3.m25.txt
-rw-r--r-- 1 root system      0 Nov 25 05:39 pbrazos041.dns_domain.m25.txt
-rw-r--r-- 1 root system     10 Nov 25 05:39 pbrazos041.dns_name_server.m25.txt
```

```
-rw-r--r-- 1 root system      9 Nov 25 05:39
pbrazos041.drhbdisk_node01_node02.m25.txt
-rw-r--r-- 1 root system      1 Nov 25 05:39
pbrazos041.drhbdisk_node01_node03.m25.txt
-rw-r--r-- 1 root system      1 Nov 25 05:39
pbrazos041.drhbdisk_node02_node03.m25.txt
-rw-r--r-- 1 root system   1659 Nov 25 05:39 pbrazos041.en0.m25.txt
-rw-r--r-- 1 root system      4 Nov 25 05:39
pbrazos041.ethernet_interfaces.m25.txt
-rw-r--r-- 1 root system    316 Nov 25 05:39
pbrazos041.fibre_adapters.fcs0.m25.txt
-rw-r--r-- 1 root system      5 Nov 25 05:39 pbrazos041.fibre_adapters.m25.txt
-rw-r--r-- 1 root system    332 Nov 25 05:39
pbrazos041.fibre_interfaces.fscsi0.m25.txt
-rw-r--r-- 1 root system      7 Nov 25 05:39
pbrazos041.fibre_interfaces.m25.txt
-rw-r--r-- 1 root system      2 Nov 25 05:39
pbrazos041.ghostdev_parameter.m25.txt
-rw-r--r-- 1 root system     10 Nov 25 05:39
pbrazos041.hostname_default_route.m25.txt
-rw-r--r-- 1 root system     12 Nov 25 05:39 pbrazos041.hostname_ip.m25.txt
-rw-r--r-- 1 root system     14 Nov 25 05:39
pbrazos041.hostname_netmask.m25.txt
-rw-r--r-- 1 root system   2178 Nov 25 05:39 pbrazos041.lpar_attributes.m25.txt
-rw-r--r-- 1 root system    162 Nov 25 05:39 pbrazos041.lspv.m25.txt
-rw-r--r-- 1 root system   4528 Nov 25 05:39
pbrazos041.system_info_sys0.m25.txt
-rw-r--r-- 1 root system   1139 Nov 25 05:39
pbrazos041.vg_attributes.rootvg.m25.txt
-rw-r--r-- 1 root system   1140 Nov 25 05:39
pbrazos041.vg_attributes.vg00.m25.txt
-rw-r--r-- 1 root system      3 Nov 25 05:39
pbrazos041.vg_major_number.rootvg.m25.txt
-rw-r--r-- 1 root system      3 Nov 25 05:39
pbrazos041.vg_major_number.vg00.m25.txt
-rw-r--r-- 1 root system     12 Nov 25 05:39 pbrazos041.volume_groups.m25.txt

./data_default:
total 88
-rw-r--r-- 1 root system    339 Nov 25 05:39 pbrazos041.cengine0.m25.txt
-rw-r--r-- 1 root system   1470 Nov 25 05:39 pbrazos041.en0.m25.txt
-rw-r--r-- 1 root system   1818 Nov 25 05:39 pbrazos041.ent0.m25.txt
-rw-r--r-- 1 root system    316 Nov 25 05:39 pbrazos041.fcs0.m25.txt
-rw-r--r-- 1 root system    332 Nov 25 05:39 pbrazos041.fscsi0.m25.txt
-rw-r--r-- 1 root system   2087 Nov 25 05:39 pbrazos041.hdisk0.m25.txt
-rw-r--r-- 1 root system   2087 Nov 25 05:39 pbrazos041.hdisk1.m25.txt
-rw-r--r-- 1 root system   2087 Nov 25 05:39 pbrazos041.hdisk2.m25.txt
-rw-r--r-- 1 root system   2087 Nov 25 05:39 pbrazos041.hdisk3.m25.txt
-rw-r--r-- 1 root system    366 Nov 25 05:39 pbrazos041.inet0.m25.txt
-rw-r--r-- 1 root system      0 Nov 25 05:39 pbrazos041.rcm0.m25.txt
-rw-r--r-- 1 root system   3339 Nov 25 05:39 pbrazos041.sys0.m25.txt
# pwd
/usr/local/bin/datamine
```

With the data regularly captured and the `failover_config.cfg` properly configured, the virtual machines are ready to run the `setup_dr.ksh` script after they are moved to the backup site.

5.6.2 Running the disaster recovery scripts in the backup site

After a disaster situation occurs and you need to move the VMs to the backup site, you can now use the `setup_dr.ksh` script to apply the configuration that was captured by the `data_collection.ksh` script, and the customization that the `failover_config.cfg` file provided. Use the following steps to perform that customization:

1. Check the `/usr/local/dr/data` directory and look for date and timestamps by running the command as follows:

   ```
   # ls -l /usr/local/dr/data
   ```

   Check that the replication is completed and the timestamps of the files match the expected time and date.

2. Run the `setup_dr.ksh` script to reconfigure the virtual machine in the backup site with the information that is captured by `data_collection.ksh` script, and also perform the site-specific customization that is specified in the `failover_config.cfg` file:

   ```
   # /usr/local/bin/datamine/setup_dr.ksh
   ```

The configuration is applied to your virtual machine and it is properly customized.

5.7 Troubleshooting in an IBM Geographically Dispersed Resiliency for Power Systems environment

This section describes useful information in case of problems while configuring or using your IBM Geographically Dispersed Resiliency for Power Systems environment. This section describes some of the log files and traces that can be used for problem determination in an IBM Geographically Dispersed Resiliency for Power Systems environment.

5.7.1 Notification for KSYS events

The KSYS node tracks several events that affect the IBM Geographically Dispersed Resiliency for Power Systems environment and saves them in log files. It also notifies you in case the notification methods have not been properly configured, as described in 4.6.8, “Setting up contacts for events notification” on page 181. You can also query the events that can be notified, and provide a description of each event (Example 5-49).

Example 5-49 Checking events that can be notified

```
(0) root @ pbrazos040: /
# ksysmgr query event

Event Name                     Description
-----------------------------------------------------------------
HMC_UNREACHABLE                HMC is down or not reachable
STG_UNREACHABLE                Storage subsystem is down or not reachable
HMC_REACHABLE                  HMC has recovered and is now reachable
VIOS_RMC_STATE_DOWN            HMC to VIOS RMC connectivity/network seems to be
having problems
```

```
INSUFFICIENT_HOST_CAPACITY     Backup host does not have sufficient capacity to do
a successful DR failover
VIOS_FAILURE                   VIOS seems to have failed
VM_CONFIG_COLLECTION_FAILURE   Configuration data collection failed for the VM
DAILY_VERIFY_FAILED            Daily verification checks have failed
REPLICATION_FAILURE            Storage reports replication problem
MIRROR_RELATIONSHIP_MISSING    Disk has no mirror pair
HOST_FAILURE                   Host failure has occurred
FILESYSTEM_SPACE_WARNING       Filesystem is reaching full condition
VM_MOVE                        VM has moved from one host to another
DAILY_VERIFY_COMPLETE          Daily verification checks have completed
successfully
HOST_IN_INVALID_STATE          Host is in invalid state
VM_STORAGE_COLLECTION_FAILURE  Storage information collection has failed for the
VM
HMC_LOGIN_FAILURE              HMC login failed
DISK_VALIDATION_FAILURE        Disk Group validation failure
VIOS_DELETED                   VIOS deletion has been detected
VM_NOT_ACTIVE                  VM does not seem to be active
DUPLICATE_VMs                  VM exists on multiple hosts
VM_DISCOVERED_ON_HOST          VM has been detected on host
VM_DELETED_FROM_HOST           VM has been deleted from host
VM_NOT_FOUND                   VM is not found
```

The events are categorized as `error`, `warning`, and `info`, and can be queried as shown in Example 5-50.

Example 5-50 Checking the events by category

```
(0) root @ pbrazos040: /
# ksysmgr query event type=error

Event Name                     Description
---------------------------------------------------------------
HMC_UNREACHABLE                HMC is down or not reachable
STG_UNREACHABLE                Storage subsystem is down or not reachable
VIOS_RMC_STATE_DOWN            HMC to VIOS RMC connectivity/network seems to be
having problems
INSUFFICIENT_HOST_CAPACITY     Backup host does not have sufficient capacity to do
a successful DR failover
VIOS_FAILURE                   VIOS seems to have failed
VM_CONFIG_COLLECTION_FAILURE   Configuration data collection failed for the VM
DAILY_VERIFY_FAILED            Daily verification checks have failed
REPLICATION_FAILURE            Storage reports replication problem
MIRROR_RELATIONSHIP_MISSING    Disk has no mirror pair
HOST_FAILURE                   Host failure has occurred
VM_STORAGE_COLLECTION_FAILURE  Storage information collection has failed for the
VM
HMC_LOGIN_FAILURE              HMC login failed
DISK_VALIDATION_FAILURE        Disk Group validation failure
VM_NOT_FOUND                   VM is not found

(0) root @ pbrazos040: /
# ksysmgr query event type=warning

Event Name                     Description
```

```
---------------------------------------------------------------
FILESYSTEM_SPACE_WARNING      Filesystem is reaching full condition
VIOS_DELETED                  VIOS deletion has been detected
VM_DELETED_FROM_HOST          VM has been deleted from host

(0) root @ pbrazos040: /
# ksysmgr query event type=info

Event Name                    Description
---------------------------------------------------------------
HMC_REACHABLE                 HMC has recovered and is now reachable
VM_MOVE                       VM has moved from one host to another
DAILY_VERIFY_COMPLETE         Daily verification checks have completed
successfully
HOST_IN_INVALID_STATE         Host is in invalid state
VM_NOT_ACTIVE                 VM does not seem to be active
DUPLICATE_VMs                 VM exists on multiple hosts
VM_DISCOVERED_ON_HOST         VM has been detected on host
```

As described in 5.3.4, "Modifying the KSYS notification" on page 223, the events are logged to the `/var/ksys/events.log` file and sent to you by the methods that were added through the **`ksysmgr add notify`** command.

5.7.2 Log files in the KSYS node

If you receive any error during configuration or use of your KSYS node, analyze the log files to find the component that is causing the error. The log files are placed in the `/var/ksys/log` directory in your KSYS node. The following main log files described next:

- Log file: /var/ksys/log/ksysmgr.log
- Log file: /var/ksys/log/ksysmgr.oplog
- Log file: /var/ksys/log/ksys_srdf.log

Log file: /var/ksys/log/ksysmgr.log

This log file contains detailed information from every time you run a **`ksysmgr`** command.

> **Note:** Use the **`-l max`** flag when running the **`ksysmgr`** command to generate detailed messages in the `ksysmgr.log` file.

This file stores commands that are run in the **`ksysmgr`** interface and internal RMC API commands used (such as **`lsrsrc`**, **`mkrsrc`**, **`chrsrc`**, **`rmrsrc`**, and **`runact`**). It also shows information about which classes on the RMC API command are called (`SITE`, `CEC`, `VIOS`, `LPAR`, and so on), and provides the exit status of the commands. Example 5-51 shows part of the `ksysmgr.log` file.

Example 5-51 Excerpt from the ksysmgr.log file

```
runSystemCommand()[232]:    ENTERING
--------------pid:18678264  time:12/02/2016 02:26:23 -------------
runSystemCommand()[270]  02:26:23 : RUNNING COMMAND:/usr/sbin/rsct/bin/lsrsrc -dxs
'CecUuid=="42BF8AE3-83BF-4DBD-A51C-645352B88EE5"' IBM.VMR_CEC ErrMsg 2>/dev/null |
/usr/bin/sed 's
/[",:]//g' > /tmp/ksysmgr.tmp; [ -s /tmp/ksysmgr.tmp ]
runSystemCommand()[295]:    EXITING SUCCESSFULLY
```

```
    ERROR: Verify has encountered an error for VM pbrazos004 please investigate
runSystemCommand()[232]:    ENTERING
--------------pid:18678264  time:12/02/2016 02:26:26 -------------
runSystemCommand()[270]  02:26:26 : RUNNING COMMAND:/usr/sbin/rsct/bin/lsrsrc -dx
-s 'Phase!="READY_TO_MOVE"' IBM.VMR_LPAR Name | /usr/bin/sed 's/[",:]//g' >
/tmp/ksysmgr.tmp
runSystemCommand()[295]:    EXITING SUCCESSFULLY
02:26:26 Verification has finished for Austin
0 out of 1 VMs have been successfully verified
Unverified VMs:
    pbrazos004

Please review the error(s) and take any corrective actions
verify_site()[2357]:    EXITING WITH ERRORS
```

Log file: /var/ksys/log/ksysmgr.oplog

This log file contains a record of all the **ksysmgr** operations you ran during a period. This file keeps the commands, date, time, and transaction ID of each operation, as shown in Example 5-52.

Example 5-52 Excerpt from the ksysmgr.oplog file

```
08/26/2016 22:19:16 ksysmgr add ksyscluster vmdr
ksysnodes=r7r3m109.ausprv.stglabs.ibm.com
08/26/2016 22:20:44 ksysmgr verify ksyscluster vmdr
08/26/2016 22:20:57 ksysmgr sync ksyscluster vmdr
08/26/2016 22:22:21 ksysmgr add site India sitetype=active
08/26/2016 22:22:31 ksysmgr add site Austin sitetype=backup
```

Log file: /var/ksys/log/ksys_srdf.log

This log file contains information about the processing of storage-specific Dell EMC functions that are performed by the KSYS node, as shown in Example 5-53.

Example 5-53 Excerpt from the ksys_srdf.log file

```
Fri Oct 28 04:36:00 CDT 2016 891:validate_emc_group: 75 : Validation Operation for
VMRDG_vmdr_Austin Requested
Fri Oct 28 04:36:00 CDT 2016 891:validate_emc_group: get_SYM_Server : Service Name
: SYMAPI_SITE_508
Fri Oct 28 04:36:00 CDT 2016 891:validate_emc_group: srdf_cmd_exec : Command
Executing : 2
Fri Oct 28 04:36:05 CDT 2016 891:validate_emc_group: configure_java_path : Jave
directory Path Set /usr/java7_64/jre/bin
Fri Oct 28 04:36:05 CDT 2016 891:validate_emc_group: output_files : XML File :
/var/ksys/log/EMC/data-0-3Ct22-891-1477647365.xml
Fri Oct 28 04:36:05 CDT 2016 891:validate_emc_group: output_files : Output File :
/var/ksys/log/EMC//output-0-3Ct22-891-1477647365.txt
Fri Oct 28 04:36:05 CDT 2016 891:validate_emc_group: srdf_cmd_exec : Command
Executing : 44
Fri Oct 28 04:36:35 CDT 2016 891:validate_emc_group: 129 : CG:VMRDG_vmdr_Austin
Exist
Fri Oct 28 04:36:35 CDT 2016 891:validate_emc_group: srdf_cmd_exec : Command
Executing : 38
Fri Oct 28 04:36:44 CDT 2016 891:validate_emc_group: srdf_cmd_exec : Command
Executing : 32
```

```
Fri Oct 28 04:36:47 CDT 2016 891:validate_emc_group: 222 : CG:VMRDG_vmdr_Austin is
in Consistent
Fri Oct 28 04:36:47 CDT 2016 891:validate_emc_group: 245 : CG:VMRDG_vmdr_Austin is
in Ready
Fri Oct 28 04:36:47 CDT 2016 891:validate_emc_group: 263 : Info:
CG:VMRDG_vmdr_Austin State:Consistent  Disk State:Ready
Fri Oct 28 04:36:47 CDT 2016 891:validate_emc_group: 264 : Info:
CG:VMRDG_vmdr_Austin Mode:Asynchronous Require Mode:Asynchronous
Fri Oct 28 04:36:47 CDT 2016 891:validate_emc_group: srdf_symrdf_list : Processing
file /opt/IBM/ksys/storages/EMC/get_cg_disk_info.xsl
```

5.7.3 RSCT traces

Along with the log files, the resource manager traces are useful during problem determination of issues with the KSYS node and the IBM Geographically Dispersed Resiliency for Power Systems environment.

As explained in 4.2.4, “Discovery” on page 135, the configuration of the KSYS node is stored in RSCT resource classes under the `/var/ct/<clustername>/registry/local_tree` location. The RSCT daemon `IBM.VMR` also maintains traces constantly running while you execute **ksysmgr** operations. These traces are in the `/var/ct/<cluster_name>/log/mc/IBM.VMR` directory, as shown in Example 5-54.

Example 5-54   IBM.VMR traces

```
(0) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# ls -l
total 31048
-rw-r--r--    1 root     system      4361929 Nov 23 14:00 tr.out
-rw-------    1 root     system       262144 Dec 02 10:39 trace.1.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.2.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.3.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.4.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.1.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.2.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.3.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.4.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.5.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.6.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.7.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krest.8.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.1.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.2.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.3.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.4.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.5.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.6.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.7.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.krestlong.8.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.1.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.10.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.11.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.12.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.13.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.14.sp
```

```
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.15.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.16.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.2.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.3.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.4.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.5.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.6.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.7.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.8.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.ksys.9.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.1.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.2.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.3.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.4.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.5.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.6.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.7.sp
-rw-------    1 root     system       262144 Dec 02 10:39 trace.user.8.sp
```

These traces capture the progress of the processes running under the control of the KSYS node. They show all success and error messages while communicating with the Dell EMC Storage and the HMCs (and then the Virtual I/O Servers), and provide detailed information that is helpful for problem determination purposes.

The traces are classified according to Table 5-5.

Table 5-5 IBM.VMR traces classification

Type	Trace files
General traces	trace.1.sp, trace.2.sp, trace.3.sp, trace.4.sp, trace.5.sp, and so on.
KSYS traces	trace.ksys.1.sp, trace.ksys.2.sp, trace.ksys.3.sp, and so on.
Krest traces	Short traces: trace.krest.1.sp, trace.krest.2.sp, and so on. Long traces: trace.krestlong.1.sp, trace.krestlong.2.sp, and so on.
User traces	trace.user.1.sp, trace.user.2.sp, trace.user.3.sp, and so on.

You can use the **rpttr** command to format the traces. The syntax is as follows:

```
# rpttr -f -o dict <trace file names>
```

Important: The **rpttr** command must be in the same level as the trace files (same level of the `rsct.core.utils` file set), so a suggestion is that you format the traces at your KSYS node where the files are collected.

You can format the all traces together and obtain the detailed messages in a readable format, as shown in Example 5-55.

Example 5-55 Formatting the traces

```
(0) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
#  rpttr -o dict trace.* > tr.out

(0) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# vi tr.out
```

Example 5-56 shows a situation where the traces can be useful. It contains a section of the `tr.out` file showing that a problem exists between the HMC and the VIOS communication as the result of an RMC failure. This situation can cause a verify, a move, or a discovery operation to fail.

Example 5-56 File excerpt showing RMC failure between VIOS and HMC

```
[17] 12/02/16 T(203) _VMR 11:40:34.108947 DEBUG libkrest.c[1763]: Got the jobstatus as
FAILED_TO_START
[17] 12/02/16 T(203) _VMR 11:40:34.108952 DEBUG libkrest.c[1793]: <MessageKey>
[11] 12/02/16 T(203) _VMR 11:40:34.108953 ERROR libkrest.c[1823]:
RMC:NOT_STARTED_NO_RMC
[17] 12/02/16 T(203) _VMR 11:40:34.108954 DEBUG libkrest.c[1793]: <result>
[11] 12/02/16 T(203) _VMR 11:40:34.108960 ERROR libkrest.c[1853]:
VIOS/HMC:job_result->rc : -1
[11] 12/02/16 T(203) _VMR 11:40:34.108961 ERROR libkrest.c[1901]: return_status:29,
                                                  retry_flag:11,  httpRC:200,
                                                  hmcError:NULL,
                                                  lastError:Job execution on HMC failed
with status <FAILED_TO_START>. Message: <Cannot issue command to VIOS, as RMC
connection between HMC and VIOS is down>.
```

5.7.4 Required documentation for PMRs

If you need to open a problem management record (PMR) to obtain help from the IBM technical support team, you are requested to send the log files. A tool is available that collects a bundle of all logs to a file. You can run this tool with the following command:

```
# snap vmsnap
```

Example 5-57 shows the **snap** command running in a KSYS node.

Example 5-57 Running the snap vmsnap command

```
(0) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# snap -r
Nothing to clean up

(24) root @ pbrazos001: /var/ct/itsocluster/log/mc/IBM.VMR
# snap vmsnap
********Checking and initializing directory structure
Creating /tmp/ibmsupt directory tree... done.
Creating /tmp/ibmsupt/vmsnap directory tree... done.
Creating /tmp/ibmsupt/testcase directory tree... done.
Creating /tmp/ibmsupt/other directory tree... done.
********Finished setting up directory /tmp/ibmsupt

Checking Space requirement for vmsnap
Checking for enough free space in filesystem... done.

Gathering vmsnap data
```

You are prompted to send the `/tmp/ibmsupt/ksys.pax.Z` file to support. This compressed file contains important log files, as shown in Example 5-58.

Example 5-58 Important log files in the ksys.pax.Z

```
(0) root @ pbrazos001: /tmp/ibmsupt
# ls -l
total 148192
-rw-------    1 root     system     75865993 Dec 02 11:49 ksys.pax.Z
drwx------    2 root     system          256 Dec 02 11:47 other
-rw-------    1 root     system          103 Dec 02 11:47 script.log
drwx------    2 root     system          256 Dec 02 11:47 testcase
drwx------    2 root     system          256 Dec 02 11:47 vmsnap

(130) root @ pbrazos001: /tmp/ibmsupt
# zcat ksys.pax.Z | pax -rvf -
PAX format archive
/tmp/ctsupt
/tmp/ctsupt/ctsnap.pbrazos001.12021147.log
/tmp/ctsupt/ctsnap.pbrazos001.12021147.tar.gz
/var/ksys/log
/var/ksys/log/EMC
/var/ksys/log/EMC/Err-1479396829.log
/var/ksys/log/EMC/output-0-2Glx8-891-1479927298.txt
/var/ksys/log/EMC/output-0-2Jlx9-889-1478627563.txt
/var/ksys/log/EMC/output-0-3Ct22-16449-1475746636.txt
/var/ksys/log/EMC/output-0-5BoV0-16449-1475692116.txt
/var/ksys/log/EMC/output-0-8Bq70-890-1478628122.txt
/var/ksys/log/EMC/output-1-2Jlx9-889-1478627600.txt
/var/ksys/log/EMC/output-1-3Ct22-16449-1475746688.txt
/var/ksys/log/EMC/output-1-5BoV0-16449-1475692177.txt
/var/ksys/log/EMC/output-1-8Bq70-890-1478628167.txt
/var/ksys/log/EMC/output-2-0Isz4-16706-1475686215.txt
/var/ksys/log/EMC/output-2-2Jlx9-889-1478627617.txt
/var/ksys/log/EMC/output-2-3Ct22-16449-1475746714.txt
/var/ksys/log/EMC/output-2-5BoV0-16449-1475692200.txt
/var/ksys/log/EMC/output-2-8Bq70-890-1478628188.txt
/var/ksys/log/EMC/output-3-0Isz4-16706-1475686222.txt
/var/ksys/log/EMC/output-3-3Ct22-16449-1475746740.txt
/var/ksys/log/EMC/output-3-5BoV0-16449-1475692206.txt
/var/ksys/log/EMC/output-4-0Isz4-16706-1475686244.txt
/var/ksys/log/EMC/output-4-3Ct22-16449-1475746745.txt
/var/ksys/log/EMC/output-4-5BoV0-16449-1475692228.txt
/var/ksys/log/SRDF-DATABASE-0Esz60l-194901326.data
/var/ksys/log/SRDF-DATABASE-0Esz60l-196800508.data
/var/ksys/log/SRDF-DATABASE-0Hsz542949672951-196800573.data
/var/ksys/log/SRDF-DATABASE-1Dmy10l-196800508.data
/var/ksys/log/SRDF-DATABASE-1Fmy742949672951-196800573.data
/var/ksys/log/SRDF-DATABASE-1Hmy542949672951-194901326.data
/var/ksys/log/SRDF-DATABASE-1Hmy542949672951-196800508.data
/var/ksys/log/SRDF-DATABASE-2Flx742949672951-196800573.data
/var/ksys/log/SRDF-DATABASE-3Ft270l-196800508.data
/var/ksys/log/SRDF-DATABASE-3Ht2542949672951-196800573.data
/var/ksys/log/SRDF-DATABASE-5BoV042949672951-196800573.data
/var/ksys/log/SRDF-DATABASE-5FoV70l-194901326.data
/var/ksys/log/SRDF-DATABASE-5FoV70l-196800508.data
/var/ksys/log/SRDF-DATABASE-5IoV442949672951-196800573.data
/var/ksys/log/SRDF-DATABASE-6Fr6742949672951-196800573.data
```

```
/var/ksys/log/SRDF-DATABASE-6Gr684294967295l-196800573.data
/var/ksys/log/SRDF-DATABASE-7CpW24294967295l-196800573.data
/var/ksys/log/SRDF-DATABASE-7DpW14294967295l-196800573.data
/var/ksys/log/SRDF-DATABASE-8Gq784294967295l-196800573.data
/var/ksys/log/SRDF-DATABASE-9Cn324294967295l-196800573.data
/var/ksys/log/SRDF-DATABASE-9Fn370l-196800508.data
/var/ksys/log/SRDF-DATABASE-9Fn374294967295l-196800573.data
/var/ksys/log/SRDF-DATABASE-9Hn354294967295l-194901326.data
/var/ksys/log/SRDF-DATABASE-9Hn354294967295l-196800508.data
/var/ksys/log/capmgr.log
/var/ksys/log/capmgr.log.librpp_last_rest.log
/var/ksys/log/data-0-0Isz4-515-1475211675.xml
/var/ksys/log/data-0-8Gq78-515-1475211682.xml
/var/ksys/log/emc_reverse_progress.log
/var/ksys/log/emc_srdf.log
/var/ksys/log/ksys_srdf.log
/var/ksys/log/ksys_srdf.log.0
/var/ksys/log/ksys_srdf.log.1
/var/ksys/log/ksys_srdf.log.2
/var/ksys/log/ksys_srdf.log.3
/var/ksys/log/ksys_srdf.log.4
/var/ksys/log/ksys_srdf.log.5
/var/ksys/log/ksys_srdf.log.6
/var/ksys/log/ksys_srdf.log.7
/var/ksys/log/ksysmgr.log
/var/ksys/log/ksysmgr.oplog
/var/ksys/log/output-0-0Isz4-515-1475211675.txt
/var/ksys/log/output-0-8Gq78-515-1475211682.txt
/var/ct/itsocluster/log/mc/IBM.VMR
/var/ct/itsocluster/log/mc/IBM.VMR/tr.out
/var/ct/itsocluster/log/mc/IBM.VMR/trace.1.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.2.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.3.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.4.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.1.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.2.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.3.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.4.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.5.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.6.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.7.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krest.8.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.1.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.2.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.3.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.4.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.5.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.6.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.7.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.krestlong.8.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.1.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.10.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.11.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.12.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.13.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.14.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.15.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.16.sp
```

```
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.2.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.3.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.4.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.5.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.6.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.7.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.8.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.ksys.9.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.1.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.2.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.3.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.4.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.5.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.6.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.7.sp
/var/ct/itsocluster/log/mc/IBM.VMR/trace.user.8.sp
```

Depending on the issues you are noticing, a useful step is to run **snap** to collect data from the Virtual I/O Servers, and PE debug (pedbg) data from the involved HMCs. See these IBM Support web pages:

- Collecting Snap Data on VIOS Server Partition
- Collecting PEDBG from the HMC

6

Testing scenarios

IBM Geographically Dispersed Resiliency for Power Systems is a platform-level disaster recovery (DR) solution. When you perform *site-switch* operations, you can face different situations. For different situations, you can choose either a *planned* or an *unplanned* move operation. And after a move operation, it is possible that there are some actions to restore or recover the environment.

The following topics are described in this chapter:

- Testing environment
- Planned recovery of a failed virtual machine
- Adding a new virtual machine to an IBM Geographically Dispersed Resilience cluster dynamically
- Planned hardware management console failure at the active site
- Unplanned failure of all HMCs at active site
- Planned failure of the SYMAPI server
- Unplanned broken SRDF link
- Planning a PowerHA cluster move
- Unplanned managed system failure
- Invoking a move with the lose_vios_redundancy attribute
- Unplanned storage failure
- Unplanned active site down

6.1 Testing environment

Figure 6-1 shows a testing environment that many scenarios in this chapter use.

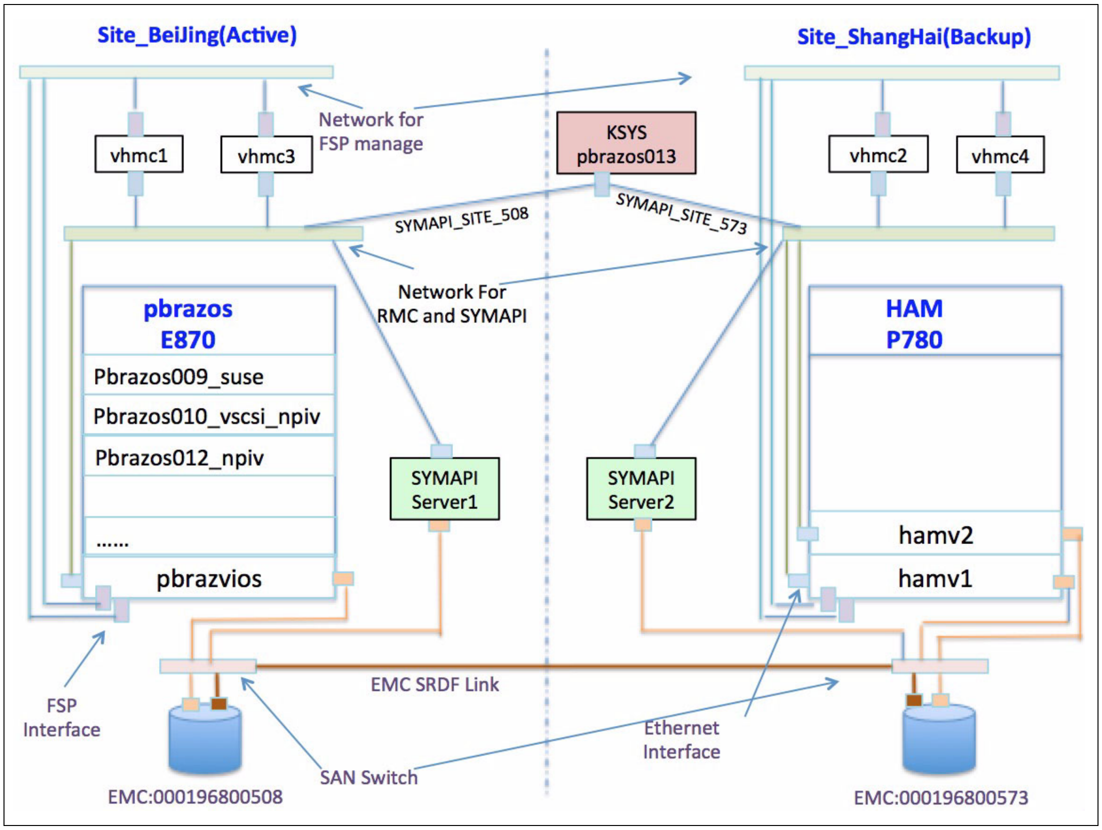


Figure 6-1 Testing environment scenario

The components that are shown in the following section are part of this testing environment.

Two sites

The sites include Site_BeiJing and Site_ShangHai. At the beginning of every scenario, Site_BeiJing is set as the active site. It is also called the source site.

Four hardware management consoles

Each site has two hardware management consoles (HMCs). VHMC1 and VHMC3 belong to Site_BeiJing. VHMC2 and VHMC4 belong to Site_ShangHai. The following string shows the HMC definition:

```
9.3.18.34       vhmc1    # In Site_BeiJing
9.3.18.35       vhmc2    # In Site_ShangHai
9.3.18.36       vhmc3    # In Site_BeiJing
9.3.18.37       vhmc4    # In Site_ShangHai
```

Two hosts

Site_BeiJing has one host, which is named pbrazos. It has one VIOS LPAR, which is named pbrazvios. There are several virtual machines (VMs) in this host. Some VMs use N_Port ID Virtualization (NPIV) to access the storage and some use the Virtual SCSI (VSCSI) adapter.

Site_ShangHai has one host, which is named HAM. It has two virtual I/O servers (VIOS) logical partitions (LPARs), which are named hamv1 and hamv2.

One KSYS node

There is one KSYS node at Site_ShangHai. Its LPAR name is pbrazos013. This KSYS node also acts as the SYMAPI client. The SYMAPI server definition is as follows:

```
SYMAPI_SITE_508 - TCPIP r7r3m106 10.40.0.30 2707 ANY
SYMAPI_SITE_573 - TCPIP r7r3m107 10.40.0.31 2707 ANY
```

Two Dell EMC VMAX 100 K Storages

Each site has one Dell EMC Storage. The Symmetrix ID for Site_BeiJing is 000196800508, and the Symmetrix ID for Site_ShangHai is 000196800573.

SRDF/A is configured between the two Dell EMC Storages.

Two SYMAPI server LPARs

Each site has one SYMAPI server to communicate with its corresponding storage. The server has an HBA adapter to access the storage's gatekeeper devices.

Network and SAN switches

Each site has a network switch and a SAN switch for communication.

> **Note:** There are three separate environments that have common hosts (HMCs, Dell EMC Storages, and network devices), but have separate KSYS nodes. They have similar cluster names but different site names. Each manages a different VMs list in each IBM Geographically Dispersed Resiliency for Power Systems cluster. So, there might be some differences per scenario. Carefully read the scenario description section for each scenario that is presented.

For more information about how to configure Dell EMC Storage, see Chapter 3, "Storage and SAN setup for the IBM Geographically Dispersed Resilience environment" on page 25.

6.2 Planned recovery of a failed virtual machine

When a site switch operation is complete, if some VMs are not moved to the target site successfully, then these VMs are called *failed VMs*. Their state is RECOVERY_ONLINE, which you can verify by running the **ksysmgr query vm** command. The VMs state changes during a site switch operation. For example, in a *planned move*, there are at least six states:

- READY_TO_MOVE (before the move)
- RECOVERY_OFFLINE (waiting for the LPAR shutdown at the source site)
- READY (shutdown complete, waiting for storage mirror reversal)
- RECOVERY_ONLINE (storage mirror reversal complete, waiting for VM online at target site)
- CLEANUP (VM online at target site complete, waiting for cleanup at source site)
- READY_TO_MOVE (cleanup complete and rediscovery completed successfully)

If one VM's state is RECOVERY_ONLINE, it failed the VM online at target site phase and the cleanup phase did not start.

Example 6-1 shows how to see the state of a VM.

Example 6-1 View a VM's state in IBM Geographically Dispersed Resiliency for Power Systems

```
# ksysmgr query vm pbrazos016_PHA1
...
Name:            pbrazos016_PHA1
UUID:            616D4AF1-8BE0-4A4C-8253-5CB7F45F8658
Host:            pbrazos_9119-MME-21BBC47
State:           RECOVERY_ONLINE
```

Here are scenarios that generate a failed VM:

- VM's LPAR name conflicts between the source site and the backup site.
- The resources on the host target are not enough to start all the VMs.
- During the site-switch operation, all HMCs in the target site are not available.
- During a site-switch operation, the servers in the target site are not available.
- During a site-switch operation, the HMC in the target site cannot access the host because of an FSP network issue
- During a site switch operation, the HMC in the target site cannot communicate with the VIOS because of an RMC issue.

If you encounter any of these situations, you can run the **ksysmgr recover** command to move the failed VM to the target site. Then, run the **ksysmgr cleanup** command to clean up the configuration at the source site.

> **Note:** This *recovery* operation can be used *only* after the storage reversal is complete, which means that the storage in the target site should be read/write-capable.

6.2.1 Scenario description

This scenario simulates a failed VM by creating one VM at the target site that has the same LPAR name with one of the VMs at the source site. Figure 6-2 shows the topology of this scenario.

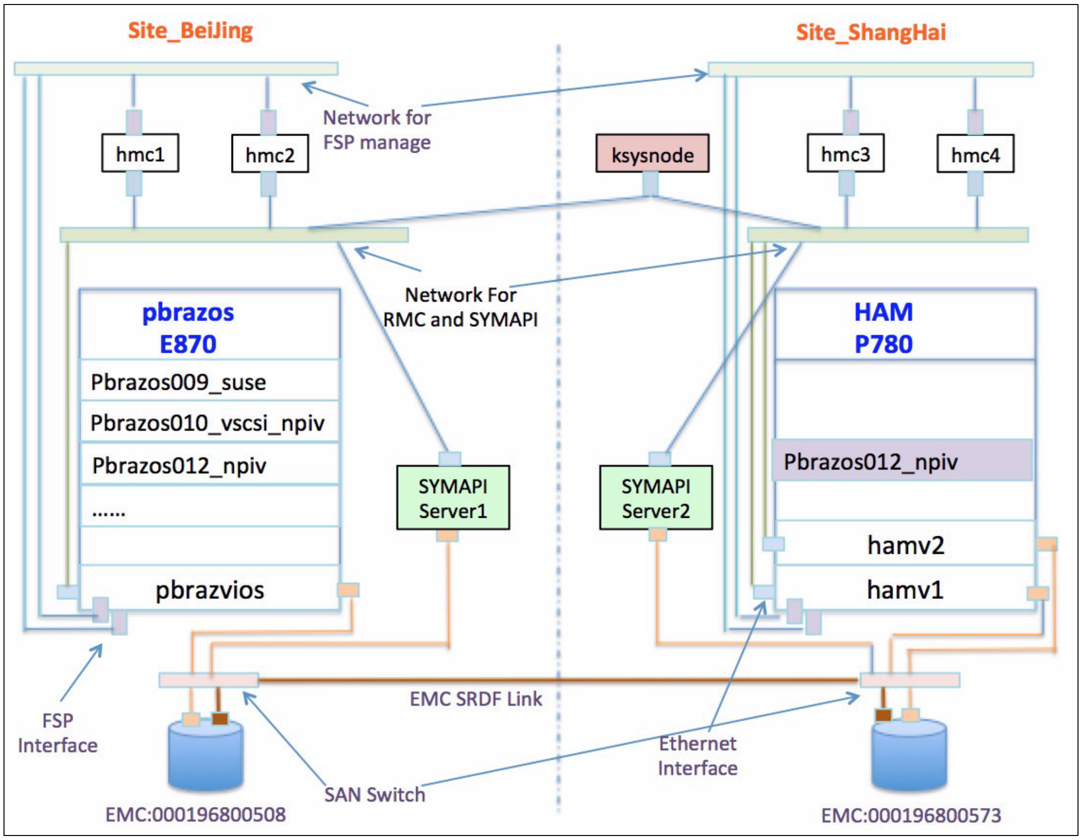


Figure 6-2 Testing topology for the recovery failed VM scenario

In this IBM Geographically Dispersed Resiliency for Power Systems cluster environment, the current active site is Site_BeiJing, which is also called the source site. The current backup site is Site_ShangHai, which is also called the target site. There are three VMs that are managed by IBM Geographically Dispersed Resiliency for Power Systems. The scenario wants to move them to the target site. You notice that there is one LPAR at the target site, and this LPAR name is pbrazos012_npiv, which conflicts with the VM at the source site.

6.2.2 Initial IBM Geographically Dispersed Resilience cluster status

This section shows the initial IBM Geographically Dispersed Resiliency for Power Systems cluster status.

IBM Geographically Dispersed Resilience configuration

Example 6-2 shows the current configuration and status before performing the site-switch operation. The backup site, Site_ShangHai, is the target and active site, and Site_BeiJing, is the source site.

Example 6-2 Current IBM Geographically Dispersed Resiliency for Power Systems cluster status in the recovery failed VM scenario

```
# ksysmgr -v report system
This is the latest KSYS configurations, please run discover to capture any changes

Status: KSYS is performing an auto discovery, please run 'ksysmgr query system status' for
details
Ksysmgr version: 1.1.0.0
Ksys version: 1.1.0.0

Current environment:
====================

Back up Site: Site_ShangHai

    HOST: HAM-9179-MHD-SN106DBEP
         HMC:
              HMC_ShangHai_vhmc1
              HMC_ShangHai_vhmc2
         VIOS:
hamv2
hamv1
         Paired Host:
pbrazos_9119-MME-21BBC47
         Number of Managed VMs: 0
         Configurable Processors: 48
         Configurable Processors: 524288

    Storage Agent:
sa_ShangHai

    Total configurable Processors: 48
    Total configurable Memory: 524288

Active Site: Site_BeiJing

    HOST: pbrazos_9119-MME-21BBC47
         HMC:
              HMC_BeiJing_vhmc1
              HMC_BeiJing_vhmc2
         VIOS:
pbrazosv1
         Paired Host:
              HAM-9179-MHD-SN106DBEP
         Number of Managed VMs: 3
```

```
        Configurable Processors: 80
        Configurable Processors: 2.09715e+06

    Storage Agent:
sa_BeiJing

    Total configurable Processors: 80
    Total configurable Memory: 2.09715e+06
```

Virtual machine status

Example 6-3 shows the current VMs status before the site-switch operation. The status is READ_TO_MOVE, which means that the VMs can be migrated to the other site.

Example 6-3 VMs status in the recovery failed VM scenario

```
# ksysmgr query vm state=manage
Managed VMs:
pbrazos009_suse
pbrazos010_vscsi_npiv
pbrazos012_npiv

All VMs:
Name:           pbrazos009_suse
UUID:           0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:           pbrazos_9119-MME-21BBC47
State:          READY_TO_MOVE

Name:           pbrazos010_vscsi_npiv
UUID:           3CE82119-A851-4DCB-BB18-79AF61021F73
Host:           pbrazos_9119-MME-21BBC47
State:          READY_TO_MOVE

Name:           pbrazos012_npiv
UUID:           1A2EA573-53E4-4743-9057-FE5822158E78
Host:           pbrazos_9119-MME-21BBC47
State:          READY_TO_MOVE
```

Dell EMC RDF status

Example 6-4 shows the current Dell EMC SRDF disk pairs status. The RDF group ID is 68. In this disk pair, each storage has six volumes.

The devices at the source site are in R1 and have a read write state, and the devices at the target site are in R2 and have the write-disable status.

Example 6-4 RDF configuration in the recovery failed VM scenario

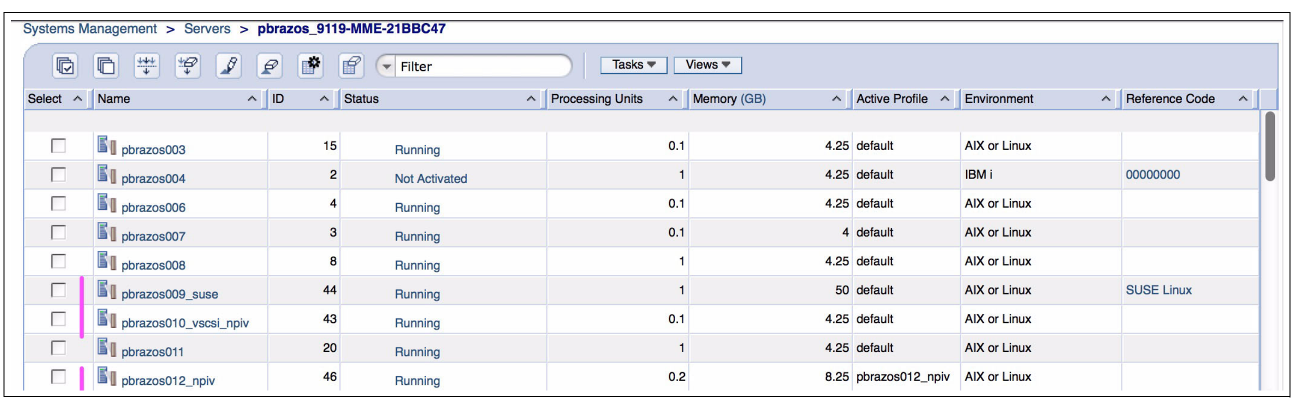
```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# export SYMCLI_CONNECT_TYPE=REMOTE
# symrdf list|grep “\:68”
---------------------------------------------------------------------------
                     STATUS    MODES                   RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
03252 02425   R1:68  RW RWRW  A..1.        0       0 RW   WD   Consistent
```

```
03253 02420   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03256 02421   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03257 02422   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03258 02423   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03259 02424   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
0325B 02426   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
0325C 02427   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent

# export SYMCLI_CONNECT=SYMAPI_SITE_573
# symrdf list|grep “\:68”
---------------------------------------------------------------------------
                     STATUS    MODES              RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv R2 Inv ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
02420 03253   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
02421 03256   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
02422 03257   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
02423 03258   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
02424 03259   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
02425 03252   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
02426 0325B   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
02427 0325C   R2:68  WD WD RW  A..2.        0       0 WD  RW   Consistent
```

Virtual machine information

Figure 6-3 shows the VM information about host pbrazos, which is at the active site. Three of these VMs are managed by IBM Geographically Dispersed Resiliency for Power Systems. The LPAR (VMs) names are pbrazos009_suse, pbrazos010_vscsi_npiv, and pbrazos012_npiv:

- The pbrazos009_suse VM is running SUSE Linux and its boot device comes from NPIV.
- The pbrazos010_vscsi_npiv VM is running AIX and its boot device comes from VSCSI. The other disks are from NPIV.
- The pbrazos02_npiv VM is running AIX and its boot device comes from NPIV.

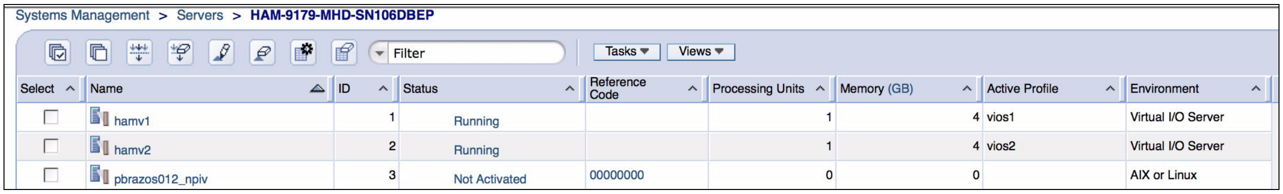

Systems Management > Servers > pbrazos_9119-MME-21BBC47

Filter Tasks Views

Select	Name	ID	Status	Processing Units	Memory (GB)	Active Profile	Environment	Reference Code
	pbrazos003	15	Running	0.1	4.25	default	AIX or Linux	
	pbrazos004	2	Not Activated	1	4.25	default	IBM i	00000000
	pbrazos006	4	Running	0.1	4.25	default	AIX or Linux	
	pbrazos007	3	Running	0.1	4	default	AIX or Linux	
	pbrazos008	8	Running	1	4.25	default	AIX or Linux	
	pbrazos009_suse	44	Running	1	50	default	AIX or Linux	SUSE Linux
	pbrazos010_vscsi_npiv	43	Running	0.1	4.25	default	AIX or Linux	
	pbrazos011	20	Running	1	4.25	default	AIX or Linux	
	pbrazos012_npiv	46	Running	0.2	8.25	pbrazos012_npiv	AIX or Linux	

Figure 6-3 Display the active site’s VM configuration

Figure 6-4 shows that there is one VM, which is named pbrazos012_npiv in host HAM, and this server is at the backup site.


Systems Management > Servers > HAM-9179-MHD-SN106DBEP

Select	Name	ID	Status	Reference Code	Processing Units	Memory (GB)	Active Profile	Environment
☐	hamv1	1	Running		1	4	vios1	Virtual I/O Server
☐	hamv2	2	Running		1	4	vios2	Virtual I/O Server
☐	pbrazos012_npiv	3	Not Activated	00000000	0	0		AIX or Linux

Figure 6-4 Display the backup site's VM configuration

> **Note:** The VM was created after the **ksysmgr verify** operation. You do not know about this change before the move operation.

6.2.3 Generating a failed virtual machine

This section generates a failed VM during the site-switch operation.

Starting the site-switch operation

Example 6-5 shows the output of the site-switch operation. This is a planned move that attempts to move all the managed VMs from Site_BeiJing to Site_ShangHai.

Example 6-5 Site switch with the planned option

```
# ksysmgr -t move site from=Site_BeiJing to=Site_ShangHai  type=planned
10:45:57 Site move started for Site_BeiJing to Site_ShangHai
        10:46:08 Shutdown on Site_BeiJing site has started for VM pbrazos009_suse
        10:46:08 Shutdown on Site_BeiJing site has started for VM pbrazos012_npiv
        10:46:08 Shutdown on Site_BeiJing site has started for VM pbrazos010_vscsi_npiv
        10:46:36 Shutdown on Site_BeiJing site has completed for VM pbrazos009_suse
        10:47:12 Shutdown on Site_BeiJing site has completed for VM pbrazos012_npiv
        10:47:21 Shutdown on Site_BeiJing site has completed for VM pbrazos010_vscsi_npiv
        10:47:21 Storage mirror reversal has started
        10:47:22 Mirroring will be setup from Site_ShangHai to Site_BeiJing
        10:50:16 Storage mirror reversal has completed
        10:50:43 Restart on Site_ShangHai site has started for VM pbrazos009_suse
        10:50:43 Restart on Site_ShangHai site has started for VM pbrazos012_npiv
        10:50:43 Restart on Site_ShangHai site has started for VM pbrazos010_vscsi_npiv
        10:51:10 Restart on Site_ShangHai site has completed for VM pbrazos009_suse
        10:51:10 Move has completed for VM pbrazos009_suse
        10:51:10 Configuration cleanup on Site_BeiJing site for VM pbrazos009_suse
        10:51:28 Rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        10:51:46 Restart on Site_ShangHai site has completed for VM pbrazos010_vscsi_npiv
        10:51:46 Move has completed for VM pbrazos010_vscsi_npiv
        10:51:46 Configuration cleanup on Site_BeiJing site for VM pbrazos010_vscsi_npiv
        10:51:55 Done rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        10:52:05 Rediscovering configuration for VM pbrazos010_vscsi_npiv on site Site_ShangHai
        10:52:05 Done rediscovering configuration for VM pbrazos010_vscsi_npiv on site
Site_ShangHai
        ERROR: Move has encountered for VM pbrazos012_npiv during shutdown
Please review errors.  The "ksysmgr query system status" command may provide additional details.
```

This move operation finishes with an error:

```
VM pbrazos012_npiv failed
```

Example 6-6 shows some messages from the KSYS trace file, which indicates that the pbrazos012_npiv VM exists on host HAM at the target site.

Example 6-6 Check the KSYS trace to get more information

```
[05] 10/21/16 _VMR 10:50:50.559221 ERROR libkrest.c[1890]:
VIOS/HMC:job_result->result : The Disaster Recovery operation failed with the
following errors:
HSCLA9A9 A partition with name pbrazos012_npiv already exists on the managed
system. Provide another name for this partition.
```

Note: To generate a KSYS trace on a KSYS node, run the following commands:

```
# hostname
pbrazos013
# pwd
/var/ct/itso3_cluster/log/mc/IBM.VMR --> the itso3_cluster is KSYS cluster name
in this case
# rpttr -odict trace.ksys* trace.user* > trc.out
```

Example 6-7 shows the current VMs status, which was obtained by running the **ksysmgr** command.

The states of VMs pbrazos009_suse and pbrazos010_vscsi_npiv are READY_TO_MOVE, which means that the two VMs were moved successfully and that the rediscovery process is complete at the target site.

The state of VM pbrazos012_npiv is RECOVERY_ONLINE, which means it failed the restart VM at target site phase, and it must be moved again.

Example 6-7 Display the VMs status after the site switch is complete

```
# ksysmgr query vm state=manage
…
Name:            pbrazos009_suse
UUID:            0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:            HAM-9179-MHD-SN106DBEP
State:           READY_TO_MOVE

Name:            pbrazos010_vscsi_npiv
UUID:            3CE82119-A851-4DCB-BB18-79AF61021F73
Host:            HAM-9179-MHD-SN106DBEP
State:           READY_TO_MOVE

Name:            pbrazos012_npiv
UUID:            1A2EA573-53E4-4743-9057-FE5822158E78
Host:            HAM-9179-MHD-SN106DBEP
State:           RECOVERY_ONLINE
```

Example 6-8 shows the current SRDF/A disk pairs status. The devices in the source site are in R2 and in the write-disable state, and the devices in the target site are in R1 and in the read write state, which indicates that the storage was reserved successfully and it meets the prerequisites of the recovery operation.

Example 6-8 Display the SRDF status after the site-switch operation completes

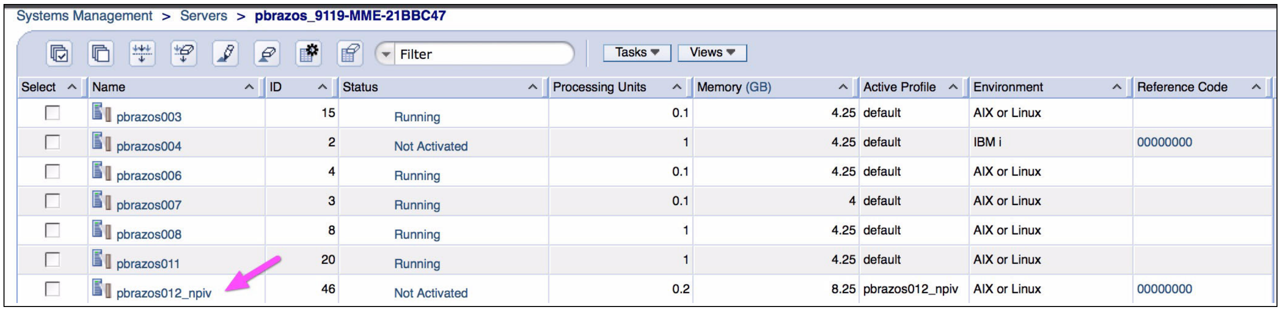
```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symrdf list
---------------------------------------------------------------------------
                          STATUS    MODES                RDF  S T A T E S
Sym   Sym   RDF           --------- ----- R1 Inv  R2 Inv ----------------------
Dev   RDev  Typ:G         SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- --------      --------- ----- ------- ------- --- ---- -------------
03252 02425   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent
03253 02420   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent
03256 02421   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent
03257 02422   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent
03258 02423   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent
03259 02424   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent
0325B 02426   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent
0325C 02427   R2:68       WD WD RW  A..2.       0       0 WD  RW   Consistent


# export SYMCLI_CONNECT=SYMAPI_SITE_573
# symrdf list
---------------------------------------------------------------------------
                          STATUS    MODES                RDF  S T A T E S
Sym   Sym   RDF           --------- ----- R1 Inv  R2 Inv ----------------------
Dev   RDev  Typ:G         SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- --------      --------- ----- ------- ------- --- ---- -------------
02420 03253   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
02421 03256   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
02422 03257   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
02423 03258   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
02424 03259   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
02425 03252   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
02426 0325B   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
02427 0325C   R1:68       RW RWRW  A..1.       0       0 RW  WD   Consistent
```

Example 6-9 shows that the current active site is changed to Site_ShangHai. Site_BeiJing is the source site and Site_ShangHai is the target site.

Example 6-9 Display the IBM Geographically Dispersed Resiliency for Power Systems site status after the site-switch operation completes

```
# ksysmgr query site
Name:           Site_BeiJing
Sitetype:       BACKUP

Name:           Site_ShangHai
Sitetype:       ACTIVE
```

Figure 6-5 shows that VM pbrazos012_npiv is shut down, but still exists at the source site.



Systems Management > Servers > pbrazos_9119-MME-21BBC47

Select	Name	ID	Status	Processing Units	Memory (GB)	Active Profile	Environment	Reference Code
	pbrazos003	15	Running	0.1	4.25	default	AIX or Linux	
	pbrazos004	2	Not Activated	1	4.25	default	IBM i	00000000
	pbrazos006	4	Running	0.1	4.25	default	AIX or Linux	
	pbrazos007	3	Running	0.1	4	default	AIX or Linux	
	pbrazos008	8	Running	1	4.25	default	AIX or Linux	
	pbrazos011	20	Running	1	4.25	default	AIX or Linux	
	pbrazos012_npiv	46	Not Activated	0.2	8.25	pbrazos012_npiv	AIX or Linux	00000000

Figure 6-5 Display the VM status through the HMC at the source site

Example 6-10 shows that the virtual adapter of VM pbrazos012_npiv still exists at the source site.

Example 6-10 Display the virtual adapter information of the pbrazos012_npiv VM at the source site

```
$ hostname
pbrazosv1
$lsmap -all –npiv
..
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost49     U9119.MME.21BBC47-V1-C160              46                 AIX

Status:NOT_LOGGED_IN
FC name:fcs1                    FC loc code:U78CD.001.FZH1401-P1-C6-T2
Ports logged in:0
Flags:4<NOT_LOGGED>

The virtual adapers of other 2 VMs have been remove from Site_BeiJing.
```

6.2.4 Removing pbrazos012_npiv from the target site (Site_ShangHai)

Before performing recovery for the failed VM, you must remove the existing VM from the host at the target site, or rename the VM’s LPAR name through the HMC.

6.2.5 Recovering the failing virtual machine

Now, you can start the recovery action. Example 6-11 shows the output of the **ksysmgr recovery** command.

Example 6-11 Recovery operation for the failed VM

```
# ksysmgr -t recover vm pbrazos012_npiv
Beginning recovery for pbrazos012_npiv
VM recover successful for pbrazos012_npiv
```

Example 6-12 shows that the state of the VM changed from RECOVERY_ONLINE to RECOVERED, which means that the recovery operation completed successfully.

Example 6-12 Display the VM's status after the recovery operation completes

```
# ksysmgr query vm state=manage
..
Name:              pbrazos009_suse
UUID:              0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:              HAM-9179-MHD-SN106DBEP
State:             READY_TO_MOVE

Name:              pbrazos010_vscsi_npiv
UUID:              3CE82119-A851-4DCB-BB18-79AF61021F73
Host:              HAM-9179-MHD-SN106DBEP
State:             READY_TO_MOVE

Name:              pbrazos012_npiv
UUID:              1A2EA573-53E4-4743-9057-FE5822158E78
Host:              HAM-9179-MHD-SN106DBEP
State:             RECOVERED
```

6.2.6 Cleanup operation after recovery is complete

During the discovery operation, the VM is moved to the target site, but the VM is not removed from the source site. KSYS provides an option to remove it, as shown in Example 6-13.

Example 6-13 Cleanup for VM pbrazos012_npiv

```
# ksysmgr -t cleanup vm pbrazos012_npiv
Beginning cleanup for pbrazos012_npiv
VM cleanup successful for pbrazos012_npiv
```

During the cleanup operation, KSYS checks whether this VM is present in the current active site. If it is, then this VM is cleaned up from the old source site, which is the current backup site.

After the cleanup operation completes, if you want to perform a planned site switch again, it fails. You need to run discover and verify because the state of VM pbrazos012_npiv is RECOVERED, not READY_TO_MOVE.

Example 6-14 shows the error information that occurs if you switch back without performing discover and verify operations.

Example 6-14 Move operation fails

```
# ksysmgr -t move site from=Site_ShangHai to=Site_BeiJing  type=planned
Some of the VMs are not ready to move, hence aborting move operation
VM List that are not ready to move:
pbrazos012_npiv
Please run verification on the entire site to check further
```

6.2.7 Scenario summary

This scenario describes how to perform the recovery of a failed VM, and how to clean up after recovery. Regarding this scenario, if you perform the verify operation before the planned site switch, KSYS can discover that there are some VMs that exist at the target site. Example 6-15 shows the output of the **verify** command.

Example 6-15 KSYS can identify potential risks during the IBM Geographically Dispersed Resiliency for Power Systems verify operation

```
# ksysmgr -t verify site Site_BeiJing
10:29:02 Site verification started for Site_BeiJing
        10:29:07 HAM-9179-MHD-SN106DBEP verification has started
        10:29:31 HAM-9179-MHD-SN106DBEP verification has completed
        10:29:31 pbrazos009_suse verification has started
        10:29:31 pbrazos010_vscsi_npiv verification has started
        10:29:31 pbrazos012_npiv verification has started
        10:29:37 pbrazos009_suse verification has completed
        10:29:37 pbrazos010_vscsi_npiv verification has completed
        ERROR: Verify has encountered an error for site Site_BeiJing please investigate
        ERROR: Verify has encountered an error for VM pbrazos012_npiv please investigate
10:29:53 Verification has finished for Site_BeiJing
2 out of 3 VMs have been successfully verified
Unverified VMs:
pbrazos012_npiv

Please review the error(s) and take any corrective actions.
```

Example 6-16 shows information from the KSYS trace file.

Example 6-16 Display information from the KSYS trace file

```
[38] 10/21/16 _VMR 10:29:32.790251 [ERROR,VMR_LPARRcp,1A2EA573-53E4-4743-9057-FE5822158E78] The
Disaster Recovery operation failed with the following errors:
HSCLA9A9 A partition with name pbrazos012_npiv already exists on the managed system. Provide
another name for this partition.
```

After the verify operation, the state of VM pbrazos012_npiv is changed from READY_TO_MOVE to VERIFY, as shown in Example 6-17.

Example 6-17 Display the VM's status after the IBM Geographically Dispersed Resiliency for Power Systems verify operation

```
#ksysmgr query vm state=manage
...
Name:              pbrazos009_suse
UUID:              0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:              pbrazos_9119-MME-21BBC47
State:             READY_TO_MOVE

Name:              pbrazos010_vscsi_npiv
UUID:              3CE82119-A851-4DCB-BB18-79AF61021F73
Host:              pbrazos_9119-MME-21BBC47
State:             READY_TO_MOVE

Name:              pbrazos012_npiv
UUID:              1A2EA573-53E4-4743-9057-FE5822158E78
```

```
Host:             pbrazos_9119-MME-21BBC47
State:            VERIFY
```

If you attempt to perform a site switch with the planned option, it fails as shown in Example 6-18.

Example 6-18 Error from planned site switch if this VM's status is VERIFY

```
# ksysmgr -t move site from=Site_BeiJing to=Site_ShangHai  type=planned
ERROR: An error was encountered during the previous verification, rerun discovery
to ensure correct configuration. You can rerun move command with -f flag to ignore
this check.
```

You must fix the current issue and run the verify operation again. Until the state of the VM is changed to READY_TO_MOVE, you cannot perform a move operation with the planned option.

6.3 Adding a new virtual machine to an IBM Geographically Dispersed Resilience cluster dynamically

If you want to add a VM to an IBM Geographically Dispersed Resiliency for Power Systems cluster dynamically, you must complete the following activities:

1. Add some VMs to the managed VM list of the existing IBM Geographically Dispersed Resiliency for Power Systems.
2. Remove some VMs from the managed VM list of the existing IBM Geographically Dispersed Resiliency for Power Systems.
3. Add disks into an existing VM that was managed by the existing IBM Geographically Dispersed Resiliency for Power Systems.
4. Remove disks from an existing VM that was managed by the existing IBM Geographically Dispersed Resiliency for Power Systems.

These kinds of activities always imply a SRDF/A disk pairs update. This update must be done before the IBM Geographically Dispersed Resiliency for Power Systems operation.

For example, if you want to add a VM to an existing IBM Geographically Dispersed Resiliency for Power Systems cluster, there are two scenarios:

- The disk pairs of the new VM have a separate RDF group ID.
- The disk pairs of the new VM share the RDF group ID with existing VMs.

For the first scenario, you do not need to update the existing RDF group.

For the secondary scenario, you must delete the current disk pairs and recreate them with the new disk pairs list.

The following section shows the procedure of the first scenario. This section also introduces important steps for the secondary scenario, including other activities.

6.3.1 Scenario description

Figure 6-6 shows the topology for this scenario.

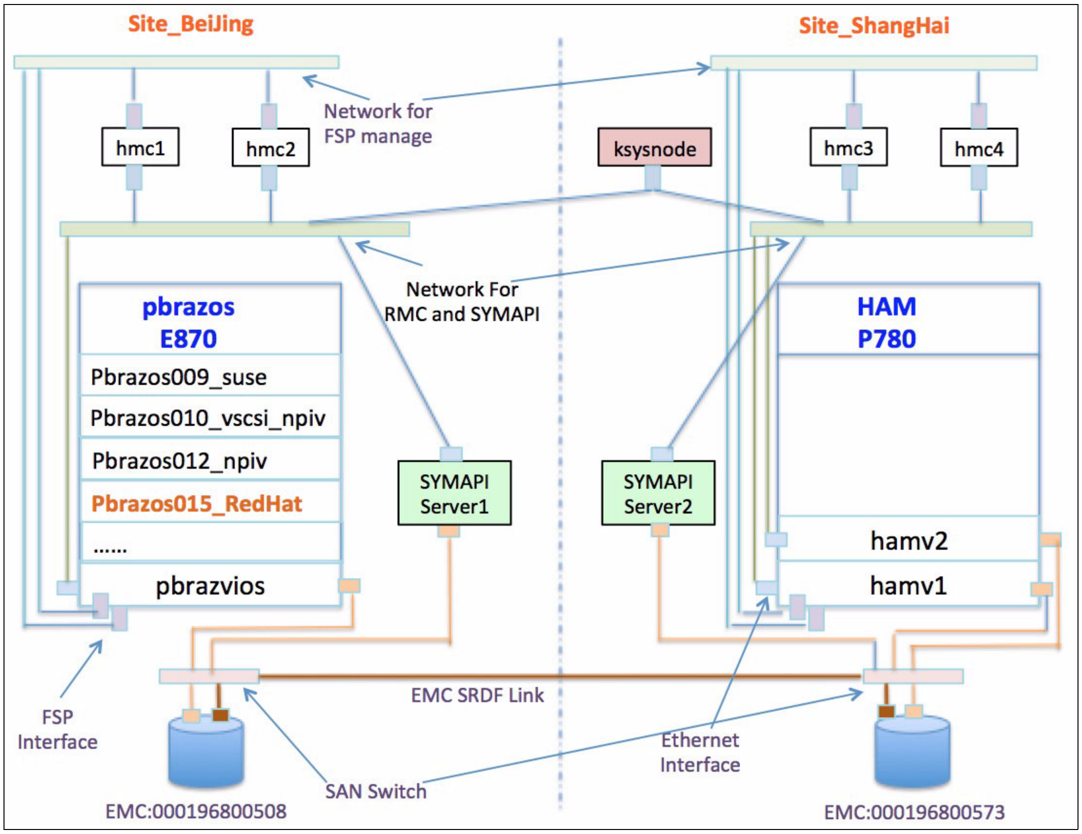


Figure 6-6 Testing topology for adding a VM in IBM Geographically Dispersed Resiliency for Power Systems scenario

There are three VMs that are managed by the existing IBM Geographically Dispersed Resiliency for Power Systems cluster. Now, create a VM and add it to the current IBM Geographically Dispersed Resiliency for Power Systems cluster. Then, move all the VMs to the target site. The new VM's name is Pbrazos015_RedHat and is running Red Hat Linux.

6.3.2 Initial IBM Geographically Dispersed Resilience cluster status

This scenario's initial status is similar to the one that is shown in 6.2, "Planned recovery of a failed virtual machine" on page 289. You can find more information in that section, including IBM Geographically Dispersed Resiliency for Power Systems configuration, VM status, disk pair's status, and site status.

Example 6-19 shows the composite group (CG) information before adding the new VM.

Example 6-19 Display RDF composite group information before adding the new VM

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
```

```
Number of RDF (RA) Groups :  1 --> this indicates there is only one RDF Group
RDF Consistency Mode      :  MSC

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number       :  68 (43) --> this is the RDF Group ID

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001    03258 RW       0       0 RW 02423 WD       0       0 A.X. Consistent
DEV002    03259 RW       0       0 RW 02424 WD       0       0 A.X. Consistent
DEV003    03256 RW       0       0 RW 02421 WD       0       0 A.X. Consistent
DEV004    03257 RW       0       0 RW 02422 WD       0       0 A.X. Consistent
DEV005    0325B RW       0       0 RW 02426 WD       0       0 A.X. Consistent
DEV006    0325C RW       0       0 RW 02427 WD       0       0 A.X. Consistent
DEV007    03253 RW       0       0 RW 02420 WD       0       0 A.X. Consistent
DEV008    03252 RW       0       0 RW 02425 WD       0       0 A.X. Consistent
```

The CG has one RDF group with ID 68. In this RDF group, there are eight disk pairs.

Note: KSYS creates CGs automatically during the discovery phase. Each storage has one CG, and KSYS enables consistency attribution for the CGs.

6.3.3 Setting the storage configuration of the pbrazos015_RedHat virtual machine

This section does not describe how to create a VM. This section shows how to set the storage configuration of the new VM.

Each storage provides one volume for the new VM. The volume ID in the Symmetrix ID 000196800508 storage is 03269, and the volume ID in the Remote Symmetrix ID 000196800573 storage is 0243D. The two volumes are in one disk pair and this disk pair belongs to one new RDF group with ID 140.

Example 6-20 shows the command that is used to create the RDF group and disk pair.

Example 6-20 Create an RDF group with ID 140

```
# symrdf addgrp -label  gdrhebing2 -rdfg 140 -sid 000196800508 -dir 01E:27
-remote_rdfg 140 -remote_sid 000196800573  -remote_dir 01E:27

# symrdf -file /tmp/redhat.srdf createpair -type R1 -sid 000196800508 -rdfg 140
-establish -rdf_mode async -nop -force

# cat /tmp/redhat.srdf
03269 0243D
```

When the disk pair is created, run the **symrdf** command to display it, as shown in Example 6-21.

Example 6-21 Display disk pairs information after the new RDF group is created

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# export SYMCLI_CONNECT_TYPE=REMOTE
# symrdf list|grep "\:68|\:140"
---------------------------------------------------------------------------
                     STATUS    MODES                  RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
03252 02425   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03253 02420   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03256 02421   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03257 02422   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03258 02423   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03259 02424   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
0325B 02426   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
0325C 02427   R1:68  RW RWRW  A..1.       0       0 RW  WD   Consistent
03269 0243D   R1:140 RW RWRW  A..1.       0       0 RW  WD   Consistent

# export SYMCLI_CONNECT=SYMAPI_SITE_573
# symrdf list|grep "\:68|\:140"
---------------------------------------------------------------------------
                     STATUS    MODES                  RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
02420 03253   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
02421 03256   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
02422 03257   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
02423 03258   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
02424 03259   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
02425 03252   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
02426 0325B   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
02427 0325C   R2:68  WD WD RW  A..2.       0       0 WD  RW   Consistent
0243D 03269   R2:140 WD WD RW  A..2.       0       0 WD  RW   Consistent
```

When the Dell EMC Storage configuration is ready, you can create the VM through the HMC and install the Red Hat operating system. After the installation is done, you add the VM to the current IBM Geographically Dispersed Resiliency for Power Systems cluster.

Note: Before you install the operating system for the new VM, you must add the SAN zone configuration for it at the active site, and add the same WWPN of this VM to the target site.

6.3.4 Running the ksysmgr discovery to add virtual machines to IBM Geographically Dispersed Resilience

When the VM is created, you can add it to IBM Geographically Dispersed Resiliency for Power Systems by running the **ksysmgr discovery** command. During this operation, KSYS identifies the new VMs, and adds them to the managed VM list, as shown in Example 6-22.

Example 6-22 Display the VM status after the discovery operation completes

```
# ksysmgr query vm state=manage
Managed VMs:
        pbrazos009_suse
        pbrazos012_npiv
        pbrazos010_vscsi_npiv
        pbrazos015_RedHat

Name:            pbrazos009_suse
UUID:            0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos012_npiv
UUID:            1A2EA573-53E4-4743-9057-FE5822158E78
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos010_vscsi_npiv
UUID:            3CE82119-A851-4DCB-BB18-79AF61021F73
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos015_RedHat
UUID:            5BA0080B-0DC2-417A-9D21-70B489462676
Host:            pbrazos_9119-MME-21BBC47
State:           MANAGED
```

If this VM is not in the managed VM list, run the **ksysmgr manage vm uuid=<UUID of the new VM**> command to add it.

6.3.5 Running the discover and verify operations for the active site

After the new VM is added into the managed list of the current IBM Geographically Dispersed Resiliency for Power Systems, run discover and verify operations at the active site. Example 6-23 shows the output of the discover and verify operations.

Example 6-23 Perform the IBM Geographically Dispersed Resiliency for Power Systems discover and verify after adding a VM

```
# ksysmgr -t discover site Site_BeiJing verify=yes
16:31:10 Running discovery on entire site, this may take few minutes...
        16:31:22 Storage state synchronization has started for Site Site_BeiJing
        16:32:04 Storage state synchronization has completed for Site Site_BeiJing
        16:32:04 Discovery has started for VM pbrazos009_suse
        16:32:04 Configuration information retrieval started for VM pbrazos009_suse
        16:32:04 Discovery has started for VM pbrazos012_npiv
```

```
        16:32:04 Configuration information retrieval started for VM pbrazos012_npiv
        16:32:04 Discovery has started for VM pbrazos010_vscsi_npiv
        16:32:04 Configuration information retrieval started for VM pbrazos010_vscsi_npiv
        16:32:04 Discovery has started for VM pbrazos015_RedHat
        16:32:04 Configuration information retrieval started for VM pbrazos015_RedHat
        16:32:13 Configuration information retrieval completed for VM pbrazos009_suse
        16:32:13 Configuration information retrieval completed for VM pbrazos012_npiv
        16:32:13 Configuration information retrieval completed for VM pbrazos010_vscsi_npiv
        16:32:13 Configuration information retrieval completed for VM pbrazos015_RedHat
        16:32:13 Storage information retrieval from VIOS started for VM pbrazos009_suse
        16:32:13 Storage information retrieval from VIOS started for VM pbrazos012_npiv
        16:32:13 Storage information retrieval from VIOS started for VM pbrazos010_vscsi_npiv
        16:32:13 Storage information retrieval from VIOS started for VM pbrazos015_RedHat
        16:32:13 Storage information retrieval from VIOS completed for VM pbrazos009_suse
        16:32:13 Discovery for VM pbrazos009_suse is complete
        16:32:13 Storage information retrieval from VIOS completed for VM pbrazos012_npiv
        16:32:13 Discovery for VM pbrazos012_npiv is complete
        16:32:23 Storage information retrieval from VIOS completed for VM pbrazos010_vscsi_npiv
        16:32:23 Discovery for VM pbrazos010_vscsi_npiv is complete
        16:32:23 Storage information retrieval from VIOS completed for VM pbrazos015_RedHat
        16:32:23 Discovery for VM pbrazos015_RedHat is complete
        16:32:52 Disk Group creation on storage subsystem started for Site Site_ShangHai
        16:40:14 Disk Group creation on storage subsystem completed for Site Site_ShangHai
16:42:42 Discovery has finished for Site_BeiJing
4 out of 4 managed VMs have been successfully discovered

16:43:00 Site verification started for Site_BeiJing
        16:43:05 HAM-9179-MHD-SN106DBEP verification has started
        16:43:37 HAM-9179-MHD-SN106DBEP verification has completed
        16:43:37 pbrazos009_suse verification has started
        16:43:37 pbrazos010_vscsi_npiv verification has started
        16:43:37 pbrazos012_npiv verification has started
        16:43:37 pbrazos015_RedHat verification has started
        16:43:45 pbrazos009_suse verification has completed
        16:43:45 pbrazos010_vscsi_npiv verification has completed
        16:43:45 pbrazos012_npiv verification has completed
        16:43:45 pbrazos015_RedHat verification has completed
        16:43:46 Disk Group verification on storage subsystem started for Site Site_BeiJing
        16:46:00 Disk Group verification on storage subsystem completed for Site Site_BeiJing
16:46:11 Verification has finished for Site_BeiJing
4 out of 4 VMs have been successfully verified
```

During these operations, KSYS collects all the configuration information about the new VM and checks whether it satisfies the prerequisites of a move operation. During this operation, KSYS also re-creates the CG on two storages. Example 6-24 shows the new CG information.

Example 6-24 Display RDF composite group status after the IBM Geographically Dispersed Resiliency for Power Systems discovery operation

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2 --> this indicates there are 2 RDF Groups now
RDF Consistency Mode      :  MSC
```

```
Symmetrix ID                  : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID           : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number         : 140 (8B) --> this is new VM's RDF Group

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV009   03269 RW       0       0 RW 0243D WD       0       0 A.X. Consistent

Symmetrix ID                  : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID           : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number         :  68 (43) --> this is old RDF Group

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   03258 RW       0       0 RW 02423 WD       0       0 A.X. Consistent
DEV002   03259 RW       0       0 RW 02424 WD       0       0 A.X. Consistent
DEV003   03256 RW       0       0 RW 02421 WD       0       0 A.X. Consistent
DEV004   03257 RW       0       0 RW 02422 WD       0       0 A.X. Consistent
DEV005   0325B RW       0       0 RW 02426 WD       0       0 A.X. Consistent
DEV006   0325C RW       0       0 RW 02427 WD       0       0 A.X. Consistent
DEV007   03253 RW       0       0 RW 02420 WD       0       0 A.X. Consistent
DEV008   03252 RW       0       0 RW 02425 WD       0       0 A.X. Consistent
```

The CG now includes two RDF groups. KSYS creates one CG for all RDF groups of the managed VMs. At the time of writing, you can perform only a site-switch operation for all VMs.

6.3.6 Scenario summary

This scenario describes how to add one VM to an existing IBM Geographically Dispersed Resiliency for Power Systems cluster. You must plan and configure the Dell EMC Storage before the IBM Geographically Dispersed Resiliency for Power Systems operation. For more information about how to perform the storage configuration, see Chapter 3, “Storage and SAN setup for the IBM Geographically Dispersed Resilience environment” on page 25.

The following sections describe additional scenarios about the disk pair update.

New disk pair sharing an existing RDF group ID

If you want to add a VM into IBM Geographically Dispersed Resiliency for Power Systems, and the disk pair of this new VM belongs to an existing RDF group, during the Dell EMC configuration phase, there are two methods to achieve this task:

- Use one temporary RDF group with no data sync required. You can accomplish this task by completing the following steps:
  a. Discover the CG of the RDF group by running the **symcg list** command. Each site has one CG.
  b. Disable the two CGs by running the following command:
  ```
  symcg -cg  <CG name> -noprompt disable -force
  ```
  c. Create a temporary RDF group and create disk pairs with new disk pairs.
  d. Suspend the current CG (do this operation only for one CG) by running the following command:
  ```
  symrdf -cg <current CG name> suspend
  ```
  e. Suspend the new disk pairs in the temporary RDG group by running the following command:
  ```
  symrdf suspend -file <SRDF device file, includes new disk pair information>
  -sid 000196800573 -rdfg <temporary RDF group ID>
  ```
  f. Synchronize data with the new by running the following command:
  ```
  ksysmgr manage VM UUID=<UUID of VM>
  ```
  g. Check that the disk pair's status is in the Consistent state, and then run the KSYS discover and verify operation. During this phase, IBM Geographically Dispersed Resiliency for Power Systems re-creates the CG.
- Re-create the current disk pairs. A full data sync is also be required. Complete the following steps:
  a. Discover the CG of the RDF group by running the **symcg list** command. Each site has one CG.
  b. Disable the two CGs by running the following command:
  ```
  symcg -cg  <CG name> -noprompt disable -force
  ```
  c. Remove the two CGs by running the following command:
  ```
  symcg delete <CG name> -force
  ```
  d. Split the current disk pairs by running the following command:
  ```
  symrdf -sid 000196800508 -file <current disk pair configure file> split -nop
  -force -rdfg <current RDF group id> -force
  ```
  e. Delete the current disk pairs by running the following command:
  ```
  symrdf -sid 000196800508 -file <current disk pair configuration file>
  deletepair -nop -force -rdfg <current RDF group id> -force
  ```
  f. Re-create a disk pair by running the following command:
  ```
  symrdf -file <new disk pair configuration file> createpair -type R1 -sid
  000196800508 -rdfg <RDF group id> -establish -rdf_mode async -nop -force
  ```

g. Manage new VMs in the KSYS cluster by running the following command:

```
ksysmgr manage VM UUID=<UUID of VM>
```

h. Check that the disk pair's status is in the Consistent state, and then run the **ksysmgr recovery** command. During this phase, IBM Geographically Dispersed Resiliency for Power Systems re-creates the CG.

In 3.3.8, "Setting up storage for the virtual machines" on page 57, there is an example with detailed steps to add one disk pair to an existing RDF group.

Removing a VM that has a separate RDF group

When you want to remove one VM from an existing managed VM list of IBM Geographically Dispersed Resiliency for Power Systems, and this VM's disks belong to a separate RDF group, complete the following steps:

1. Unmanage this VM by running the following command:

```
ksysmgr unmanage vm uuid=<the uuid of the VM want to remove>
```

2. Run **ksysmgr discovery** again to see the current active site.

Removing a VM that shares the RDF group with other managed VMs

When you want to remove one VM from an existing managed IBM Geographically Dispersed Resiliency for Power Systems VM list, and if this VM shares the RDF group with other managed VMs, you must complete the following steps:

1. Disable the consistency attribute for the CG.
2. Delete the CGs from the two storages.
3. Suspend the disk pairs that you want to remove.
4. Delete the disk pairs.
5. Unmanage this VM from the current IBM Geographically Dispersed Resiliency for Power Systems cluster.
6. Run *discovery* for the current active site.

During the last discovery process, KSYS recreates the CG with the new disk pairs for each storage. Complete the following steps:

1. The current IBM Geographically Dispersed Resiliency for Power Systems cluster has three VMs managed:

```
pbrazos016_PHA1
pbrazos017_PHA2
pbrazos015_RedHat --> this VM will be removed
```

There are eight disk pairs that belong to three VMs, all the disk pairs share one RDF group, and the ID is 143. VM pbrazos015_RedHat has one disk pair:03269 0243D. Run the following command:

```
# symrdf list|egrep "\:143"
0018F 0075C   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
00192 0174E   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
00194 01751   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
00196 01B84   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
00198 01C56   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
03269 0243D   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
0326E 02442   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
0326F 02443   R1:143 RW RW RW  A..1.      0        0 RW  WD   Consistent
```

The CG information can be discovered by running the following command:

```
# symrdf -cg  VMRDG_itso4_cluster_ITS04_NewYork query
```

```
Composite Group Name      :  VMRDG_itso4_cluster_ITSO4_NewYork
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  NONE

Symmetrix ID               : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID        : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number      : 143 (8E)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   0326F RW       0        0 RW 02443 WD       0        0 A... Consistent
DEV002   0018F RW       0        0 RW 0075C WD       0        0 A... Consistent
DEV003   00192 RW       0        0 RW 0174E WD       0        0 A... Consistent
DEV004   00194 RW       0        0 RW 01751 WD       0        0 A... Consistent
DEV005   0326E RW       0        0 RW 02442 WD       0        0 A... Consistent
DEV006   00196 RW       0        0 RW 01B84 WD       0        0 A... Consistent
DEV007   00198 RW       0        0 RW 01C56 WD       0        0 A... Consistent
DEV008   03269 RW       0        0 RW 0243D WD       0        0 A... Consistent
```

2. Disable consistency for the CG by running the following commands:

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# /usr/symcli/bin/symcg -cg  VMRDG_itso4_cluster_ITSO4_NewYork -noprompt
disable -force
A consistency 'Disable' operation execution is
in progress for composite group 'VMRDG_itso4_cluster_ITSO4_NewYork'. Please
wait...
The consistency 'Disable' operation successfully executed for
composite group 'VMRDG_itso4_cluster_ITSO4_NewYork'.
```

3. Delete the CG from the storage at the active site by running the following command:

```
# symcg delete  VMRDG_itso4_cluster_ITSO4_NewYork -force
```

4. Delete the CG from the storage at the target site by running the following commands:

```
# export SYMCLI_CONNECT=SYMAPI_SITE_573
# symcg delete  VMRDG_itso4_cluster_ITSO4_Austin -force
```

5. Suspend *only* the disk pair that belongs to VM pbrazos015_RedHat by running the following command:

```
symrdf suspend -file /tmp/redhat.srdf -sid 000196800508 -rdfg 143 -cons_exempt

/tmp/redhat.srdf includes the disk pairs that need to remove
#cat /tmp/redhat.srdf
03269 0243D

# symrdf list|egrep "\:143"
0018F 0075C   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00192 0174E   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00194 01751   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
```

```
00196 01B84   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00198 01C56   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
03269 0243D   R1:143 RW RW NR  A..1X       0    3205 RW  WD   Suspended
0326E 02442   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
0326F 02443   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
```

You can see that the RDF group state changed to Suspended.

6. Delete *only* the disk pair that belongs to VM pbrazos015_RedHat by running the following commands:

```
# symrdf -sid 000196800508 -file /tmp/redhat.srdf deletepair -nop -force -rdfg
143

# symrdf list|egrep "\:143|\:140"
0018F 0075C   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00192 0174E   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00194 01751   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00196 01B84   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
00198 01C56   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
0326E 02442   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
0326F 02443   R1:143 RW RW RW  A..1.       0       0 RW  WD   Consistent
```

The disk pair disappeared from the list.

7. Unmanage VM pbrazos015_RedHat by running the following command:

```
# ksysmgr unmanage vm uuid=5BA0080B-0DC2-417A-9D21-70B489462676
VM 5BA0080B-0DC2-417A-9D21-70B489462676 was successfully unmanaged

# ksysmgr q vm state=manage|more
Managed VMs:
        pbrazos016_PHA1
        pbrazos017_PHA2
```

8. Run the discovery operation by running the following command.SYS generates a new CG, so there are seven LUNs now.

```
# symrdf -cg  VMRDG_itso4_cluster_ITSO4_NewYork  query

Composite Group Name      :  VMRDG_itso4_cluster_ITSO4_NewYork
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  MSC

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number       : 143 (8E)

         Source (R1) View                Target (R2) View     MODE
--------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T  R1 Inv   R2 Inv  K Sym    T  R1 Inv  R2 Inv       RDF Pair
Device   Dev    E  Tracks   Tracks  S Dev    E  Tracks  Tracks  MACE STATE
-------------------------------- -- ------------------------ ---- ------------
DEV001   0326F RW       0        0 RW 02443 WD       0       0 A.X. Consistent
DEV002   0018F RW       0        0 RW 0075C WD       0       0 A.X. Consistent
DEV003   00192 RW       0        0 RW 0174E WD       0       0 A.X. Consistent
```

```
DEV004    00194 RW      0       0 RW 01751 WD      0       0 A.X. Consistent
DEV005    0326E RW      0       0 RW 02442 WD      0       0 A.X. Consistent
DEV006    00196 RW      0       0 RW 01B84 WD      0       0 A.X. Consistent
DEV007    00198 RW      0       0 RW 01C56 WD      0       0 A.X. Consistent
```

9. Run the verify operation to prepare the next site-switch operation.

6.4 Planned hardware management console failure at the active site

You can use KSYS to configure more than one HMC for each site. When you perform a KSYS operation, if KSYS cannot access one HMC, it switches to another HMC automatically and continues its operation. This scenario simulates an HMC failure at the active site, and how KSYS works during the site-switch operation.

6.4.1 Scenario description

Figure 6-7 shows the topology for this scenario.

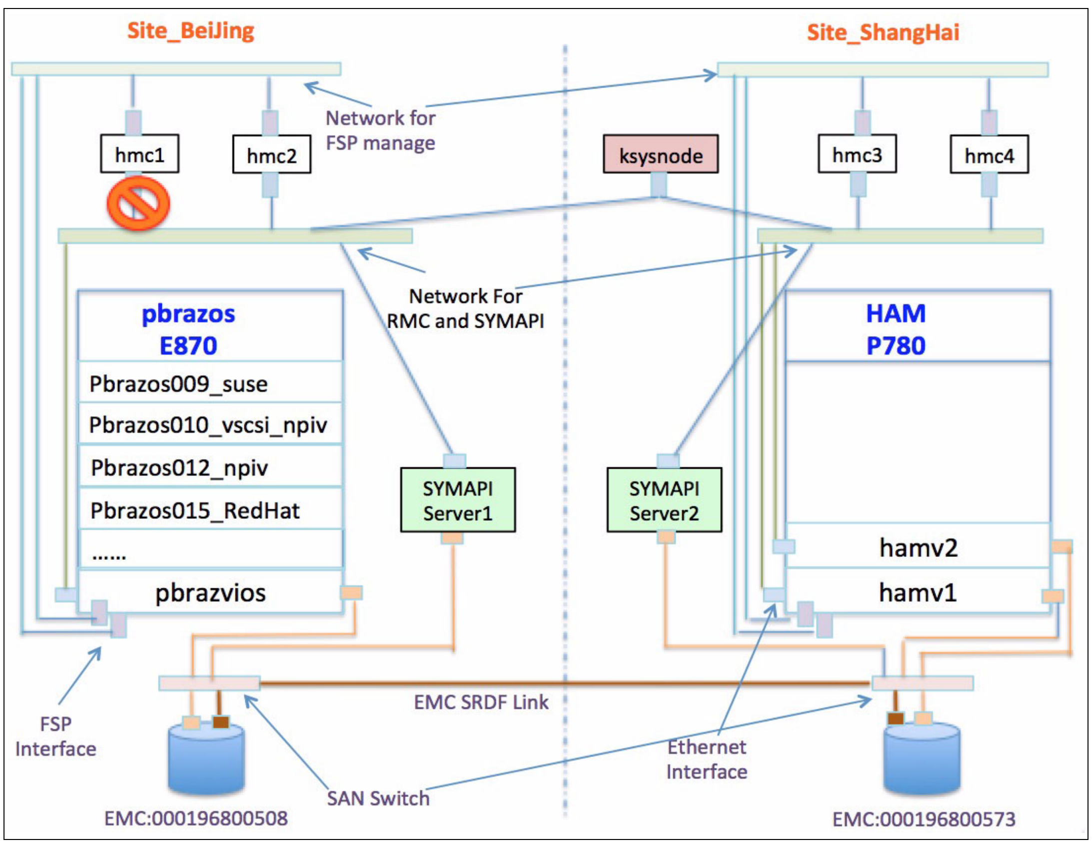


Figure 6-7 Testing topology if 'one HMC fails at the active site' scenario

From the topology that is shown in Figure 6-7, you can see that when vhmc1 fails, the KSYS node cannot communicate with it. Because the pbrazos host is managed by two HMCs, vhmc1 and vhmc3, you can expect KSYS to continue to operate with the pbrazos host by using vhmc3 after identifying that vhmc1 failed.

6.4.2 Initial status

Example 6-25 shows the IBM Geographically Dispersed Resiliency for Power Systems cluster initial status before the move operation.

Example 6-25 Display the IBM Geographically Dispersed Resiliency for Power Systems status before the planned site-switch operation

```
# ksysmgr -v report system
This is the latest KSYS configurations, please run discover to capture any changes

Status: KSYS subsystem is doing a verify, please run 'ksysmgr query system status' for details
Ksysmgr version: 1.1.0.0
Ksys version: 1.1.0.0

Current environment:
====================

Active Site: Site_BeiJing

    HOST: pbrazos_9119-MME-21BBC47
         HMC:
              HMC_BeiJing_vhmc1
              HMC_BeiJing_vhmc2 --> Active site has 2 HMCs
         VIOS:
              pbrazosv1
         Paired Host:
              HAM-9179-MHD-SN106DBEP
         Number of Managed VMs: 4
         Managed Processors: Unable to determine, please run discover
         Managed Memory: Unable to determine, please run discover

    Storage Agent:
              sa_BeiJing

    Total Managed Processors: 0
    Total Managed Memory: 0

Back up Site: Site_ShangHai

    HOST: HAM-9179-MHD-SN106DBEP
         HMC:
              HMC_ShangHai_vhmc1
              HMC_ShangHai_vhmc2
         VIOS:
              hamv1
              hamv2
         Paired Host:
              pbrazos_9119-MME-21BBC47
         Number of Managed VMs: 0
         Configurable Processors: 48
         Configurable Memory: 524288

    Storage Agent:
              sa_ShangHai

    Total configurable Processors: 48
    Total configurable Memory: 524288
```

Example 6-26 shows detailed information about the HMC configuration in the IBM Geographically Dispersed Resiliency for Power Systems cluster. The vhmc1's name in IBM Geographically Dispersed Resiliency for Power Systems is HMC_BeiJing_vhmc1. The vhmc3's name in IBM Geographically Dispersed Resiliency for Power Systems is HMC_BeiJing_vhmc2.

Example 6-26 Display the HMC configuration

```
# ksysmgr query hmc
Name:             HMC_BeiJing_vhmc1
Site:             Site_BeiJing
Ip:               9.3.18.34
Login:            hscroot

                        Managed Host List:
Host Name                               Uuid
=========                               ====
pbrazos_9119-MME-21BBC47                6ce366c5-f05d-3a12-94f8-94a3fdfc1319
...
============================================================================

Name:             HMC_BeiJing_vhmc2
Site:             Site_BeiJing
Ip:               9.3.18.36
Login:            hscroot

                        Managed Host List:

Host Name                               Uuid
=========                               ====
pbrazos_9119-MME-21BBC47                6ce366c5-f05d-3a12-94f8-94a3fdfc1319
...
============================================================================
Name:             HMC_ShangHai_vhmc1
Site:             Site_ShangHai
Ip:               9.3.18.35
Login:            hscroot

                        Managed Host List:

Host Name                               Uuid
=========                               ====
HAM-9179-MHD-SN106DBEP                  8405b4db-629d-3f8d-907e-201d1ffd8f13
...
============================================================================

Name:             HMC_ShangHai_vhmc2
Site:             Site_ShangHai
Ip:               9.3.18.37
Login:            hscroot

                        Managed Host List:

Host Name                               Uuid
=========                               ====
HAM-9179-MHD-SN106DBEP                  8405b4db-629d-3f8d-907e-201d1ffd8f13
...
============================================================================
```

Example 6-27 shows the current VM status in the IBM Geographically Dispersed Resiliency for Power Systems cluster. All four VMs are in the READY_TO_MOVE state.

Example 6-27 Display the VM status before the planned site-switch operation

```
# ksysmgr query vm state=manage|more
Managed VMs:
        pbrazos015_RedHat
        pbrazos010_vscsi_npiv
        pbrazos012_npiv
        pbrazos009_suse

Name:            pbrazos015_RedHat
UUID:            5BA0080B-0DC2-417A-9D21-70B489462676
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos010_vscsi_npiv
UUID:            3CE82119-A851-4DCB-BB18-79AF61021F73
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos012_npiv
UUID:            1A2EA573-53E4-4743-9057-FE5822158E78
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE

Name:            pbrazos009_suse
UUID:            0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE
...
```

Example 6-28 shows the current SRDF status in the IBM Geographically Dispersed Resiliency for Power Systems cluster. The disks of the active site storage are in R1 and have a Read Write status. The storage's ID is 000196800508.

Example 6-28 Display the disk pair's status before a planned site-switch operation

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symrdf list|egrep "\:68|\:140"
Local Device View
-------------------------------------------------------------------------
                     STATUS    MODES                 RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
03252 02425   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
03253 02420   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
03256 02421   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
03257 02422   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
03258 02423   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
03259 02424   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
0325B 02426   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
0325C 02427   R1:68  RW RW RW  A..1.       0       0 RW  WD   Consistent
03269 0243D   R1:140 RW RW RW  A..1.       0       0 RW  WD   Consistent
```

6.4.3 The result of the discover and verify operations

Before beginning the discover and verify phase, shut down vhmc1 (HMC_BeiJing_vhmc1) with IP address 9.3.18.34. Another HMC in the active site is vhmc3 (HMC_BeiJing_vhmc2) with IP address 9.3.18.36.

Example 6-29 shows the output of the discovery operation, including the error information.

Example 6-29 IBM Geographically Dispersed Resiliency for Power Systems discovery operation in one HMC fails at active site scenario

```
# ksysmgr -l max -t discovery site Site_BeiJing
21:53:14 Running discovery on entire site, this may take few minutes...
        21:53:27 Storage state synchronization has started for Site Site_BeiJing
        21:54:25 Storage state synchronization has completed for Site Site_BeiJing
        22:00:15 Discovery has started for VM pbrazos009_suse
        22:00:15 Configuration information retrieval started for VM pbrazos009_suse
        22:00:15 Discovery has started for VM pbrazos012_npiv
        22:00:15 Configuration information retrieval started for VM pbrazos012_npiv
        22:00:15 Discovery has started for VM pbrazos010_vscsi_npiv
        22:00:15 Configuration information retrieval started for VM pbrazos010_vscsi_npiv
        22:00:15 Discovery has started for VM pbrazos015_RedHat
        22:00:15 Configuration information retrieval started for VM pbrazos015_RedHat
        22:00:26 Configuration information retrieval completed for VM pbrazos009_suse
        22:00:26 Configuration information retrieval completed for VM pbrazos012_npiv
        22:00:26 Configuration information retrieval completed for VM pbrazos010_vscsi_npiv
        22:00:26 Configuration information retrieval completed for VM pbrazos015_RedHat
        22:00:26 Storage information retrieval from VIOS started for VM pbrazos009_suse
        22:00:26 Storage information retrieval from VIOS started for VM pbrazos012_npiv
        22:00:26 Storage information retrieval from VIOS started for VM pbrazos010_vscsi_npiv
        22:00:26 Storage information retrieval from VIOS started for VM pbrazos015_RedHat
        22:00:26 Storage information retrieval from VIOS completed for VM pbrazos009_suse
        22:00:26 Discovery for VM pbrazos009_suse is complete
        22:00:26 Storage information retrieval from VIOS completed for VM pbrazos012_npiv
        22:00:26 Discovery for VM pbrazos012_npiv is complete
        22:00:26 Storage information retrieval from VIOS completed for VM pbrazos010_vscsi_npiv
        22:00:26 Discovery for VM pbrazos010_vscsi_npiv is complete
        22:00:26 Storage information retrieval from VIOS completed for VM pbrazos015_RedHat
        22:00:26 Discovery for VM pbrazos015_RedHat is complete
        22:00:38 Disk Group creation on storage subsystem started for Site Site_ShangHai
        22:00:38 Disk Group creation on storage subsystem started for Site Site_BeiJing
        22:05:57 Disk Group creation on storage subsystem completed for Site Site_ShangHai
        22:05:57 Disk Group creation on storage subsystem completed for Site Site_BeiJing
22:09:32 Discovery has finished for Site_BeiJing
4 out of 4 managed VMs have been successfully discovered
```

From the output of Example 6-29, you see that it took about five minutes to switch the HMC (between the second line to the third line).

Example 6-30 shows information from the KSYS trace file, and indicates that KSYS tried vhmc1 first, and then vhmc3 to continue the discovery operation.

Example 6-30 Display detailed information from the KSYS trace file

```
[13] 11/03/16 T(203) _VMR 21:55:21.499573HMC_SchedPingCb - Addr UNREACHABLE: HMC_BeiJing_vhmc1, IP=9.3.18.34
[13] 11/03/16 T(381) _VMR 21:55:35.019634            DEBUG VMR_HMC.C[3432]: REST Error!. krigetHmcInfo() Failed. rc = -1
[13] 11/03/16 T(381) _VMR 21:55:35.019636            DEBUG librest Error: return Status: 3
                                                        retry_flag = 11, httpRC = 0, lastErrorLength = 512
                                                        hmcError = ,
                                                        lastError = Unable to connect to host.| Could not retrieve
</rest/api/uom/ManagementConsole>: <>.
[13] 11/03/16 T(381) _VMR 21:55:35.019660            VMR_HMC.C(2799):[ERROR,HMC,HMC_BeiJing_vhmc1] Coudn't get the HMC details
[13] 11/03/16 T(381) _VMR 21:55:35.019661          VMR_HMCRcp::discover_HMC Leaving
[13] 11/03/16 T(381) _VMR 21:55:35.019666          VMR_HMC.C(2853):[ INFO,HMC,HMC_BeiJing_vhmc1] End discover_HMC HMC_BeiJing_vhmc1
[13] 11/03/16 T(381) _VMR 21:55:35.019676      VMR_HMC.C(1253):[ INFO,HMC,HMC_BeiJing_vhmc1] Verify_HMCRcp for HMC = HMC_BeiJing_vhmc1
completed
[13] 11/03/16 T(381) _VMR 21:55:35.019683    VMR_HMCRcp::verify_HMCRcp Entered. HMC Name = HMC_BeiJing_vhmc2, HmcIP = 9.3.18.36
[13] 11/03/16 T(381) _VMR 21:55:35.019687        VMR_HMC.C(1208):[ INFO,HMC,HMC_BeiJing_vhmc2] Verify_HMCRcp for HMC = HMC_BeiJing_vhmc2,
IP = 9.3.18.36
[13] 11/03/16 T(381) _VMR 21:55:35.019689         VMR_HMCRcp::discover_HMC Entered. type = 3
[13] 11/03/16 T(381) _VMR 21:55:35.019692            VMR_HMC.C(2762):[ INFO,HMC,HMC_BeiJing_vhmc2] Start discover_HMC HMC_BeiJing_vhmc2
```

Example 6-31 shows the output of the verify operation. Because the verify operation mainly checks the resources of the target site, this operation succeeded.

Example 6-31 IBM Geographically Dispersed Resiliency for Power Systems verify in one HMC fails at active site scenario

```
# ksysmgr -l max -t verify site Site_BeiJing
22:12:34 Site verification started for Site_BeiJing
        22:12:39 HAM-9179-MHD-SN106DBEP verification has started
        22:12:56 HAM-9179-MHD-SN106DBEP verification has completed
        22:13:05 pbrazos009_suse verification has started
        22:13:05 pbrazos010_vscsi_npiv verification has started
        22:13:05 pbrazos012_npiv verification has started
        22:13:05 pbrazos015_RedHat verification has started
        22:13:14 pbrazos009_suse verification has completed
        22:13:14 pbrazos010_vscsi_npiv verification has completed
        22:13:14 pbrazos012_npiv verification has completed
        22:13:14 pbrazos015_RedHat verification has completed
        22:13:14 Disk Group verification on storage subsystem started for Site Site_BeiJing
        22:16:34 Disk Group verification on storage subsystem completed for Site Site_BeiJing
22:16:45 Verification has finished for Site_BeiJing
4 out of 4 VMs have been successfully verified
```

6.4.4 Starting the planned move operation

During the discover and verify processes, IBM Geographically Dispersed Resiliency for Power Systems knows that vhmc1 (HMC_BeiJing_vhmc1) is unreachable, but because there is another HMC at the active site, it can access the pbrazos host, so the process also succeeded. Now, start a planned move operation. Example 6-32 shows the output of a planned move operation.

Example 6-32 Planned site move in the one HMC fails at active site scenario

```
# ksysmgr -t move site from=Site_BeiJing to=Site_ShangHai  type=planned
15:45:29 Site move started for Site_BeiJing to Site_ShangHai
        15:45:40 Shutdown on Site_BeiJing site has started for VM pbrazos009_suse
        15:45:40 Shutdown on Site_BeiJing site has started for VM pbrazos012_npiv
        15:45:40 Shutdown on Site_BeiJing site has started for VM pbrazos010_vscsi_npiv
        15:45:40 Shutdown on Site_BeiJing site has started for VM pbrazos015_RedHat
```

```
        15:50:00 Shutdown on Site_BeiJing site has completed for VM pbrazos015_RedHat --Wait for
GDR to switch to another HMC to continue shutdown operation.
        15:50:08 Shutdown on Site_BeiJing site has completed for VM pbrazos009_suse
        15:50:44 Shutdown on Site_BeiJing site has completed for VM pbrazos012_npiv
        15:50:53 Shutdown on Site_BeiJing site has completed for VM pbrazos010_vscsi_npiv
        15:50:53 Storage mirror reversal has started
        15:50:54 Mirroring will be setup from Site_ShangHai to Site_BeiJing
        15:53:30 Storage mirror reversal has completed
        15:54:07 Restart on Site_ShangHai site has started for VM pbrazos009_suse
        15:54:07 Restart on Site_ShangHai site has started for VM pbrazos012_npiv
        15:54:07 Restart on Site_ShangHai site has started for VM pbrazos010_vscsi_npiv
        15:54:07 Restart on Site_ShangHai site has started for VM pbrazos015_RedHat
        15:55:11 Restart on Site_ShangHai site has completed for VM pbrazos012_npiv
        15:55:11 Move has completed for VM pbrazos012_npiv
        15:55:11 Configuration cleanup on Site_BeiJing site for VM pbrazos012_npiv
        15:55:20 Restart on Site_ShangHai site has completed for VM pbrazos009_suse
        15:55:20 Move has completed for VM pbrazos009_suse
        15:55:20 Configuration cleanup on Site_BeiJing site for VM pbrazos009_suse
        15:55:20 Restart on Site_ShangHai site has completed for VM pbrazos010_vscsi_npiv
        15:55:20 Move has completed for VM pbrazos010_vscsi_npiv
        15:55:20 Configuration cleanup on Site_BeiJing site for VM pbrazos010_vscsi_npiv
        15:55:20 Restart on Site_ShangHai site has completed for VM pbrazos015_RedHat
        15:55:20 Move has completed for VM pbrazos015_RedHat
        15:55:20 Configuration cleanup on Site_BeiJing site for VM pbrazos015_RedHat
        15:55:29 Rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        15:55:38 Done rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        15:55:56 Rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        15:55:56 Rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
        15:55:56 Done rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
        15:56:05 Done rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        15:56:14 Rediscovering configuration for VM pbrazos010_vscsi_npiv on site Site_ShangHai
        15:56:23 Done rediscovering configuration for VM pbrazos010_vscsi_npiv on site
Site_ShangHai
Site move completed from Site_BeiJing to Site_ShangHai
4 out of 4 VMs have been successfully moved from Site_BeiJing to Site_ShangHai
Site_ShangHai is now the active site
```

From the output that is shown in Example 6-32 on page 317, you see that the planned move operation succeeds. During the shutdown VM process, it takes about 4 minutes (from 15:45:40 to 15:50:00). Example 6-33 shows how IBM Geographically Dispersed Resiliency for Power Systems switches to another HMC in the VMR trace file.

Example 6-33 Display detailed information from the KSYS trace file

```
[28] 10/31/16 _VMR 15:48:34.720666HMC_SchedPingCb - Addr UNREACHABLE: HMC_BeiJing_vhmc1, IP=9.3.18.34
[28] 10/31/16 _VMR 15:48:34.720674VMR_HMCRccp::pingReport Entered, reachable=3, unreachable=1
[28] 10/31/16 _VMR 15:48:34.720696VMR_HMCRccp::pingReport Leaving
[28] 10/31/16 _VMR 15:48:40.380488 DEBUG VMR_retry.C[381]: VIOS Busy: No of retries exhausted!
[28] 10/31/16 _VMR 15:48:40.380489 DEBUG VMR_retry.C[423]: In do_retry, fnrc is -1
[28] 10/31/16 _VMR 15:48:40.380490 DEBUG VMR_retry.C[427]: Error at REST HMC connect level even after
retrying multiple times, retry with other HMCs ()!
[28] 10/31/16 _VMR 15:48:40.380496 DEBUG VMR_retry.C[148]: Failed to do operation with HMC
HMC_BeiJing_vhmc1, need to try with other HMCs if present
[28] 10/31/16 _VMR 15:48:40.380507 DEBUG VMR_retry.C[165]: retrying the operation with next HMC
[28] 10/31/16 _VMR 15:48:40.380514 DEBUG VMR_HMC.C[4401]: INFO: Checking state of VM. VMid:
616D4AF1-8BE0-4A4C-8253-5CB7F45F8658.
```

```
[28] 10/31/16 _VMR 15:48:40.380517 DEBUG VMR_HMC.C[3898]: Calling krigetLparInfo.. HMC:9.3.18.36, lpar uuid
= 616D4AF1-8BE0-4A4C-8253-5CB7F45F8658
[05] 10/31/16 _VMR 15:48.40 380520 DEBUG libkrest.c[1191]:
krigetLparInfo:hmc->(9.3.18.36),vm->(616D4AF1-8BE0-4A4C-8253-5CB7F45F8658)
[28] 10/31/16 _VMR 15:48:40.380729 DEBUG VMR_retry.C[381]: VIOS Busy: No of retries exhausted!
[28] 10/31/16 _VMR 15:48:40.380730 DEBUG VMR_retry.C[423]: In do_retry, fnrc is -1
[28] 10/31/16 _VMR 15:48:40.380731 DEBUG VMR_retry.C[427]: Error at REST HMC connect level even after
retrying multiple times, retry with other HMCs ()!
```

IBM Geographically Dispersed Resiliency for Power Systems tries HMC_BeiJing_vhmc1 to shut down the VM, but failed. After several attempts, IBM Geographically Dispersed Resiliency for Power Systems gives up and switches to HMC_BeiJing_vhmc2 to continue the operation.

Because this is a planned move operation, the SRDF is reversed. Example 6-34 shows that the RDF type of source site's devices is changed to R2 and write-disable while the disk pair's state is still Consistent. This situation indicates that the disks pairs reversed successfully.

Example 6-34 Display the SRDF devices status after a planned move operation

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symrdf list
---------------------------------------------------------------------------
                      STATUS    MODES                    RDF  S T A T E S
Sym   Sym   RDF       --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G     SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- --------  --------- ----- ------- ------- --- ---- -------------
03252 02425   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
03253 02420   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
03256 02421   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
03257 02422   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
03258 02423   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
03259 02424   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
0325B 02426   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
0325C 02427   R2:68   WD WD RW  A..2.       0       0 WD  RW   Consistent
03269 0243D   R2:140  WD WD RW  A..2.       0       0 WD  RW   Consistent
```

6.4.5 Scenario summary

In the IBM Geographically Dispersed Resiliency for Power Systems solution, if you configure redundant HMCs for one site, IBM Geographically Dispersed Resiliency for Power Systems can switch to the other HMC when one HMC fails.

6.5 Unplanned failure of all HMCs at active site

Section 6.4, “Planned hardware management console failure at the active site” on page 312 illustrates that IBM Geographically Dispersed Resiliency for Power Systems provides HMC redundancy configuration for each site, and can switch to another available HMC when one HMC fails. If all the HMCs at one site fail, IBM Geographically Dispersed Resiliency for Power Systems cannot perform any operation for the VMs at this site. You must run an unplanned move if you want to migrate the VMs to another site.

6.5.1 Scenario description

In this scenario (Figure 6-8), each site has two HMCs, and at Site_BeiJing, the two HMCs manage the pbrazos host. This scenario simulates the failures of two HMC and describes how to perform a site-switch operation.

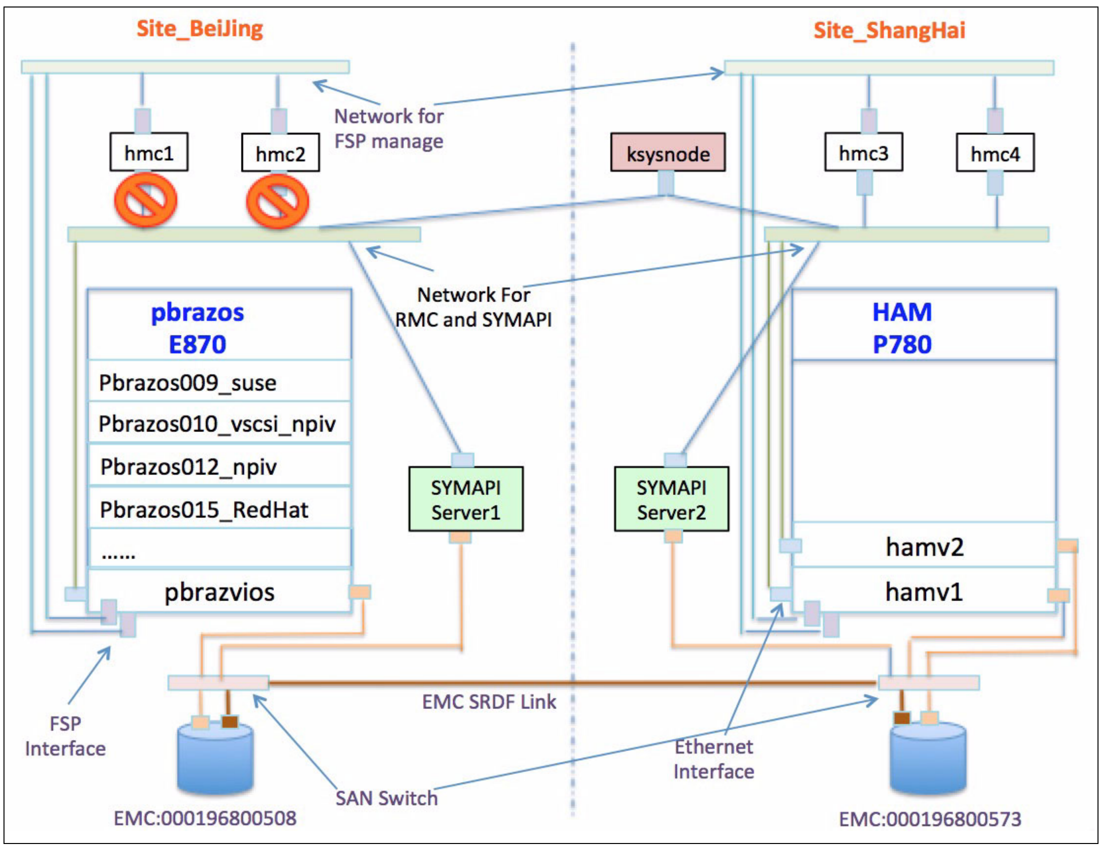


Figure 6-8 Testing topology where all the HMCs fail at the active site scenario

6.5.2 Initial status

The cluster initial status is similar to 6.4.2, “Initial status” on page 313. The difference is KSYS cannot access all the HMCs at Site_BeiJing.

6.5.3 Result of the discover and verify operations

All of the VMs' state are READY_TO_MOVE. If you perform a verify operation, it succeeds because the verify operation checks whether the target site is ready for a move. Example 6-35 shows the output of the verify operation. After the verify operation, the VMs' state are still READY_TO_MOVE.

Example 6-35 IBM Geographically Dispersed Resiliency for Power Systems verify when all HMCs fail at the active site scenario

```
# ksysmgr -l max -t verify site Site_BeiJing
11:10:00 Site verification started for Site_BeiJing
        11:10:06 HAM-9179-MHD-SN106DBEP verification has started
        11:10:23 HAM-9179-MHD-SN106DBEP verification has completed
        11:10:23 pbrazos009_suse verification has started
        11:10:23 pbrazos010_vscsi_npiv verification has started
        11:10:23 pbrazos012_npiv verification has started
        11:10:23 pbrazos015_RedHat verification has started
        11:10:32 pbrazos009_suse verification has completed
        11:10:32 pbrazos010_vscsi_npiv verification has completed
        11:10:32 pbrazos012_npiv verification has completed
        11:10:32 pbrazos015_RedHat verification has completed
        11:10:32 Disk Group verification on storage subsystem started for Site Site_BeiJing
        11:14:01 Disk Group verification on storage subsystem completed for Site Site_BeiJing
11:14:19 Verification has finished for Site_BeiJing
4 out of 4 VMs have been successfully verified
```

There are no errors from the output of the verify operation. If you perform a discovery operation at this time, there is nothing that IBM Geographically Dispersed Resiliency for Power Systems can discover because IBM Geographically Dispersed Resiliency for Power Systems cannot access all the HMCs at the active site. Example 6-36 shows the output of the discovery operation.

Example 6-36 IBM Geographically Dispersed Resiliency for Power Systems discovery when all HMCs fail at the active site scenario

```
# ksysmgr -l max -t discovery site Site_BeiJing
11:14:59 Running discovery on entire site, this may take few minutes...
        11:15:12 Storage state synchronization has started for Site Site_BeiJing
        11:16:10 Storage state synchronization has completed for Site Site_BeiJing
        11:27:36 Disk Group creation on storage subsystem started for Site Site_BeiJing
        11:30:43 Disk Group creation on storage subsystem completed for Site Site_BeiJing
11:30:59 Discovery has finished for Site_BeiJing
0 out of 0 managed VMs have been successfully discovered
```

From the output, you can see that no VM is discovered. From the KSYS trace log, you can see that KSYS tried the HMCs but failed, as shown in Example 6-37.

Example 6-37 Display detailed information from the KSYS trace file

```
[09] 11/01/16 T(37e) _VMR 11:19:47.710414         VMR_CEC.C(7787):[ INFO,CEC,6ce366c5-f05d-3a12-94f8-94a3fdfc1319]
With HMC:HMC_BeiJing_vhmc1VIOS/HMC_BUSY condition: Retrying.... Operation failed with error code:3, error:
                                                  Unable to connect to host.| Could not retrieve
</rest/api/uom/ManagedSystem/6ce366c5-f05d-3a12-94f8-94a3fdfc1319?group=None>: <>.
[16] 11/01/16 T(37e) _VMR 11:19:47.710395     [ WARN]: VIOS/HMC_BUSY condition: Retrying...
..
[16] 11/01/16 T(37e) _VMR 11:24:02.720837     [ INFO,VMR_CECRcp,6ce366c5-f05d-3a12-94f8-94a3fdfc1319] With
HMC:HMC_BeiJing_vhmc2VIOS/HMC_BUSY condition: Retrying.... Operation failed with error code:3, error:
                                             Unable to connect to host.| Could not retrieve
</rest/api/uom/ManagedSystem/6ce366c5-f05d-3a12-94f8-94a3fdfc1319?group=None>: <>.
[09] 11/01/16 T(37e) _VMR 11:24:02.720790         DEBUG VMR_HMC.C[3503]: REST Error!. krigetCecInfo failed. rc = -1
..
[09] 11/01/16 T(203) _VMR 11:24:29.729576HMC_SchedPingCb - Addr UNREACHABLE: HMC_BeiJing_vhmc1, IP=9.3.18.34
[09] 11/01/16 T(203) _VMR 11:24:29.729580HMC_SchedPingCb - Addr UNREACHABLE: HMC_BeiJing_vhmc2, IP=9.3.18.36
...
```

During the discovery operation, the VM state changed to INIT. Example 6-38 shows the current VM state.

Example 6-38 Display VM state after the IBM Geographically Dispersed Resiliency for Power Systems discovery operation

```
# ksysmgr q vm state=manage|more
Managed VMs:
        pbrazos015_RedHat
        pbrazos012_npiv
        pbrazos009_suse
        pbrazos010_vscsi_npiv


All VMs:
Name:           pbrazos015_RedHat
UUID:           5BA0080B-0DC2-417A-9D21-70B489462676
Host:           pbrazos_9119-MME-21BBC47
State:          INIT

Name:           pbrazos012_npiv
UUID:           1A2EA573-53E4-4743-9057-FE5822158E78
Host:           pbrazos_9119-MME-21BBC47
State:          INIT

Name:           pbrazos009_suse
UUID:           0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:           pbrazos_9119-MME-21BBC47
State:          INIT

Name:           pbrazos010_vscsi_npiv
UUID:           3CE82119-A851-4DCB-BB18-79AF61021F73
Host:           pbrazos_9119-MME-21BBC47
State:          INIT
```

When one VM is in the INIT state, you cannot perform a verify and planned move operation. Otherwise, KSYS gives an error and refuses this operation, as shown in Example 6-39.

Example 6-39 IBM Geographically Dispersed Resiliency for Power Systems verify operation when all HMCs at the active site fail scenario

```
# ksysmgr -l max -t verify site Site_BeiJing
Some of the VMs are not ready for verify, please run "ksysmgr discover site -h"
VM List that are undiscovered:
                        pbrazos009_suse
                        pbrazos010_vscsi_npiv
                        pbrazos012_npiv
                        pbrazos015_RedHat
Please run discover on the entire site to proceed with verification
```

6.5.4 Starting an unplanned move operation

When all the HMCs at the active site fail and you want to perform a site-switch operation, run an unplanned move, as shown in Example 6-40.

Example 6-40 Unplanned site switch when all HMCs fail at the active site scenario

```
# ksysmgr -t move site from=Site_BeiJing to=Site_ShangHai  type=unplanned
16:27:30 Site move started for Site_BeiJing to Site_ShangHai
        16:27:41 Shutdown on Site_BeiJing site has started for VM pbrazos009_suse
        16:27:41 Shutdown on Site_BeiJing site has started for VM pbrazos012_npiv
        16:27:41 Shutdown on Site_BeiJing site has started for VM pbrazos010_vscsi_npiv
        16:27:41 Shutdown on Site_BeiJing site has started for VM pbrazos015_RedHat
        16:35:47 Shutdown on Site_BeiJing site has completed for VM pbrazos009_suse
        16:35:47 Shutdown on Site_BeiJing site has completed for VM pbrazos012_npiv
        16:35:47 Shutdown on Site_BeiJing site has completed for VM pbrazos010_vscsi_npiv
        16:35:47 Shutdown on Site_BeiJing site has completed for VM pbrazos015_RedHat
        16:35:47 Storage mirror reversal has started
        16:35:48 Mirroring will be setup from Site_ShangHai to Site_BeiJing
        16:36:25 Storage mirror reversal has completed
        16:37:02 Restart on Site_ShangHai site has started for VM pbrazos009_suse
        16:37:02 Restart on Site_ShangHai site has started for VM pbrazos012_npiv
        16:37:02 Restart on Site_ShangHai site has started for VM pbrazos010_vscsi_npiv
        16:37:02 Restart on Site_ShangHai site has started for VM pbrazos015_RedHat
        16:38:24 Restart on Site_ShangHai site has completed for VM pbrazos009_suse
        16:38:24 Move has completed for VM pbrazos009_suse
        16:38:24 Rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        16:38:24 Restart on Site_ShangHai site has completed for VM pbrazos010_vscsi_npiv
        16:38:24 Move has completed for VM pbrazos010_vscsi_npiv
        16:38:24 Rediscovering configuration for VM pbrazos010_vscsi_npiv on site Site_ShangHai
        16:38:33 Done rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        16:38:33 Restart on Site_ShangHai site has completed for VM pbrazos012_npiv
        16:38:33 Move has completed for VM pbrazos012_npiv
        16:38:33 Rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        16:38:33 Done rediscovering configuration for VM pbrazos010_vscsi_npiv on site Site_ShangHai
        16:38:33 Restart on Site_ShangHai site has completed for VM pbrazos015_RedHat
        16:38:33 Move has completed for VM pbrazos015_RedHat
        16:38:33 Rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
        16:38:42 Done rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        16:38:42 Done rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
        ERROR: Move has encountered for host pbrazos_9119-MME-21BBC47 please investigate
Please review errors.  The "ksysmgr query system status" command may provide additional details.
```

During the unplanned move operation, KSYS tries to shut down VMs at the active site. After attempting the shutdown for about 8 minutes, KSYS gives up and continues the operation. At the end of the move operation, there is a rediscover phase where KSYS checks the source site's status. Because the two HMCs are still offline, KSYS reports an ERROR message in this rediscovery phase.

Figure 6-9 shows the four VMs that are online at the target site after the move operation.

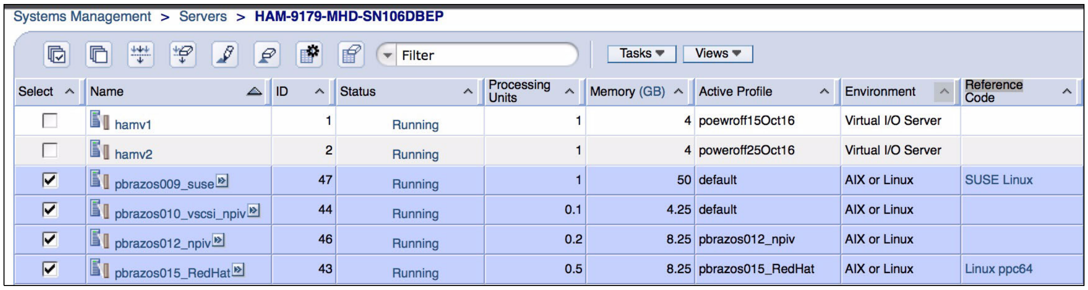


Figure 6-9 All four VMs are online at the target site

Example 6-41 shows that KSYS tries the two HMCs but fails, gives up, and continues other operations.

Example 6-41 KSYS trace file shows that two hardware management consoles fail

```
[32] 10/31/16 _VMR 16:35:34.699871 HMC_SchedPingCb - Addr UNREACHABLE: HMC_BeiJing_vhmc2, IP=9.3.18.36
[32] 10/31/16 _VMR 16:35:34.699874 HMC_SchedPingCb - Addr UNREACHABLE: HMC_BeiJing_vhmc1, IP=9.3.18.34
...
[32] 10/31/16 _VMR 16:35:42.179975 DEBUG VMR_retry.C[381]: VIOS Busy: No of retries exhausted!
[32] 10/31/16 _VMR 16:35:42.179977 DEBUG VMR_retry.C[423]: In do_retry, fnrc is -1
[32] 10/31/16 _VMR 16:35:42.179978 DEBUG VMR_retry.C[427]: Error at REST HMC connect level even after retrying multiple
times, retry with other HMCs ()!


[32] 10/31/16 _VMR 16:35:42.179983 DEBUG VMR_retry.C[148]: Failed to do operation with HMC HMC_BeiJing_vhmc2, need to
try with other HMCs if present
[36] 10/31/16 _VMR 16:35:42.180001 [ERROR,VMR_LPARRcp,5BA0080B-0DC2-417A-9D21-70B489462676] POWER OFF failed for LPAR
pbrazos015_RedHat. uuid: 5BA0080B-0DC2-417A-9D21-70B489462676, but continuing as unplanned.
[32] 10/31/16 _VMR 16:35:42.180004 VMR_LPAR.C(5026):[ERROR,LPAR,5BA0080B-0DC2-417A-9D21-70B489462676] POWER OFF failed
for LPAR pbrazos015_RedHat. uuid: 5BA0080B-0DC2-417A-9D21-70B489462676, but continuing as unplanned.
[36] 10/31/16 _VMR 16:35:42.180008 [ INFO,VMR_LPARRcp,5BA0080B-0DC2-417A-9D21-70B489462676] STATE: Phase is being
changed from: RECOVERY_OFFLINE to: READY
```

The last phase of site switch is the rediscovery operation at the target site, which reports an error during this process. Example 6-42 shows the error message during the rediscovery phase in the KSYS trace file.

Example 6-42 KSYS trace file shows rediscovery error message

```
[36] 10/31/16 _VMR 16:42:53.761929   [ERROR,VMR_CECRcp,6ce366c5-f05d-3a12-94f8-94a3fdfc1319]
Discover_CEC failed for CEC pbrazos_9119-MME-21BBC47!
[32] 10/31/16 _VMR 16:42:53.761931
VMR_CEC.C(6657):[ERROR,CEC,6ce366c5-f05d-3a12-94f8-94a3fdfc1319] Discover_CEC failed for CEC
pbrazos_9119-MME-21BBC47!
```

How KSYS handles SRDF/A in an unplanned move

Because this move operation is an unplanned one, KSYS performs the following steps for the CG at the target site:

1. Disables consistency attribution for the CG.
2. Sets write-disable for R1 devices.
3. Fails over the RDF group.
4. Enables consistency attribution for the CG.

Example 6-43 shows the steps in the `ksys_srdf.log` file.

> **Note:** By default, the `ksys_srdf.log` file is in the `/var/ksys/log` directory.

Example 6-43 Display the SRDF operation during the unplanned site switch operation

```
Mon Oct 31 16:35:43 CDT 2016 896:reverse_emc_srdf_cg: 71 : Reverse Operation for
VMRDG_itso3_cluster_Site_ShangHai Requested
Mon Oct 31 16:35:43 CDT 2016 896:reverse_emc_srdf_cg: get_SYM_Server : Service Name :
SYMAPI_SITE_573
Mon Oct 31 16:35:55 CDT 2016 896:reverse_emc_srdf_cg: 119 : CG:
VMRDG_itso3_cluster_Site_ShangHai in Asynchronous
Mon Oct 31 16:35:55 CDT 2016 896:reverse_emc_srdf_cg: 136 : Info: CG
VMRDG_itso3_cluster_Site_ShangHai in UNPLAN
Mon Oct 31 16:35:55 CDT 2016 896:reverse_emc_srdf_cg: 150 : SID:196800573 : SOURCE for
VMRDG_itso3_cluster_Site_ShangHai
Mon Oct 31 16:35:55 CDT 2016 896:reverse_emc_srdf_cg: 161 : Info: CG
VMRDG_itso3_cluster_Site_ShangHai in State:Consistent Type:RDF2
Mon Oct 31 16:35:55 CDT 2016 896:reverse_emc_srdf_cg: CG_DisableConsistency :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Mon Oct 31 16:35:57 CDT 2016 896:reverse_emc_srdf_cg: CG_DisableConsistency : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Mon Oct 31 16:35:57 CDT 2016 896:reverse_emc_srdf_cg: CG_WriteDisable :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Mon Oct 31 16:36:00 CDT 2016 896:reverse_emc_srdf_cg: CG_WriteDisable : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Mon Oct 31 16:36:00 CDT 2016 896:reverse_emc_srdf_cg: CG_Failover :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Mon Oct 31 16:36:20 CDT 2016 896:reverse_emc_srdf_cg: CG_Failover : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Mon Oct 31 16:36:20 CDT 2016 896:reverse_emc_srdf_cg: CG_EnableConsistency :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Mon Oct 31 16:36:24 CDT 2016 896:reverse_emc_srdf_cg: CG_EnableConsistency : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Mon Oct 31 16:36:24 CDT 2016 896:reverse_emc_srdf_cg: 507 : CG VMRDG_itso3_cluster_Site_ShangHai
Reverse Operation Completed
Mon Oct 31 16:36:24 CDT 2016 896:reverse_emc_srdf_cg: 508 : Operation Completed Successfully
```

When the unplanned move operation is complete, the devices at the source site are in R1 and in the write-disable status, and devices at the target site are in R2 and in the read-write status. The disk pairs are in the failed-over status, as shown in Example 6-44.

Example 6-44 Display the SRDF status after the unplanned site switch operation

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symrdf list|egrep "\:68|\:140"
---------------------------------------------------------------------------
                     STATUS    MODES                    RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
03252 02425   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
03253 02420   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
03256 02421   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
03257 02422   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
03258 02423   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
03259 02424   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
0325B 02426   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
0325C 02427   R1:68  WD RW NR  A..1.       0       0 WD  RW   Failed Over
03269 0243D   R1:140 WD RW NR  A..1.       0       2 WD  RW   Failed Over

# export SYMCLI_CONNECT=SYMAPI_SITE_573
# symrdf list|egrep "\:68|\:140"
02420 03253   R2:68  RW RW NR  A..2.     533       0 RW  WD   Failed Over
02421 03256   R2:68  RW RW NR  A..2.       0       0 RW  WD   Failed Over
02422 03257   R2:68  RW RW NR  A..2.       0       0 RW  WD   Failed Over
02423 03258   R2:68  RW RW NR  A..2.     510       0 RW  WD   Failed Over
02424 03259   R2:68  RW RW NR  A..2.       0       0 RW  WD   Failed Over
02425 03252   R2:68  RW RW NR  A..2.   82337       0 RW  WD   Failed Over
02426 0325B   R2:68  RW RW NR  A..2.       0       0 RW  WD   Failed Over
02427 0325C   R2:68  RW RW NR  A..2.       0       0 RW  WD   Failed Over
0243D 03269   R2:140 RW RW NR  A..2.      86       0 RW  WD   Failed Over
```

You can also see the status in the storage CG's view, as shown in Example 6-45.

Example 6-45 Display the Dell EMC Consistency Group's status after the unplanned site switch operation

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        : 140 (8B)

         Source (R1) View                Target (R2) View      MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
```

```
Standard        A                  N        A
Logical   Sym   T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv      RDF Pair
Device    Dev   E Tracks  Tracks   S Dev    E Tracks  Tracks MACE STATE
-------------------------------- -- ------------------------ ---- ------------
DEV008    03269 WD       0       2 NR 0243D RW      86        0 A.X. Failed Over

Symmetrix ID                  : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID           : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number         :  68 (43)

         Source (R1) View                Target (R2) View     MODE
--------------------------------    ------------------------ ---- ------------
              ST                  LI       ST
Standard        A                  N        A
Logical   Sym   T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv      RDF Pair
Device    Dev   E Tracks  Tracks   S Dev    E Tracks  Tracks MACE STATE
-------------------------------- -- ------------------------ ---- ------------
DEV001    03252 WD       0       0 NR 02425 RW   82336        0 A.X. Failed Over
DEV002    03258 WD       0       0 NR 02423 RW     510        0 A.X. Failed Over
DEV003    03259 WD       0       0 NR 02424 RW       0        0 A.X. Failed Over
DEV004    03256 WD       0       0 NR 02421 RW       0        0 A.X. Failed Over
DEV005    03257 WD       0       0 NR 02422 RW       0        0 A.X. Failed Over
DEV006    0325B WD       0       0 NR 02426 RW       0        0 A.X. Failed Over
DEV007    0325C WD       0       0 NR 02427 RW       0        0 A.X. Failed Over
DEV009    03253 WD       0       0 NR 02420 RW     533        0 A.X. Failed Over
```

During the unplanned move operation, KSYS tries to shut down the VMs at the source site. Because all of the HMCs are offline, the shutdown fails. After the HMCs are recovered, you can see the VMs are still online from the HMC GUI, as shown in Figure 6-10.

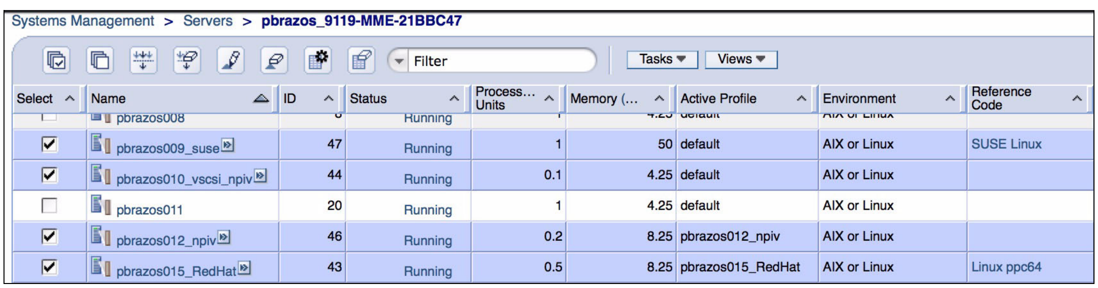


Figure 6-10 Display the VMs status from the source site's HMC after the HMC recovers

Note: Because the devices at the source site are in the write-disable state, the VMs cannot perform any I/O, so the data is safe.

After the unplanned move, the SRDF/A status is broken. You must set the devices in the R1 role at the target site, Site_ShangHai, and set the devices in the R2 role at source site, Site_BeiJing. Then, you must rebuild the data transfer channel from the target site to the source site. The following section describes how to recover the SRDF/A status.

6.5.5 Recovering the SRDF/A status

There are four steps:

- Disable the consistency attribute for the CGs.
- Swap the RDF group.
- Synchronize the data with the **establish** option.
- Enable the consistency attribute for the CGs.

Disabling the consistency attribute for the composite groups

Example 6-46 shows the output of the disable consistency attribute operation.

Example 6-46 Disable the consistency attribute operation

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# /usr/symcli/bin/symcg -cg VMRDG_itso3_cluster_Site_BeiJing -noprompt disable
-force

A consistency 'Disable' operation execution is
in progress for composite group 'VMRDG_itso3_cluster_Site_BeiJing'. Please wait...


The consistency 'Disable' operation successfully executed for
composite group 'VMRDG_itso3_cluster_Site_BeiJing'.
```

Example 6-47 shows that the MODE column of the CG changed from A.X. to A..., which means the consistency attribute is disabled.

Example 6-47 Check the consistency group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  NONE

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        : 140 (8B)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV008   03269 WD       0       2 NR 0243D RW      86       0 A... Failed Over

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        :  68 (43)

         Source (R1) View                Target (R2) View     MODE
```

```
--------------------------------    ----------------------- ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
-------------------------------- -- ----------------------- ---- ------------
DEV001   03252 WD       0        0 NR 02425 RW   82364        0 A... Failed Over
DEV002   03258 WD       0        0 NR 02423 RW     521        0 A... Failed Over
DEV003   03259 WD       0        0 NR 02424 RW       0        0 A... Failed Over
DEV004   03256 WD       0        0 NR 02421 RW       0        0 A... Failed Over
DEV005   03257 WD       0        0 NR 02422 RW       0        0 A... Failed Over
DEV006   0325B WD       0        0 NR 02426 RW       0        0 A... Failed Over
DEV007   0325C WD       0        0 NR 02427 RW       0        0 A... Failed Over
DEV009   03253 WD       0        0 NR 02420 RW     547        0 A... Failed Over
```

Swapping the composite group

Example 6-48 shows the output of the swap operation.

Example 6-48 Swap the consistency group

```
# /usr/symcli/bin/symrdf -cg VMRDG_itso3_cluster_Site_BeiJing swap -noprompt

An RDF 'Swap Personality' operation execution is
in progress for composite group 'VMRDG_itso3_cluster_Site_BeiJing'. Please wait...

    Suspend RDF link(s) for device(s) in (0508,140)..................Started.
    Suspend RDF link(s) for device(s) in (0508,068)..................Started.
    Suspend RDF link(s) for device(s) in (0508,140)..................Done.
    Suspend RDF link(s) for device(s) in (0508,068)..................Done.
    Swap RDF Personality in (0508,140)..............................Started.
    Swap RDF Personality in (0508,068)..............................Started.
    Swap RDF Personality in (0508,140)..............................Done.
    Swap RDF Personality in (0508,068)..............................Done.

The RDF 'Swap Personality' operation successfully executed for
composite group 'VMRDG_itso3_cluster_Site_BeiJing'.
```

Example 6-49 shows that the R1 and R2 roles are swapped. Currently, the devices at the source site are R2 and the devices at the target site are R1.

Example 6-49 Display the composite group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  NONE

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number       : 140 (8B)

         Target (R2) View                Source (R1) View     MODE
```

```
--------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
-------------------------------- -- ------------------------ ---- ------------
DEV008    03269 WD       2       0 NR 0243D RW       0      86 A... Suspended

Symmetrix ID                    : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID             : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number           :  68 (43)

         Target (R2) View                Source (R1) View     MODE
--------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
-------------------------------- -- ------------------------ ---- ------------
DEV001    03252 WD       0       0 NR 02425 RW       0   82364 A... Suspended
DEV002    03258 WD       0       0 NR 02423 RW       0     522 A... Suspended
DEV003    03259 WD       0       0 NR 02424 RW       0       0 A... Suspended
DEV004    03256 WD       0       0 NR 02421 RW       0       0 A... Suspended
DEV005    03257 WD       0       0 NR 02422 RW       0       0 A... Suspended
DEV006    0325B WD       0       0 NR 02426 RW       0       0 A... Suspended
DEV007    0325C WD       0       0 NR 02427 RW       0       0 A... Suspended
DEV009    03253 WD       0       0 NR 02420 RW       0     547 A... Suspended
```

Synchronizing the data with the establish option

Example 6-50 shows the output of the **establish** operation. The **establish** operation synchronizes data from R1 to R2.

Example 6-50 Output of the establish operation

```
# /usr/symcli/bin/symrdf -cg VMRDG_itso3_cluster_Site_BeiJing establish -noprompt

An RDF 'Incremental Establish' operation execution is
in progress for composite group 'VMRDG_itso3_cluster_Site_BeiJing'. Please wait...

    Suspend RDF link(s) for device(s) in (0508,140)..................Done.
    Suspend RDF link(s) for device(s) in (0508,068)..................Done.
    Mark target device(s) in (0508,140) to refresh from source.......Started.
    Devices: 3269-3269 in (0508,140)...............................Marked.
    Mark target device(s) in (0508,140) to refresh from source.......Done.
    Merge track tables between source and target in (0508,140).......Started.
    Devices: 243D-243D in (0508,140)...............................Merged.
    Merge track tables between source and target in (0508,140).......Done.
    Resume RDF link(s) for device(s) in (0508,068)...................Started.
    Resume RDF link(s) for device(s) in (0508,140)...................Started.
    Merge track tables between source and target in (0508,068).......Started.
    Resume RDF link(s) for device(s) in (0508,140)...................Done.
    Devices: 2420-2427 in (0508,068)...............................Merged.
    Merge track tables between source and target in (0508,068).......Done.
    Resume RDF link(s) for device(s) in (0508,068)...................Done.
```

```
The RDF 'Incremental Establish' operation successfully initiated for
composite group 'VMRDG_itso3_cluster_Site_BeiJing'.
```

Example 6-51 shows that the data is in the process of synchronization.

Example 6-51 Display composite groups status

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  NONE

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        : 140 (8B)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T  R1 Inv  R2 Inv   K Sym    T  R1 Inv  R2 Inv      RDF Pair
Device    Dev   E  Tracks  Tracks   S Dev    E  Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------

DEV008   03269 WD       0       1 RW 0243D RW       0      49 A... SyncInProg

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        :  68 (43)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T  R1 Inv  R2 Inv   K Sym    T  R1 Inv  R2 Inv      RDF Pair
Device    Dev   E  Tracks  Tracks   S Dev    E  Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------

DEV001   03252 WD       0       0 RW 02425 RW       0     959 A... SyncInProg
DEV002   03258 WD       0       0 RW 02423 RW       0     522 A... SyncInProg
DEV003   03259 WD       0       0 RW 02424 RW       0       0 A... SyncInProg
DEV004   03256 WD       0       0 RW 02421 RW       0       0 A... SyncInProg
DEV005   03257 WD       0       0 RW 02422 RW       0       0 A... SyncInProg
DEV006   0325B WD       0       0 RW 02426 RW       0       0 A... SyncInProg
DEV007   0325C WD       0       0 RW 02427 RW       0       0 A... SyncInProg
DEV009   03253 WD       0       0 RW 02420 RW       0     547 A... SyncInProg
```

Enabling the consistency attribute for the composite group

Example 6-52 shows the output of enabling the consistency attribute for all the devices in the current CG.

Example 6-52 Enable the composite group consistency attribute

```
# /usr/symcli/bin/symcg -cg VMRDG_itso3_cluster_Site_BeiJing -noprompt enable

A consistency 'Enable' operation execution is
in progress for composite group 'VMRDG_itso3_cluster_Site_BeiJing'. Please wait...


The consistency 'Enable' operation successfully executed for
composite group 'VMRDG_itso3_cluster_Site_BeiJing'.
```

Example 6-53 shows that the MODE column of the CG changed from A. to A.X, which means that the CG is enabled with the consistency attribute.

Example 6-53 Enable the consistency attribution for the composite group

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number       : 140 (8B)

         Target (R2) View              Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv      RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV008   03269 WD       0       1 RW 0243D RW       0      49 A.X. SyncInProg

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number       :  68 (43)

         Target (R2) View              Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv      RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   03252 WD       0       0 RW 02425 RW       0     959 A.X. SyncInProg
DEV002   03258 WD       0       0 RW 02423 RW       0     522 A.X. SyncInProg
DEV003   03259 WD       0       0 RW 02424 RW       0       0 A.X. SyncInProg
DEV004   03256 WD       0       0 RW 02421 RW       0       0 A.X. SyncInProg
```

```
DEV005    03257 WD       0       0 RW 02422 RW       0       0 A.X. SyncInProg
DEV006    0325B WD       0       0 RW 02426 RW       0       0 A.X. SyncInProg
DEV007    0325C WD       0       0 RW 02427 RW       0       0 A.X. SyncInProg
DEV009    03253 WD       0       0 RW 02420 RW       0     547 A.X. SyncInProg
```

After some time, the RDF group status changes from SyncInProg to Consistent, as shown in Example 6-54.

Example 6-54 The data is synced after some time

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        : 140 (8B)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv      RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV008    03269 WD       0       0 RW 0243D RW       0       0 A.X. Consistent

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        :  68 (43)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv      RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001    03252 WD       0       0 RW 02425 RW       0       0 A.X. Consistent
DEV002    03258 WD       0       0 RW 02423 RW       0       0 A.X. Consistent
DEV003    03259 WD       0       0 RW 02424 RW       0       0 A.X. Consistent
DEV004    03256 WD       0       0 RW 02421 RW       0       0 A.X. Consistent
DEV005    03257 WD       0       0 RW 02422 RW       0       0 A.X. Consistent
DEV006    0325B WD       0       0 RW 02426 RW       0       0 A.X. Consistent
DEV007    0325C WD       0       0 RW 02427 RW       0       0 A.X. Consistent
DEV009    03253 WD       0       0 RW 02420 RW       0       0 A.X. Consistent
```

Now, the SRDF/A status is recovered.

6.5.6 Cleaning up the virtual machines at the source site

When the unplanned move is complete, the VMs state change to READY, and their host (pbrzaos) changes to HAM. Example 6-55 shows the current VMs status.

Example 6-55 VMs status after the unplanned move

```
# ksysmgr q vm state=manage|more
Managed VMs:
        pbrazos015_RedHat
        pbrazos012_npiv
        pbrazos009_suse
        pbrazos010_vscsi_npiv


All VMs:
Name:            pbrazos015_RedHat
UUID:            5BA0080B-0DC2-417A-9D21-70B489462676
Host:            HAM-9179-MHD-SN106DBEP
State:           READY

Name:            pbrazos012_npiv
UUID:            1A2EA573-53E4-4743-9057-FE5822158E78
Host:            HAM-9179-MHD-SN106DBEP
State:           READY

Name:            pbrazos009_suse
UUID:            0647FBE2-B8B5-4A2E-86ED-4242702F036C
Host:            HAM-9179-MHD-SN106DBEP
State:           READY

Name:            pbrazos010_vscsi_npiv
UUID:            3CE82119-A851-4DCB-BB18-79AF61021F73
Host:            HAM-9179-MHD-SN106DBEP
State:           READY
```

After the HMCs at the source site are recovered and the VMs are still online, you must shut down the VMs first. Then, you can perform a cleanup operation on them. You can use the **vm** or the **site** option during the cleanup operation. Example 6-56 shows the output of a VM-level cleanup operation.

Example 6-56 Clean up the VMs at the virtual machine level

```
# ksysmgr -t cleanup vm pbrazos015_RedHat
Beginning cleanup for pbrazos015_RedHat
VM cleanup successful for pbrazos015_RedHat

# ksysmgr -t cleanup vm pbrazos012_npiv
Beginning cleanup for pbrazos012_npiv
VM cleanup successful for pbrazos012_npiv

# ksysmgr -t cleanup vm pbrazos009_suse
Beginning cleanup for pbrazos009_suse
VM cleanup successful for pbrazos009_suse

# ksysmgr -t cleanup vm pbrazos010_vscsi_npiv
Beginning cleanup for pbrazos010_vscsi_npiv
VM cleanup successful for pbrazos010_vscsi_npiv
```

Example 6-57 shows the output of the site-level cleanup operation.

Example 6-57 Clean up the virtual machines at the site level

```
# ksysmgr cleanup site  Site_BeiJing
VM cleanup successful for pbrazos009_suse
VM cleanup successful for pbrazos012_npiv
VM cleanup successful for pbrazos010_vscsi_npiv
VM cleanup successful for pbrazos015_RedHat
```

Sometimes, it is not possible to clean up by running the **ksysmgr** command. In this case, you must manually clean up by completing the following steps:

1. Shut down the VMs at the source site.
2. Note the virtual adapters of the VMs, including VSCSI and NPIV.
3. Remove all the VMs from the HMC.
4. Unmap the NPIV virtual adapter from the physical Fibre Channel Port by running the following command:

   ```
   vfcmap -vadapter <Virtual Server Adapter> -fcp
   ```

5. Remove the virtual target device for the VSCSI device by running the following command:

   ```
   rmvdev -vtd <Virtual Target Device>
   ```

6. Remove all the virtual devices by using dynamic LPAR operation, including NPIV and VSCSI.

After these steps are complete, run recovery and verify operations to check whether the current situation satisfies the next move operation.

6.5.7 Scenario summary

This scenario describes the situation when all HMCs are down at the active site, how KSYS performs a site switch operation, and how to recover the environment after an unplanned move.

6.6 Planned failure of the SYMAPI server

In an IBM Geographically Dispersed Resiliency for Power Systems solution, the SYMAPI server is an important module. The KSYS node relies on it to access the Dell EMC Storage. At the time of writing, IBM Geographically Dispersed Resiliency for Power Systems supports only one SYMAPI server for one storage. This scenario introduces how IBM Geographically Dispersed Resiliency for Power Systems performs a move operation if the SYMAPI server at the active site fails.

6.6.1 Scenario description

Figure 6-11 shows the topology for this scenario.

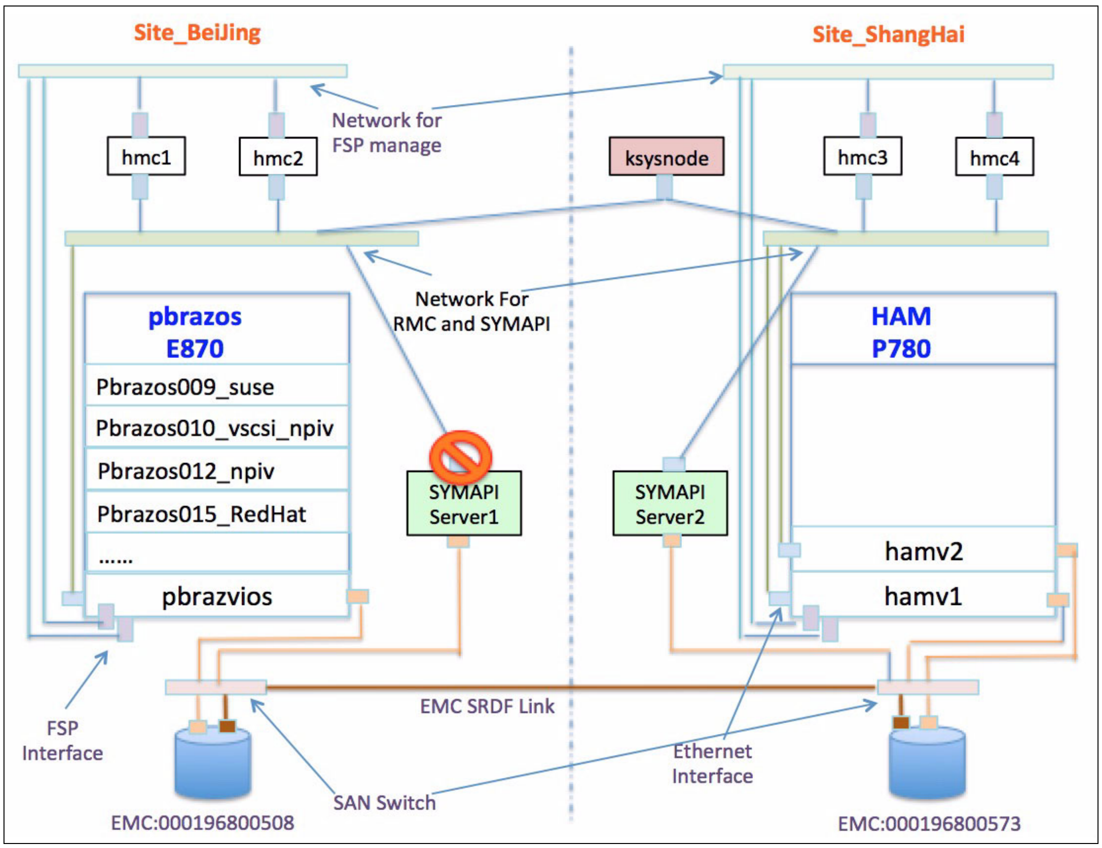


Figure 6-11 Testing topology if the SYMAPI server fails at the active site scenario

In this scenario, Site_BeiJing is the active site, and is the source site. SYMAPI Server1 is at the active site. The KSYS node cannot access the active site's Dell EMC through SYMAPI Server1. At the same time, SYMAPI Server2 is operational.

6.6.2 Initial status

The initial status is the same as described in 6.5.2, “Initial status” on page 320. This section shows only the storage agent configuration in IBM Geographically Dispersed Resiliency for Power Systems, as shown in Example 6-58.

Example 6-58 Display storage agent status

```
# ksysmgr query storage_agent
Name:            sa_ShangHai
Serial:          196800573
Storagetype:     SRDF
Site:            Site_ShangHai
Ip:              10.40.0.31
Login:           default

Name:            sa_BeiJing
Serial:          196800508
Storagetype:     SRDF
Site:            Site_BeiJing
Ip:              10.40.0.30
Login:           default
```

6.6.3 Discover and verify operation before the move operation

When SYMAPI Server1 fails, perform a discovery operation, as shown in Example 6-59.

Example 6-59 IBM Geographically Dispersed Resiliency for Power Systems discovery when the SYMAPI server at the active site fails scenario

```
# ksysmgr -l max -t discovery site Site_BeiJing
19:24:13 Running discovery on entire site, this may take few minutes...
        19:24:25 Storage state synchronization has started for Site Site_BeiJing
        19:24:25 Storage state synchronization has completed for Site Site_BeiJing
        19:24:25 Discovery has started for VM pbrazos009_suse
        19:24:25 Configuration information retrieval started for VM pbrazos009_suse
        19:24:25 Discovery has started for VM pbrazos012_npiv
        19:24:25 Configuration information retrieval started for VM pbrazos012_npiv
        19:24:25 Discovery has started for VM pbrazos010_vscsi_npiv
        19:24:25 Configuration information retrieval started for VM pbrazos010_vscsi_npiv
        19:24:25 Discovery has started for VM pbrazos015_RedHat
        19:24:25 Configuration information retrieval started for VM pbrazos015_RedHat
        19:24:25 Configuration information retrieval completed for VM pbrazos009_suse
        19:24:25 Configuration information retrieval completed for VM pbrazos012_npiv
        19:24:25 Configuration information retrieval completed for VM pbrazos010_vscsi_npiv
        19:24:25 Configuration information retrieval completed for VM pbrazos015_RedHat
        19:24:25 Storage information retrieval from VIOS started for VM pbrazos009_suse
        19:24:25 Storage information retrieval from VIOS started for VM pbrazos012_npiv
        19:24:25 Storage information retrieval from VIOS started for VM pbrazos010_vscsi_npiv
        19:24:25 Storage information retrieval from VIOS started for VM pbrazos015_RedHat
        19:24:25 Storage information retrieval from VIOS completed for VM pbrazos009_suse
        19:24:25 Discovery for VM pbrazos009_suse is complete
        19:24:25 Storage information retrieval from VIOS completed for VM pbrazos012_npiv
        19:24:25 Discovery for VM pbrazos012_npiv is complete
        19:24:25 Storage information retrieval from VIOS completed for VM pbrazos010_vscsi_npiv
        19:24:25 Discovery for VM pbrazos010_vscsi_npiv is complete
        19:24:25 Storage information retrieval from VIOS completed for VM pbrazos015_RedHat
        19:24:25 Discovery for VM pbrazos015_RedHat is complete
```

```
        19:24:51 Storage state synchronization has started for Site Site_BeiJing
        19:24:51 Storage state synchronization has completed for Site Site_BeiJing
        ERROR: Discovery has encountered an error for site Site_BeiJing please investigate
        ERROR: Discovery has encountered an error for VM pbrazos009_suse during disk group creation
        ERROR: Discovery has encountered an error for VM pbrazos012_npiv during disk group creation
        ERROR: Discovery has encountered an error for VM pbrazos010_vscsi_npiv during disk group creation
        ERROR: Discovery has encountered an error for VM pbrazos015_RedHat during disk group creation
19:25:10 Discovery has finished for Site_BeiJing
0 out of 4 managed VMs have been successfully discovered
Errors encountered while collecting configuration for the following VMs:
        0647FBE2-B8B5-4A2E-86ED-4242702F036C
        1A2EA573-53E4-4743-9057-FE5822158E78
        3CE82119-A851-4DCB-BB18-79AF61021F73
        5BA0080B-0DC2-417A-9D21-70B489462676

Please review the error(s) and take any corrective actions
```

The KSYS trace file that is shown in Example 6-60 indicates that the KSYS node cannot ping SYMAPI Server1.

Example 6-60 KSYS trace file shows that the KSYS node cannot ping SYMAPI Server1

```
[15] 11/01/16 T(37f) _VMR 19:24:16.577330 DEBUG VMR_SA.C[3139]: INFO: Checking storage ping for
SA: sa_BeiJing
[15] 11/01/16 T(37f) _VMR 19:24:16.577375 DEBUG STG_EMC.C[909]: Running storage command:
/opt/IBM/ksys/storages/EMC/ping_srdf_array -e 9Dn31 -s 196800508 -i 10.40.0.30 -t 895
[15] 11/01/16 T(37f) _VMR 19:24:17.311735 DEBUG STG_EMC.C[577]: ERROR:SA:EMC: Storage module
returned error. CMD:/opt/IBM/ksys/storages/EMC/ping_srdf_array -e 9Dn31 -s 196800508 -i
10.40.0.3
0 -t 895  ERROR:218: Error with config File $EMC_NETCNFG_ERROR
                                          rc: 218 errMsg:  Error with config File
$EMC_NETCNFG_ERROR
                                          .
[17] 11/01/16 T(37f) _VMR 19:24:17.311759 [ERROR,VMR_SARcp,sa_BeiJing] Storage not reachable for
SA = sa_BeiJing errNo: 218
[15] 11/01/16 T(37f) _VMR 19:24:17.311765 VMR_SA.C(2735):[ERROR,SA,sa_BeiJing] Storage not
reachable for SA = sa_BeiJing errNo: 218
[15] 11/01/16 T(37f) _VMR 19:24:17.311780 DEBUG VMR_SITE.C[5882]: INFO: eventNotify entering.
event:STG_UNREACHABLE, event type:2, comp:SA, notificationLevel:low, dupEventProcess:yes
[15] 11/01/16 T(37f) _VMR 19:24:17.312126 DEBUG VMR_SITE.C[6498]: ERROR: no user contact exists.
Please register user first
[15] 11/01/16 T(37f) _VMR 19:24:17.312250 [ERROR,VMR_SITERccp,] rc = 1, msg: No user contact
exists, please register user
```

When the recovery action is complete, the VMs state change to READY. Then, start the verify operation, as shown in Example 6-61. The output indicates that it failed when checking the disk group at the active site.

Example 6-61 IBM Geographically Dispersed Resiliency for Power Systems verify in SYMAPI Server when the active site fails scenario

```
# ksysmgr -l max -t verify site Site_BeiJing
16:49:13 Site verification started for Site_BeiJing
        16:49:18 HAM-9179-MHD-SN106DBEP verification has started
        16:49:42 HAM-9179-MHD-SN106DBEP verification has completed
        16:49:42 pbrazos009_suse verification has started
        16:49:42 pbrazos010_vscsi_npiv verification has started
```

```
        16:49:42 pbrazos012_npiv verification has started
        16:49:42 pbrazos015_RedHat verification has started
        16:49:49 pbrazos009_suse verification has completed
        16:49:49 pbrazos010_vscsi_npiv verification has completed
        16:49:49 pbrazos012_npiv verification has completed
        16:49:49 pbrazos015_RedHat verification has completed
        16:49:49 Disk Group verification on storage subsystem started for Site Site_BeiJing
        ERROR: Verify has encountered an error for site Site_BeiJing please investigate
        ERROR: Verify has encountered a Disk Group error for site Site_BeiJing please
investigate
Disk Group: VMRDG_itso3_cluster_Site_BeiJing,  Error with config File $EMC_NETCNFG_ERROR
Disk Group, Verification failed, run discovery.
16:50:00 Verification has finished for Site_BeiJing
4 out of 4 VMs have been successfully verified
Please review errors.  The "ksysmgr query system status" command may provide additional details.
```

After the verify operation completes, although it reports an error message about the SYMAPI server, the VMs state is still changed to READY_TO_MOVE. You still can perform a planned move.

6.6.4 Starting the move operation

During the site-switch operation process, there is a *storage mirror reversal* phase, which always manages the CG at the target site. In this case, although the SYMAPI server at the source site fails, the KSYS node can still access the target site's storage through another SYMAPI server. The SRDF link and storage at the active site are normal, so a planned move option can work in this case.

> **Note:** Regarding this scenario, you can choose the planned or the unplanned move method.

Example 6-62 shows the output of the planned move. When this move operation is complete, all the VMs are online at the target site, and the VMs configurations at the source site are cleaned automatically during this operation.

Example 6-62 Planned site switch when the SYMAPI server fails at the active site scenario

```
# ksysmgr -t move site from=Site_BeiJing to=Site_ShangHai  type=planned
16:19:19 Site move started for Site_BeiJing to Site_ShangHai
        16:19:31 Shutdown on Site_BeiJing site has started for VM pbrazos009_suse
        16:19:31 Shutdown on Site_BeiJing site has started for VM pbrazos012_npiv
        16:19:31 Shutdown on Site_BeiJing site has started for VM pbrazos010_vscsi_npiv
        16:19:31 Shutdown on Site_BeiJing site has started for VM pbrazos015_RedHat
        16:19:41 Shutdown on Site_BeiJing site has completed for VM pbrazos015_RedHat
        16:20:10 Shutdown on Site_BeiJing site has completed for VM pbrazos009_suse
        16:20:40 Shutdown on Site_BeiJing site has completed for VM pbrazos012_npiv
        16:20:50 Shutdown on Site_BeiJing site has completed for VM pbrazos010_vscsi_npiv
        16:20:50 Storage mirror reversal has started
        16:20:51 Mirroring will be setup from Site_ShangHai to Site_BeiJing
        16:24:00 Storage mirror reversal has completed
        16:24:30 Restart on Site_ShangHai site has started for VM pbrazos009_suse
        16:24:30 Restart on Site_ShangHai site has started for VM pbrazos012_npiv
        16:24:30 Restart on Site_ShangHai site has started for VM pbrazos010_vscsi_npiv
        16:24:30 Restart on Site_ShangHai site has started for VM pbrazos015_RedHat
```

```
        16:25:10 Restart on Site_ShangHai site has completed for VM pbrazos009_suse
        16:25:10 Move has completed for VM pbrazos009_suse
        16:25:10 Configuration cleanup on Site_BeiJing site for VM pbrazos009_suse
        16:25:20 Restart on Site_ShangHai site has completed for VM pbrazos010_vscsi_npiv
        16:25:20 Move has completed for VM pbrazos010_vscsi_npiv
        16:25:20 Configuration cleanup on Site_BeiJing site for VM pbrazos010_vscsi_npiv
        16:25:30 Rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        16:25:30 Restart on Site_ShangHai site has completed for VM pbrazos015_RedHat
        16:25:30 Move has completed for VM pbrazos015_RedHat
        16:25:30 Configuration cleanup on Site_BeiJing site for VM pbrazos015_RedHat
        16:25:40 Done rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        16:25:40 Restart on Site_ShangHai site has completed for VM pbrazos012_npiv
        16:25:40 Move has completed for VM pbrazos012_npiv
        16:25:40 Configuration cleanup on Site_BeiJing site for VM pbrazos012_npiv
        16:26:10 Rediscovering configuration for VM pbrazos010_vscsi_npiv on site Site_ShangHai
        16:26:10 Done rediscovering configuration for VM pbrazos010_vscsi_npiv on site
Site_ShangHai
        16:26:40 Rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
        16:26:50 Rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        16:26:50 Done rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        16:26:50 Done rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
Site move completed from Site_BeiJing to Site_ShangHai
4 out of 4 VMs have been successfully moved from Site_BeiJing to Site_ShangHai
Site_ShangHai is now the active site
```

How KSYS handles the SRDF in a planned move scenario

Example 6-63 shows the process of a CG reversal. Here are the steps:

1. Disable the consistency attribute for the CG.
2. Enable AcpMode for the CG.
3. Set write-disable for R1 devices.
4. Fail over the CG.
5. Swap the CG.
6. Synchronize data with the **establish** option.
7. Set async mode for the CG.
8. Enable the consistency attribute for the CG.

Example 6-63 Display the composite group reverse process in the ksys_srdf.log file

```
Tue Nov  1 16:20:48 CDT 2016 892:reverse_emc_srdf_cg: 71 : Reverse Operation for
VMRDG_itso3_cluster_Site_ShangHai Requested
Tue Nov  1 16:20:48 CDT 2016 892:reverse_emc_srdf_cg: get_SYM_Server : Service Name :
SYMAPI_SITE_573
Tue Nov  1 16:21:05 CDT 2016 892:reverse_emc_srdf_cg: 119 : CG:
VMRDG_itso3_cluster_Site_ShangHai in Asynchronous
Tue Nov  1 16:21:05 CDT 2016 892:reverse_emc_srdf_cg: 136 : Info: CG
VMRDG_itso3_cluster_Site_ShangHai in PLAN
Tue Nov  1 16:21:05 CDT 2016 892:reverse_emc_srdf_cg: 150 : SID:196800573 : SOURCE for
VMRDG_itso3_cluster_Site_ShangHai
Tue Nov  1 16:21:05 CDT 2016 892:reverse_emc_srdf_cg: 161 : Info: CG
VMRDG_itso3_cluster_Site_ShangHai in State:Consistent Type:RDF2
Tue Nov  1 16:21:05 CDT 2016 892:reverse_emc_srdf_cg: CG_DisableConsistency :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
```

```
Tue Nov  1 16:21:07 CDT 2016 892:reverse_emc_srdf_cg: CG_DisableConsistency : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:21:07 CDT 2016 892:reverse_emc_srdf_cg: CG_EnableAcpMode :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Tue Nov  1 16:21:32 CDT 2016 892:reverse_emc_srdf_cg: CG_EnableAcpMode : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:21:32 CDT 2016 892:reverse_emc_srdf_cg: Wait4State :
CG:VMRDG_itso3_cluster_Site_ShangHai State:synchronized Start
Tue Nov  1 16:21:33 CDT 2016 892:reverse_emc_srdf_cg: Wait4State : CG:
VMRDG_itso3_cluster_Site_ShangHai State: synchronized  succeed
Tue Nov  1 16:21:33 CDT 2016 892:reverse_emc_srdf_cg: CG_WriteDisable :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Tue Nov  1 16:21:38 CDT 2016 892:reverse_emc_srdf_cg: CG_WriteDisable : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:21:38 CDT 2016 892:reverse_emc_srdf_cg: CG_Failover :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Tue Nov  1 16:21:40 CDT 2016 892:reverse_emc_srdf_cg: CG_Failover : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:21:40 CDT 2016 892:reverse_emc_srdf_cg: CG_Swap :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Tue Nov  1 16:21:44 CDT 2016 892:reverse_emc_srdf_cg: CG_Swap : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:21:44 CDT 2016 892:reverse_emc_srdf_cg: CG_Establish :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Tue Nov  1 16:21:45 CDT 2016 892:reverse_emc_srdf_cg: CG_Establish : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:21:45 CDT 2016 892:reverse_emc_srdf_cg: CG_AsyncMode :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Tue Nov  1 16:21:47 CDT 2016 892:reverse_emc_srdf_cg: CG_AsyncMode : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:21:47 CDT 2016 892:reverse_emc_srdf_cg: Wait4State :
CG:VMRDG_itso3_cluster_Site_ShangHai State:asynchronous Start
Tue Nov  1 16:21:48 CDT 2016 892:reverse_emc_srdf_cg: Wait4State : CG:
VMRDG_itso3_cluster_Site_ShangHai State: asynchronous  succeed
Tue Nov  1 16:21:48 CDT 2016 892:reverse_emc_srdf_cg: CG_EnableConsistency :
CG:VMRDG_itso3_cluster_Site_ShangHai Start
Tue Nov  1 16:22:56 CDT 2016 892:reverse_emc_srdf_cg: CG_EnableConsistency : CG:
VMRDG_itso3_cluster_Site_ShangHai succeed
Tue Nov  1 16:22:56 CDT 2016 892:reverse_emc_srdf_cg: Wait4State :
CG:VMRDG_itso3_cluster_Site_ShangHai State:cg_consistent Start
Tue Nov  1 16:23:55 CDT 2016 892:reverse_emc_srdf_cg: Wait4State : CG:
VMRDG_itso3_cluster_Site_ShangHai State: cg_consistent  succeed
Tue Nov  1 16:23:55 CDT 2016 892:reverse_emc_srdf_cg: 507 : CG VMRDG_itso3_cluster_Site_ShangHai
Reverse Operation Completed
Tue Nov  1 16:23:55 CDT 2016 892:reverse_emc_srdf_cg: 508 : Operation Completed Succesfully
```

Example 6-64 shows the CG's status. You can see that the CG is reversed, and the RDF pair state is Consistent.

Example 6-64 Display composite group's status

```
# symrdf -cg VMRDG_itso3_cluster_Site_ShangHai query

Composite Group Name      :  VMRDG_itso3_cluster_Site_ShangHai
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
```

```
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800508    (Microcode Version: 5977)
RDF (RA) Group Number        : 140 (8B)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV009    0243D RW       0       0 RW 03269 WD       0       0 A.X. Consistent

Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800508    (Microcode Version: 5977)
RDF (RA) Group Number        :  68 (43)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001    02425 RW       0       0 RW 03252 WD       0       0 A.X. Consistent
DEV002    02426 RW       0       0 RW 0325B WD       0       0 A.X. Consistent
DEV003    02427 RW       0       0 RW 0325C WD       0       0 A.X. Consistent
DEV004    02421 RW       0       0 RW 03256 WD       0       0 A.X. Consistent
DEV005    02422 RW       0       0 RW 03257 WD       0       0 A.X. Consistent
DEV006    02423 RW       0       0 RW 03258 WD       0       0 A.X. Consistent
DEV007    02424 RW       0       0 RW 03259 WD       0       0 A.X. Consistent
DEV008    02420 RW       0       0 RW 03253 WD       0       0 A.X. Consistent
```

6.6.5 Scenario summary

This scenario describes when the SYMAPI server in the active site fails. In this case, you can still use the planned move method to perform a site-switch operation.

6.7 Unplanned broken SRDF link

In real DR cases, the link between the two sites is critical, and a weak component. This scenario introduces how KSYS works when the SRDF link is down.

6.7.1 Scenario description

Figure 6-12 shows the topology for this scenario.

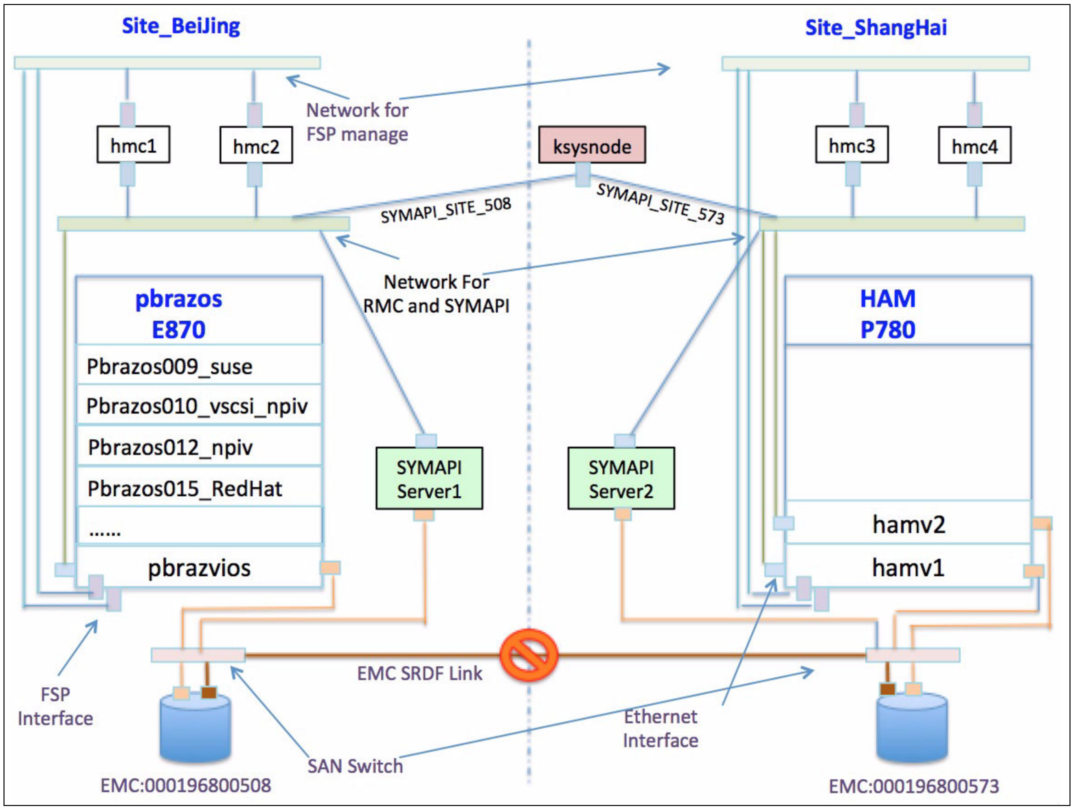


Figure 6-12 Testing topology for the SRDF link that is broken between two Dell EMC Storages scenario

In this scenario, Dell EMC 508 is in the active site. You simulate the down SRDF link by disabling one zone, EMC_573_EMC_0508_SRDF. Figure 6-13 shows detailed information about this zone.

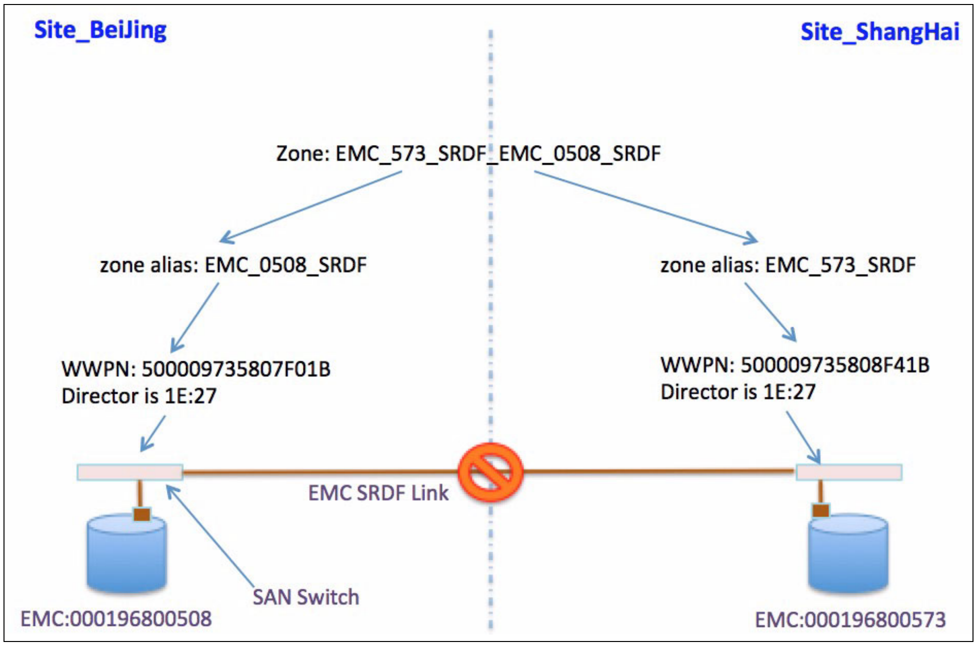


Figure 6-13 Display SAN zone-related information

Each storage provides one FC port for SRDF/A data transference.

How to get the Dell EMC Storage FC port's WWN by using Dell EMC Director

When you create the RDF group, run the command that shown in Example 6-65.

Example 6-65 Display the command line when you create the RDF group

```
symrdf addgrp -label  gdrhebing1 -rdfg 68 -sid 000196800508 -dir 01E:27
-remote_rdfg 68 -remote_sid 000196800573  -remote_dir 01E:27
```

If you want to know the WWN for the Dell EMC Director: 01E:27 port, run the commands that are shown in Example 6-66, which shows the Dell EMC Storage ports at the active site.

Example 6-66 Display WWN the Dell EMC Director at the active site

```
# export SYMCLI_CONNECT=SYMAPI_SITE_508
# symcfg -sid 000196800508 list -port -rf 1E

Symmetrix ID: 000196800508 (Local)

         S Y M M E T R I X    D I R E C T O R    P O R T S

                                                Speed
  Ident  Port  WWN              Type            Gb/sec  Status
  -----  ----  ---------------- ------------    ------  -------
```

```
RF-1E     27  500009735807F01B  RDF-BI-DIR          8  Online
RF-1E     31  500009735807F01F  RDF-BI-DIR          8  Online
```

Then, you can use this WWN to get the zone alias and zone in the SAN switch, or you can get this information from the storage administrator.

6.7.2 Initial status

The initial status is the same as shown in 6.6.2, "Initial status" on page 337. For this scenario, the SRDF link is not down.

6.7.3 Simulating a broken SRDF link

You can simulate a broken SRDF/A link by disabling the zone, as shown in Example 6-67.

Example 6-67 Display SAN zone

```
hastk4-6:admin> cfgremove stk4_cfg,EMC_573_SRDF_EMC_0508_SRDF

hastk4-6:admin> cfgsave
You are about to save the Defined zoning configuration. This
action will only save the changes on Defined configuration.
Any changes made on the Effective configuration will not
take effect until it is reenabled.
Do you want to save Defined zoning configuration only?  (yes, y, no, n): [no] yes
Updating flash ...

hastk4-6:admin> cfgenable stk4_cfg
You are about to enable a new zoning configuration.
This action will replace the old zoning configuration with the
current configuration selected. If the update includes changes
to one or more traffic isolation zones, the update may result in
localized disruption to traffic on ports associated with
the traffic isolation zone changes
Do you want to enable 'stk4_cfg' configuration  (yes, y, no, n): [no] yes
zone config "stk4_cfg" is in effect
Updating flash ...
```

When the zone is disabled, the RDF disk pairs state change from Consistent to TransIdle (transmit idle). Example 6-68 shows the status of the CG at the source site. The devices at the source site are in R1 and read-write status. The remote storage cannot be detected, so the RDF pair's state is TransIdle.

Example 6-68 Display the composite group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                : 000196800508     (Microcode Version: 5977)
Remote Symmetrix ID         : N/A              (Microcode Version: N/A)
```

```
RDF (RA) Group Number        : 140 (8B)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV009    03269 RW       0       0 RW NA     NA       NA       NA A.X. TransIdle

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : N/A             (Microcode Version: N/A)
RDF (RA) Group Number        :  68 (43)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001    03252 RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
DEV002    0325B RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
DEV003    0325C RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
DEV004    03256 RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
DEV005    03257 RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
DEV006    03258 RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
DEV007    03259 RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
DEV008    03253 RW       0       0 RW NA     NA       NA       NA A.X. TransIdle
```

Example 6-69 shows the status of the CG at the target site. The devices at the target site are in the read-write status.

Example 6-69 Display the composite group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_ShangHai query

Composite Group Name       :  VMRDG_itso3_cluster_Site_ShangHai
Composite Group Type       :  RDF2
Number of Symmetrix Units  :  1
Number of RDF (RA) Groups  :  2
RDF Consistency Mode       :  NONE

Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : N/A             (Microcode Version: N/A)
RDF (RA) Group Number        : 140 (8B)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV009    0243D WD       0       0 RW NA     NA       NA       NA A... TransIdle
```

```
Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : N/A             (Microcode Version: N/A)
RDF (RA) Group Number        :  68 (43)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   02425 WD       0       0 RW NA     NA       NA       NA A... TransIdle
DEV002   02426 WD       0       0 RW NA     NA       NA       NA A... TransIdle
DEV003   02427 WD       0       0 RW NA     NA       NA       NA A... TransIdle
DEV004   02421 WD       0       0 RW NA     NA       NA       NA A... TransIdle
DEV005   02422 WD       0       0 RW NA     NA       NA       NA A... TransIdle
DEV006   02423 WD       0       0 RW NA     NA       NA       NA A... TransIdle
DEV007   02424 WD       0       0 RW NA     NA       NA       NA A... TransIdle
DEV008   02420 WD       0       0 RW NA     NA       NA       NA A... TransIdle
```

The broken SRDF link does not impact any VMs I/O at the active site, but there is no data protection.

At this time, you must decide whether you want to perform a site-switch operation. IBM Geographically Dispersed Resiliency for Power Systems supports a site-switch operation, but the storage at the target site does not have the latest data because the data that was generated after the broken SRDF link has not been synchronized from the source site to the target site.

Recovering the data after the SRDF link is restored

If you decide not to perform a site switch when the SRDF link is restored, the data can be synchronized automatically and the RDF state changes to Consistent again.

The Dell EMC SRDF/A TransIdle state provides the maximum level of resilience to any unplanned replication link outages. TransIdle allows SRDF/A to continue processing during periods of SRDF link disruption. When the link recovers, the replication across the link continues transferring data. You do not need to synchronize the data manually.

Example 6-70 shows how to enable the zone from the SAN switch by using the command line.

Example 6-70 Enable the SAN zone

```
hastk4-6:admin> cfgadd "stk4_cfg","EMC_573_SRDF_EMC_0508_SRDF"

hastk4-6:admin> cfgsave
You are about to save the Defined zoning configuration. This
action will only save the changes on Defined configuration.
Any changes made on the Effective configuration will not
take effect until it is reenabled.
Do you want to save Defined zoning configuration only?  (yes, y, no, n): [no] yes
Updating flash ...

hastk4-6:admin> cfgenable stk4_cfg
You are about to enable a new zoning configuration.
```

```
This action will replace the old zoning configuration with the
current configuration selected. If the update includes changes
to one or more traffic isolation zones, the update may result in
localized disruption to traffic on ports associated with
the traffic isolation zone changes
Do you want to enable 'stk4_cfg' configuration  (yes, y, no, n): [no] yes
zone config "stk4_cfg" is in effect
Updating flash ...
```

After the zone is enabled, the incremental data is quickly transmitted. Example 6-71 shows the RDF state changes to Consistent after the data transmit completes.

Example 6-71 Display the composite group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        : 140 (8B)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV002   03269 RW       0        0 RW 0243D WD       0        0 A.X. Consistent

Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        :  68 (43)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   03252 RW       0        0 RW 02425 WD       0        0 A.X. Consistent
DEV003   03256 RW       0        0 RW 02421 WD       0        0 A.X. Consistent
DEV004   03257 RW       0        0 RW 02422 WD       0        0 A.X. Consistent
DEV005   03258 RW       0        0 RW 02423 WD       0        0 A.X. Consistent
DEV006   03259 RW       0        0 RW 02424 WD       0        0 A.X. Consistent
DEV007   0325B RW       0        0 RW 02426 WD       0        0 A.X. Consistent
DEV008   0325C RW       0        0 RW 02427 WD       0        0 A.X. Consistent
DEV009   03253 RW       0        0 RW 02420 WD       0        0 A.X. Consistent
```

6.7.4 Planned site switch

When the SRDF link is broken, perform a site switch as shown in Example 6-72. If you perform a planned move, it fails.

Example 6-72 Planned site switch in SRDF link broken scenario

```
# ksysmgr -t move site from=Site_BeiJing to=Site_ShangHai  type=planned
22:26:17 Site move started for Site_BeiJing to Site_ShangHai
        22:26:29 Shutdown on Site_BeiJing site has started for VM pbrazos009_suse
        22:26:29 Shutdown on Site_BeiJing site has started for VM pbrazos012_npiv
        22:26:29 Shutdown on Site_BeiJing site has started for VM pbrazos010_vscsi_npiv
        22:26:29 Shutdown on Site_BeiJing site has started for VM pbrazos015_RedHat
        22:26:39 Shutdown on Site_BeiJing site has completed for VM pbrazos015_RedHat
        22:26:59 Shutdown on Site_BeiJing site has completed for VM pbrazos009_suse
        22:27:38 Shutdown on Site_BeiJing site has completed for VM pbrazos012_npiv
        22:27:48 Shutdown on Site_BeiJing site has completed for VM pbrazos010_vscsi_npiv
        22:27:48 Storage mirror reversal has started
        22:27:49 Mirroring will be setup from Site_ShangHai to Site_BeiJing
        ERROR: Move has encountered for site Site_ShangHai please investigate
        ERROR: Move has encountered for site Site_BeiJing please investigate
Please review errors.  The "ksysmgr query system status" command may provide additional details
```

Example 6-73 shows the storage mirror reversal process that tries to get the source CG of the target site. Because RDF is in the TransIdle state, it returns an error. The message is from the `/var/ksys/log/ksys_srdf.log` file.

Example 6-73 KSYS trace file shows storage mirror reversal process error

```
Tue Nov  1 22:27:45 CDT 2016 902:reverse_emc_srdf_cg: 71 : Reverse Operation for
VMRDG_itso3_cluster_Site_ShangHai Requested
Tue Nov  1 22:27:45 CDT 2016 902:reverse_emc_srdf_cg: get_SYM_Server : Service Name :
SYMAPI_SITE_573
Tue Nov  1 22:28:00 CDT 2016 902:reverse_emc_srdf_cg: 119 : CG:
VMRDG_itso3_cluster_Site_ShangHai in Asynchronous
Tue Nov  1 22:28:00 CDT 2016 902:reverse_emc_srdf_cg: 136 : Info: CG
VMRDG_itso3_cluster_Site_ShangHai in PLAN
Tue Nov  1 22:28:00 CDT 2016 902:reverse_emc_srdf_cg: 150 : SID:196800573 : SOURCE for
VMRDG_itso3_cluster_Site_ShangHai
Tue Nov  1 22:28:00 CDT 2016 902:reverse_emc_srdf_cg: 161 : Info: CG
VMRDG_itso3_cluster_Site_ShangHai in State:TransIdle Type:RDF2
Tue Nov  1 22:28:00 CDT 2016 902:reverse_emc_srdf_cg: 495 : Error:
Tue Nov  1 22:28:00 CDT 2016 902:reverse_emc_srdf_cg: 495 : CG in Trans IDle State
```

In this case, IBM Geographically Dispersed Resiliency for Power Systems supports only an unplanned move.

6.7.5 Running a discover and verify operation before the move operation

When the SRDF link is in the broken state and if you run a verify operation, an error message indicates that there is an error with the storage. Example 6-74 shows the output of the verify operation.

Example 6-74 IBM Geographically Dispersed Resiliency for Power Systems verify operation

```
# ksysmgr -l max -t verify site Site_BeiJing
20:54:03 Site verification started for Site_BeiJing
        20:54:08 HAM-9179-MHD-SN106DBEP verification has started
        20:54:40 HAM-9179-MHD-SN106DBEP verification has completed
        20:54:41 pbrazos009_suse verification has started
        20:54:41 pbrazos010_vscsi_npiv verification has started
        20:54:41 pbrazos012_npiv verification has started
        20:54:41 pbrazos015_RedHat verification has started
        20:54:49 pbrazos009_suse verification has completed
        20:54:49 pbrazos010_vscsi_npiv verification has completed
        20:54:49 pbrazos012_npiv verification has completed
        20:54:49 pbrazos015_RedHat verification has completed
        20:54:50 Disk Group verification on storage subsystem started for Site Site_BeiJing
        ERROR: Verify has encountered an error for site Site_BeiJing please investigate
        ERROR: Verify has encountered a Disk Group error for site Site_BeiJing please investigate
Disk Group: VMRDG_itso3_cluster_Site_BeiJing,  CLI call failed.
Disk Group, Verification failed, run discovery.
20:56:58 Verification has finished for Site_BeiJing
4 out of 4 VMs have been successfully verified
Please review errors.  The "ksysmgr query system status" command may provide additional details.
```

Example 6-75 shows the detailed information in the `ksys_srdf.log` file. The log file shows the failure in the storage validation process.

Example 6-75 Display some error information in ksys_srdf.log

```
[02] 11/01/16 T(381) _VMR 20:54:45.100490       DEBUG VMR_DG.C[2605]: verify_DGRcp: DG
VMRDG_itso3_cluster_Site_BeiJing, CG VMRDG_itso3_cluster_Site_BeiJing
[02] 11/01/16 T(381) _VMR 20:54:45.100508       DEBUG VMR_DG.C[2638]: verify_DGRcp: storage ID is 196800508
[02] 11/01/16 T(381) _VMR 20:54:45.100514       DEBUG VMR_DG.C[2667]: verify_DGRcp: Calling SA
validateGroup() modeFromSite=Async
[02] 11/01/16 T(381) _VMR 20:56:42.690260       DEBUG STG_EMC.C[577]: ERROR:SA:EMC: Storage module returned
error. CMD:/opt/IBM/ksys/storages/EMC/validate_emc_group -s 196800508 -e 3It24 -g
VMRDG_itso3_cluster_Site_BeiJing -m async -f 1 -i 10.40.0.30 -t 897  ERROR:1: CLI call failed.
                                                 rc: 1 errMsg:  CLI call failed.
                                                .
[02] 11/01/16 T(381) _VMR 20:56:42.690269       DEBUG VMR_SA.C[2607]: ERROR:SA: Storage call
stg_validate_group failed. CGname: VMRDG_itso3_cluster_Site_BeiJing Mode: async err: 1.
[02] 11/01/16 T(381) _VMR 20:56:42.690272       DEBUG VMR_DG.C[2677]: verify_DGRcp: CG
VMRDG_itso3_cluster_Site_BeiJing validateGroup() rc = -1, err_sev=240, err_stg_type=227, err_num=1 err_
info= CLI call failed.
```

When the SRDF link is in the broken state, if you run a discovery, an error message indicates that there is an error with the storage. The discovery process is shown in Example 6-76.

Example 6-76 IBM Geographically Dispersed Resiliency for Power Systems discovery operation

```
# ksysmgr -l max -t discovery site Site_BeiJing
21:02:51 Running discovery on entire site, this may take few minutes...
        21:03:03 Storage state synchronization has started for Site Site_BeiJing
        21:03:45 Storage state synchronization has completed for Site Site_BeiJing
        21:03:45 Discovery has started for VM pbrazos009_suse
        21:03:45 Configuration information retrieval started for VM pbrazos009_suse
        21:03:45 Discovery has started for VM pbrazos012_npiv
        21:03:45 Configuration information retrieval started for VM pbrazos012_npiv
        21:03:45 Discovery has started for VM pbrazos010_vscsi_npiv
        21:03:45 Configuration information retrieval started for VM pbrazos010_vscsi_npiv
        21:03:45 Discovery has started for VM pbrazos015_RedHat
        21:03:45 Configuration information retrieval started for VM pbrazos015_RedHat
        21:03:55 Configuration information retrieval completed for VM pbrazos009_suse
        21:03:55 Configuration information retrieval completed for VM pbrazos012_npiv
        21:03:55 Configuration information retrieval completed for VM pbrazos010_vscsi_npiv
        21:03:55 Configuration information retrieval completed for VM pbrazos015_RedHat
        21:03:55 Storage information retrieval from VIOS started for VM pbrazos009_suse
        21:03:55 Storage information retrieval from VIOS started for VM pbrazos012_npiv
        21:03:55 Storage information retrieval from VIOS started for VM pbrazos010_vscsi_npiv
        21:03:55 Storage information retrieval from VIOS started for VM pbrazos015_RedHat
        21:03:55 Storage information retrieval from VIOS completed for VM pbrazos009_suse
        21:03:55 Discovery for VM pbrazos009_suse is complete
        21:03:55 Storage information retrieval from VIOS completed for VM pbrazos012_npiv
        21:03:55 Discovery for VM pbrazos012_npiv is complete
        21:03:55 Storage information retrieval from VIOS completed for VM pbrazos010_vscsi_npiv
        21:03:55 Discovery for VM pbrazos010_vscsi_npiv is complete
        21:04:04 Storage information retrieval from VIOS completed for VM pbrazos015_RedHat
        21:04:04 Discovery for VM pbrazos015_RedHat is complete
        21:04:38 Storage state synchronization has started for Site Site_BeiJing
        21:04:38 Storage state synchronization has completed for Site Site_BeiJing
        ERROR: Discovery has encountered an error for site Site_BeiJing please investigate
        ERROR: Discovery has encountered an error for VM pbrazos009_suse during disk group creation
        ERROR: Discovery has encountered an error for VM pbrazos012_npiv during disk group creation
        ERROR: Discovery has encountered an error for VM pbrazos010_vscsi_npiv during disk group creation
        ERROR: Discovery has encountered an error for VM pbrazos015_RedHat during disk group creation
21:04:57 Discovery has finished for Site_BeiJing
0 out of 4 managed VMs have been successfully discovered
Errors encountered while collecting configuration for the following VMs:
        0647FBE2-B8B5-4A2E-86ED-4242702F036C
        1A2EA573-53E4-4743-9057-FE5822158E78
        3CE82119-A851-4DCB-BB18-79AF61021F73
        5BA0080B-0DC2-417A-9D21-70B489462676
```

Example 6-77 shows the error information of the discovery operation. It fails at the get_emc_pair_disk function. The error information comes from the VMR trace file.

Example 6-77 KSYS trace file shows the get_emc_pair_disk function failure

```
[23] 11/01/16 T(4041) _VMR 21:03:57.864260 DEBUG VMR_DP.C[1873]: setDiskInfo: Calling SA getDiskPairList() with
discovery string 7IpW40l.
[23] 11/01/16 T(4041) _VMR 21:03:57.870360 DEBUG STG_EMC.C[402]: INFO: CMD: /opt/IBM/ksys/storages/EMC/get_emc_pair_disk
-s 196800508 -e 7IpW40l -d /var/ksys/tmp/4EkU6_16449_28183068
 10.40.0.30 -t 16449
[23] 11/01/16 T(4041) _VMR 21:03:58.840368 DEBUG VMR_DP.C[2334]: postOptimize: Skip 60000970000196800508533033323639
[23] 11/01/16 T(4041) _VMR 21:03:58.840380 DEBUG VMR_DP.C[1909]: setDiskInfo: aSiteVolIDList.size=1
sSiteDiskPairs.size=1
```

```
[23] 11/01/16 T(4041) _VMR 21:03:58.840382 DEBUG VMR_DP.C[1921]: setDiskInfo: ERROR Invalid disk_pair info.
[23] 11/01/16 T(4041) _VMR 21:03:58.840384 DEBUG VMR_DP.C[1923]:   dp->s_stg_id=196800508
dp->s_disk=60000970000196800508533033323639
[23] 11/01/16 T(4041) _VMR 21:03:58.840389 DEBUG VMR_DP.C[1925]:   dp->r_stg_id=196800573 dp->r_disk=
[38] 11/01/16 T(4041) _VMR 21:03:58.840441 [ INFO,VMR_LPARRcp,5BA0080B-0DC2-417A-9D21-70B489462676] STATE: PhaseDetail
is being changed from: 0xc300 to: 0x4000000c301
[23] 11/01/16 T(4041) _VMR 21:03:58.840446 VMR_LPAR.C(3777):[ INFO,LPAR,5BA0080B-0DC2-417A-9D21-70B489462676] STATE:
PhaseDetail is being changed from: 0xc300 to: 0x4000000c301
[38] 11/01/16 T(4041) _VMR 21:03:58.890124 [ERROR,VMR_LPARRcp,5BA0080B-0DC2-417A-9D21-70B489462676] Error return from
setDiskInfo
[23] 11/01/16 T(4041) _VMR 21:03:58.890128 VMR_LPAR.C(4750):[ERROR,LPAR,5BA0080B-0DC2-417A-9D21-70B489462676] Error
return from setDiskInfo
```

When the discovery operation is complete, the VMs state change to DISCOVERY_ONLY. If you want to perform a site switch, only the unplanned option is allowed.

6.7.6 Starting the move operation with the unplanned option

Note: If you decide to perform a site switch after the SRDF link is broken, remember that the data at the target site is not the latest at this time.

Example 6-78 shows the output of an unplanned move that succeeds without errors.

Example 6-78 Unplanned site switch in SRDF link broken scenario

```
# ksysmgr -t move site from=Site_BeiJing to=Site_ShangHai  type=unplanned
21:20:53 Site move started for Site_BeiJing to Site_ShangHai
        21:21:04 Shutdown on Site_BeiJing site has started for VM pbrazos009_suse
        21:21:04 Shutdown on Site_BeiJing site has started for VM pbrazos012_npiv
        21:21:04 Shutdown on Site_BeiJing site has started for VM pbrazos010_vscsi_npiv
        21:21:04 Shutdown on Site_BeiJing site has completed for VM pbrazos010_vscsi_npiv
        21:21:04 Shutdown on Site_BeiJing site has started for VM pbrazos015_RedHat
        21:21:13 Shutdown on Site_BeiJing site has completed for VM pbrazos009_suse
        21:21:13 Shutdown on Site_BeiJing site has completed for VM pbrazos012_npiv
        21:21:13 Shutdown on Site_BeiJing site has completed for VM pbrazos015_RedHat
        21:21:13 Storage mirror reversal has started
        21:21:14 Mirroring will be setup from Site_ShangHai to Site_BeiJing
        21:21:42 Storage mirror reversal has completed
        21:22:10 Restart on Site_ShangHai site has started for VM pbrazos009_suse
        21:22:10 Restart on Site_ShangHai site has started for VM pbrazos012_npiv
        21:22:10 Restart on Site_ShangHai site has started for VM pbrazos010_vscsi_npiv
        21:22:10 Restart on Site_ShangHai site has started for VM pbrazos015_RedHat
        21:23:13 Restart on Site_ShangHai site has completed for VM pbrazos009_suse
        21:23:13 Move has completed for VM pbrazos009_suse
        21:23:13 Rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        21:23:13 Restart on Site_ShangHai site has completed for VM pbrazos012_npiv
        21:23:13 Move has completed for VM pbrazos012_npiv
        21:23:13 Rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        21:23:13 Restart on Site_ShangHai site has completed for VM pbrazos010_vscsi_npiv
        21:23:13 Move has completed for VM pbrazos010_vscsi_npiv
        21:23:13 Rediscovering configuration for VM pbrazos010_vscsi_npiv on site Site_ShangHai
        21:23:31 Done rediscovering configuration for VM pbrazos009_suse on site Site_ShangHai
        21:23:31 Done rediscovering configuration for VM pbrazos012_npiv on site Site_ShangHai
        21:23:31 Done rediscovering configuration for VM pbrazos010_vscsi_npiv on site Site_ShangHai
        21:23:31 Restart on Site_ShangHai site has completed for VM pbrazos015_RedHat
        21:23:31 Move has completed for VM pbrazos015_RedHat
        21:23:31 Rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
        21:23:41 Done rediscovering configuration for VM pbrazos015_RedHat on site Site_ShangHai
```

```
Site move completed from Site_BeiJing to Site_ShangHai
4 out of 4 VMs have been successfully moved from Site_BeiJing to Site_ShangHai
Site_ShangHai is now the active site
```

During this operation, you see the change of the RDF pair's state. Example 6-79 shows the status of the CG at the source site. The RDF pair state changes from TransIdle to Partitioned.

Example 6-79 Display the composite group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : N/A             (Microcode Version: N/A)
RDF (RA) Group Number       : 140 (8B)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T  R1 Inv  R2 Inv   K  Sym   T  R1 Inv  R2 Inv      RDF Pair
Device    Dev   E  Tracks  Tracks   S  Dev   E  Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV009    03269 RW       0       9 NR NA    NA       NA      NA A.X. Partitioned

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : N/A             (Microcode Version: N/A)
RDF (RA) Group Number       :  68 (43)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T  R1 Inv  R2 Inv   K  Sym   T  R1 Inv  R2 Inv      RDF Pair
Device    Dev   E  Tracks  Tracks   S  Dev   E  Tracks  Tracks MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001    03252 RW       0      52 NR NA    NA       NA      NA A.X. Partitioned
DEV002    0325B RW       0       0 NR NA    NA       NA      NA A.X. Partitioned
DEV003    0325C RW       0       0 NR NA    NA       NA      NA A.X. Partitioned
DEV004    03256 RW       0       0 NR NA    NA       NA      NA A.X. Partitioned
DEV005    03257 RW       0       0 NR NA    NA       NA      NA A.X. Partitioned
DEV006    03258 RW       0      92 NR NA    NA       NA      NA A.X. Partitioned
DEV007    03259 RW       0       0 NR NA    NA       NA      NA A.X. Partitioned
DEV008    03253 RW       0      87 NR NA    NA       NA      NA A.X. Partitioned
```

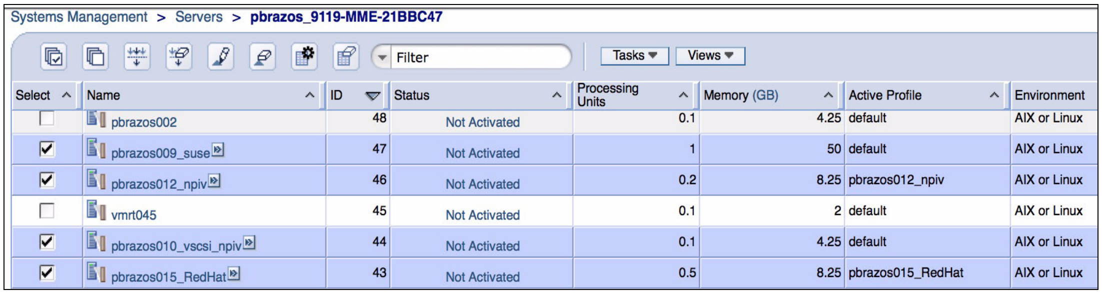
Example 6-80 shows the status of the CG at the target site. The RDF pair's state change from TransIdle to Partitioned.

Example 6-80 Display composite group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_ShangHai query

Composite Group Name      :  VMRDG_itso3_cluster_Site_ShangHai
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  NONE

Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : N/A             (Microcode Version: N/A)
RDF (RA) Group Number        : 140 (8B)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T  R1 Inv   R2 Inv  K Sym    T  R1 Inv  R2 Inv       RDF Pair
Device    Dev   E  Tracks   Tracks  S Dev    E  Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV009    0243D RW       0        0 NR NA     NA       NA       NA S... Partitioned

Symmetrix ID                 : 000196800573    (Microcode Version: 5977)
Remote Symmetrix ID          : N/A             (Microcode Version: N/A)
RDF (RA) Group Number        :  68 (43)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T  R1 Inv   R2 Inv  K Sym    T  R1 Inv  R2 Inv       RDF Pair
Device    Dev   E  Tracks   Tracks  S Dev    E  Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001    02425 RW   82273        0 NR NA     NA       NA       NA S... Partitioned
DEV002    02426 RW       0        0 NR NA     NA       NA       NA S... Partitioned
DEV003    02427 RW       0        0 NR NA     NA       NA       NA S... Partitioned
DEV004    02421 RW       0        0 NR NA     NA       NA       NA S... Partitioned
DEV005    02422 RW       0        0 NR NA     NA       NA       NA S... Partitioned
DEV006    02423 RW     215        0 NR NA     NA       NA       NA S... Partitioned
DEV007    02424 RW       0        0 NR NA     NA       NA       NA S... Partitioned
DEV008    02420 RW     163        0 NR NA     NA       NA       NA S... Partitioned
```

When the unplanned move completes, all VMs are shut down at the source site and online at the target site successfully. Because this is an unplanned move, the VMs are not removed from the HMC at the source site.

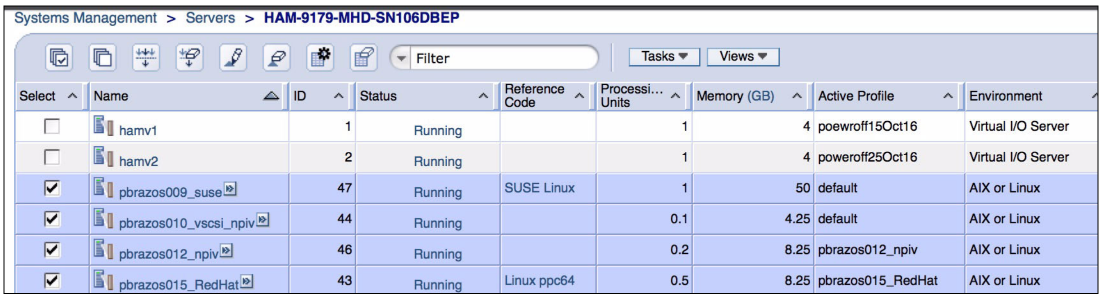
Figure 6-14 shows the four VMs that are shut down at the source site.


Systems Management > Servers > pbrazos_9119-MME-21BBC47

Select	Name	ID	Status	Processing Units	Memory (GB)	Active Profile	Environment
☐	pbrazos002	48	Not Activated	0.1	4.25	default	AIX or Linux
☑	pbrazos009_suse	47	Not Activated	1	50	default	AIX or Linux
☑	pbrazos012_npiv	46	Not Activated	0.2	8.25	pbrazos012_npiv	AIX or Linux
☐	vmrt045	45	Not Activated	0.1	2	default	AIX or Linux
☑	pbrazos010_vscsi_npiv	44	Not Activated	0.1	4.25	default	AIX or Linux
☑	pbrazos015_RedHat	43	Not Activated	0.5	8.25	pbrazos015_RedHat	AIX or Linux

Figure 6-14 Display VMs status from the HMC at the source site

Figure 6-15 shows the four VMs that are online at the target site.


Systems Management > Servers > HAM-9179-MHD-SN106DBEP

Select	Name	ID	Status	Reference Code	Processi... Units	Memory (GB)	Active Profile	Environment
☐	hamv1	1	Running		1	4	poewroff15Oct16	Virtual I/O Server
☐	hamv2	2	Running		1	4	poweroff25Oct16	Virtual I/O Server
☑	pbrazos009_suse	47	Running	SUSE Linux	1	50	default	AIX or Linux
☑	pbrazos010_vscsi_npiv	44	Running		0.1	4.25	default	AIX or Linux
☑	pbrazos012_npiv	46	Running		0.2	8.25	pbrazos012_npiv	AIX or Linux
☑	pbrazos015_RedHat	43	Running	Linux ppc64	0.5	8.25	pbrazos015_RedHat	AIX or Linux

Figure 6-15 Display VMs status from the HMC at the target site

6.7.7 SRDF link restored

This section simulates the SRDF link restore by enabling the zone. The method is introduced in “Recovering the data after the SRDF link is restored” on page 347. When the link is restored, the RDF pair state changes from Partitioned to Split. Example 6-81 shows that the devices at the source site are in the R1 role.

Example 6-81 Display composite group status

```
# symrdf -cg VMRDG_itso3_cluster_Site_BeiJing query

Composite Group Name      :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  MSC

Symmetrix ID                : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number       : 140 (8B)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV009    03269 RW       0       9 NR 0243D RW      80        0 A.X. Split
```

```
Symmetrix ID                 : 000196800508    (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800573    (Microcode Version: 5977)
RDF (RA) Group Number        :  68 (43)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical  Sym    T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   03252 RW       0      52 NR 02425 RW   82277        0 A.X. Split
DEV002   0325B RW       0       0 NR 02426 RW       0        0 A.X. Split
DEV003   0325C RW       0       0 NR 02427 RW       0        0 A.X. Split
DEV004   03256 RW       0       0 NR 02421 RW       0        0 A.X. Split
DEV005   03257 RW       0       0 NR 02422 RW       0        0 A.X. Split
DEV006   03258 RW       0      92 NR 02423 RW     469        0 A.X. Split
DEV007   03259 RW       0       0 NR 02424 RW       0        0 A.X. Split
DEV008   03253 RW       0      87 NR 02420 RW     494        0 A.X. Split
```

6.7.8 Restoring the storage

After the SRDF link is restored, you must restore the RDF group. The method to perform the storage recovery is the same that is shown in 6.5.5, “Recovering the SRDF/A status” on page 328.

6.7.9 Cleaning up the virtual machines

Because the VMs at the source site have not been removed, it is necessary to clean them up before the next site -switch operation. The method to clean up the VMs is the same as the one shown in 6.5.6, “Cleaning up the virtual machines at the source site” on page 334.

After completing the storage restore and the VM cleanup operation, you can start a discover and verify operation to confirm that the environment is ready to perform another site-switch operation.

6.7.10 Scenario summary

This section described a broken SRDF link scenario. If you decide to perform a site switch, IBM Geographically Dispersed Resiliency for Power Systems supports it through the unplanned option.

6.8 Planning a PowerHA cluster move

During a normal IBM Geographically Dispersed Resiliency for Power Systems move operation, the VM is restarted at the target site and does not change anything in the VMs.

IBM Geographically Dispersed Resiliency for Power Systems can manage PowerHA cluster nodes and also can move them between the source and the target site with one consideration. Beginning with PowerHA 7.1, Cluster Aware AIX (CAA) is a necessary module that runs under PowerHA software. Each CAA cluster has at least one repository disk, stores the cluster configuration, acts as disk heartbeating device, and so on. The repository disks UUIDs are used in the CAA design. At the time of writing, you cannot change these UUIDs because the CAA service cannot start normally if you change it.

With the IBM Geographically Dispersed Resiliency for Power Systems solution, when PowerHA 7.1 or PowerHA 7.2 cluster nodes are moved to the target site, the UUIDs of the disks are changed because of storage requirements, which include the repository disk. The CAA service cannot start at the target site, so the PowerHA service does not start. This scenario provides two solutions for the recovery of the CAA cluster at the target site. These solutions are based on scripts.

6.8.1 Scenario description

Figure 6-16 shows the topology for this scenario. There are two VMs in the IBM Geographically Dispersed Resiliency for Power Systems cluster, pbrazos016_PHA1 and pbrazos017_PHA2, which are running AIX 7.1.4 and PowerHA 7.2.

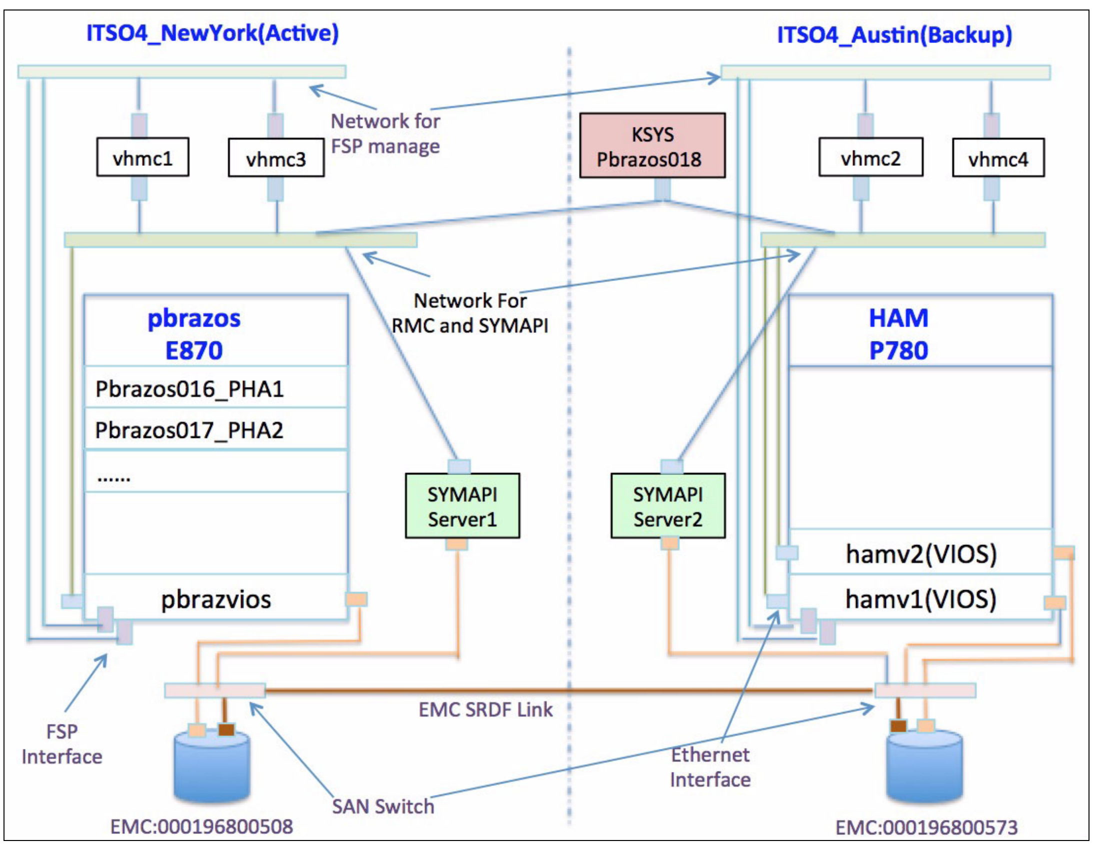


Figure 6-16 Testing topology in the move PowerHA cluster scenario

In this scenario, you have a new KSYS node, pbrazos018. The IBM Geographically Dispersed Resiliency for Power Systems cluster includes two sites, ITSO4_NewYork and ITSO4_Austin. The other devices are the same as in the previous scenarios.

6.8.2 Initial status

This section describes the cluster's initial status.

PowerHA configuration

Table 6-1 shows the PowerHA cluster's attributes of a simple two-node PowerHA cluster.

Table 6-1 PowerHA cluster's configuration

Component	pbrazos016_PHA1	pbrazos017_PHA2
Cluster name	gdr_cluster Cluster type: NSC (No Site Cluster)	
Network interface	en0: 10.40.2.216 Netmask: 255.255.254.0 Gateway: 10.40.2.1	en0: 10.40.2.217 Netmask: 255.255.254.0 Gateway: 10.40.2.1
Network	net_ether_01 (10.40.2.0/24)	
CAA	Unicast Primary disk: hdisk1	
shared	sharevg: hdisk4 and hdisk5	
Service IP	10.40.2.219 pbrazos_srv	
Resource Group	gdr_rg includes sharevg, pbrazos_srv The node order is pbrazos016 pbrazos017 Startup Policy: Online On Home Node Only Fallover Policy: Fallover To Next Priority Node In The List Fallback Policy: Never Fallback	

IBM Geographically Dispersed Resiliency for Power Systems configuration

Example 6-82 shows the IBM Geographically Dispersed Resiliency for Power Systems configuration. ITSO4_NewYork is the active site and ITSO4_Austin is the backup site.

Example 6-82 Display current IBM Geographically Dispersed Resiliency for Power Systems configuration

```
# ksysmgr -v report system
This is the latest KSYS configurations, please run discover to capture any changes

Status: KSYS is performing an auto discovery, please run 'ksysmgr query system
status' for details
Ksysmgr version: 1.1.0.0
Ksys version: 1.1.0.0

Current environment:
====================

Active Site: ITSO4_NewYork
```

```
    HOST: pbrazos_9119-MME-21BBC47
         HMC:
              ITSO4_NewYork_vhmc1
              ITSO4_NewYork_vhmc2
         VIOS:
              pbrazosv1
         Paired Host:
              HAM-9179-MHD-SN106DBEP
         Number of Managed VMs: 2
         Managed Processors: Unable to determine, please run discover
         Managed Memory: Unable to determine, please run discover

    Storage Agent:
              sa_ITSO4_NewYork

    Total Managed Processors: 0
    Total Managed Memory: 0

Back up Site: ITSO4_Austin

    HOST: HAM-9179-MHD-SN106DBEP
         HMC:
              ITSO4_Austin_vhmc1
              ITSO4_Austin_vhmc2
         VIOS:
              hamv2
              hamv1
         Paired Host:
              pbrazos_9119-MME-21BBC47
         Number of Managed VMs: 0
         Configurable Processors: 48
         Configurable Memory: 524288

    Storage Agent:
              sa_ITSO4_Austin

    Total configurable Processors: 48
    Total configurable Memory: 524288
```

Example 6-83 shows that the two PowerHA cluster nodes are managed by IBM Geographically Dispersed Resiliency for Power Systems and running at the active site.

Example 6-83 Display the current VM status in IBM Geographically Dispersed Resiliency for Power Systems

```
# ksysmgr query vm state=manage|more
Managed VMs:
        pbrazos016_PHA1
        pbrazos017_PHA2


All VMs:
Name:            pbrazos016_PHA1
UUID:            616D4AF1-8BE0-4A4C-8253-5CB7F45F8658
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE
```

```
Name:            pbrazos017_PHA2
UUID:            1B10A101-E3A4-418A-8DF2-07A391960C56
Host:            pbrazos_9119-MME-21BBC47
State:           READY_TO_MOVE
```

PowerHA and Cluster Aware AIX status

Example 6-84 shows the current PowerHA resource group status. The resource group is online at the pbrazos016 node.

Example 6-84 Display the current PowerHA RG status

```
# clRGinfo -v

Cluster Name: gdr_cluster

Resource Group Name: gdr_RG
Startup Policy: Online On Home Node Only
Fallover Policy: Fallover To Next Priority Node In The List
Fallback Policy: Never Fallback
Site Policy: ignore
Node                                                             State
---------------------------------------------------------------- ---------------
pbrazos016                                                       ONLINE
pbrazos017                                                       OFFLINE
```

Example 6-85 shows the disks status. Hdisk1 is for the repository disk, and hdisk4 and hdisk5 are for sharevg.

Example 6-85 Display the current PV status

```
# lspv
hdisk0          00cbbc47e96a085c                    rootvg          active
hdisk1          00cbbc47ea310219                    caavg_private   active
hdisk2          00cbbc47ea3101c9                    None
hdisk3          00cbbc47ea31017a                    None
hdisk4          00cbbc47ea31011f                    sharevg         concurrent
hdisk5          00cbbc47ea3100cf                    sharevg         concurrent
```

Example 6-86 shows the UUID of the repository disk before the move operation.

Example 6-86 Display the current UUID information

```
# lspv -u
hdisk0          00cbbc47e96a085c                    rootvg          active
2009800508!xW09SYMMETRIX03EMCfcp
a9f824c4-01ed-6238-1bc2-239ac36085b8
hdisk1          00cbbc47ea310219                    caavg_private   active
200980050818F09SYMMETRIX03EMCfcp
8f0ecd17-1bb7-b5d2-c847-74a78d53fcfe
```

Example 6-87 shows the current CAA cluster.

Example 6-87 Display the current Cluster Aware AIX status and repository disk's status

```
# lscluster -d
Storage Interface Query

Cluster Name: gdr_cluster
Cluster UUID: 0b6f1bd2-9880-11e6-8003-62fcd3ef9802
Number of nodes reporting = 2
Number of nodes expected = 2

Node pbrazos016.ausprv.stglabs.ibm.com
Node UUID = 0b4b3492-9880-11e6-8003-62fcd3ef9802
Number of disks discovered = 1
        hdisk1:
              State : UP
               uDid : 200980050818F09SYMMETRIX03EMCfcp
               uUid : 8f0ecd17-1bb7-b5d2-c847-74a78d53fcfe
          Site uUid : 51735173-5173-5173-5173-517351735173
               Type : REPDISK

Node pbrazos017.ausprv.stglabs.ibm.com
Node UUID = 0b4b34c4-9880-11e6-8003-62fcd3ef9802
Number of disks discovered = 1
        hdisk1:
              State : UP
               uDid : 200980050818F09SYMMETRIX03EMCfcp
               uUid : 8f0ecd17-1bb7-b5d2-c847-74a78d53fcfe
          Site uUid : 51735173-5173-5173-5173-517351735173
               Type : REPDISK
```

6.8.3 Migrating the PowerHA nodes to the target site

Example 6-88 shows the move procedure for the two VMs.

Example 6-88 Planned site switch during the move PowerHA cluster scenario

```
# ksysmgr -t move site from=ITSO4_NewYork to=ITSO4_Austin dr_type=planned
11:09:34 Site move started for ITSO4_NewYork to ITSO4_Austin
        11:09:44 Shutdown on ITSO4_NewYork site has started for VM pbrazos017_PHA2
        11:09:44 Shutdown on ITSO4_NewYork site has started for VM pbrazos016_PHA1
        11:10:55 Shutdown on ITSO4_NewYork site has completed for VM pbrazos017_PHA2
        11:10:55 Shutdown on ITSO4_NewYork site has completed for VM pbrazos016_PHA1
        11:10:55 Storage mirror reversal has started
        11:10:56 Mirroring will be setup from ITSO4_Austin to ITSO4_NewYork
        11:12:23 Storage mirror reversal has completed
        11:12:54 Restart on ITSO4_Austin site has started for VM pbrazos017_PHA2
        11:12:54 Restart on ITSO4_Austin site has started for VM pbrazos016_PHA1
        11:13:49 Restart on ITSO4_Austin site has completed for VM pbrazos016_PHA1
        11:13:49 Move has completed for VM pbrazos016_PHA1
        11:13:49 Configuration cleanup on ITSO4_NewYork site for VM pbrazos016_PHA1
        11:13:57 Restart on ITSO4_Austin site has completed for VM pbrazos017_PHA2
        11:13:57 Move has completed for VM pbrazos017_PHA2
        11:13:57 Configuration cleanup on ITSO4_NewYork site for VM pbrazos017_PHA2
```

```
        11:14:05 Rediscovering configuration for VM pbrazos016_PHA1 on site ITSO4_Austin
        11:14:13 Done rediscovering configuration for VM pbrazos016_PHA1 on site ITSO4_Austin
        11:14:21 Rediscovering configuration for VM pbrazos017_PHA2 on site ITSO4_Austin
        11:14:29 Done rediscovering configuration for VM pbrazos017_PHA2 on site ITSO4_Austin
Site move completed from ITSO4_NewYork to ITSO4_Austin
2 out of 2 VMs have been successfully moved from ITSO4_NewYork to ITSO4_Austin
ITSO4_Austin is now the active site
```

Example 6-89 shows the disk information after the move operation. The disk names are changed.

Example 6-89 PV status after planned site-switch operation

```
# hostname
pbrazos016
# lspv
hdisk6          00cbbc47e96a085c                    rootvg          active
hdisk7          00cbbc47ea310219                    caavg_private   active
hdisk8          00cbbc47ea3101c9                    None
hdisk9          00cbbc47ea31017a                    None
hdisk10         00cbbc47ea31011f                    sharevg
hdisk11         00cbbc47ea3100cf                    sharevg

# lsdev -Cc disk
hdisk0  Defined 63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk1  Defined 63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk2  Defined 63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk3  Defined 63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk4  Defined 63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk5  Defined 63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk6  Available   63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk7  Available   63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk8  Available   63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk9  Available   63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk10 Available   63-T1-01 MPIO Other FC SCSI Disk Drive
hdisk11 Available   63-T1-01 MPIO Other FC SCSI Disk Drive
```

Example 6-90 shows the new UUID after the move operation. The UUID changed from 8f0ecd17-1bb7-b5d2-c847-74a78d53fcfe to 972d0db1-9213-1621-5780-ee8c3c5fb654.

Example 6-90 Display the UUID of the repository disk after the move operation

```
# lspv -u
hdisk6          00cbbc47e96a085c                    rootvg          active
2009800573!:+09SYMMETRIX03EMCfcp
bf57c18f-c76a-9546-a49f-7743892907ab
hdisk7          00cbbc47ea310219                    caavg_private   active
200980057375C09SYMMETRIX03EMCfcp
972d0db1-9213-1621-5780-ee8c3c5fb654
hdisk8          00cbbc47ea3101c9                    None
200980057374E09SYMMETRIX03EMCfcp
249184d1-1bc4-a595-99c9-84d655d63d35
```

Because the repository disk's UUID changed, the CAA service cannot start. Example 6-91 shows that the CAA service is offline.

Example 6-91 CAA status after the move operation

```
# lscluster -m
1035-053 lscluster: Cluster services are not active.
# lscluster -d
1035-053 lscluster: Cluster services are not active.
```

Example 6-92 shows the error message in the `/var/adm/ras/syslog.caa log` file, which indicates that the current repository disk's UUID is different from the previous ones.

Example 6-92 CAA's log from syslog.caa file

```
Oct 22 11:09:01 pbrazos016 caa:debug cluster[8716406]: cluster_bootutils.c      is_clvdisk
447     1       FINISH return = 1
..
Oct 22 11:15:33 pbrazos016 caa:err|error cluster[7405814]: cluster_utils.c
cluster_repository_read_data    4777    1       Could not get name of cluster repository disk fr
om ODM (ODMDIR=/etc/objrepos).
Oct 22 11:15:33 pbrazos016 caa:info cluster[7405814]: cluster_utils.c   cl_kern_repos_check
11858   1       Could not read the repository.
Oct 22 11:15:33 pbrazos016 caa:debug cluster[7405814]: caa_other_disk.c
register_other_repos_disk       1405    1       START
Oct 22 11:15:33 pbrazos016 caa:err|error cluster[7405814]: register_other_repos_disk: Could not
find any disks that use third-party disk drivers.
Oct 22 11:15:33 pbrazos016 caa:err|error cluster[7405814]: 1035-014 Node list contains node that
does not exist in the cluster.
Oct 22 11:15:33 pbrazos016 caa:debug cluster[7405814]: caa_query.c      cl_query        1957
1       This node has not been configured.
Oct 22 11:15:33 pbrazos016 caa:err|error cluster[7405814]: clusterconf_lib.c
_find_and_load_repos    1482    1       cluster_repository_query() found a UUID but no correspon
ding disk. This condition may be temporary.
Oct 22 11:15:33 pbrazos016 caa:warn|warning cluster[7405814]: 1035-242 clusterconf: Non-fatal
error when loading the topology.
......
Oct 22 11:15:33 pbrazos016 caa:debug syslog: caa_query.c        cl_query        1957    1
This node has not been configured.
Oct 22 11:15:33 pbrazos016 caa:info syslog: clconfd.c   main    726     1       Failed to get
cluster entity: 109
```

Note: At the time of writing, CAA relies on the repository disk's UUID. IBM intends to deliver enhancements that rely on the PVID if the UUID changes. These enhancements allow CAA services to start in the target site automatically because the PVID is not changed.

Example 6-93 shows that PowerHA still stores the repository disk's PVID in its ODM object. You can use this information to recover CAA. For more information, see 6.8.4, "First workaround to recover CAA and the PowerHA cluster" on page 364 and 6.8.5, "Second workaround to recover the CAA and the PowerHA cluster" on page 371.

Example 6-93 Display the repository disk configuration in the PowerHA ODM database

```
# odmget HACMPsircol

HACMPsircol:
        name = "gdr_cluster_sircol"
        id = 0
        uuid = "0"
        ip_address = ""
        repository = "00cbbc47ea310219"
        backup_repository = ""
```

6.8.4 First workaround to recover CAA and the PowerHA cluster

This section describes the first workaround to recover CAA and the PowerHA cluster.

Workaround introduction

This workaround uses the **chrepos -c** command to reconfigure the CAA cluster with a new UUID.

Restoration steps and logs

There are three scripts in this workaround solution. Complete the following steps:

1. Run `W1_node1_step1.sh` on the first node.
2. Run `W1_node2.sh` on the secondary node.
3. Run `W1_node1_step2.sh` on the first node.

Example 6-94 shows the output when you run `W1_node1_step1.sh` on the first node.

Example 6-94 Display the output of the W1_node1_step1.sh script on the prazos016_PHA1 node

```
# sh W1_node1_step1.sh
Sat Oct 22 16:49:07 CDT 2016
--> Start first step on Node:pbrazos016, total is two......
--> Delete all hdisks marked Defined

--> Varyoffvg caavg_private volume group

--> Remove CAA cluster forcely
rmcluster: This operation will scrub hdisk7, removing any volume groups and clearing cluster identifiers.
If another cluster is using this disk, that cluster will be destroyed.
Are you sure? (y/[n]) WARNING: Force continue.
rmcluster: Successfully removed hdisk7.

--> Change hdisks's reserve policy for Resource Group
chdev -l hdisk7 -a reserve_policy=no_reserve;
chdev -l hdisk8 -a reserve_policy=no_reserve;
chdev -l hdisk9 -a reserve_policy=no_reserve;
chdev -l hdisk10 -a reserve_policy=no_reserve;
chdev -l hdisk11 -a reserve_policy=no_reserve;
hdisk7 changed
hdisk8 changed
```

```
hdisk9 changed
hdisk10 changed
hdisk11 changed

--> Reconfigure CAA Repository with current new UUID
WARNING: Local node is STOPPED in cache file.
WARNING: Clearing the STOPPED flag for pbrazos016.ausprv.stglabs.ibm.com
Complete the first step on Node:pbrazos016. Now, you need to run W1_node2.sh on the other node.
After that, you will come back to this node and run W1_node1_step2.sh script

--> The elapsed time is from  to Sat Oct 22 16:51:22 CDT 2016
```

Example 6-95 shows the output of the W1_node2.sh script when it is run on the secondary node.

Example 6-95 Display the output of W1_node2.sh script on the prazos017_PHA2 node

```
# sh W1_node2.sh
Sat Oct 22 16:52:19 CDT 2016
--> Start the step on Node:pbrazos017......
--> Remove all hdisks marked Defined
hdisk0 deleted
hdisk1 deleted
hdisk2 deleted
hdisk3 deleted
hdisk4 deleted
hdisk5 deleted
--> Remove caavg_private VG
0516-010 lqueryvg: Volume group must be varied on; use varyonvg command.
0516-010 lvaryoffvg: Volume group must be varied on; use varyonvg command.
0516-942 varyoffvg: Unable to vary off volume group caavg_private.

--> Change hdisks's reserve policy for Resource Group
chdev -l hdisk7 -a reserve_policy=no_reserve;
chdev -l hdisk8 -a reserve_policy=no_reserve;
chdev -l hdisk9 -a reserve_policy=no_reserve;
chdev -l hdisk10 -a reserve_policy=no_reserve;
chdev -l hdisk11 -a reserve_policy=no_reserve;
hdisk7 changed
hdisk8 changed
hdisk9 changed
hdisk10 changed
hdisk11 changed

--> Join new CAA cluster
0516-012 lvaryoffvg: Logical volume must be closed.  If the logical
        volume contains a filesystem, the umount command will close
        the LV device.
0516-942 varyoffvg: Unable to vary off volume group caavg_private.

--> Complete the step on Node:pbrazos017. Now need to run S2_node1_step2.sh on the other node.

--> The elapsed time is from Sat Oct 22 16:52:19 CDT 2016 to Sat Oct 22 16:52:55 CDT 2016.
```

Example 6-96 shows the output of the `W1_node1_step2.sh` script when it is run on the first node.

Example 6-96 Display the output of the W1_node1_step2.sh script on the prazos016_PHA1 node

```
# sh W1_node1_step2.sh
Sat Oct 22 16:53:48 CDT 2016
--> Start the last step on Node:pbrazos016......
--> Start CAA and PowerHA service

Warning: "WHEN" must be specified. Since it was not, a default of "now" will be
         used.


Warning: "MANAGE" must be specified. Since it was not, a default of "offline"
         will be used.

Warning: cluster services are already offline on node "pbrazos016" (state is
         "ST_INIT"). Removing that node from the shutdown list.
Warning: cluster services are already offline on node "pbrazos017" (state is
         "ST_INIT"). Removing that node from the shutdown list.

Cluster "gdr_cluster" is already offline.

Warning: "WHEN" must be specified. Since it was not, a default of "now" will be
         used.


Warning: "MANAGE" must be specified. Since it was not, a default of "auto" will
         be used.


Verifying Cluster Configuration Prior to Starting Cluster Services.


WARNING: No backup repository disk is UP and not already part of a VG for nodes :
WARNING: File 'netmon.cf' is missing or empty on the following nodes:
pbrazos016
pbrazos017
WARNING: The kernel parameter pinnable_frames is not same on node pbrazos016 with value 1775618
and on node pbrazos017 with value 1789711
pbrazos016: start_cluster: Starting PowerHA SystemMirror
pbrazos016:   3866754      -  0:00 syslogd
pbrazos016: Setting routerevalidate to 1


Broadcast message from root@pbrazos016 (tty) at 16:56:01 ...

Starting Event Manager (clevmgrdES) subsystem on pbrazos016


pbrazos016: 0513-059 The clevmgrdES Subsystem ha

Broadcast message from root@pbrazos016 (tty) at 16:56:02 ...

Starting Concurrent Logical Volume Manager (gsclvmd) subsystem on pbrazos016
```

```
s been started. Subsystem PID is 14156000.
pbrazos016: 0513-059 The gsclvmd Subsystem has been started. Subsystem PID is 13565984.
pbrazos017: start_cluster: Starting PowerHA SystemMirror
pbrazos017:   3866782      -  0:00 syslogd
pbrazos017: Setting routerevalidate to 1
pbrazos017: 0513-059 The clevmgrdES Subsystem has been started. Subsystem PID is 15859732.
pbrazos017: 0513-059 The gsclvmd Subsystem has been started. Subsystem PID is 15335436.

The cluster is now online.



Starting Cluster Services on node: pbrazos016
This may take a few minutes.  Please wait...
pbrazos016: Oct 22 2016 16:55:58 Starting execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos016: with parameters: -boot -N -b -P cl_rc_cluster -A
pbrazos016:
pbrazos016: Oct 22 2016 16:55:58 Checking for srcmstr active...
pbrazos016: Oct 22 2016 16:55:58 complete.
pbrazos016: Oct 22 2016 16:56:00
pbrazos016: /usr/es/sbin/cluster/utilities/clstart: called with flags -m -G -b -P cl_rc_cluster
-B -A
pbrazos016:
pbrazos016:     Oct 22 2016 16:56:02
pbrazos016: Completed execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos016: with parameters: -boot -N -b -P cl_rc_cluster -A.
pbrazos016: Exit status = 0
pbrazos016:


Starting Cluster Services on node: pbrazos017
This may take a few minutes.  Please wait...
pbrazos017: Oct 22 2016 16:56:03 Starting execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos017: with parameters: -boot -N -b -P cl_rc_cluster -A
pbrazos017:
pbrazos017: Oct 22 2016 16:56:03 Checking for srcmstr active...
pbrazos017: Oct 22 2016 16:56:03 complete.
pbrazos017: Oct 22 2016 16:56:04
pbrazos017: /usr/es/sbin/cluster/utilities/clstart: called with flags -m -G -b -P cl_rc_cluster
-B -A
pbrazos017:
pbrazos017:     Oct 22 2016 16:56:07
pbrazos017: Completed execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos017: with parameters: -boot -N -b -P cl_rc_cluster -A.
pbrazos017: Exit status = 0
pbrazos017:

--> Complete all steps!

--> The elapsed time is from Sat Oct 22 16:53:48 CDT 2016 to Sat Oct 22 16:56:10 CDT 2016.
```

After completing these three steps, the CAA and PowerHA service are online at the target site.

Example 6-97 shows the CAA cluster information. The repository disk is changed to hdisk7 and the UUID is updated.

Example 6-97 Display the CAA repository disk's status after running the scripts

```
# lscluster -d
Storage Interface Query

Cluster Name: gdr_cluster
Cluster UUID: f35b3566-9876-11e6-8003-62fcd3ef9802
Number of nodes reporting = 2
Number of nodes expected = 2

Node pbrazos016.ausprv.stglabs.ibm.com
Node UUID = f32ccafa-9876-11e6-8003-62fcd3ef9802
Number of disks discovered = 1
        hdisk7:
              State : UP
               uDid : 200980057375C09SYMMETRIX03EMCfcp
               uUid : 972d0db1-9213-1621-5780-ee8c3c5fb654
          Site uUid : 51735173-5173-5173-5173-517351735173
               Type : REPDISK

Node pbrazos017.ausprv.stglabs.ibm.com
Node UUID = f32ccb40-9876-11e6-8003-62fcd3ef9802
Number of disks discovered = 1
        hdisk7:
              State : UP
               uDid : 200980057375C09SYMMETRIX03EMCfcp
               uUid : 972d0db1-9213-1621-5780-ee8c3c5fb654
          Site uUid : 51735173-5173-5173-5173-517351735173
               Type : REPDISK
```

Example 6-98 shows that the PowerHA service is online and the resource group is online at pbrazos016_PHA1 node.

Example 6-98 Display PowerHA Resource Group status

```
# clRGinfo -v

Cluster Name: gdr_cluster

Resource Group Name: gdr_RG
Startup Policy: Online On Home Node Only
Fallover Policy: Fallover To Next Priority Node In The List
Fallback Policy: Never Fallback
Site Policy: ignore
Node                                                             State
---------------------------------------------------------------- ---------------
pbrazos016                                                       ONLINE
pbrazos017                                                       OFFLINE
```

In the following sections, the scripts are shown and described in more detail.

W1_node1_step1.sh

Example 6-99 shows the `W1_node1_step1.sh` script.

Example 6-99 W1_node1_step1.sh script

```
#!/bin/ksh93
#----Workaround 1: using chrepos -c command ----#
#W1_node1_step1.sh
#+++++++++++++++++++++++++++ Node1: +++++++++++++++++++++++++
date
LV_start_date="`date"

#echo "Get local node's hostname"
LV_N1=`/usr/es/sbin/cluster/utilities/get_local_nodename`

echo "--> Start first step on Node:${LV_N1}, total is two......"

echo "--> Delete all hdisks marked Defined"
lsdev -Cc disk|grep Defined|awk '{print "rmdev -dl "$1" -R;"}' | ksh

#echo "--> Get previous repository disk"
LV_PVID=`odmget HACMPsircol|grep -w repository | awk '{print $3}' | sed 's/"//g'`
LV_REPDISK=$(lspv | grep ${LV_PVID} | awk '{print $1}')

#p_utils=/usr/es/sbin/cluster/utilities
#repdisk=$(/usr/lib/cluster/clras lsrepos 2>&1 |awk '/hdisk/{print $1}')
#resgrp=`$p_utils/cllsgrp`
#echo "repdisk=$repdisk; resgrp=$resgrp"

echo "\n--> Varyoffvg caavg_private volume group"
LV_T_VG=`lspv|grep caavg_private|wc|awk '{print $1}'`
if [ ${LV_T_VG} -eq "1" ]
then
varyoffvg caavg_private
exportvg caavg_private
fi

echo "\n--> Remove CAA cluster forcely"
export CAA_FORCE_ENABLED=true
echo "y" | rmcluster -r ${LV_REPDISK}

echo "\n--> Change hdisks's reserve policy for Resource Group"
LV_P_UTILS=/usr/es/sbin/cluster/utilities
${LV_P_UTILS}/cllsgrp | sed "s#^#${LV_P_UTILS}/cllsdisk -g #" |ksh |sort |uniq
>/tmp/hadisk.$(hostname).txt
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a
reserve_policy=no_reserve;"}'
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a
reserve_policy=no_reserve;"}' |ksh

echo "\n--> Reconfigure CAA Repository with current new UUID"
chrepos -c ${LV_REPDISK}
clusterconf

#Complete first step of Node1
```

```
echo "Complete the first step on Node:${LV_N1}. ANow, you need to run W1_node2.sh on the other node.\n"
echo "After that, you will come back to this node and run W1_node1_step2.sh script.\n"

LV_end_time="`date"
echo "\n--> The elapsed time is from ${LV_start_time} to ${LV_end_time} "
```

W1_node2.sh

Example 6-100 shows the `W1_node2.sh` script.

Example 6-100 W1_node2.sh script

```
#!/bin/ksh93
#----Workaround 2: backup and restore snapshot----#
#W1_node2.sh

date
LV_start_time="`date"

#echo "get local node's hostname"
LV_N1=`/usr/es/sbin/cluster/utilities/get_local_nodename`
echo "--> Start the step on Node:${LV_N1}......"

echo "--> Remove all hdisks marked Defined"
lsdev -Cc disk|grep Defined|awk '{print "rmdev -dl "$1" -R;"}' | ksh

#LV_P_UTILS=/usr/es/sbin/cluster/utilities
#LV_REPDISK=$(/usr/lib/cluster/clras lsrepos 2>&1 |awk '/hdisk/{print $1}')
#resgrp=`${LV_P_UTILS}/cllsgrp`
#echo "repdisk=$repdisk; resgrp=$resgrp"

echo "--> Remove caavg_private VG"
LV_T_VG=`lspv|grep caavg_private|wc|awk '{print $1}'`
if [ ${LV_T_VG} -eq "1" ]
then
varyoffvg caavg_private
exportvg caavg_private
fi

echo "\n--> Change hdisks's reserve policy for Resource Group"
LV_P_UTILS=/usr/es/sbin/cluster/utilities
${LV_P_UTILS}/cllsgrp | sed "s#^#${LV_P_UTILS}/cllsdisk -g #" |ksh |sort |uniq
>/tmp/hadisk.$(hostname).txt
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a
reserve_policy=no_reserve;"}'
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a
reserve_policy=no_reserve;"}' |ksh

echo "\n--> Join new CAA cluster"
LV_PVID=`odmget HACMPsircol|grep -w repository | awk '{print $3}' | sed 's/"//g'`
LV_REPDISK=$(lspv | grep ${LV_PVID} | awk '{print $1}')

clusterconf -r ${LV_REPDISK}
varyoffvg caavg_private
```

```
echo "\n--> Complete the step on Node:${LV_N1}. Now need to run W1_node1_step2.sh on the other
node."

LV_end_time="`date"
echo "\n--> The elapsed time is from ${LV_start_time} to ${LV_end_time}. "
```

W1_node1_step2.sh script

Example 6-101 shows the `W1_node1_step2.sh` script.

Example 6-101 W1_node1_step2.sh script

```
#!/bin/ksh93
#----Workaround 1: backup and restore snapshot----#
#W1_node1_step2.sh

date
LV_start_time="`date"

#echo "get local node's hostname"
LV_N1=`/usr/es/sbin/cluster/utilities/get_local_nodename`
echo "--> Start the last step on Node:${LV_N1}......"

echo "--> Start CAA and PowerHA service"
LV_P_UTILS=/usr/es/sbin/cluster/utilities
${LV_P_UTILS}/clmgr stop cluster STOP_CAA=yes
${LV_P_UTILS}/clmgr start cluster START_CAA=yes

echo "\n--> Complete all steps!"
LV_end_time="`date"
echo "\n--> The elapsed time is from ${LV_start_time} to ${LV_end_time}."
```

6.8.5 Second workaround to recover the CAA and the PowerHA cluster

This section describes the second workaround to recover the CAA and the PowerHA cluster.

Workaround introduction

This solution uses the PowerHA snapshot function to recreate the CAA and PowerHA clusters.

Restoration steps and logs

There are three scripts in this workaround solution. Complete the following steps:

1. Run `W2_node1_step1.sh` on the first node.
2. Run `W2_node2.sh` on the secondary node.
3. Run `W2_node1_step2.sh` on the first node.

Example 6-102 shows the output when you run `W2_node2_step1.sh` on the first node.

Example 6-102 Display the output of the W2_node2_step1.sh script

```
# sh W2_node1_step1.sh
Sat Oct 22 15:41:06 CDT 2016
--> Start first step on Node:pbrazos016, total is two......
```

```
--> Get PVID of previous repository disk

--> Check whether the snapshot file exist, delete it if exist

clsnapshot: Removing cluster snapshot: /usr/es/sbin/cluster/snapshots/snapshot_for_gdr.odm

clsnapshot: Removing cluster snapshot: /usr/es/sbin/cluster/snapshots/snapshot_for_gdr.info

clsnapshot: Succeeded removing Cluster Snapshot: snapshot_for_gdr.

--> Create a snapshot from current environment

clsnapshot: Creating file /usr/es/sbin/cluster/snapshots/snapshot_for_gdr.odm...

clsnapshot: Creating file /usr/es/sbin/cluster/snapshots/snapshot_for_gdr.info...

clsnapshot: Executing clsnapshotinfo command on node: pbrazos016...

clsnapshot: Executing clsnapshotinfo command on node: pbrazos017...

clsnapshot: Succeeded creating Cluster Snapshot: snapshot_for_gdr.
v
--> Delete current PowerHA cluster configuration

Deleting the cluster definition from "pbrazos016"...

--> Varyoffvg caavg_private volume group

--> Remove CAA cluster definition forcely
hdisk7 changed
rmcluster: This operation will scrub hdisk7, removing any volume groups and clearing cluster
identifiers.
If another cluster is using this disk, that cluster will be destroyed.
Are you sure? (y/[n]) WARNING: Force continue.
rmcluster: Successfully removed hdisk7.
cluster0 deleted

--> Remove all hdisks in 'Defined' status
hdisk0 deleted
hdisk1 deleted
hdisk2 deleted
hdisk3 deleted
hdisk4 deleted
hdisk5 deleted

--> Change RG's hdisks's reserve policy into no_reserve
Complete the first step on Node:pbrazos016. Now, you need to run W2_node2.sh on the other node.
After that, you will come back to this node and run W2_node1_step2.sh script.

The elapsed time is from Sat Oct 22 15:41:06 CDT 2016 to
```

Example 6-103 shows the output of running `W2_node2.sh` on the secondary node.

Example 6-103 Display the output of the W2_node2.sh script

```
# sh W2_node2.sh
Sat Oct 22 15:44:01 CDT 2016
--> Start the step on Node:pbrazos017......

--> remove all hdisks in 'Defined' status
hdisk0 deleted
hdisk1 deleted
hdisk2 deleted
hdisk3 deleted
hdisk4 deleted
hdisk5 deleted

--> get PVID of previous repository disk
hdisk7 changed

Deleting the cluster definition from "pbrazos017"...
cluster0 deleted

--> varyoffvg caavg_private volume group
0516-010 lqueryvg: Volume group must be varied on; use varyonvg command.
0516-010 lvaryoffvg: Volume group must be varied on; use varyonvg command.
0516-942 varyoffvg: Unable to vary off volume group caavg_private.

--> change RG's hdisks's reserve policy into no_reserve

--> Complete the step on Node:pbrazos017. Now need to run W2_node1_step2.sh on the other node.
The elapsed time is from Sat Oct 22 15:44:01 CDT 2016 to .
```

Example 6-104 shows the output of running the `W2_node1_step2.sh` script on the first node.

Example 6-104 Display the output of the W2_node1_step2.sh script

```
# sh W2_node1_step2.sh
Warning: There is no cluster found.
Sat Oct 22 15:45:49 CDT 2016
--> Start the last step on Node:......

--> Restore PowerHA configuration from snapshop

clsnapshot: Removing any existing temporary PowerHA SystemMirror ODM entries...

clsnapshot: Creating temporary PowerHA SystemMirror ODM object classes...
clsnapshot: Adding PowerHA SystemMirror ODM entries to a temporary directory.

clsnapshot: Verifying configuration using temporary PowerHA SystemMirror ODM entries...
Verification to be performed on the following:
        Cluster Topology
        Cluster Resources

Retrieving data from available cluster nodes.  This could take a few minutes.

        Start data collection on node pbrazos016
```

```
        Start data collection on node pbrazos017
        Waiting on node pbrazos016 data collection, 15 seconds elapsed
        Waiting on node pbrazos017 data collection, 15 seconds elapsed
        Collector on node pbrazos017 completed
        Collector on node pbrazos016 completed
        Data collection complete
        Completed 10 percent of the verification checks


For nodes with a single Network Interface Card per logical
network configured, it is recommended to include the file
'/usr/es/sbin/cluster/netmon.cf' with a "pingable"
IP address as described in the 'PowerHA SystemMirror Planning Guide'.
WARNING: File 'netmon.cf' is missing or empty on the following nodes:
pbrazos016
pbrazos017
0519-010 libodm: The specified object class does not exist.
        Check path name and permissions.

0519-010 libodm: The specified object class does not exist.
        Check path name and permissions.

        Completed 20 percent of the verification checks
WARNING: The kernel parameter pinnable_frames is not same on node pbrazos016 with value 1814947
and on node pbrazos017 with value 1815596
        Completed 30 percent of the verification checks
This cluster uses Unicast heartbeat
        Completed 40 percent of the verification checks
        Completed 50 percent of the verification checks
        Completed 60 percent of the verification checks
        Completed 70 percent of the verification checks
        Completed 80 percent of the verification checks

Verifying XD Solutions...

        Completed 90 percent of the verification checks
        Completed 100 percent of the verification checks

Verification has completed normally.

clsnapshot: Removing current PowerHA SystemMirror cluster information...
Deleting the cluster definition from "pbrazos016"...

clsnapshot: Adding new PowerHA SystemMirror ODM entries...

clsnapshot: Synchronizing cluster configuration to all cluster nodes...
/etc/es/objrepos
Saving existing /tmp/clmigcheck/clmigcleanup.log to /tmp/clmigcheck/clmigcleanup.log.bak

Committing any changes, as required, to all available nodes...
lscluster: Cluster services are not active.
Adding any necessary PowerHA SystemMirror entries to /etc/inittab and /etc/rc.net for IPAT on
node pbrazos016.

cldare: Configuring a 2 node cluster in AIX may take up to 2 minutes. Please wait.
```

```
1 tunable updated on cluster gdr_cluster.
Adding any necessary PowerHA SystemMirror entries to /etc/inittab and /etc/rc.net for IPAT on
node pbrazos017.

Verification has completed normally.
WARNING: refreshing clxd daemon failed.
Please wait for clxd to stabilize...
== INFO >>
Invoked in the context of SNAPSHOT, GENXD Configuration will not perform any operation. User
need to run verify and sync after snapshot restoration to make genxd configuration in sync.


clsnapshot: Succeeded applying Cluster Snapshot: snapshot_for_gdr.

--> Start CAA and PowerHA service for all nodes

Warning: "WHEN" must be specified. Since it was not, a default of "now" will be
         used.


Warning: "MANAGE" must be specified. Since it was not, a default of "auto" will
         be used.

pbrazos016.ausprv.stglabs.ibm.com is already up. Skipping.
pbrazos017.ausprv.stglabs.ibm.com is already up. Skipping.

Verifying Cluster Configuration Prior to Starting Cluster Services.


WARNING: No backup repository disk is UP and not already part of a VG for nodes :
WARNING: File 'netmon.cf' is missing or empty on the following nodes:
pbrazos016
pbrazos017
WARNING: The disk reserve policy of hdisk10 on the node pbrazos016 is single_path which is not a
recommended value
WARNING: The disk reserve policy of hdisk11 on the node pbrazos016 is single_path which is not a
recommended value
WARNING: The disk reserve policy of hdisk10 on the node pbrazos017 is single_path which is not a
recommended value
WARNING: The disk reserve policy of hdisk11 on the node pbrazos017 is single_path which is not a
recommended value
WARNING: The kernel parameter pinnable_frames is not same on node pbrazos016 with value 1788073
and on node pbrazos017 with value 1776733
pbrazos016: start_cluster: Starting PowerHA SystemMirror
pbrazos016:   3080334      -  0:00 syslogd
pbrazos016: Setting routerevalidate to 1


Broadcast message from root@pbrazos016 (tty) at 15:49:04 ...

Starting Concurrent Logical Volume Manager (gsclvmd) subsystem on pbrazos016


pbrazos016: 0513-059 The gsclvmd Subsystem has been started. Subsystem PID is 8978656.
```

```
pbrazos017: start_cluster: Starting PowerHA SystemMirror
pbrazos017:   4456622      -  0:00 syslogd
pbrazos017: Setting routerevalidate to 1
pbrazos017: 0513-059 The gsclvmd Subsystem has been started. Subsystem PID is 17891476.

The cluster is now online.


WARNING: Cannot perform START_NODE operation if the node is already not stopped.
WARNING: Cannot perform START_NODE operation if the node is already not stopped.


Starting Cluster Services on node: pbrazos016
This may take a few minutes.  Please wait...
pbrazos016: Oct 22 2016 15:49:01 Starting execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos016: with parameters: -boot -N -b -P cl_rc_cluster -A
pbrazos016:
pbrazos016: Oct 22 2016 15:49:01 Checking for srcmstr active...
pbrazos016: Oct 22 2016 15:49:01 complete.
pbrazos016: Oct 22 2016 15:49:03
pbrazos016: /usr/es/sbin/cluster/utilities/clstart: called with flags -m -G -b -P cl_rc_cluster
-B -A
pbrazos016:
pbrazos016:     Oct 22 2016 15:49:04
pbrazos016: Completed execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos016: with parameters: -boot -N -b -P cl_rc_cluster -A.
pbrazos016: Exit status = 0
pbrazos016:


Starting Cluster Services on node: pbrazos017
This may take a few minutes.  Please wait...
pbrazos017: Oct 22 2016 15:49:05 Starting execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos017: with parameters: -boot -N -b -P cl_rc_cluster -A
pbrazos017:
pbrazos017: Oct 22 2016 15:49:05 Checking for srcmstr active...
pbrazos017: Oct 22 2016 15:49:05 complete.
pbrazos017: Oct 22 2016 15:49:06
pbrazos017: /usr/es/sbin/cluster/utilities/clstart: called with flags -m -G -b -P cl_rc_cluster
-B -A
pbrazos017:
pbrazos017:     Oct 22 2016 15:49:07
pbrazos017: Completed execution of /usr/es/sbin/cluster/etc/rc.cluster
pbrazos017: with parameters: -boot -N -b -P cl_rc_cluster -A.
pbrazos017: Exit status = 0
pbrazos017:

--> Complete all steps!
The elapsed time is from Sat Oct 22 15:45:49 CDT 2016 to Sat Oct 22 15:49:08 CDT 2016.
```

When you finish these three steps in the second workaround, check the CAA and PowerHA services to see whether they are online again.

The following sections provide the scripts for the second workaround.

W2_node1_step1.sh

Example 6-105 shows the `W2_node1_step1.sh` script.

Example 6-105 W2_node1_step1.sh

```
#!/bin/ksh93
#----Solution 2: backup and restore snapshot----#
#S2_step1_node1.sh

date
LV_start_time="`date"
#echo "Define a snapshot name"
LV_SS="snapshot_for_gdr"

#echo "Get local node's hostname"
LV_N1=`/usr/es/sbin/cluster/utilities/get_local_nodename`

echo "--> Start first step on Node:${LV_N1}, total is two......"

echo "\n--> Get PVID of previous repository disk"
LV_PVID=`odmget HACMPsircol|grep -w repository | awk '{print $3}' | sed 's/"//g'`
LV_HDISK=`lspv|grep ${LV_PVID}|awk '{print $1}'`

echo "\n--> Check whether the snapshot file exist, delete it if exist"
if [ -f "/usr/es/sbin/cluster/snapshots/${LV_SS}.odm" ]
then
/usr/es/sbin/cluster/utilities/clsnapshot -r -n "${LV_SS}"
fi

echo "\n--> Create a snapshot from current environment"
/usr/es/sbin/cluster/utilities/clsnapshot -c -i -n "${LV_SS}" -d 'for GDR cluster'

echo "v\n--> Delete current PowerHA cluster configuration"
echo 'y'|/usr/es/sbin/cluster/utilities/clmgr delete cluster NODES=ALL

echo "\n--> Varyoffvg caavg_private volume group"
LV_T_VG=`lspv|grep caavg_private|wc|awk '{print $1}'`
if [ ${LV_T_VG} -eq "1" ]
then
varyoffvg caavg_private
exportvg caavg_private
fi

echo "\n--> Remove CAA cluster definition forcely"
chdev -l ${LV_HDISK} -a reserve_policy=no_reserve
export CAA_FORCE_ENABLED=true
echo 'y'|rmcluster -r ${LV_HDISK}
rmdev -dl cluster0 -R;cfgmgr

echo "\n--> Remove all hdisks in 'Defined' status"
lsdev -Cc disk|grep Defined|awk '{print "rmdev -dl "$1" -R;"}' | ksh

echo "\n--> Change RG's hdisks's reserve policy into no_reserve"
LV_P_UTILS=/usr/es/sbin/cluster/utilities
${LV_P_UTILS}/cllsgrp | sed "s#^#${LV_P_UTILS}/cllsdisk -g #" |ksh |sort |uniq >/tmp/hadisk.$(hostname).txt
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a reserve_policy=no_reserve;"}'
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a reserve_policy=no_reserve;"}'
|ksh

#Complete first stage of Node1
```

```
echo "Complete the first step on Node:${LV_N1}. Now, you need to run S2_step_node2.sh on the other node.\n"
echo "After that, you will come back to this node and run S2_step2_node1.sh script.\n"

LV_end_time="`date"

echo "\n\n--> The elapsed time is from ${LV_start_time} to ${LV_end_time} \n"
```

W2_node2.sh

Example 6-106 shows the `W2_node2.sh` script.

Example 6-106 W2_node2.sh script

```
#!/bin/ksh93
#----Solution 2: backup and restore snapshot----#
#S2_step_node2.sh

date
LV_start_time="`date"

#echo "get local node's hostname"
LV_N1=`/usr/es/sbin/cluster/utilities/get_local_nodename`
echo "--> Start the step on Node:${LV_N1}......"

echo "\n--> remove all hdisks in 'Defined' status"
/usr/sbin/lsdev -Cc disk|grep Defined|awk '{print "/usr/sbin/rmdev -dl "$1" -R;"}' | ksh

echo "\n--> get PVID from previous repository disk"
LV_PVID=`odmget HACMPsircol|grep -w repository | awk '{print $3}' | sed 's/"//g'`
LV_HDISK=`lspv|grep ${LV_PVID}|awk '{print $1}'`

/usr/sbin/chdev -l ${LV_HDISK} -a reserve_policy=no_reserve
/usr/bin/echo 'y'|/usr/es/sbin/cluster/utilities/clmgr delete cluster NODES=ALL
/usr/sbin/rmdev -dl cluster0 -R
/usr/sbin/cfgmgr

echo "\n--> varyoffvg caavg_private volume group"
LV_T_VG=`lspv|grep caavg_private|wc|awk '{print $1}'`
if [ ${LV_T_VG} -eq "1" ]
then
varyoffvg caavg_private
exportvg caavg_private
fi

echo "\n--> change RG's hdisks's reserve policy into no_reserve"
LV_P_UTILS=/usr/es/sbin/cluster/utilities
${LV_P_UTILS}/cllsgrp | sed "s#^#${LV_P_UTILS}/cllsdisk -g #" |ksh |sort |uniq
>/tmp/hadisk.$(hostname).txt
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a
reserve_policy=no_reserve;"}'
lspv |grep -wf /tmp/hadisk.$(hostname).txt |awk '{print "chdev -l",$1,"-a
reserve_policy=no_reserve;"}' |ksh

echo "\n--> Complete the step on Node:${LV_N1}. Now need to run S2_step2_node1.sh on the other
node."
```

```
LV_end_time="`date"

echo "\n\n--> The elapsed time is from ${LV_start_time} to ${LV_end_time}. \n"
```

W1_node1_step2.sh

Example 6-107 shows the `W2_node1_step2.sh` script.

Example 6-107 W2_node1_step2.sh

```
#!/bin/ksh93
#----Solution 2: backup and restore snapshot----#
#S2_step2_node1.sh

LV_N1=`/usr/es/sbin/cluster/utilities/get_local_nodename`

date
LV_start_time="`date"

echo "--> Start the last step on Node:${LV_N1}......"
LV_SS="snapshot_for_gdr"

echo "\n--> Restore PowerHA configuration from snapshop"
/usr/es/sbin/cluster/utilities/clsnapshot -a -n "${LV_SS}" -f'false'

echo "\n--> Start CAA and PowerHA service for all nodes"
clmgr start cluster START_CAA=yes

echo "\n--> Complete all steps!"

LV_end_time="`date"

echo "\n\n--> The elapsed time is from ${LV_start_time} to ${LV_end_time}.\n"
```

6.8.6 Scenario summary

The first workaround does not support a multiple repository disks configuration. If there are one or more backup repository disks in the previous configurations, the CAA and PowerHA services can start after the three scripts run, but the backup repository disks are not online because the UUIDs of the backup repository disks also changed. After the IBM Geographically Dispersed Resiliency for Power Systems site move operation when CAA is re-created with the new UUID of primary repository disk, it could not discover the new UUIDs of the backup repository disks, so the status of backup repository disks is DOWN.

Example 6-108 shows a PowerHA cluster where there are two backup repository disks. Before the site-switch operation, their UUIDs are 0aafcfbc-8202-e504-20d8-0029eb1da96c and 8a3be450-69ce-d18f-9093-4e8c703ffa10. After the site switch operation, the UUIDs changed to 249184d1-1bc4-a595-99c9-84d655d63d35 and '134d2c0a-5de6-1d59-8fd4-958afdbac378'. When CAA and PowerHA are re-created, the two disks are marked DOWN in CAA, but this does not impact CAA and PowerHA.

Example 6-108 An example with a backup repository disk

```
# lscluster -d
Storage Interface Query

Cluster Name: gdr_cluster
Cluster UUID: ffeaaa1e-9f92-11e6-8003-62fcd3ef9802
Number of nodes reporting = 2
Number of nodes expected = 2

Node pbrazos016.ausprv.stglabs.ibm.com
Node UUID = ffc4cd30-9f92-11e6-8003-62fcd3ef9802
Number of disks discovered = 3
        :
              State : DOWN
               uDid : 200980050819409SYMMETRIX03EMCfcp
               uUid : 0aafcfbc-8202-e504-20d8-0029eb1da96c
           Site uUid : 51735173-5173-5173-5173-517351735173
               Type : BACKUP_DISK
        :
              State : DOWN
               uDid : 200980050819209SYMMETRIX03EMCfcp
               uUid : 8a3be450-69ce-d18f-9093-4e8c703ffa10
           Site uUid : 51735173-5173-5173-5173-517351735173
               Type : BACKUP_DISK
        hdisk1:
              State : UP
               uDid : 200980057375C09SYMMETRIX03EMCfcp
               uUid : 972d0db1-9213-1621-5780-ee8c3c5fb654
           Site uUid : 51735173-5173-5173-5173-517351735173
               Type : REPDISK

Node pbrazos017.ausprv.stglabs.ibm.com
Node UUID = ffc4cd6c-9f92-11e6-8003-62fcd3ef9802
Number of disks discovered = 3
        :
              State : DOWN
               uDid : 200980050819409SYMMETRIX03EMCfcp
               uUid : 0aafcfbc-8202-e504-20d8-0029eb1da96c
           Site uUid : 51735173-5173-5173-5173-517351735173
               Type : BACKUP_DISK
        :
              State : DOWN
               uDid : 200980050819209SYMMETRIX03EMCfcp
               uUid : 8a3be450-69ce-d18f-9093-4e8c703ffa10
           Site uUid : 51735173-5173-5173-5173-517351735173
               Type : BACKUP_DISK
        hdisk1:
              State : UP
```

```
          uDid : 200980057375C09SYMMETRIX03EMCfcp
          uUid : 972d0db1-9213-1621-5780-ee8c3c5fb654
     Site uUid : 51735173-5173-5173-5173-517351735173
          Type : REPDISK

# lspv -u|more
hdisk0          00cbbc47e96e4879                    rootvg          active
2009800573!:,09SYMMETRIX03EMCfcp
7db56cdb-60f6-6e79-bbda-b777cfa75dde
hdisk1          00cbbc47ea310219                    caavg_private   active
200980057375C09SYMMETRIX03EMCfcp
972d0db1-9213-1621-5780-ee8c3c5fb654
hdisk2          00cbbc47ea3101c9                    None
200980057374E09SYMMETRIX03EMCfcp
249184d1-1bc4-a595-99c9-84d655d63d35
hdisk3          00cbbc47ea31017a                    None
200980057375109SYMMETRIX03EMCfcp
134d2c0a-5de6-1d59-8fd4-958afdbac378
......

# clRGinfo -v
Cluster Name: gdr_cluster

Resource Group Name: gdr_RG
Startup Policy: Online On Home Node Only
Fallover Policy: Fallover To Next Priority Node In The List
Fallback Policy: Never Fallback
Site Policy: ignore
Node                                                             State
---------------------------------------------------------------- ---------------
pbrazos016                                                       ONLINE
pbrazos017                                                       OFFLINE
```

The second workaround does not have this limitation because it stores the backup repository disks' information in the snapshot file, and the workaround uses the PVID, not the UUID. So, during the restore process, IBM Geographically Dispersed Resiliency for Power Systems can discover the correct hdisks to add them into the CAA cluster. Example 6-109 shows snapshot repository disk information.

Example 6-109 PowerHA snapshot restore backup repository disks information

```
HACMPsircol:
        name = "gdr_cluster_sircol"
        id = 0
        uuid = "0"
        ip_address = ""
        repository = "00cbbc47ea310219"
        backup_repository = "00cbbc47ea3101c9 00cbbc47ea31017a"
```

6.9 Unplanned managed system failure

This section simulates the managed system failure by powering off the server to see how IBM Geographically Dispersed Resiliency for Power Systems responds in that situation.

6.9.1 Scenario description

Figure 6-17 shows the topology for the scenario that changes the active site to ShangHai and sets up a new KSYS node at Beijing to simulate the managed system failure scenario. After the environment is set up, power off HAM-P780.

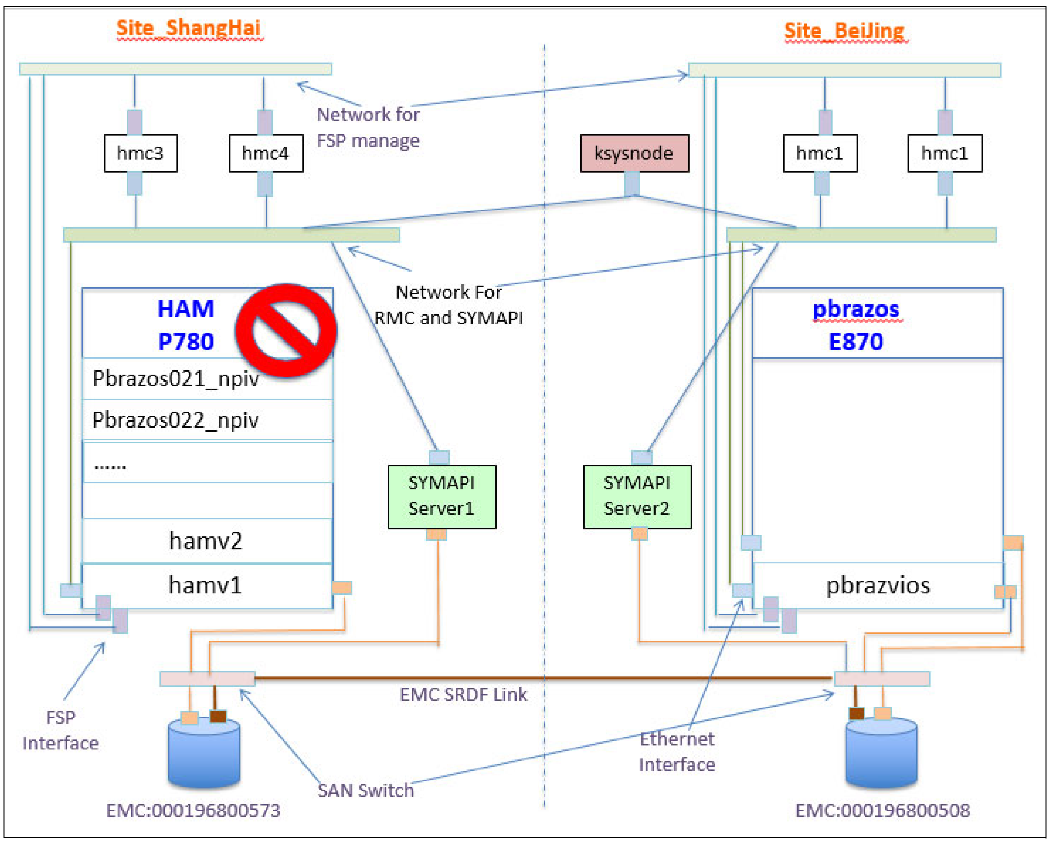


Figure 6-17 Topology of the managed system failure scenario

6.9.2 Result of the discover and verify operation

In this scenario, if you run a discovery operation, it fails because the managed system HAM-P780 is not operational. However, if you run a verify operation, it succeeds because the verify operation checks whether the target site is ready to move. Example 6-110 shows the output of the verify operation. After this verify operation, the VMs state is still READY_TO_MOVE.

Example 6-110 Run the verify operation at the ShangHai site

```
ksysmgr verify site ITSO2_ShangHai
Site verification started for ITSO2_ShangHai
        pbrazos_9119-MME-21BBC47 verification has started
        pbrazos_9119-MME-21BBC47 verification has completed
        pbrazos021_npiv verification has started
        pbrazos022_npiv verification has started
        pbrazos021_npiv verification has completed
        pbrazos022_npiv verification has completed
        Disk Group verification on storage subsystem started for Site
ITSO2_ShangHai
        Disk Group verification on storage subsystem completed for Site
ITSO2_ShangHai
Verification has finished for ITSO2_ShangHai
2 out of 2 VMs have been successfully verified
```

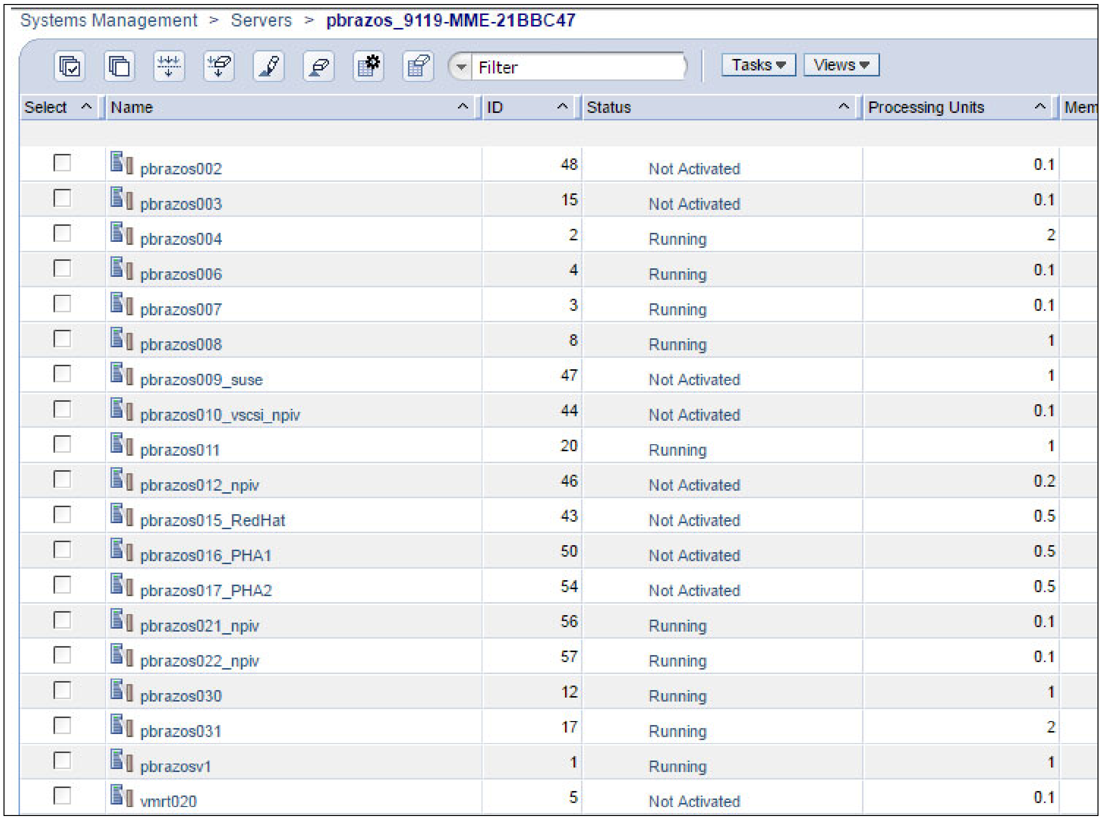
6.9.3 Starting the unplanned move operation

Now that the managed system HAM-P780 is not in the operational state, move the site with the unplanned move operation, as shown in Example 6-111.

Example 6-111 Unplanned move due to managed system failure

```
# ksysmgr move site from=ITSO2_ShangHai to=ITSO2_BeiJing dr_type=unplanned
Site move started for ITSO2_ShangHai to ITSO2_BeiJing
        Shutdown on ITSO2_ShangHai site has started for VM pbrazos021_npiv
        Shutdown on ITSO2_ShangHai site has started for VM pbrazos022_npiv
        Shutdown on ITSO2_ShangHai site has completed for VM pbrazos021_npiv
        Shutdown on ITSO2_ShangHai site has completed for VM pbrazos022_npiv
        Storage mirror reversal has started
        Mirroring will be setup from ITSO2_BeiJing to ITSO2_ShangHai
        Storage mirror reversal has completed
        Restart on ITSO2_BeiJing site has started for VM pbrazos021_npiv
        Restart on ITSO2_BeiJing site has started for VM pbrazos022_npiv
        Restart on ITSO2_BeiJing site has completed for VM pbrazos021_npiv
        Move has completed for VM pbrazos021_npiv
        Rediscovering configuration for VM pbrazos021_npiv on site ITSO2_BeiJing
        Restart on ITSO2_BeiJing site has completed for VM pbrazos022_npiv
        Move has completed for VM pbrazos022_npiv
        Rediscovering configuration for VM pbrazos022_npiv on site ITSO2_BeiJing
        Done rediscovering configuration for VM pbrazos021_npiv on site ITSO2_BeiJing
        Done rediscovering configuration for VM pbrazos022_npiv on site ITSO2_BeiJing
Site move completed from ITSO2_ShangHai to ITSO2_BeiJing
2 out of 2 VMs have been successfully moved from ITSO2_ShangHai to ITSO2_BeiJing
ITSO2_BeiJing is now the active site
```

Check that the target site after the unplanned move completes, as shown in Figure 6-18.



Select	Name	ID	Status	Processing Units	Mem
☐	pbrazos002	48	Not Activated	0.1	
☐	pbrazos003	15	Not Activated	0.1	
☐	pbrazos004	2	Running	2	
☐	pbrazos006	4	Running	0.1	
☐	pbrazos007	3	Running	0.1	
☐	pbrazos008	8	Running	1	
☐	pbrazos009_suse	47	Not Activated	1	
☐	pbrazos010_vscsi_npiv	44	Not Activated	0.1	
☐	pbrazos011	20	Running	1	
☐	pbrazos012_npiv	46	Not Activated	0.2	
☐	pbrazos015_RedHat	43	Not Activated	0.5	
☐	pbrazos016_PHA1	50	Not Activated	0.5	
☐	pbrazos017_PHA2	54	Not Activated	0.5	
☐	pbrazos021_npiv	56	Running	0.1	
☐	pbrazos022_npiv	57	Running	0.1	
☐	pbrazos030	12	Running	1	
☐	pbrazos031	17	Running	2	
☐	pbrazosv1	1	Running	1	
☐	vmrt020	5	Not Activated	0.1	

Figure 6-18 The pbrazos021 and pbrazos022 nodes show a running status at the target site

For an unplanned move, you must manually clean up the source site after the move operation completes, as shown in Example 6-112. The managed system is powered off. After the managed system is powered back on, run the following cleanup command:

```
ksysmgr cleanup site SiteA
```

Example 6-112 Clean up site ShangHai

```
# ksysmgr -t cleanup site ITSO2_ShangHai
Beginning cleanup for ITSO2_ShangHai
Site cleanup successful for ITSO2_ShangHai
```

Verify the disk status of VMs, as shown in Example 6-113.

Example 6-113 Verify the disk pair of the VMs

```
# symrdf list -rdfg 69

Symmetrix ID: 000196800573

                              Local Device View
---------------------------------------------------------------------------
                     STATUS    MODES                    RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------
```

```
0242A 0325A   R1:69  WD RW NR  A..1.       0       0 WD  RW   Failed Over
0242B 0325D   R1:69  WD RW NR  A..1.       0       0 WD  RW   Failed Over
0242C 0325E   R1:69  WD RW NR  A..1.       0       0 WD  RW   Failed Over
0242D 0325F   R1:69  WD RW NR  A..1.       0       0 WD  RW   Failed Over

Symmetrix ID: 000196800508

                              Local Device View
---------------------------------------------------------------------------
                     STATUS    MODES                   RDF  S T A T E S
Sym   Sym   RDF      --------- ----- R1 Inv  R2 Inv  ----------------------
Dev   RDev  Typ:G    SA RA LNK MDATE Tracks  Tracks  Dev RDev Pair
----- ----- -------- --------- ----- ------- ------- --- ---- -------------

0325A 0242A   R2:69  RW RW NR  A..2.     523       0 RW  WD   Failed Over
0325D 0242B   R2:69  RW RW NR  A..2.     522       0 RW  WD   Failed Over
0325E 0242C   R2:69  RW RW NR  A..2.       0       0 RW  WD   Failed Over
0325F 0242D   R2:69  RW RW NR  A..2.       0       0 RW  WD   Failed Over
```

The unplanned move breaks the synchronization of the storage because data is not replicated back to the previously active storage. After the problems in the previously active site are resolved, you must manually resynchronize the storage. For more information, see the recovery disk pairs steps in 6.5.5, "Recovering the SRDF/A status" on page 328.

To recover the disk pairs, you must complete the following steps:

1. Disable consistency for all the devices in the current CG.
2. Swap the RDF group.
3. Synchronize the data with the **establish** option.
4. Enable consistency for all the devices in the current CG.

Disabling consistency for all the devices in the current composite group

Example 6-114 shows how to disable the CG.

Example 6-114 Disable the composite group operation

```
# export SYMCLI_CONNECT=SYMAPI_SITE_573
# /usr/symcli/bin/symcg -cg VMRDG_itso2_cluster_Site_ShangHai -noprompt disable
-force

A consistency 'Disable' operation execution is
in progress for composite group 'VMRDG_itso2_cluster_Site_ShangHai'. Please
wait...


The consistency 'Disable' operation successfully executed for
composite group 'VMRDG_itso2_cluster_Site_ShangHai'.
```

Example 6-115 shows that the MODE column changed from A.X. to A..., which means that the CG is disabled.

Example 6-115 Check the composite group status

```
# symrdf -cg VMRDG_itso2_cluster_Site_ShangHai query

Composite Group Name      :  VMRDG_itso2_cluster_Site_ShangHai
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  NONE

Symmetrix ID                : 000196800573 (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800508 (Microcode Version: 5977)
RDF (RA) Group Number       :  69 (44)

         Source (R1) View                Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   0242A WD       0       0 NR 0325A RW   82364       0 A... Failed Over
DEV002   0242B WD       0       0 NR 0325D RW     521       0 A... Failed Over
DEV003   0242C WD       0       0 NR 0325E RW       0       0 A... Failed Over
DEV004   0242D WD       0       0 NR 0325F RW       0       0 A... Failed Over
```

Swapping the consistency group

Example 6-116 shows the output of the swap operation.

Example 6-116 Swap the consistency group

```
# /usr/symcli/bin/symrdf -cg VMRDG_itso2_cluster_Site_ShangHai swap -noprompt

An RDF 'Swap Personality' operation execution is
in progress for composite group 'VMRDG_itso2_cluster_Site_ShangHai'. Please
wait...

    Suspend RDF link(s) for device(s) in (0573,069)..................Started.
    Suspend RDF link(s) for device(s) in (0573,069)..................Done.
    Swap RDF Personality in (0573,069)...............................Started.
    Swap RDF Personality in (0573,069)...............................Done.

The RDF 'Swap Personality' operation successfully executed for
composite group 'VMRDG_itso2_cluster_Site_ShangHai'.
```

Example 6-117 shows that the R1 and R2 roles are swapped. At this time, the devices at the source site are R2 and the devices at the target site are R1.

Example 6-117 Verify the consistency group

```
# symrdf -cg VMRDG_itso2_cluster_Site_ShangHai query

Composite Group Name      :  VMRDG_itso2_cluster_Site_ShangHai
Composite Group Type      :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  NONE

Symmetrix ID                : 000196800573 (Microcode Version: 5977)
Remote Symmetrix ID         : 000196800508 (Microcode Version: 5977)
RDF (RA) Group Number       :  69 (44)

         Target (R2) View               Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001    0242A WD       0        0 NR 0325A RW   61785        0 A... Suspended
DEV002    0242B WD       0        0 NR 0325D RW     387        0 A... Suspended
DEV003    0242C WD       0        0 NR 0325E RW       0        0 A... Suspended
DEV004    0242D WD       0        0 NR 0325F RW       0        0 A... Suspended
```

Synchronizing the data with the establish option

Example 6-118 shows the output of the **establish** operation.

Example 6-118 Output of the establish operation

```
# /usr/symcli/bin/symrdf -cg VMRDG_itso2_cluster_Site_ShangHai establish -noprompt

An RDF 'Incremental Establish' operation execution is
in progress for composite group 'VMRDG_itso2_cluster_Site_ShangHai'. Please
wait...

    Suspend RDF link(s) for device(s) in (0573,069).................Done.
    Resume RDF link(s) for device(s) in (0573,069)..................Started.
    Merge track tables between source and target in (0573,069).......Started.
    Devices: 325A-325A, 325D-325F in (0573,069).....................Merged.
    Merge track tables between source and target in (0573,069).......Done.
    Resume RDF link(s) for device(s) in (0573,069)..................Done.

The RDF 'Incremental Establish' operation successfully initiated for
composite group 'VMRDG_itso2_cluster_Site_ShangHai'.
```

Example 6-119 shows the data synchronization progress.

Example 6-119 Data in synchronization progress

```
# symrdf -cg VMRDG_itso2_cluster_Site_ShangHai query

Composite Group Name      :  VMRDG_itso2_cluster_Site_ShangHai
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  NONE

Symmetrix ID                 : 000196800573 (Microcode Version: 5977)
Remote Symmetrix ID          : 000196800508 (Microcode Version: 5977)
RDF (RA) Group Number        :  69 (44)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym    T R1 Inv  R2 Inv   K Sym    T R1 Inv  R2 Inv       RDF Pair
Device    Dev    E Tracks  Tracks   S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   0242A WD       0       0 NR 0325A RW     634       0 A... SyncInProg
DEV002   0242B WD       0       0 NR 0325D RW     522       0 A... SyncInProg
DEV003   0242C WD       0       0 NR 0325E RW       0       0 A... SyncInProg
DEV004   0242D WD       0       0 NR 0325F RW       0       0 A... SyncInProg
```

Enabling consistency for all the devices in the current composite group

Example 6-120 shows the output of enabling the consistency attribution for all the devices in the current CG.

Example 6-120 Enable the consistency attribution for all devices in the composite group

```
# /usr/symcli/bin/symcg -cg VMRDG_itso2_cluster_Site_ShangHai -noprompt enable

A consistency 'Enable' operation execution is
in progress for composite group 'VMRDG_itso2_cluster_Site_ShangHai'. Please
wait...


The consistency 'Enable' operation successfully executed for
composite group 'VMRDG_itso2_cluster_Site_ShangHai'.
```

Example 6-121 shows that the MODE column changed from A... to A.X, which means that the CG is enabled with the consistency attribute.

Example 6-121 Enable the consistency attribute for the composite group

```
# symrdf -cg VMRDG_itso2_cluster_Site_ShangHai query

Composite Group Name      :  VMRDG_itso2_cluster_Site_ShangHai
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  MSC
```

```
Symmetrix ID                  : 000196800573 (Microcode Version: 5977)
Remote Symmetrix ID           : 000196800508 (Microcode Version: 5977)
RDF (RA) Group Number         :  69 (44)

        Target (R2) View             Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                LI       ST
Standard        A                 N        A
Logical  Sym    T R1 Inv  R2 Inv  K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks  S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   0242A WD       0       0 NR 0325A RW     659       0 A.X. SyncInProg
DEV002   0242B WD       0       0 NR 0325D RW     218       0 A.X. SyncInProg
DEV003   0242C WD       0       0 NR 0325E RW       0       0 A.X. SyncInProg
DEV004   0242D WD       0       0 NR 0325F RW       0       0 A.X. SyncInProg
```

After some time, the RDF group status changes from SyncInProg to Consistent, as shown in Example 6-122.

Example 6-122 The data is synced

```
# symrdf -cg VMRDG_itso2_cluster_Site_ShangHai query

Composite Group Name      :  VMRDG_itso2_cluster_Site_ShangHai
Composite Group Type      :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode      :  MSC

Symmetrix ID                  : 000196800573 (Microcode Version: 5977)
Remote Symmetrix ID           : 000196800508 (Microcode Version: 5977)
RDF (RA) Group Number         :  69 (44)

        Target (R2) View             Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                LI       ST
Standard        A                 N        A
Logical  Sym    T R1 Inv  R2 Inv  K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev    E Tracks  Tracks  S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
DEV001   0242A WD       0       0 NR 0325A RW       0       0 A.X. Consistent
DEV002   0242B WD       0       0 NR 0325D RW       0       0 A.X. Consistent
DEV003   0242C WD       0       0 NR 0325E RW       0       0 A.X. Consistent
DEV004   0242D WD       0       0 NR 0325F RW       0       0 A.X. Consistent
```

After these steps are complete, run recovery and verify operations to check whether the current situation satisfies the next move operation.

6.9.4 Scenario summary

This scenario describes when the managed system failed at the active site, and how IBM Geographically Dispersed Resiliency for Power Systems uses the unplanned move operation.

6.10 Invoking a move with the lose_vios_redundancy attribute

This scenario describes the `lose_vios_redundancy` attribute. You can use the `lose_vios_redundancy` attribute to start the VMs on another site without the dual-VIOS setup in the target hosts. However, If the VMs are started with single VIOS on the backup site and must move back to the previous site that has a dual-VIOS configuration, you must manually reconfigure the VIOS configuration to discover the redundancy VIOS after a move back to the previous site.

6.10.1 Scenario description

In this scenario (Figure 6-19), the VM pbrazos021_npiv has two virtual Fibre Channel adapters, which are VFC-390 (slot 390 from HAMV1) and VFC-378 (slot 378 from HAMV2) on the HAM-P780 managed system. At the target site, there is only one VIOS, and you can move the VM to the target site by using the `lose_vios_redundancy` attribute.

Note: Check the prerequisites of the IBM Geographically Dispersed Resiliency for Power Systems solution on VIOS before you perform the move.

.

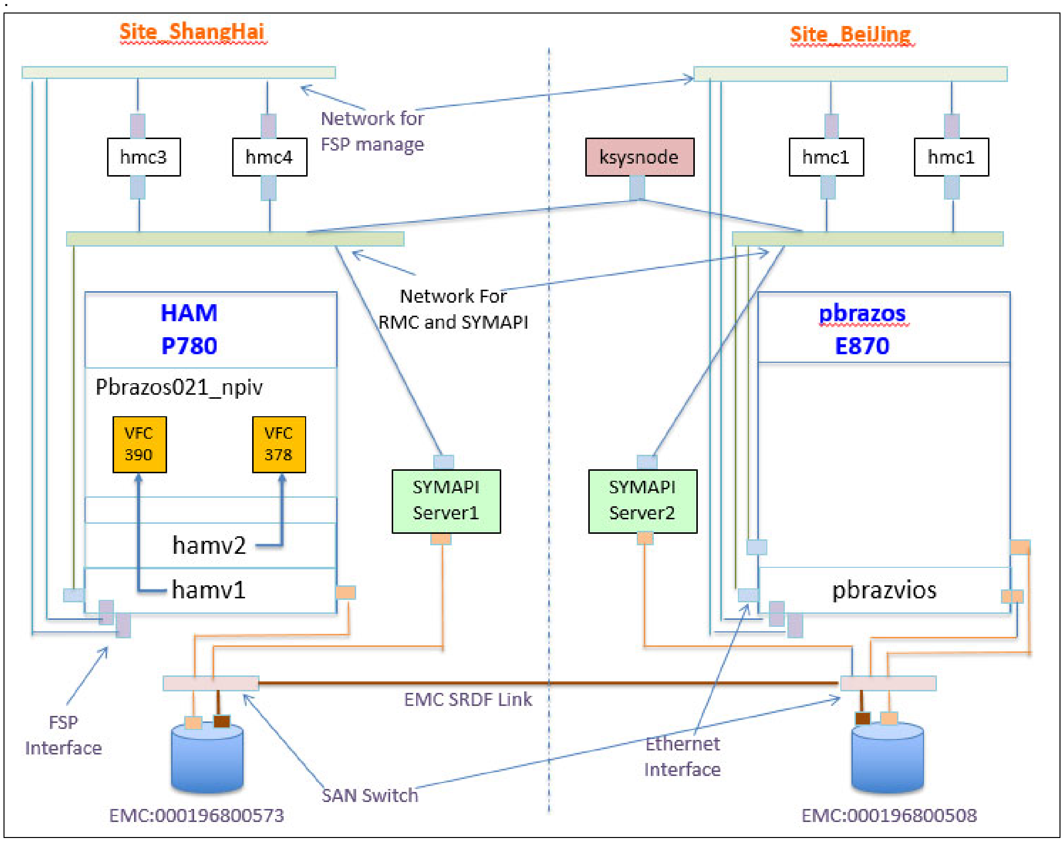


Figure 6-19 Topology of the move with lose_vios_redundancy attribute scenario

6.10.2 Result of the discover and verify operations

In this situation, run the discovery operation normally to gather the VMs information, as shown in Example 6-123.

Example 6-123 Run the discovery operation

```
# ksysmgr -t discover site ITSO4_ShangHai
15:01:57 Running discovery on entire site, this may take few minutes...
        15:02:09 Storage state synchronization has started for Site ITSO4_ShangHai
        15:02:50 Storage state synchronization has completed for Site ITSO4_ShangHai
        15:02:59 Discovery has started for VM pbrazos021_npiv
        15:02:59 Configuration information retrieval started for VM pbrazos021_npiv
        15:03:09 Configuration information retrieval completed for VM pbrazos021_npiv
        15:03:09 Storage information retrieval from VIOS started for VM pbrazos021_npiv
        15:03:18 Storage information retrieval from VIOS completed for VM pbrazos021_npiv
        15:03:18 Discovery for VM pbrazos021_npiv is complete
        15:08:24 Disk Group creation on storage subsystem started for Site ITSO4_ShangHai
        15:11:00 Storage state synchronization has completed for Site ITSO4_ShangHai
15:11:00 Discovery has finished for ITSO4_ShangHai
1 out of 1 managed VMs have been successfully discovered
```

However, for the verify operation, you must enable **lose_vios_redundancy** in the system-wide attributes, as shown in Example 6-124.

Example 6-124 Query the system-wide attributes and enable lose_vios_redundancy

```
# ksysmgr query system
System-Wide Persistent Attributes
auto_discovery_time  ="00:00" hours
lose_vios_redundancy ="no"
auto_reverse_mirror  ="yes"
notification_level   ="low"
dup_event_processing ="yes"

# ksysmgr modify system lose_vios_redundancy=yes
KSYS lose_vios_redundancy has been updated
System-Wide Persistent Attributes
auto_discovery_time  ="00:00" hours
lose_vios_redundancy ="yes"
auto_reverse_mirror  ="yes"
notification_level   ="low"
dup_event_processing ="yes"
```

Note: By default, the system-wide attributes of the **lose_vios_redundancy** value are set to no. It must be changed to yes before running the verify operation, or the verify operation fails.

After changing the system-wide attributes, run a verify operation to check the target site. Example 6-125 shows the verify operation after setting the system-wide attributes.

Example 6-125 Run the verify operation after you set the system-wide attributes

```
# ksysmgr -t verify site ITSO2_ShangHai
15:14:30 Site verification started for ITSO2_ShangHai
        15:14:35 pbrazos_9119-MME-21BBC47 verification has started
        15:14:43 pbrazos_9119-MME-21BBC47 verification has completed
        15:14:51 pbrazos021_npiv verification has started
        15:14:59 pbrazos021_npiv verification has completed
        15:14:59 Disk Group verification on storage subsystem started for Site ITSO2_ShangHai
        15:17:13 Disk Group verification on storage subsystem completed for Site ITSO2_ShangHai
15:17:30 Verification has finished for ITSO2_ShangHai
1 out of 1 VMs have been successfully verified
```

6.10.3 Starting a move operation with lose_vios_redundancy=yes

In the move operation of this scenario, you must set **lose_vios_redundancy=yes** because the default is no. Example 6-126 shows the move operation with **lose_vios_redundancy=yes**.

Example 6-126 Move operation with lose_vios_redundancy=yes

```
#ksysmgr -t move site from=ITSO4_ShangHai to=ITSO4_BeiJing lose_vios_redundancy=yes
dr_type=planned
15:23:46 Site move started for ITSO4_ShangHai to ITSO4_BeiJing
        15:23:57 Shutdown on ITSO4_ShangHai site has started for VM pbrazos021_npiv
        15:25:19 Shutdown on ITSO4_ShangHai site has completed for VM pbrazos021_npiv
        15:25:19 Storage mirror reversal has started
        15:25:20 Mirroring will be setup from ITSO4_BeiJing to ITSO4_ShangHai
        15:28:04 Storage mirror reversal has completed
        15:28:13 Restart on ITSO4_BeiJing site has started for VM pbrazos021_npiv
        15:29:44 Restart on ITSO4_BeiJing site has completed for VM pbrazos021_npiv
        15:29:44 Move has completed for VM pbrazos021_npiv
        15:29:44 Configuration cleanup on ITSO4_ShangHai site for VM pbrazos021_npiv
        15:30:02 Rediscovering configuration for VM pbrazos021_npiv on site ITSO4_BeiJing
        15:30:11 Done rediscovering configuration for VM pbrazos021_npiv on site ITSO4_BeiJing
Site move completed from ITSO4_ShangHai to ITSO4_BeiJing
1 out of 1 VMs have been successfully moved from ITSO4_ShangHai to ITSO4_BeiJing
ITSO4_BeiJing is now the active site
```

Check that the VM moved to the backup site, as shown in Figure 6-20.

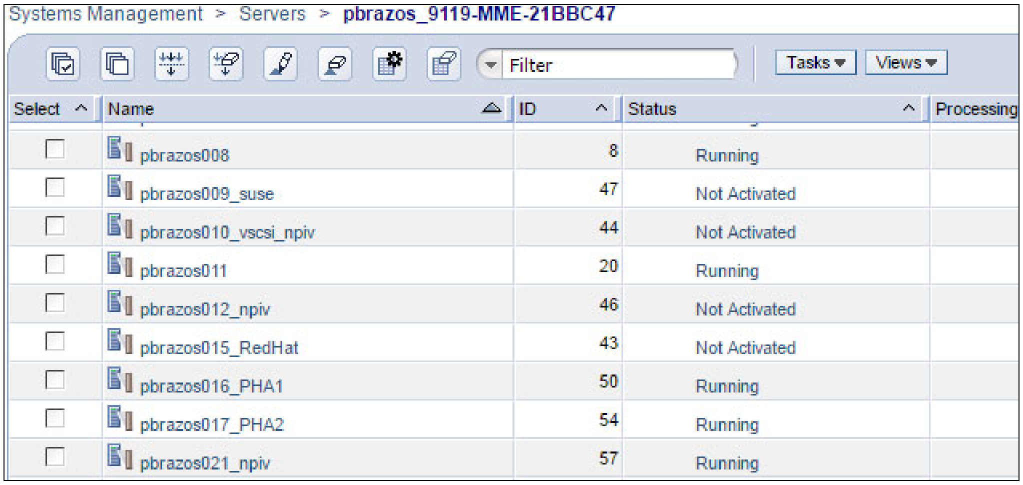


Figure 6-20 VM pbrazos021_npiv is online at the target site

Check the device's details in both VM and VIOS. Example 6-127 and Example 6-128 on page 394 show the device's details in the VM and VIOS.

Example 6-127 Show device details in VM pbrazos021_npiv

```
# hostname
pbrazos021
# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 78-T1 Virtual Fibre Channel Client Adapter
fcs1   Available 90-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter
vscsi0 Available       Virtual SCSI Client Adapter
# lspath
Enabled hdisk0 fscsi1
Enabled hdisk1 fscsi1
Enabled hdisk1 fscsi0
# lscfg -vl fcs0 < This VFC from HAMV2 now move to PBRAZOSV01
  fcs0             U9119.MME.21BBC47-V57-C378-T1  Virtual Fibre Channel Client Adapter

        Network Address.............C0507608E22C0200
        ROS Level and ID............
        Device Specific.(Z0)........
        Device Specific.(Z1)........
        Device Specific.(Z2)........
        Device Specific.(Z3)........
        Device Specific.(Z4)........
        Device Specific.(Z5)........
        Device Specific.(Z6)........
        Device Specific.(Z7)........
        Device Specific.(Z8)........C0507608E22C0200
        Device Specific.(Z9)........
        Hardware Location Code......U9119.MME.21BBC47-V57-C378-T1

# lscfg -vl fcs1 < This VFC from HAMV1 now move to PBRAZOSV01
  fcs1             U9119.MME.21BBC47-V57-C390-T1  Virtual Fibre Channel Client Adapter
```

```
        Network Address.............C0507608E22C01DE
        ROS Level and ID............
        Device Specific.(Z0)........
        Device Specific.(Z1)........
        Device Specific.(Z2)........
        Device Specific.(Z3)........
        Device Specific.(Z4)........
        Device Specific.(Z5)........
        Device Specific.(Z6)........
        Device Specific.(Z7)........
        Device Specific.(Z8)........C0507608E22C01DE
        Device Specific.(Z9)........
        Hardware Location Code......U9119.MME.21BBC47-V57-C390-T1
```

Example 6-128 Show device details in VIOS

```
(0) padmin @ pbrazosv1: /home/padmin
$ lsmap -all -npiv
.
.
.
Name          Physloc                            ClntID ClntName      ClntOS
------------- ---------------------------------- ------ ------------- -------
vfchost55     U9119.MME.21BBC47-V1-C390              43 pbrazos021_npi AIX

Status:LOGGED_IN
FC name:fcs1                  FC loc code:U78CD.001.FZH1401-P1-C6-T2
Ports logged in:2
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs1          VFC client DRC:U9119.MME.21BBC47-V43-C390
.
.
Name          Physloc                            ClntID ClntName      ClntOS
------------- ---------------------------------- ------ ------------- -------
vfchost68     U9119.MME.21BBC47-V1-C378              43 pbrazos021_npi AIX

Status:LOGGED_IN
FC name:fcs0                  FC loc code:U78CD.001.FZH1401-P1-C6-T1
Ports logged in:2
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs0          VFC client DRC:U9119.MME.21BBC47-V43-C378
```

The VM moved to the target site without any errors.

6.10.4 Moving virtual machines back to the previously active site

Move pbrazos021_npiv back to the previously active site. For the return operation from one VIOS to two VIOSs with the redundancy configuration, you must manually assign the mapping of VFC-378 to hamv2 (VIOS2).

Now, the state of pbrazos021_npiv should be READY_TO_MOVE, but to ensure that the previously active site is ready for the move back, perform the verify operation again, as shown in Example 6-129.

Example 6-129 Verify before performing the move to the previously active site

```
#ksysmgr -t verify site ITSO4_BeiJing
15:41:30 Site verification started for ITSO4_BeiJing
        15:41:35 HAM-9179-MHD-SN106DBEP verification has started
        15:42:07 HAM-9179-MHD-SN106DBEP verification has completed
        15:42:07 pbrazos021_npiv verification has started
        15:42:15 pbrazos021_npiv verification has completed
        15:42:16 Disk Group verification on storage subsystem started for Site ITSO4_BeiJing
        15:44:29 Disk Group verification on storage subsystem completed for Site ITSO4_BeiJing
15:44:40 Verification has finished for ITSO4_BeiJing
1 out of 1 VMs have been successfully verified
```

After the verify operation completes, move the VM back to the previously active site, as shown in Example 6-130.

Example 6-130 Move the VM back to the previously active site

```
# ksysmgr -t move site from=ITSO4_Beijing to=ITSO4_ShangHai type=planned
15:50:46 Site move started for ITSO4_Beijing to ITSO4_ShangHai
        15:50:57 Shutdown on ITSO4_Beijing site has started for VM pbrazos021_npiv
        15:52:10 Shutdown on ITSO4_Beijing site has completed for VM pbrazos021_npiv
        15:52:10 Storage mirror reversal has started
        15:52:11 Mirroring will be setup from ITSO4_ShangHai to ITSO4_Beijing
        15:59:05 Storage mirror reversal has completed
        16:00:32 Restart on ITSO4_ShangHai site has started for VM pbrazos021_npiv
        16:02:18 Restart on ITSO4_ShangHai site has completed for VM pbrazos021_npiv
        16:02:18 Move has completed for VM pbrazos021_npiv
        16:02:18 Configuration cleanup on ITSO4_Beijing site for VM pbrazos021_npiv
        16:02:36 Rediscovering configuration for VM pbrazos021_npiv on site ITSO4_ShangHai
        16:05:45 Done rediscovering configuration for VM pbrazos021_npiv on site ITSO4_ShangHai
Site move completed from ITSO4_Beijing to ITSO4_ShangHai
1 out of 1 VMs have been successfully moved from ITSO4_Beijing to ITSO4_ShangHai
ITSO4_ShangHai is now the active site
```

Check that the VMs are moved to the previously active site, as shown in Figure 6-21.

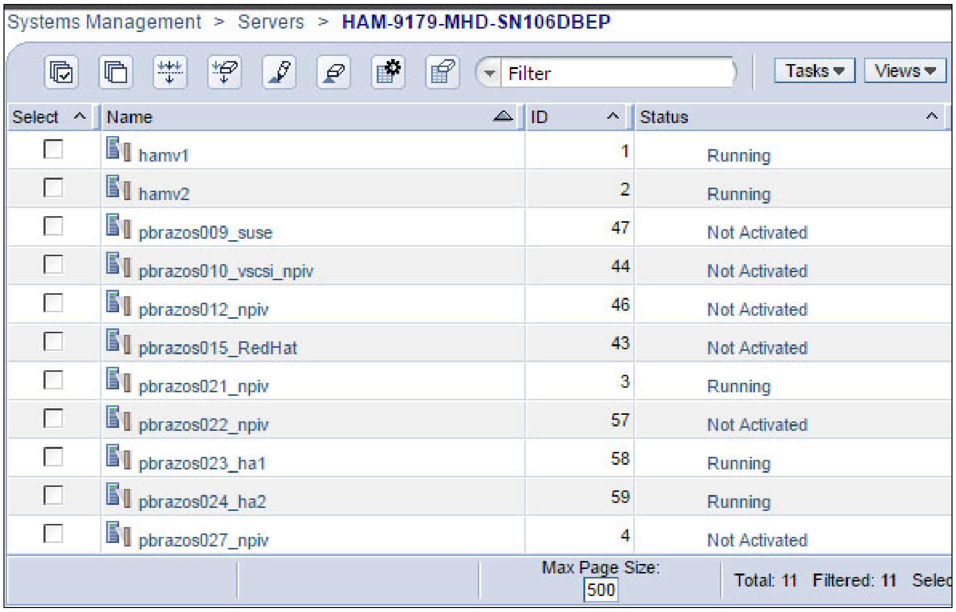


Figure 6-21 The pbrazos021_npiv VM moved and started normally

Verify the VFC-390 and VFC-378 configurations in hamv1. VFC378 should be on hamv2 for the redundancy configuration, as shown in Example 6-131.

Example 6-131 List the NPIV configuration on hamv1

```
Name           Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost0      U9179.MHD.106DBEP-V1-C390               3 pbrazos021_npi AIX

Status:LOGGED_IN
FC name:fcs1                   FC loc code:U2C4E.001.DBJC633-P2-C1-T2
Ports logged in:5
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs1           VFC client DRC:U9179.MHD.106DBEP-V3-C390

Name           Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------

Vfchost11      U9179.MHD.106DBEP-V1-C378               3 pbrazos021_npi AIX

Status:LOGGED_IN
FC name:fcs1                   FC loc code:U2C4E.001.DBJC633-P2-C1-T1
Ports logged in:5
Flags:a<LOGGED_IN,STRIP_MERGE>
VFC client name:fcs1           VFC client DRC:U9179.MHD.106DBEP-V3-C378
```

To move VFC-378 from hamv1 to hamv2, complete the following steps:

1. Access the HMC in command-line mode and run the **lssyscfg** command to view the current settings of the VM profile and list the WWPN value of VFC-378, as shown in Example 6-132. For more information, see this website.

Example 6-132 View the current settings of the VM profile

```
hscroot@vmhmc2:~> lssyscfg -m HAM-9179-MHD-SN106DBEP -r prof --filter
"lpar_names=pbrazos021_npiv,profile_names=default"
name=default,lpar_name=pbrazos021_npiv,lpar_id=3,lpar_env=aixlinux,all_resource
s=0,min_mem=4352,desired_mem=4352,max_mem=4352,min_num_huge_pages=0,desired_num
_huge_pages=0,max_num_huge_pages=0,mem_mode=ded,hpt_ratio=1:128,proc_mode=share
d,min_proc_units=0.1,desired_proc_units=0.1,max_proc_units=0.1,min_procs=1,desi
red_procs=1,max_procs=1,sharing_mode=cap,uncap_weight=0,shared_proc_pool_id=0,s
hared_proc_pool_name=DefaultPool,affinity_group_id=none,io_slots=none,lpar_io_p
ool_ids=none,max_virtual_slots=500,"virtual_serial_adapters=0/server/1/any//any
/1,1/server/1/any//any/1",virtual_scsi_adapters=398/client/1/hamv1/22/0,virtual
_eth_adapters=2/0/1//0/0/ETHERNET0//all/0,virtual_eth_vsi_profiles=none,"virtua
l_fc_adapters=""390/client/1/hamv1/390/c0507608e22c01de,c0507608e22c01df/0"",""
378/client/1/hamv1/378/c0507608e22c0200,c0507608e22c0201/0""",vtpm_adapters=non
e,hca_adapters=none,boot_mode=norm,conn_monitoring=0,auto_start=0,power_ctrl_lp
ar_ids=none,work_group_id=none,redundant_err_path_reporting=0,bsr_arrays=0,lpar
_proc_compat_mode=default,electronic_err_reporting=null,sriov_eth_logical_ports
=none,sriov_roce_logical_ports=none
```

2. Note the WWPN value of VFC-378, and then back up the HMC profiles of hamv1 and hamv2 by clicking the LPAR's name, and then clicking **Configuration** → **Save current configuration**.

3. Remove device VFC-378 on pbrazos021_npiv by running the following command:

   ```
   rmdev -dRl fcs0
   ```

4. Remove device VFC-378 on pbrazos021_npiv profile by using the DLPAR HMC GUI (Figure 6-22). Click the LPAR's name, and then click **Dynamic partitioning** → **Virtual adapters**.

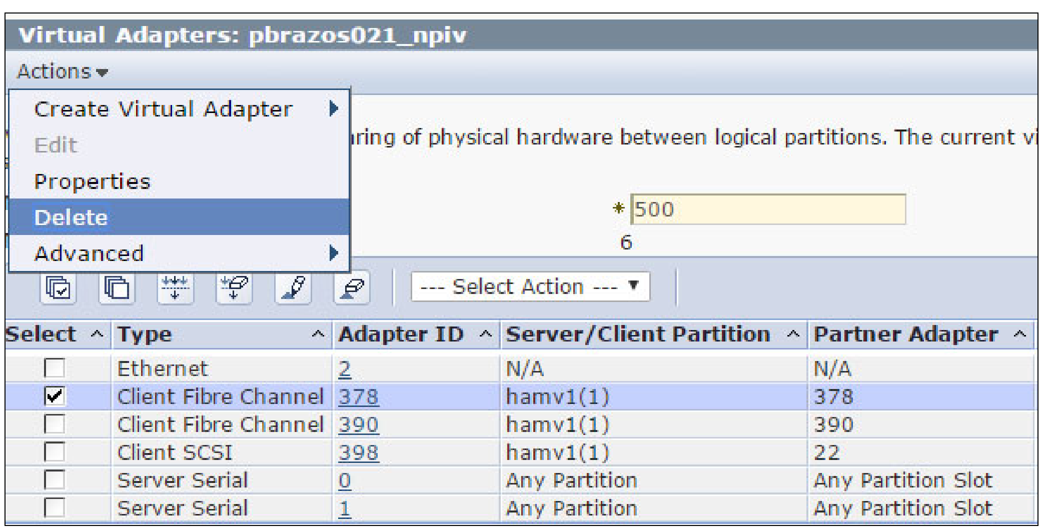


Figure 6-22 Delete VFC-378

5. Remove device VFC-378 on hamv1 by running the **rmdev** command, as shown in Example 6-133.

Example 6-133 Remove VFC-378 on hamv1 (VIOS)

```
# lscfg -vl vfchost11
  vfchost11        U9179.MHD.106DBEP-V1-C378  Virtual FC Server Adapter

        Hardware Location Code......U9179.MHD.106DBEP-V1-C378

rmdev -dRl vfchost11
vfchost11 deleted
```

6. Then, delete VFC-378 from the profile of hamv1 by using the DLPAR HMC GUI, as shown in Figure 6-23.

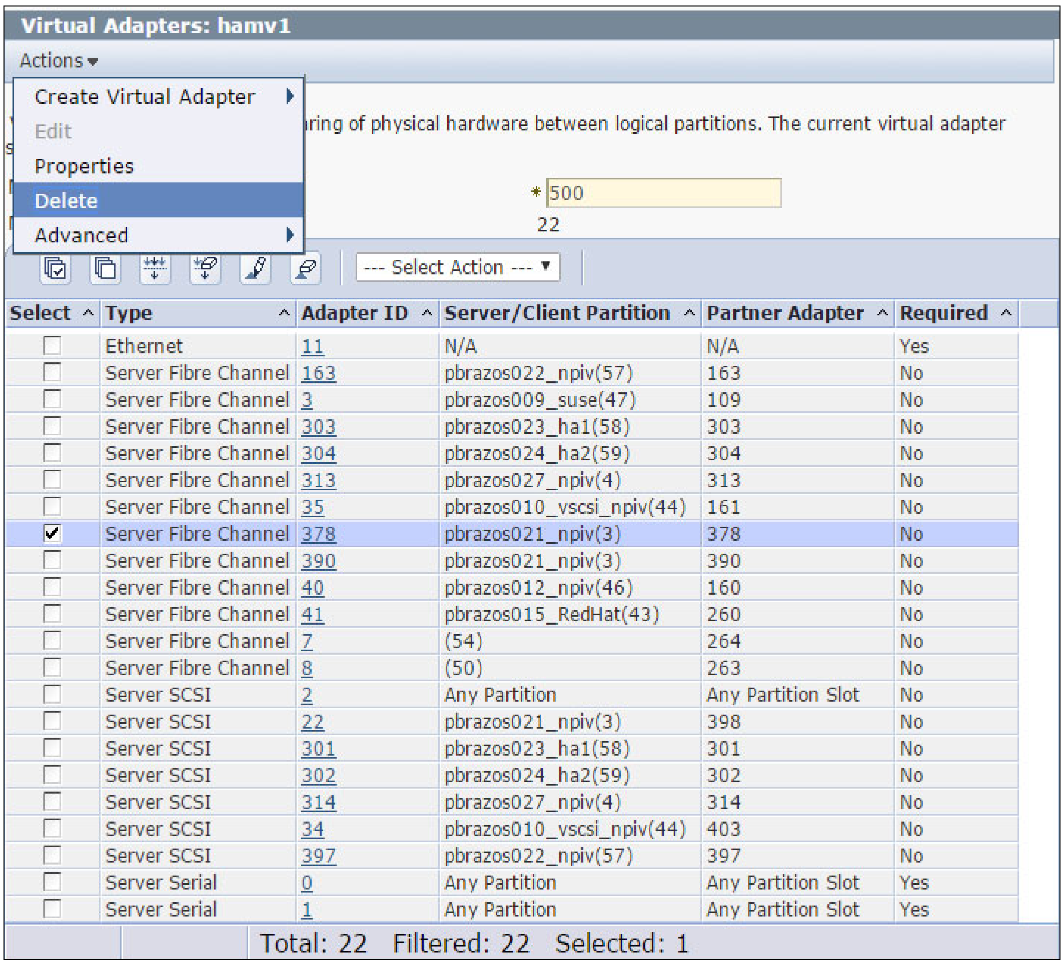


Figure 6-23 Delete VFC-378 from the profile

7. Next, add device VFC-378 to ham2 by using the DLPAR menu on the HMC GUI, as shown in Figure 6-24.

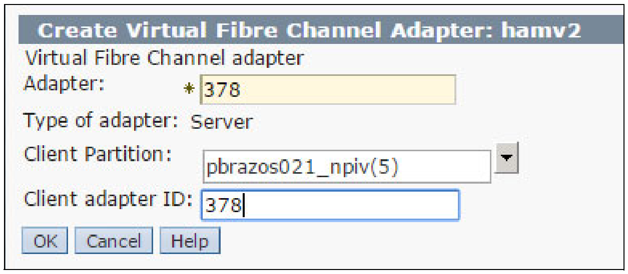


Figure 6-24 Create VFC-378 on hamv2 by using the DLPAR menu

8. Map the NPIV of VFC-378 on hamv2, as shown in Example 6-134.

Example 6-134 Map the NPIV of VFC-378 on hamv2

```
# lscfg -vl vfchost1
  vfchost1         U9179.MHD.106DBEP-V2-C378  Virtual FC Server Adapter

        Hardware Location Code......U9179.MHD.106DBEP-V2-C378

Then mapping vfcadapter to the fiber adapter that was zoning
$ lsmap -all -npiv
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost1      U9179.MHD.106DBEP-V2-C378               3

Status:NOT_LOGGED_IN
FC name:                        FC loc code:
Ports logged in:0
Flags:1<NOT_MAPPED,NOT_CONNECTED>
VFC client name:                VFC client DRC:

$ vfcmap -vadapter vfchost1 -fcp fcs0
$ lsmap -all -npiv
Name          Physloc                            ClntID ClntName       ClntOS
------------- ---------------------------------- ------ -------------- -------
vfchost1      U9179.MHD.106DBEP-V2-C378               3

Status:NOT_LOGGED_IN
FC name:fcs0                    FC loc code:U2C4E.001.DBJC671-P2-C2-T1
Ports logged in:0
Flags:4<NOT_LOGGED>
VFC client name:                VFC client DRC:
```

9. After the mapping is finished, add VFC-378 to pbrazos021_npiv with the override WWPN to the same value by using the HMC command-line (Example 6-135) or use the following command:

```
chhwres -r virtualio -m <managed-sys> -o a --rsubtype fc -p <partition name> -s
<slot> -a
adapter_type=client,remote_lpar_id=<remote_lpar_id>,remote_slot_num=<remote_slo
t_num>,\"wwpns=xxxxxx,xxxxxx\"
```

Example 6-135 Add VFC-378

```
WWPN of VFC-78 : c0507608e22c0200 and c0507608e22c0201

hscroot@vmhmc2:~> chhwres -r virtualio -m HAM-9179-MHD-SN106DBEP -o a
--rsubtype fc -p pbrazos021_npiv -s 378 -a
adapter_type=client,remote_lpar_id=2,remote_slot_num=378,\"wwpns=c0507608e22c02
00, c0507608e22c0201\"

Verify the WWPN value of VFC-378

hscroot@vmhmc2:~> lssyscfg -m HAM-9179-MHD-SN106DBEP -r prof --filter
"lpar_names=pbrazos021_npiv,profile_names=default"
name=default,lpar_name=pbrazos021_npiv,lpar_id=5,lpar_env=aixlinux,all_resource
s=0,min_mem=4352,desired_mem=4352,max_mem=4352,min_num_huge_pages=0,desired_num
_huge_pages=0,max_num_huge_pages=0,mem_mode=ded,hpt_ratio=1:128,proc_mode=share
d,min_proc_units=0.1,desired_proc_units=0.1,max_proc_units=0.1,min_procs=1,desi
red_procs=1,max_procs=1,sharing_mode=cap,uncap_weight=0,shared_proc_pool_id=0,s
hared_proc_pool_name=DefaultPool,affinity_group_id=none,io_slots=none,lpar_io_p
ool_ids=none,max_virtual_slots=500,"virtual_serial_adapters=0/server/1/any//any
/1,1/server/1/any//any/1",virtual_scsi_adapters=398/client/1/hamv1/22/0,virtual
_eth_adapters=2/0/1//0/0/ETHERNET0//all/0,virtual_eth_vsi_profiles=none,"virtua
l_fc_adapters=""390/client/1/hamv1/390/c0507608e22c01de,c0507608e22c01df/0"",""
378/client/2/hamv2/378/c0507608e22c0200,c0507608e22c0201/0""",vtpm_adapters=non
e,hca_adapters=none,boot_mode=norm,conn_monitoring=0,auto_start=0,power_ctrl_lp
ar_ids=none,work_group_id=none,redundant_err_path_reporting=0,bsr_arrays=0,lpar
_proc_compat_mode=default,electronic_err_reporting=null,sriov_eth_logical_ports
=none,sriov_roce_logical_ports=none
```

10. Verify the device and configuration on pbrazos021_npiv, as shown in Example 6-136.

Example 6-136 Verify device and configuration on pbrazos021_npiv

```
# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs1   Available 90-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter
vscsi0 Available       Virtual SCSI Client Adapter
# cfgmgr
# lsdev -Cc adapter
ent0   Available       Virtual I/O Ethernet Adapter (l-lan)
fcs0   Available 78-T1 Virtual Fibre Channel Client Adapter
fcs1   Available 90-T1 Virtual Fibre Channel Client Adapter
pkcs11 Available       ACF/PKCS#11 Device
vsa0   Available       LPAR Virtual Serial Adapter
vscsi0 Available       Virtual SCSI Client Adapter
# lspath
```

```
Enabled hdisk0 fscsi1
Enabled hdisk1 fscsi1
Enabled hdisk1 fscsi0
```

6.10.5 Scenario summary

This scenario introduced the **lose_vios_redundancy** attribute, which you can use to start the VMs on another site without the dual-VIOS setup on the target host. However, if you want to move the VMs back to the previous site that has a dual-VIOS configuration, you must manually add the second VIOS to the configuration.

6.11 Unplanned storage failure

This scenario introduces how KSYS works when a storage access failure occurs between the server and the storage.

6.11.1 Scenario description

Figure 6-25 shows the topology for the storage access failure scenario.

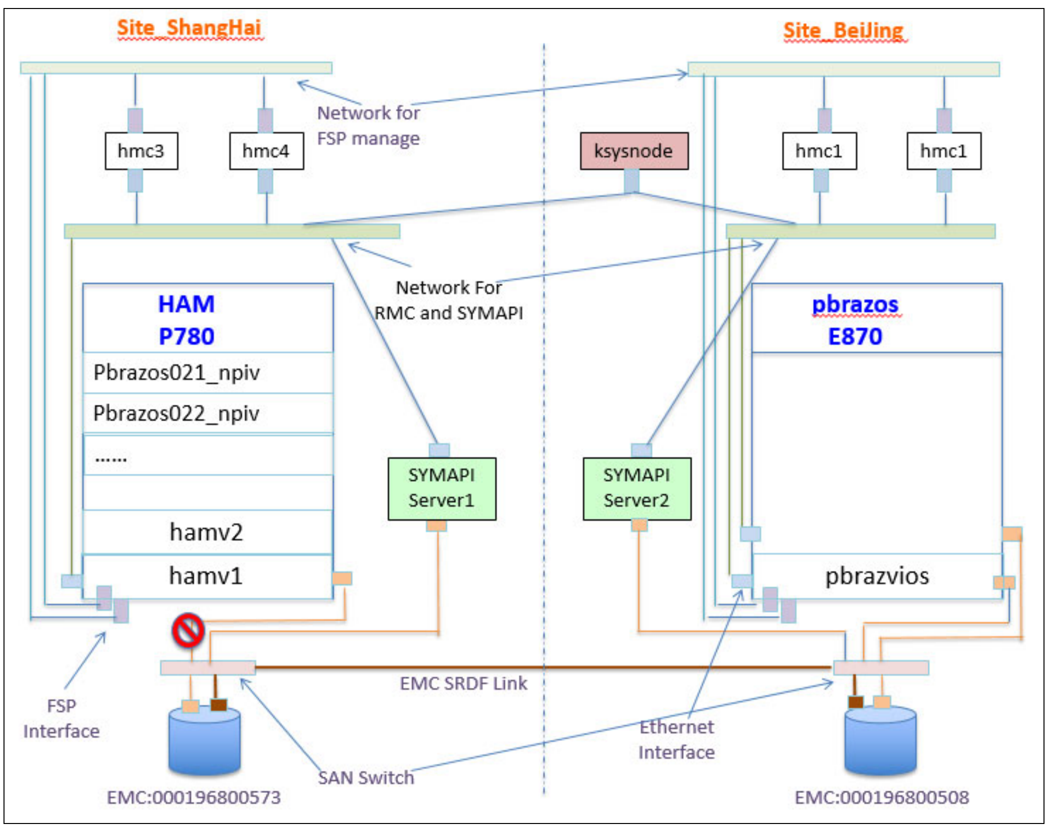


Figure 6-25 Topology of storage access failure scenario

This scenario simulates a problem with the storage access between zones by disabling the port between EMC:000196800573 and the HAM-P780 managed system. When the storage access loss occurs, there is an impact to the VMs on the managed system.

6.11.2 Run discover and verify operations before the move operation

The storage access failure impacts directly the VMs because all of the rootvgs are in EMC:000196800573. When you run the **discovery** command, errors appear as shown in Example 6-137.

Example 6-137 Discovery operation output

```
# ksysmgr -t discovery site ITSO2_ShangHai
08:46:39 Running discovery on entire site, this may take few minutes...
        08:46:48 Storage state synchronization has started for Site ITSO2_ShangHai
        08:47:03 Storage state synchronization has completed for Site ITSO2_ShangHai
        08:47:10 Discovery has started for VM pbrazos021_npiv
        08:47:10 Configuration information retrieval started for VM pbrazos021_npiv
        08:47:10 Discovery has started for VM pbrazos022_npiv
        08:47:10 Configuration information retrieval started for VM pbrazos022_npiv
        08:47:53 Storage state synchronization has started for Site ITSO2_ShangHai
        08:47:53 Storage state synchronization has completed for Site ITSO2_ShangHai
        ERROR: Discovery has encountered an error for site ITSO2_ShangHai please investigate
        ERROR: Discovery has encountered an error for VM pbrazos021_npiv during configuration information retrieval
08:47:57 Discovery has finished for ITSO2_ShangHai
0 out of 2 managed VMs have been successfully discovered
Errors encountered while collecting configuration for the following VMs:
        0C448266-DAD9-4921-B880-0FE43E2AD5EF
        7B42CD08-D003-4AA8-8CFC-E4A88D9A911B
```

Run the **verify** command because the target site and SRDF link are still in normal phase, as shown in Example 6-138.

Example 6-138 Run the verify operation

```
# ksysmgr -t verify site ITSO2_ShangHai
09:14:30 Site verification started for ITSO2_ShangHai
        09:14:35 pbrazos_9119-MME-21BBC47 verification has started
        09:14:43 pbrazos_9119-MME-21BBC47 verification has completed
        09:14:51 pbrazos021_npiv verification has started
        09:14:51 pbrazos022_npiv verification has started
        09:15:59 pbrazos021_npiv verification has completed
        09:16:01 pbrazos022_npiv verification has completed
        09:16:02 Disk Group verification on storage subsystem started for Site ITSO2_ShangHai
        09:20:13 Disk Group verification on storage subsystem completed for Site ITSO2_ShangHai
09:20:15 Verification has finished for ITSO2_ShangHai
2 out of 2 VMs have been successfully verified
```

6.11.3 Starting the move operation with the unplanned option

Start the move operation with the unplanned option because of the storage access problem. Example 6-139 shows the output of the move operation with the unplanned option, which succeeds without any errors.

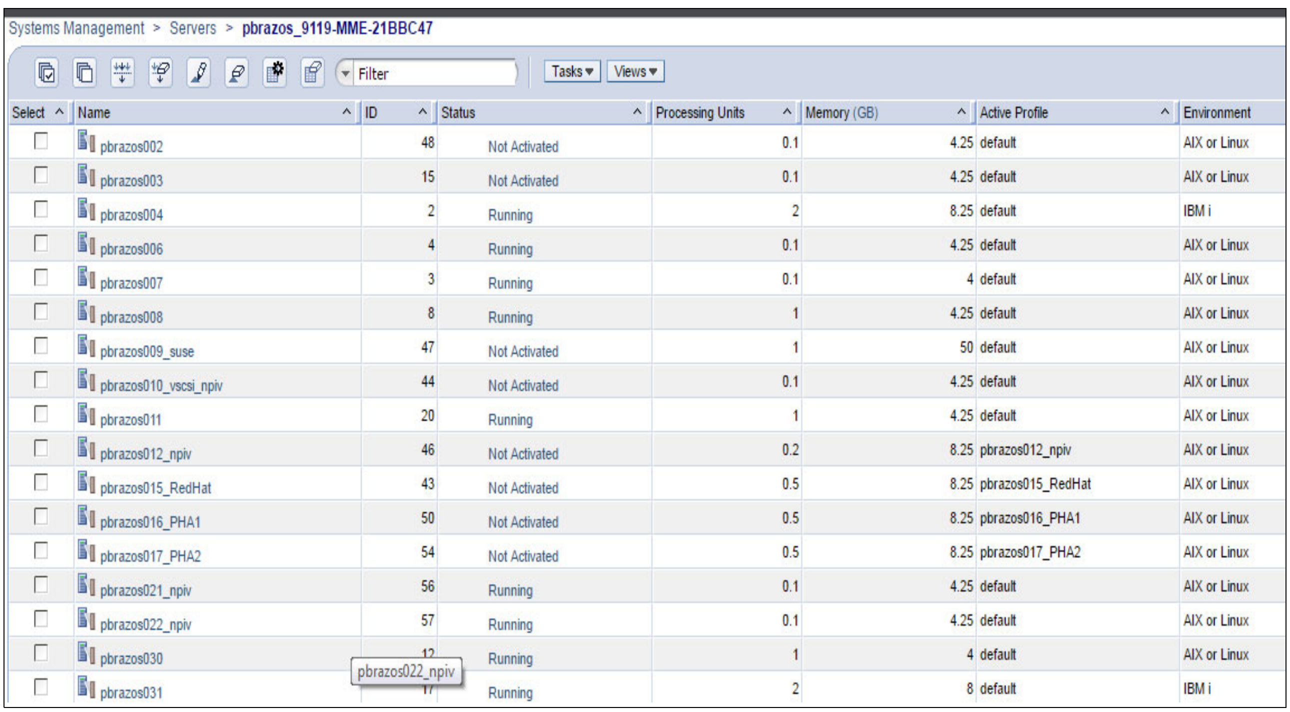
Example 6-139 Output of the move operation with the unplanned option

```
# ksysmgr -t move site from=ITSO2_ShangHai to=ITSO2_BeiJing type=unplanned
09:21:30 Site move started for ITSO2_ShangHai to ITSO2_BeiJing
        09:21:42 Shutdown on ITSO2_ShangHai site has started for VM pbrazos021_npiv
        09:21:43 Shutdown on ITSO2_ShangHai site has started for VM pbrazos022_npiv
        09:24:40 ShangHai site has completed for VM pbrazos021_npiv
        09:24:43 ShangHai site has completed for VM pbrazos022_npiv
```

```
        09:24:54 Storage mirror reversal has started
        09:24:55 Mirroring will be setup from ITSO2_BeiJing to ITSO2_ShangHai
        09:26:04 Storage mirror reversal has completed
        09:26:33 Restart on ITSO2_BeiJing site has started for VM pbrazos021_npiv
        09:26:33 Restart on ITSO2_BeiJing site has started for VM pbrazos022_npiv
        09:32:48 Restart on ITSO2_BeiJing site has completed for VM pbrazos021_npiv
        09:32:48 Move has completed for VM pbrazos021_npiv
        09:32:49 Rediscovering configuration for VM pbrazos021_npiv on site ITSO2_BeiJing
        09:32:57 Done rediscovering configuration for VM pbrazos021_npiv on site ITSO2_BeiJing
        09:32:59 Restart on ITSO2_BeiJing site has completed for VM pbrazos022_npiv
        09:33:22 Move has completed for VM pbrazos022_npiv
        09:33:01 Rediscovering configuration for VM pbrazos022_npiv on site ITSO2_BeiJing
        09:33:49 Done rediscovering configuration for VM pbrazos022_npiv on site ITSO2_BeiJing
Site move completed from ITSO2_ShangHai to ITSO2_BeiJing
2 out of 2 VMs have been successfully moved from ITSO2_ShangHai to ITSO2_BeiJing
ITSO2_BeiJing is now the active site
```

When the unplanned move completes, all VMs are shut down at the source site and are now online at the target site. Because this is an unplanned move, the VMs are not removed from the HMC at the source site.

Figure 6-26 shows the two VMs online at the target site.


Systems Management > Servers > pbrazos_9119-MME-21BBC47

Select	Name	ID	Status	Processing Units	Memory (GB)	Active Profile	Environment
	pbrazos002	48	Not Activated	0.1	4.25	default	AIX or Linux
	pbrazos003	15	Not Activated	0.1	4.25	default	AIX or Linux
	pbrazos004	2	Running	2	8.25	default	IBM i
	pbrazos006	4	Running	0.1	4.25	default	AIX or Linux
	pbrazos007	3	Running	0.1	4	default	AIX or Linux
	pbrazos008	8	Running	1	4.25	default	AIX or Linux
	pbrazos009_suse	47	Not Activated	1	50	default	AIX or Linux
	pbrazos010_vscsi_npiv	44	Not Activated	0.1	4.25	default	AIX or Linux
	pbrazos011	20	Running	1	4.25	default	AIX or Linux
	pbrazos012_npiv	46	Not Activated	0.2	8.25	pbrazos012_npiv	AIX or Linux
	pbrazos015_RedHat	43	Not Activated	0.5	8.25	pbrazos015_RedHat	AIX or Linux
	pbrazos016_PHA1	50	Not Activated	0.5	8.25	pbrazos016_PHA1	AIX or Linux
	pbrazos017_PHA2	54	Not Activated	0.5	8.25	pbrazos017_PHA2	AIX or Linux
	pbrazos021_npiv	56	Running	0.1	4.25	default	AIX or Linux
	pbrazos022_npiv	57	Running	0.1	4.25	default	AIX or Linux
	pbrazos030	12	Running	1	4	default	AIX or Linux
	pbrazos031	17	Running	2	8	default	IBM i

Figure 6-26 Virtual machines online at the target site

6.11.4 Restoring storage

After the SRDF link is restored, you must restore the RDF group by using the method that is shown in 6.5.5, “Recovering the SRDF/A status” on page 328.

6.11.5 Cleaning up the virtual machine

Due to the fact the VMs at source site have not been removed, it is necessary to clean them up before the next site-switch operation. The cleanup method is described in 6.5.6, “Cleaning up the virtual machines at the source site” on page 334.

After completing the storage restore and VM cleanup operation, start the discover and verify operation to check whether the environment is ready to perform the next site-switch action.

6.11.6 Scenario summary

This scenario describes when there is a storage access failure at the target site. You can decide to perform the site switch with the unplanned option.

6.12 Unplanned active site down

This scenario gives an example of how KSYS operates when the active site is down. This scenario simulates the active site down by powering off both HMCs, shutting down all managed systems, disabling the zone, and closing the connection of the SYMAPI server at the active site.

6.12.1 Scenario description

This scenario might look familiar because it uses many parts of previous scenarios:

- 6.5, “Unplanned failure of all HMCs at active site” on page 320
- 6.6, “Planned failure of the SYMAPI server” on page 336
- 6.7, “Unplanned broken SRDF link” on page 343
- 6.9, “Unplanned managed system failure” on page 382
- 6.11, “Unplanned storage failure” on page 401

In this scenario, all components on the active site are down.

Figure 6-27 shows the topology configuration for this scenario.

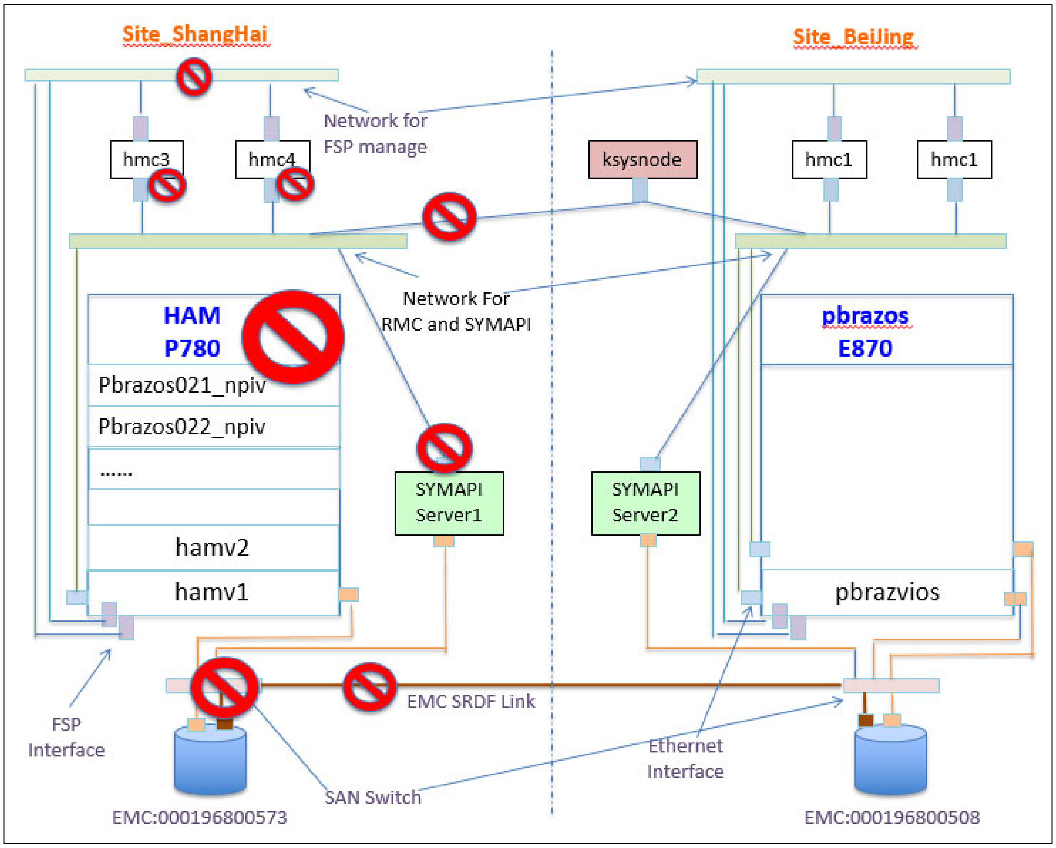


Figure 6-27 Topology of scenario active site down

6.12.2 Result of the verify operation before the move

If you run the verify operation, KSYS shows an error because the SRDF link is broken, as shown in Example 6-140.

Example 6-140 Run the verify operation at the ShangHai site

```
ksysmgr verify site ITSO2_ShangHai
Site verification started for ITSO2_ShangHai
        pbrazos_9119-MME-21BBC47 verification has started
        pbrazos_9119-MME-21BBC47 verification has completed
        pbrazos021_npiv verification has started
        pbrazos022_npiv verification has started
        pbrazos021_npiv verification has completed
        pbrazos022_npiv verification has completed
        Disk Group verification on storage subsystem started for Site ITSO2_ShangHai
        ERROR: Verify has encountered an error for site ITSO2_ShangHai please investigate
        ERROR: Verify has encountered a Disk Group error for site ITSO2_ShangHai please investigate
Disk Group: VMRDG_itso2_cluster_Site_ShangHai,  CLI call failed.
Disk Group, Verification failed, run discovery.
        Verification has finished for ITSO2_ShangHai
2 out of 2 VMs have been successfully verified
Please review errors.  The "ksysmgr query system status" command may provide additional details.
        Disk Group verification on storage subsystem started for Site ITSO2_ShangHai
        Disk Group verification on storage subsystem completed for Site ITSO2_ShangHai
Verification has finished for ITSO2_ShangHai
2 out of 2 VMs have been successfully verified
```

6.12.3 Starting the unplanned move operation

Because the managed system HAM-P780 and EMC:000196800573 (active site) are not in the operational state, the unplanned move options is the preferred way to recover your VMs, as shown in Example 6-141.

> **Caution:** A move operation while the SRDF link is broken is not recommended because the data sync is not the latest.

Example 6-141 Unplanned move due to a down active site

```
# ksysmgr -t move site from=ITSO2_ShangHai to=ITSO2_BeiJing type=unplanned
21:05:30 Site move started for ITSO2_ShangHai to ITSO2_BeiJing
        21:05:42 Shutdown on ITSO2_ShangHai site has started for VM pbrazos021_npiv
        21:05:43 Shutdown on ITSO2_ShangHai site has started for VM pbrazos022_npiv
        21:20:40 ShangHai site has completed for VM pbrazos021_npiv
        21:20:43 ShangHai site has completed for VM pbrazos022_npiv
        21:20:54 Storage mirror reversal has started
        21:20:55 Mirroring will be setup from ITSO2_BeiJing to ITSO2_ShangHai
        21:21:04 Storage mirror reversal has completed
        21:21:23 Restart on ITSO2_BeiJing site has started for VM pbrazos021_npiv
        21:21:23 Restart on ITSO2_BeiJing site has started for VM pbrazos022_npiv
        21:22:48 Restart on ITSO2_BeiJing site has completed for VM pbrazos021_npiv
        21:22:48 Move has completed for VM pbrazos021_npiv
        21:22:49 Rediscovering configuration for VM pbrazos021_npiv on site ITSO2_BeiJing
        21:22:57 Done rediscovering configuration for VM pbrazos021_npiv on site ITSO2_BeiJing
        21:22:59 Restart on ITSO2_BeiJing site has completed for VM pbrazos022_npiv
        21:23:00 Move has completed for VM pbrazos022_npiv
        21:23:01 Rediscovering configuration for VM pbrazos022_npiv on site ITSO2_BeiJing
        21:23:49 Done rediscovering configuration for VM pbrazos022_npiv on site ITSO2_BeiJing
        ERROR: Move has encountered for host HAM-9179-MHD-SN106DBEP please investigate
Please review errors.  The "ksysmgr query system status" command may provide additional details
```

Errors occur because the KSYS cannot connect to the HMCs at the target site. Check the target site after the unplanned move complete, as shown in Figure 6-28.

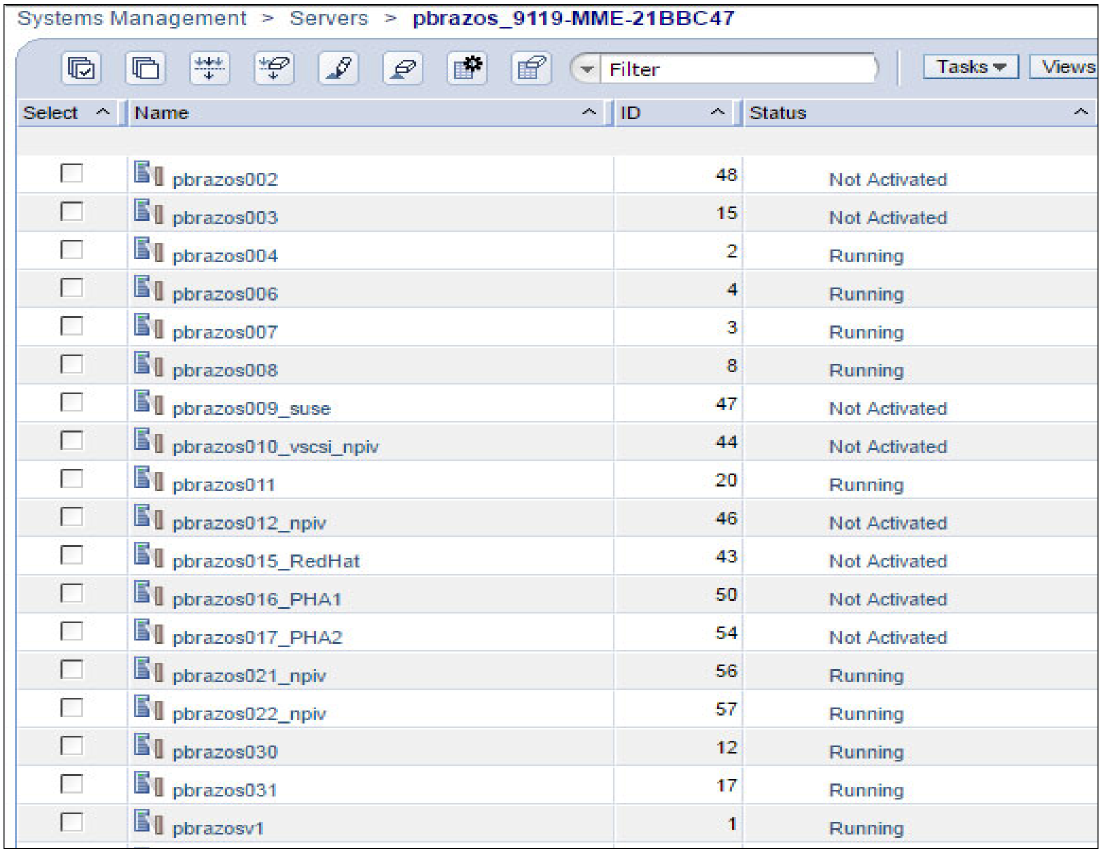


Figure 6-28 Nodes pbrazos021 and pbrazos022 status at the target site

Verify the status of the CG on the target site because it should be in the partitioned state after moving the VMs to the target site, as shown inExample 6-142.

Example 6-142 Verify the status of the composite group

```
# symrdf -cg VMRDG_itso2_cluster_Site_BeiJing query

Composite Group Name       :  VMRDG_itso3_cluster_Site_BeiJing
Composite Group Type       :  RDF2
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode       :  NONE

Symmetrix ID                 : 000196800508 (Microcode Version: 5977)
Remote Symmetrix ID          : N/A           (Microcode Version: N/A)
RDF (RA) Group Number        :  69 (44)

         Target (R2) View                Source (R1) View     MODE
---------------------------------    ------------------------ ---- ------------
               ST                  LI       ST
Standard        A                   N        A
Logical   Sym   T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv        RDF Pair
Device    Dev   E Tracks  Tracks    S Dev    E Tracks  Tracks   MACE STATE
--------------------------------- -- ------------------------ ---- ------------
```

```
DEV001    0325A RW   82173        0 NR NA     NA       NA       NA S... Partitioned
DEV002    0325D RW       0        0 NR NA     NA       NA       NA S... Partitioned
DEV003    0325E RW       0        0 NR NA     NA       NA       NA S... Partitioned
DEV004    0325F RW       0        0 NR NA     NA       NA       NA S... Partitioned
```

6.12.4 Restoring the storage

After the SRDF link is restored, restore the RDF group. The method is described in 6.5.5, “Recovering the SRDF/A status” on page 328.

6.12.5 Cleaning up the virtual machine

Because the VMs at the source site are not removed, it is necessary to clean up before performing the next site-switch operation. The method is described in 6.5.6, “Cleaning up the virtual machines at the source site” on page 334.

After completing the storage restore and the VM cleanup operation, start the discover and verify operation to confirm whether the environment is ready to perform the next site-witch action.

6.12.6 Scenario summary

This scenario describes a down active site, and the IBM Geographically Dispersed Resiliency for Power Systems can perform the move operation with the unplanned option.

Related publications

The publications that are listed in this section are considered suitable for a more detailed discussion of the topics that are covered in this book.

IBM Redbooks

The following IBM Redbooks publication provides additional information:

- *Power Enterprise Pools on IBM Power Systems*, REDP-5101

You can search for, view, download, or order this document and other Redbooks, Redpapers, Web Docs, draft, and additional materials, at the following website:

ibm.com/redbooks

Other publications

These publications are also relevant as further information sources:

- *EMC Symmetrix Remote Data Facility (SRDF) Product Guide*:

  https://support.emc.com/docu45690_Symmetrix-Remote-Data-Facility-%28SRDF%29-Product-Guide.pdf

- *An Overview of Groups in EMC Symmetrix and Solutions Enabler Environments*:

  http://www.emc.com/collateral/hardware/white-papers/h2313-overview-grps-symmetrix-sol-enblr-env.pdf

- *EMC Unisphere for VMAX, Version 8.3.0, Installation Guide*:

  https://www.emc.com/collateral/TechnicalDocument/docu78884.pdf

Online resources

These websites are also relevant as further information sources:

- Frequently asked questions (FAQ) for IBM Geographically Dispersed Resiliency (GDR) For Power Systems:

  http://ibm.co/2gPFWNI

- IBM Geographically Dispersed Resiliency (GDR) wiki:

  https://ibm.biz/PowerGDR

- IBM Geographically Dispersed Resiliency (GDR) Linkedin discussion forum:

  https://www.linkedin.com/groups/12012982

- IBM Disaster Recovery as a Service:

  http://www.ibm.com/services/us/en/it-services/business-continuity/draas/

- Announcement letter: IBM Geographically Dispersed Resiliency for Power Systems enables Power users to reliably realize low recovery times and achieve recovery point objectives:

  http://ibm.co/2gzzxGD

Help from IBM

IBM Support and downloads

ibm.com/support

IBM Global Services

ibm.com/services

Redbooks

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