

IBM VM Recovery Manager DR for Power
Systems

Version 1.5

Deployment Guide



Note

Before using this information and the product it supports, read the information in [“Notices” on page 195.](#)

This edition applies to IBM® VM Recovery Manager DR for Power Systems Version 1.5 and to all subsequent releases and modifications until otherwise indicated in new editions.

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Contents

- About this document..... vii**
 - Highlighting..... vii
 - Case-sensitivity in VM Recovery Manager DR.....vii
 - ISO 9000..... viii

- Overview..... 1**

- Concepts..... 5**
 - KSYS..... 5
 - HMC..... 7
 - Sites..... 7
 - Hosts.....8
 - Workgroup..... 9
 - Virtual machines..... 11
 - VIOS..... 11
 - Storage agents..... 12
 - EMC storage subsystem..... 13
 - SAN Volume Controller system and Storwize system..... 15
 - DS8000 storage system..... 17
 - Hitachi storage systems..... 18
 - XIV Storage System..... 26
 - Network..... 27

- Planning..... 29**
 - Requirements..... 29
 - Limitations..... 33
 - Prerequisites..... 37
 - Prerequisite for virtual machines that run on the Linux operating system..... 40

- Disaster recovery mechanism..... 43**

- Installing..... 47**
 - KSYS package..... 48
 - Installing..... 50
 - Upgrading..... 53

- Configuring..... 57**
 - Flow chart for KSYS configuration..... 58
 - Setting up the KSYS subsystem..... 58
 - Initiating the KSYS node..... 58
 - Creating sites..... 59
 - Adding HMCs to the KSYS..... 60
 - Adding hosts to the KSYS..... 61
 - Creating host pairs..... 63
 - Creating host groups..... 63
 - Adding storage agents to the KSYS..... 67
 - Setting up contacts for event notification..... 72
 - Configuring VIOS..... 72
 - Customizing consistency group name..... 73

Configuring the site-specific IP address.....	76
Configuring Single-Root I/O Virtualization (SR-IOV) override feature.....	77
Discovering resources.....	77
Verifying the configuration.....	80
Daily checks by KSYS.....	80
High availability features.....	82
Setting up KSYS high availability through PowerHA SystemMirror.....	84
Recovering VMs.....	87
Failover rehearsal of the disaster recovery operation.....	87
Performing the DR failover rehearsal operation.....	91
Flow chart for disaster recovery.....	95
Initiating the disaster recovery.....	96
Recovering the failed virtual machines.....	98
Moving the virtual machines by using the force option.....	98
Moving the virtual machines by using other options.....	99
Relocation plan for virtual machines.....	99
Unmanaged disks.....	100
Administering.....	103
Generating the KSYS system report.....	103
Configuring the flexible capacity policies.....	104
Configuring the network mapping policy.....	107
Modifying the KSYS configuration.....	111
Removing resources from the KSYS configuration.....	113
Managing the KSYS notifications.....	114
Managing the system attributes.....	115
Managing the shared storage configuration.....	118
Backing up and restoring the configuration data	120
Saving and restoring snapshots.....	122
Managing the CoD resources.....	123
VM Recovery Manager DR and Power Enterprise Pool.....	123
VM Recovery Manager DR and Elastic (On/Off) CoD	126
VM Recovery Manager DR coexistence with other products and offerings.....	127
Live Partition Mobility and VM Recovery Manager DR coexistence.....	127
IBM PowerVC and VM Recovery Manager DR coexistence.....	127
PowerHA SystemMirror and VM Recovery Manager DR coexistence.....	128
Running scripts for additional checks.....	130
Running the disaster recovery scripts.....	133
Commands.....	137
ksysmgr command.....	137
ksysrppmgr command.....	158
VM Recovery Manager DR GUI	163
What's new.....	163
Logging in to the VM Recovery Manager DR GUI.....	163
Navigating the VM Recovery Manager DR GUI.....	164
Working in the GUI.....	165
GUI certificate private key pairs	166
GUI log collection utility.....	167
User role management in GUI.....	167
Deployment with high availability (HA) features.....	169
Configuring HADR.....	170
Configuring HADRHA.....	174
Limitations.....	178

Configuring HA monitor.....	178
Local database mode.....	179
Troubleshooting.....	181
Notification for the KSYS events.....	181
Analyzing the log files.....	183
Solving common problems.....	187
FAQ.....	193
Notices.....	195
Privacy policy considerations.....	196
Trademarks.....	197
Index.....	199

About this document

The IBM VM Recovery Manager DR for Power Systems solution is a set of software components that together provide a disaster recovery mechanism for virtual machines running on POWER7® processor-based server, or later. This document describes various components, subsystems, and tasks that are associated with the VM Recovery Manager DR solution. This information provides system administrators with complete information about the following sections:

- Components that are used in the VM Recovery Manager DR solution.
- Planning the VM Recovery Manager DR implementation in your production environment and the minimum software requirements.
- Installing the VM Recovery Manager DR filesets.
- Configuring your environment to use the VM Recovery Manager DR solution.
- Recovering the virtual machines after a planned or unplanned outage by using the VM Recovery Manager DR solution.
- Administering other tasks associated with the VM Recovery Manager DR solution.
- Troubleshooting any issues associated with the VM Recovery Manager DR solution.
- Using the VM Recovery Manager DR commands.

Highlighting

The following highlighting conventions are used in this document:

Bold	Identifies commands, subroutines, keywords, files, structures, directories, and other items whose names are predefined by the system. Bold highlighting also identifies graphical objects, such as buttons, labels, and icons that you select.
<i>Italics</i>	Identifies parameters for actual names or values that you supply.
Monospace	Identifies examples of specific data values, examples of text similar to what you might see displayed, examples of portions of program code similar to what you might write as a programmer, messages from the system, or text that you must type.

Case-sensitivity in VM Recovery Manager DR

The command name and some flags in the VM Recovery Manager DR solution are case-sensitive, which means that it distinguishes between uppercase and lowercase letters. To avoid causing undesirable actions to be performed, always ensure that you use the correct case.

The case-sensitivity of the command name and the flags are listed as follows:

- The command name is case-sensitive.
- The **ACTION** flag is not case-sensitive.
- The **CLASS** flag is not case-sensitive.
- The **NAME** flag is case-sensitive.
- The **ATTR** flag and the corresponding *VALUE* parameter are case-sensitive.

Correct example

```
ksysmgr ADD SITE site_name sitetype=active
```

Incorrect example

```
KSYSMGR ADD Site Site_name SiteType=Active
```

ISO 9000

ISO 9000 registered quality systems were used in the development and manufacturing of this product.

Overview for IBM VM Recovery Manager DR for Power Systems

Disaster recovery of applications and services is a key component to provide continuous business services. The IBM VM Recovery Manager DR for Power Systems solution is a disaster recovery solution that is easy to deploy and provides automated operations to recover the production site. The VM Recovery Manager DR solution is based on the Geographically Dispersed Parallel Sysplex (GDPS®) offering concept that optimizes the usage of resources. This solution does not require you to deploy the backup virtual machines (VMs) for disaster recovery. Thus, the VM Recovery Manager DR solution reduces the software license and administrative costs.

Note: VM Recovery Manager DR now supports Single-Root I/O Virtualization (SR-IOV) and Virtual Network Interface Controller (vNIC) features.

The following high availability (HA) and disaster recovery (DR) models are commonly used by customers:

- Cluster-based technology
- VM restart-based technology

Clustered HA and DR solutions typically deploy redundant hardware and software components to provide near real-time failover when one or more components fail. The VM restart-based HA and DR solution relies on an out-of-band monitoring and management component that restarts the virtual machines on other hardware when the host infrastructure fails. The VM Recovery Manager DR solution is based on the VM restart technology.

The following figure shows the conventional high-availability and disaster recovery solution that is based on the HA clustering model. The VM Recovery Manager DR solution does not use this model.

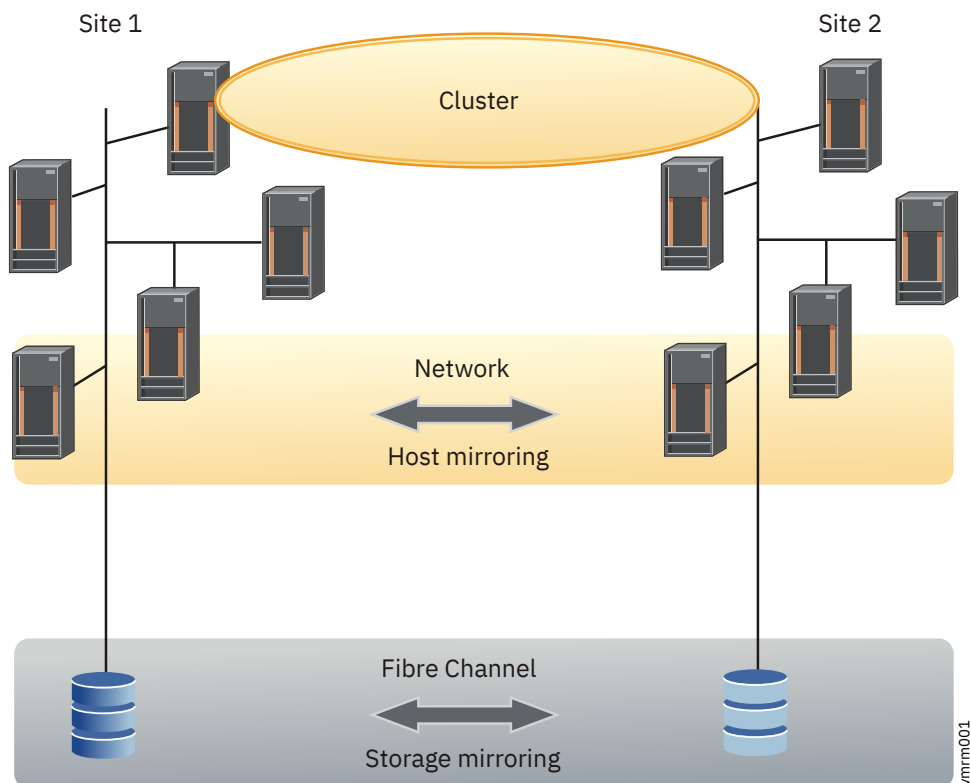
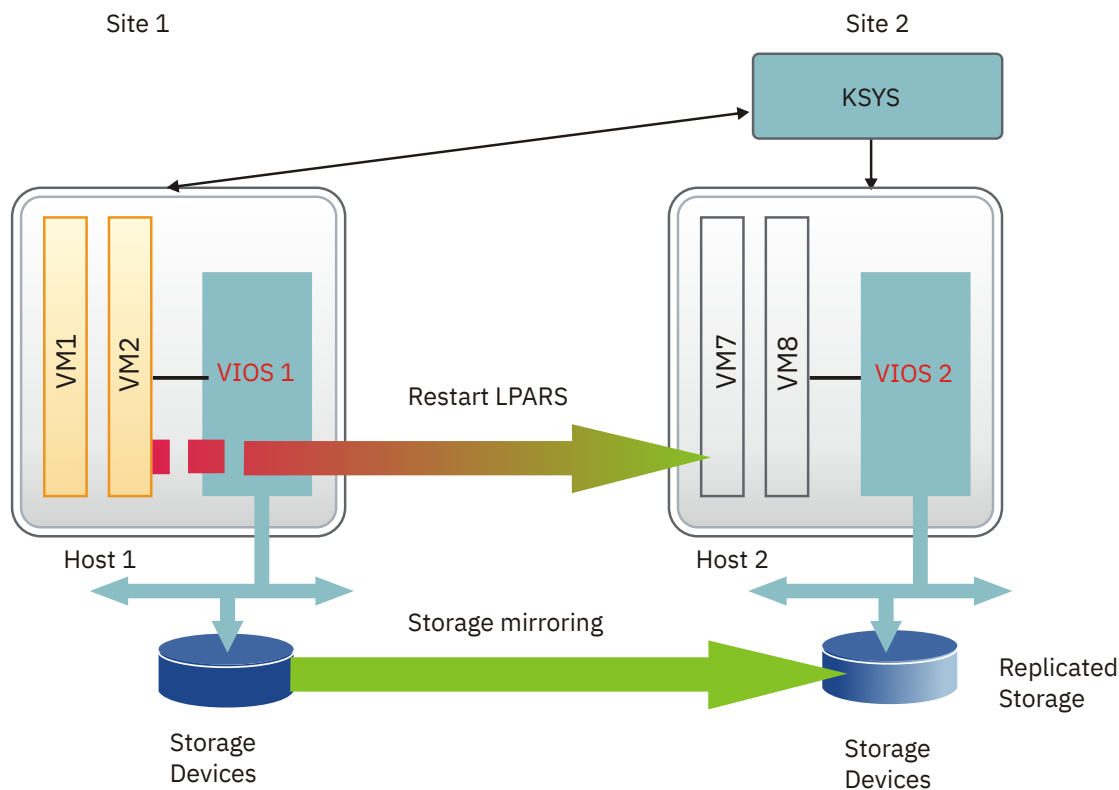


Figure 1. Cluster-based disaster recovery model

The following figure shows the disaster recovery solution that uses the VM restart-based technology. The VM Recovery Manager DR solution uses this model.



vmrm002

Figure 2. VM restart-based disaster recovery model

The following table identifies the differences between the conventional cluster-based disaster recovery model and the VM Recovery Manager DR solution:

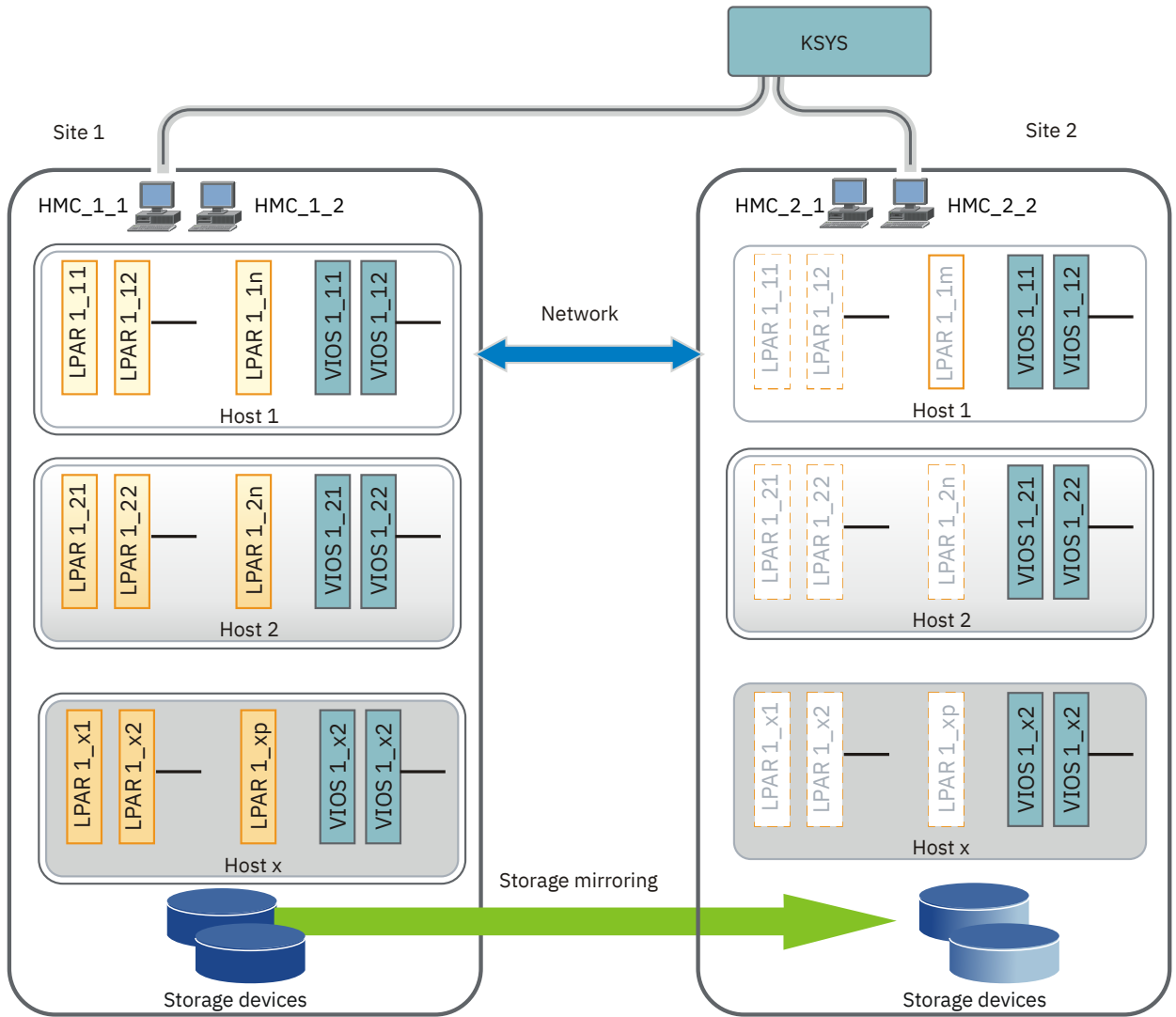
Table 1. Comparison between the cluster-based DR solution and the VM Recovery Manager DR solution		
Parameters	Cluster-based disaster recovery model	VM restart disaster recovery model that is used by the VM Recovery Manager DR solution
Deployment method	Redundant hardware and software components are deployed in the beginning of implementation to provide near real-time failovers when some of the components fail.	With virtualization technology, many images of the operating system are deployed in a system. These virtual machines are deployed on physical hardware by the hypervisor that allocates and manages the CPU, memory, and I/O physical resources that are shared among the VMs.
Dependency	This solution relies on monitoring and heartbeat capabilities within the cluster to monitor the health of the cluster and take recovery action if a failure condition is detected.	This solution relies on an out-of-band monitoring software that works closely with the hypervisor to monitor the VM environment and to provide a disaster recovery mechanism for the VM environment.
Workload startup time	The workload startup time is faster because the virtual machines and the software stack are already available.	The VMs require additional time to restart in the backup environment.
Cluster administration required	Yes	No

Table 1. Comparison between the cluster-based DR solution and the VM Recovery Manager DR solution (continued)

Parameters	Cluster-based disaster recovery model	VM restart disaster recovery model that is used by the VM Recovery Manager DR solution
Error coverage	Comprehensive. This solution monitors the entire cluster for any errors.	Limited. This solution monitors the servers, virtual machines, and storage devices for errors.
Deployment simplicity	This solution must be set up in each VM.	Aggregated deployment at the site level.
Protected workload type	Critical workloads can be protected by using this solution.	Less critical workloads can be selected for protection by using this solution.
Software license and administrative costs	This solution costs more because redundant software and hardware are required to deploy this solution.	This solution costs less because of optimized usage of resources.

A disaster recovery implementation that uses a set of scripts and manual processes at a site level might take more time to recover and restore the services. The VM Recovery Manager DR solution automates the operations to recover your production site. This solution provides an easy deployment model that uses a controller system (KSYS) to monitor the entire virtual machine (VM) environment. This solution also provides flexible failover policies and storage replication management.

The following figure shows the architecture and the basic components that are used in the VM Recovery Manager DR solution:



vmrm003

Figure 3. An example of VM Recovery Manager DR solution architecture

Related information

Redbook: [IBM Geographically Dispersed Resiliency for IBM Power Systems](#)

VM Recovery Manager DR concepts

The VM Recovery Manager DR solution provides a highly available environment by identifying a set of resources that are required for processing the virtual machines in a server during disaster situations.

The VM Recovery Manager DR solution uses the following subsystems:

- Controller system (KSYS)
- Site
- Host
- Virtual machines (VMs) or logical partitions (LPARs)
- Storage
- Network
- Hardware Management Console (HMC)
- Virtual I/O Server (VIOS)
- Host group

The following figure shows the VM Recovery Manager DR architecture:

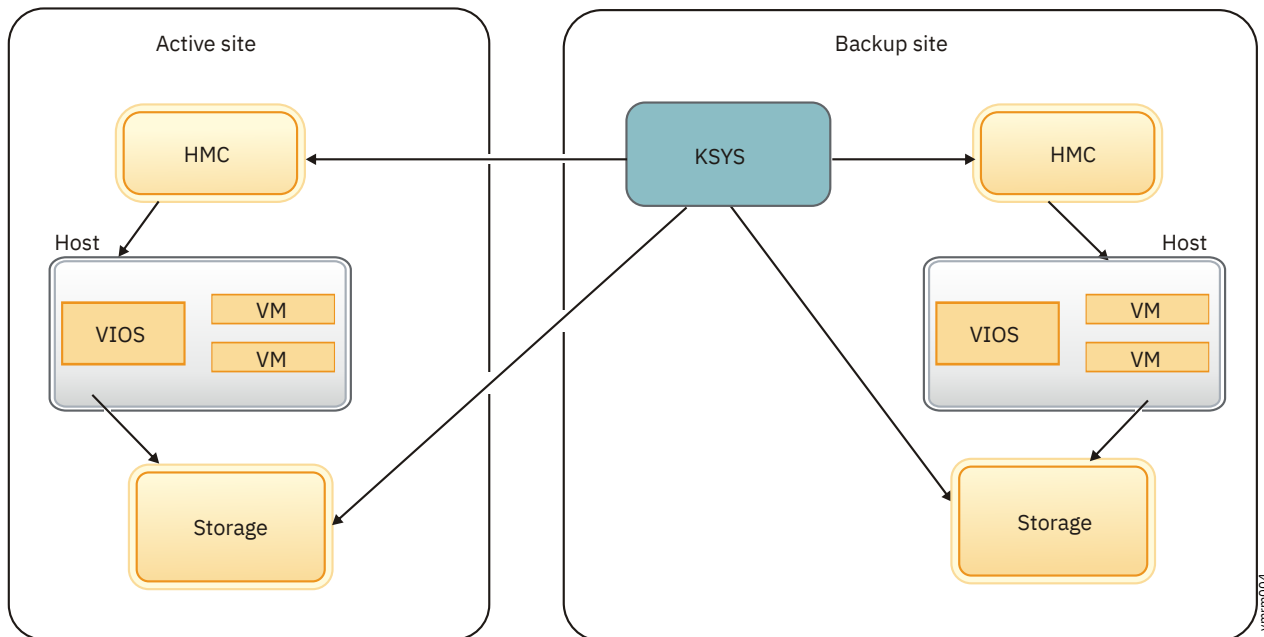


Figure 4. Components of VM Recovery Manager DR solution

Controller system (KSYS)

The controlling system, also called *KSYS*, is a fundamental component in the IBM VM Recovery Manager DR for Power Systems (VM Recovery Manager DR) solution. It provides a single point of control for the entire environment managed by the VM Recovery Manager DR solution.

The *KSYS* cannot be affected by errors that can cause an outage in the production systems. Therefore, the *KSYS* must be self-contained and share a minimum number of resources with the production system. Ensure that you deploy the *KSYS* in the backup site so that the *KSYS* is isolated from any issues or failure in the active site. In the VM Recovery Manager DR solution, the *KSYS* must have an out-of-band deployment in its own logical partition that must be running on AIX Version 7.2 with the 7200-01 Technology Level, or later.

The following figure shows a logical interaction between the KSYS and other physical components of the VM Recovery Manager DR solution:

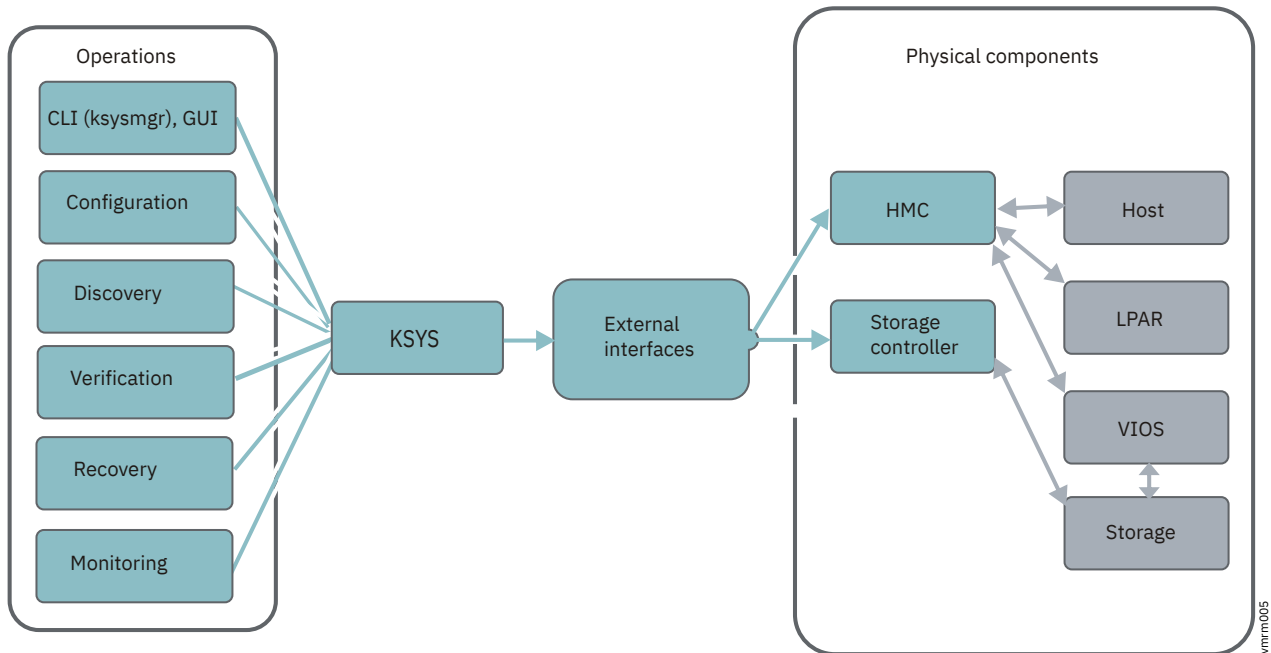


Figure 5. Logical interaction between KSYS and other components

The KSYS is responsible for recovery actions if a disaster or a potential disaster occurs. Therefore, the availability of KSYS is a fundamental requirement of the solution. The KSYS must be deployed in the backup site. The KSYS must remain operational even if the active site fails or if the disks located in the active site fail.

The KSYS constantly monitors the production environment for any unplanned outage that affects the production site or the disk subsystems. If an unplanned outage occurs, the KSYS analyzes the situation to determine the status of the production environment. When a site fails, the KSYS notifies the administrator about the failure. If the failure is severe, the administrator can initiate a site takeover. The KSYS pauses the processing of the data replication to ensure secondary data consistency and to process the site takeover.

The KSYS handles discovery, verification, monitoring, notification, and recovery operations to support disaster recovery for the VM Recovery Manager DR solution. The KSYS interacts with the Hardware Management Console (HMC) to collect configuration information of the managed systems. The KSYS interacts with the Virtual I/O Server (VIOS) through the HMC to obtain storage configuration information of the virtual machines. The KSYS also provides storage replication management and Capacity on Demand (CoD) management.

You can configure the KSYS by using the **ksysmgr** command. The **ksysmgr** command has the following format:

```
ksysmgr ACTION CLASS [NAME] [ATTRIBUTES...]
```

Security implementation for the KSYS subsystem

The KSYS subsystem runs in an AIX logical partition (LPAR). You can customize security for this LPAR as per the AIX security requirements of your organization.

The KSYS management is enabled only for the root user in the KSYS LPAR. The KSYS subsystem does not communicate to any external systems except HMC, Storage subsystem and ksysmgr.

The KSYS subsystem uses REST APIs to communicate to HMC. You must enable HTTPS in your environment for REST API communication.

The KSYS subsystem communicates to the storage subsystems by using APIs provided by the storage vendors. Refer to storage vendor documentation for any specific security requirements of these APIs.

The `ksysmgr` is the command-line interface (CLI) that communicates to the KSYS subsystem. You can configure and view the status of the KSYS subsystem and its resource by using the `ksysmgr` CLI.

Related reference

[ksysmgr command](#)

Hardware Management Console (HMC)

The controller system (KSYS) interacts with the HMC for processes that involve host, Virtual I/O Server (VIOS), and disk subsystem resources. These processes include discovery, monitoring, recovery, and cleanup.

The HMC is a virtual as well as a physical appliance that is used to manage the IBM Power systems servers (hosts), VIOS, and logical partitions (LPARs) that can be managed by the KSYS.

The HMC provides Representational State Transfer (REST) application programming interfaces (APIs) to the KSYS subsystem. The KSY subsystem performs various configuration and operation tasks by using the REST API.

The KSYS subsystem collects all details from HMC about managed systems, Virtual I/O Servers (VIOSeS), and virtual machines by using the REST API queries. The KSYS subsystem also collects detailed information about system processor, system memory, hardware, worldwide port name (WWPN) of the physical Fibre Channel (FC) adapter from HMC. The KSYS subsystem performs the following operations from HMC by using the REST API:

- Checks system capability for each operation.
- Periodically collects information about the host state, LPAR state, VIOS state, and the IP addresses of the host, VIOS, and LPAR that KSYS subsystem 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 are capable of the 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.

To ensure enhanced availability, you can configure dual Hardware Management Consoles in your environment. In this case, if one HMC is down or unreachable, the KSYS can use another configured HMC to collect the required information.

Related information

[HMC REST APIs](#)

Sites

Sites are logical names that represent your sites. You must create sites at the KSYS level. All the Hardware Management Consoles, hosts, VIOS, and storage devices are mapped to one of the sites.

You can configure only two sites: home site and backup site. A workgroup or a host group can be active on any of the two sites. You can query the details about a site, active host groups on the site, and active workgroups on the site by using the `ksysmgr` command.

Sites can be of the following types:

Home site (or primary site)

Indicates the site where the workloads primarily run.

The `ksysmgr` command can display and configure the current attributes of the active site.

Backup site (or disaster recovery site)

Indicates the site that acts as a backup for the workload at a specific time. During a disaster, or a potential disaster, workloads are moved to the backup site.

You can create and configure sites by using the **ksysmgr** command.

The following figure shows the site attributes:

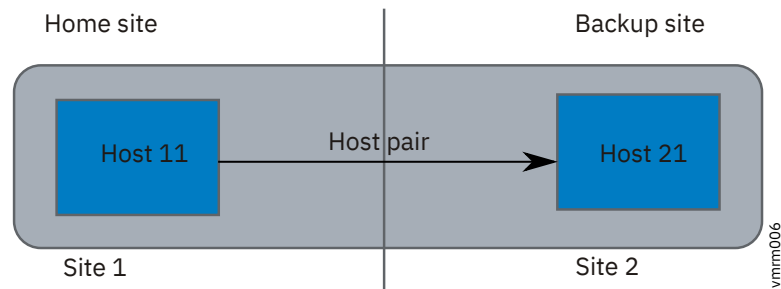


Figure 6. Site attributes

In this example, the Site 1 and Site 2 sites can switch back and forth as active and backup sites depending on where the logical partitions are currently located. You can set Site 1 as the active site for the logical partitions in the Host 11 host.

Related reference

[ksysmgr command](#)

Hosts

A *host* is a managed system in HMC that is primarily used to run the virtual machines that runs the workload. A host can also be called as a server or a Central Electronics Complex (CEC). Hosts are identified by its universal unique identifier (UUID) as tracked in the HMC.

The VM Recovery Manager DR solution uses the following host-specific terms:

Host pair

Indicates the set of hosts that are paired across the sites for high-availability and disaster recovery.

Each host in the host pair must meet all the resource requirements (for example, CPU, memory, VIOS-based virtual I/O aspects) to run the same workload in a disaster or a potential disaster.

Host group

Indicates a group of hosts that are logically chosen and named by the administrator.

You can group a set of hosts based on your business requirements. Each host must belong to a host group. For example, you can group the hosts that run similar type of workloads. Or, you can group the most important hosts together so that the monitoring and recovery operations can be performed for the set of hosts together and quickly. By grouping the most important hosts in their own group, in the event of a disaster, you can move the host group to the backup site.

You can perform discovery, verification, move, and recovery operations at host group level. If you run these operations at site level, all the host groups are included in the operation. If a host group is already moved to the backup site, and then a site-level move operation is started from the home site, that host group is skipped for the operation.

The following figure shows the host-related configuration across sites:

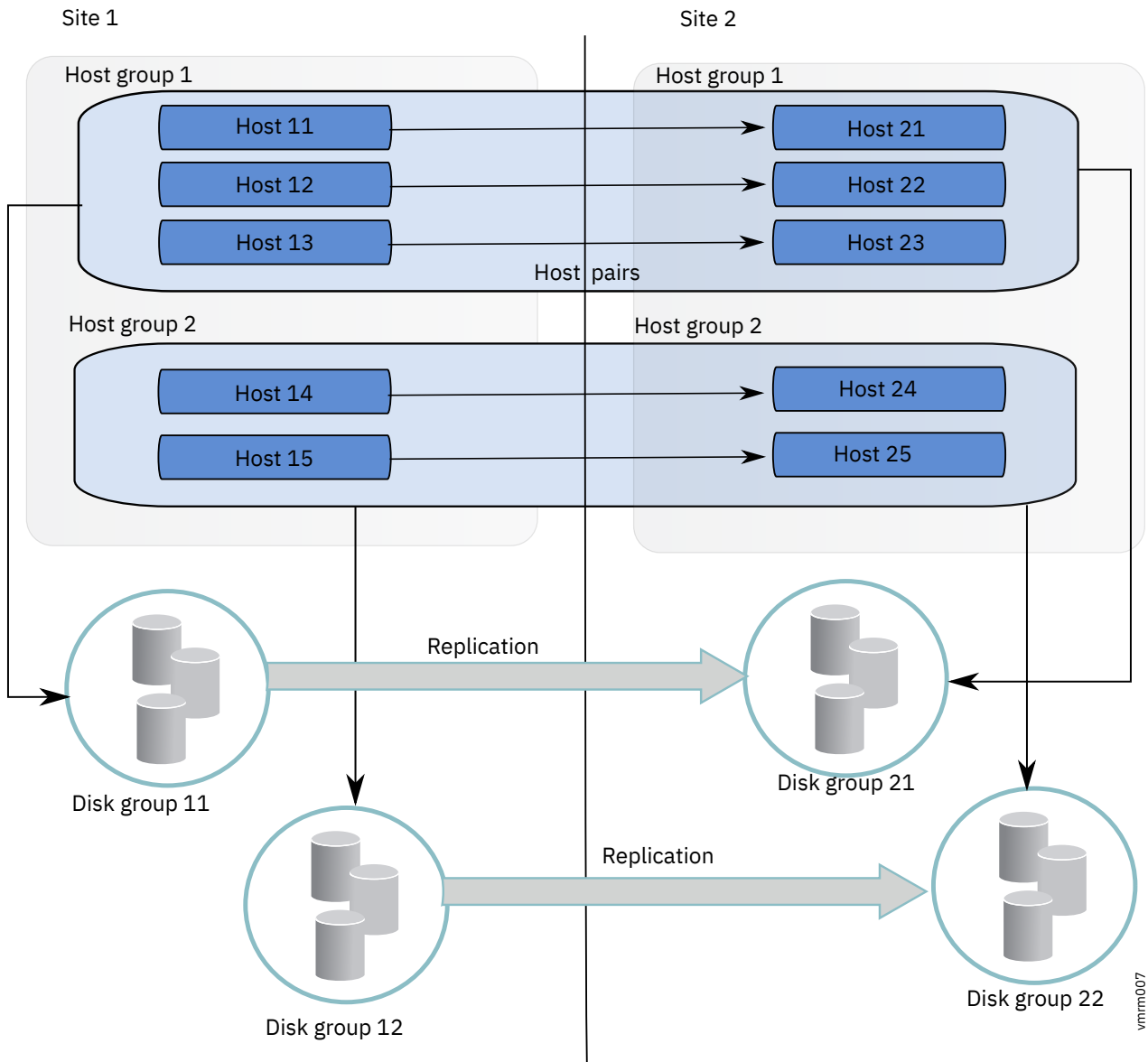


Figure 7. Host configuration

Note: The VM Recovery Manager DR solution manages an environment in which M number of hosts on the home site are configured to failover with N number of hosts on the backup site. This is referred as M host-to-N host (MXN) pairing. The host group with the one-to-many pairing is called *asymmetric host group*.

Host pairing is not required in an asymmetric host group configuration.

Workgroup

You can create one or more workgroups within a host group and add virtual machines to the workgroup.

All operations and commands that are run for host group, can also be run for a workgroup. A default workgroup is created automatically when you create a host group. If you do not create a workgroup, and add virtual machines to your workgroup, all the virtual machines are added to the default workgroup.

If you run a command on a workgroup, the command operation takes effect on all the virtual machines that are added to the workgroup. If you run the discovery, verify, move, and DR-test operations at a host group level, the operations also take the same effect on the workgroups within the host group.

You can create a host group without workgroup support. Set the *workgroup* attribute to no in the command that you run to create a host group.

Note: The HADR type of deployment does not support the workgroup feature.

The following figure shows the host group, workgroup, and virtual machine configuration.

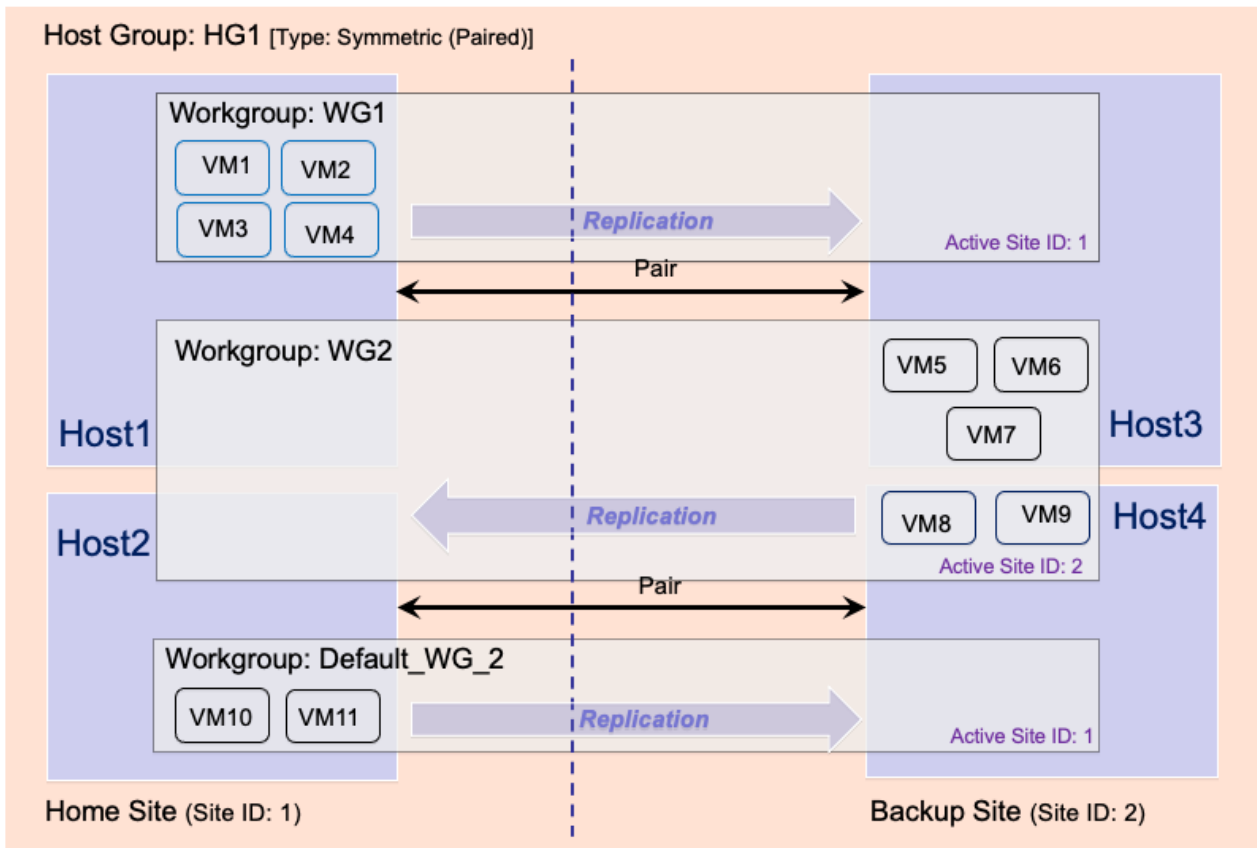


Figure 8. Host group and workgroup configuration

Four host groups are added in this symmetric host group configuration. Host1 and Host2 belongs to home site. Host3 and Host4 belongs to backup site. The hosts from home site, Host1 and Host2, are paired to the hosts in the backup site, Host3 and Host4 respectively. The virtual machines of the host groups are added to the two different workgroups. If you do not create a workgroup, and add virtual machines to your workgroup, all the virtual machines are added to the default workgroup.

Virtual machines

Virtual machines, also known as logical partitions (LPARs), are associated with specific Virtual I/O Server (VIOS) partitions for a virtualized storage to run a workload. A host can contain multiple virtual machines.

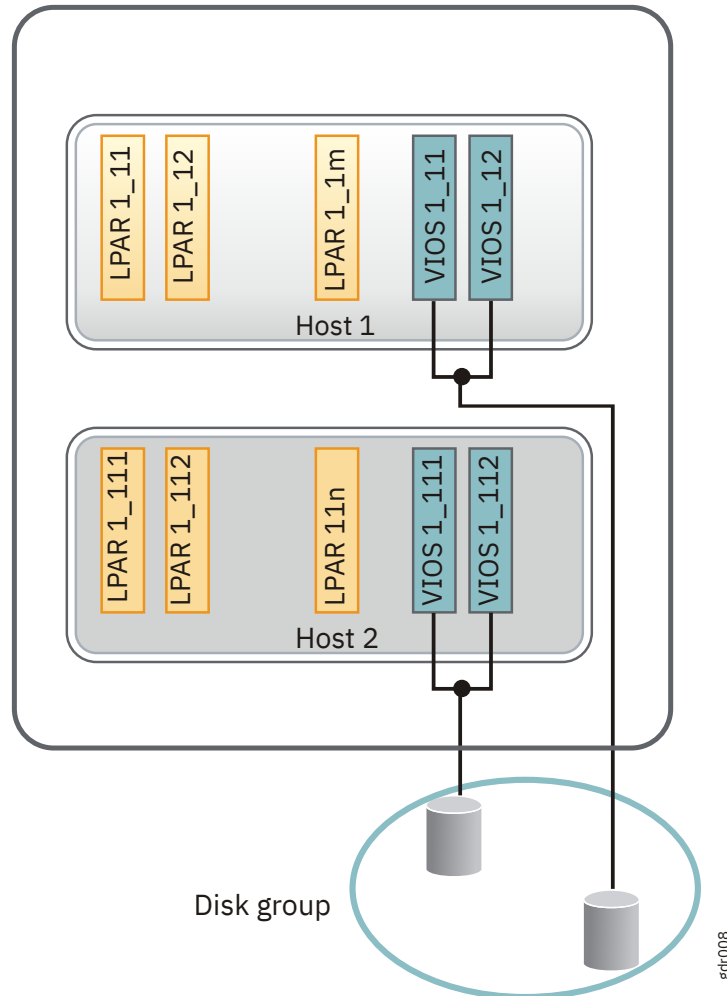


Figure 9. Virtual machine configuration

Virtual I/O Server (VIOS)

The KSYS receives information about the storage configuration of the virtual machines from VIOS.

The storage area network (SAN) zoning and logical unit number (LUN) masking must be performed so that the VIOS can access the disks information. The KSYS interacts with the VIOS to obtain information about the disks that are provisioned to the client partitions. During the validation process, the data that is collected from the active site is used on the backup site to validate whether virtual machines can be moved to the backup site during disaster situations.

The KSYS interacts with the VIOS to get information about the LPAR storage. The KSYS also interacts with the VIOS when the KSYS starts the various virtual machines during the disaster recovery operations. Therefore, the VIOS must have sufficient capacity to handle requests from the KSYS apart from handling the regular I/O activities that are in progress on the VIOS. If your environment contains multiple virtual machines that are clients of VIOS pairs, you might dedicate additional capacity during the disaster recovery operation. For example, you can have at least 0.1 CPU and 1 GB of memory in addition to the planned capacity for the VIOS.

You can back up and restore the virtual and logical configuration by using the **viosbr** command on the VIOS partitions. Also, you can collect, apply, and verify device settings in a VIOS run-time environment by

using the VIOS rules management. The VIOS rules support consistent device settings on multiple VIOS partitions, and also improves usability of VIOS.

Related information

[viosbr command](#)

[VIOS rules management](#)

Storage agents

A disaster recovery solution requires an organized storage management because storage is a vital entity in any data center. The VM Recovery Manager DR solution relies on data replication from the active site to the backup site.

In the VM Recovery Manager DR solution, the data is replicated from the active site to the backup site by using storage replication. Depending on the type of storage devices in your environment, the initial storage configuration might involve installation of the storage controller software that is used to perform replication operations. The general storage management operations include starting, stopping, suspending, reversing, resyncing, pausing, and resuming the replication. For more information about installation of storage controller software, see the documentation from the storage vendor.

The following figure shows an example of storage device configuration in a site.

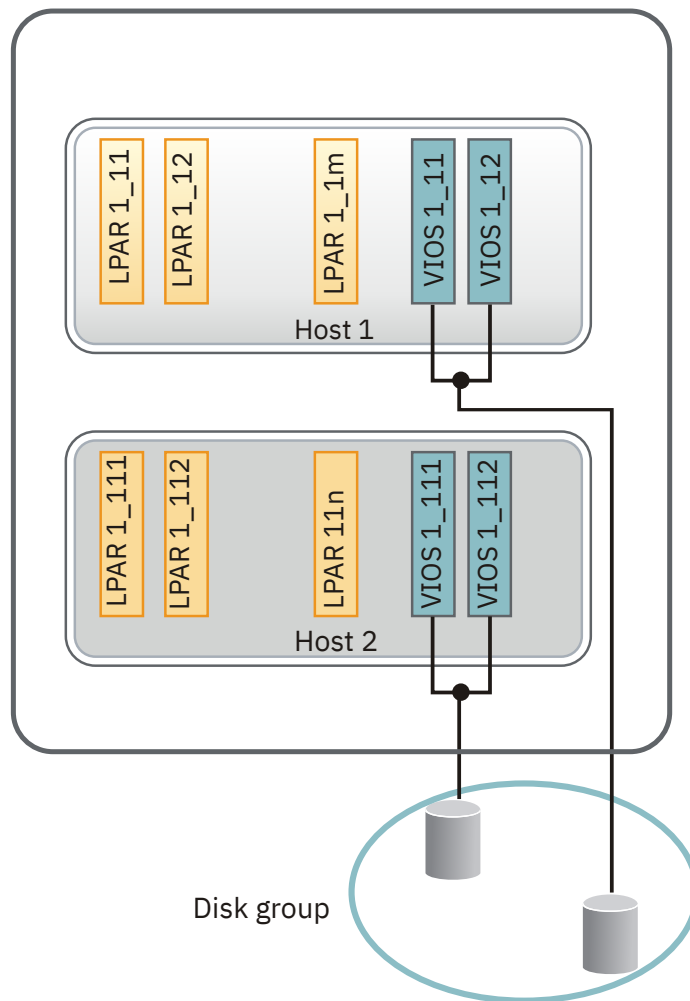


Figure 10. Storage device configuration in a site

The following figure shows an example of mapping storage devices across the active site and the backup site.

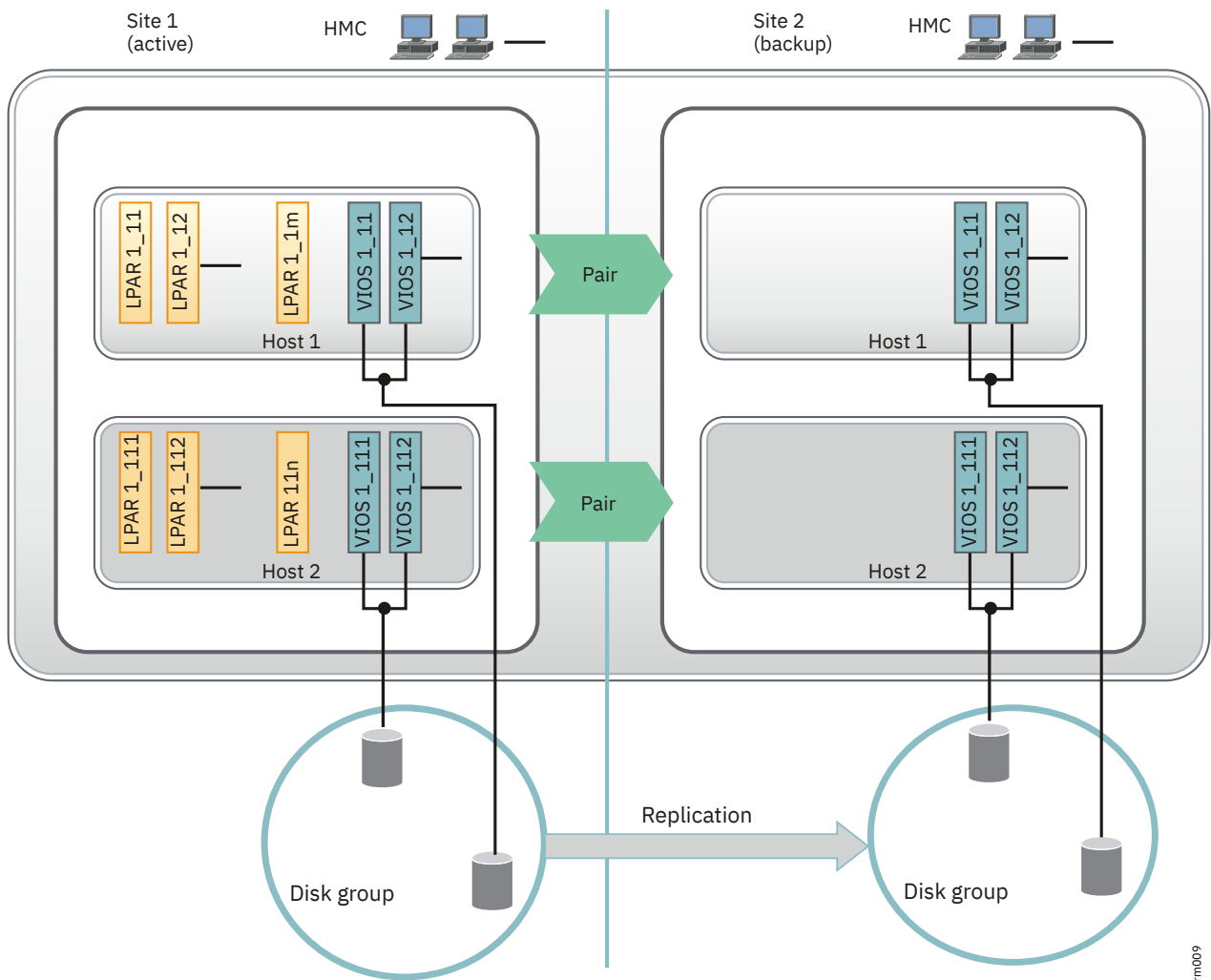


Figure 11. Storage replication across sites

After the initial storage setup, you must add a *storage agent* to the KSYS configuration that interacts with the storage subsystem. If you have a storage controller software, the storage agents interact with the storage controller to perform storage-specific operations in the disks.

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

Storage controller

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. This group of storage devices maintain the consistency of data. For more information about consistency groups, see [Consistency groups](#).

Disk pair

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

EMC storage subsystem

The VM Recovery Manager DR solution implements disaster recovery with Symmetrix Remote Data Facility (SRDF) storage devices by using the EMC supplied Symmetrix command-line interface (SYMCLI).

The VM Recovery Manager DR solution uses the Symmetrix application program interface (SYMAPI) server that runs on the EMC Solution Enabler server node for the SYMCLI operations.

To enable disaster recovery of EMC storage devices, complete the following steps before you implement the VM Recovery Manager DR solution:

1. Plan the storage deployment and mirroring functions that are necessary for your environment. This step is related to the applications and middleware that are deployed in the environment.
2. Use the EMC tools to configure and deploy the storage devices.
3. Use the SYMCLI interface to discover the storage devices that are deployed.

Note: Complete [step 1](#) and [step 2](#) before you configure the KSYS for disaster recovery management of EMC storage devices. You can perform [step 3](#) after the VM Recovery Manager DR implementation.

All EMC SRDF operations in the VM Recovery Manager DR solution are performed on a composite group, which is a group of disks that belong to multiple storage arrays. The consistency group that is enabled in the EMC storage devices for consistency is known as the *composite group*. The composite groups operate simultaneously to preserve the integrity and consistency of the dependent write operation of data that is distributed across multiple arrays. Consistency for an SRDF replicated resource is maintained at the composite group level on the EMC storage device.

The VM Recovery Manager DR solution supports SRDF replicated resources in the following modes:

SRDF/S (synchronous) replication

In the synchronous mode, when the host issues a write operation to the source of the composite group, the EMC storage device responds to the host after the target EMC storage device acknowledges that it has received and checked the data.

SRDF/A (asynchronous) replication

In the asynchronous mode, the EMC storage device provides dependent write consistent, point-in-time data to the secondary storage devices that slightly lags in time from the primary storage devices. Asynchronous mode is managed in sessions. In the asynchronous mode, the data is transferred in predefined cycles (delta sets). You can change this default cycle time to change the time difference of dependent write operations on the secondary storage devices that suits your business requirement.

During the discovery phase, the storage subsystem uses the following process:

1. The KSYS interacts with the HMC to get the list of virtual machines and the corresponding VIOS information. The KSYS then interacts with the VIOS to fetch the storage disk information used by these virtual machines.
2. The KSYS verifies the disk pair to check whether the disk is set up for mirroring.
3. The KSYS checks whether the disks on the storage subsystem are part of any existing composite groups. If the disk is part of any existing composite group, the discovery operation fails.
4. The KSYS creates a composite group for each site that contains the corresponding disks and enables data consistency. The KSYS uses this composite group to change the replication direction of the corresponding disks during a planned recovery operation.

For the SRDF-capable storage subsystems of the EMC VMAX family, at least one SYMAPI client must be installed in each site on any virtual machine in the Power servers or any other systems. For more information about the installation of these components, see the documentation from the storage vendor.

In the VM Recovery Manager DR solution, the storage agents, which are added to the KSYS configuration, interact with the corresponding storage controllers in each site. The storage controller is called the EMC Solution Enabler in the EMC configuration. The following figure shows the EMC Solution Enabler configuration for the VM Recovery Manager DR solution:

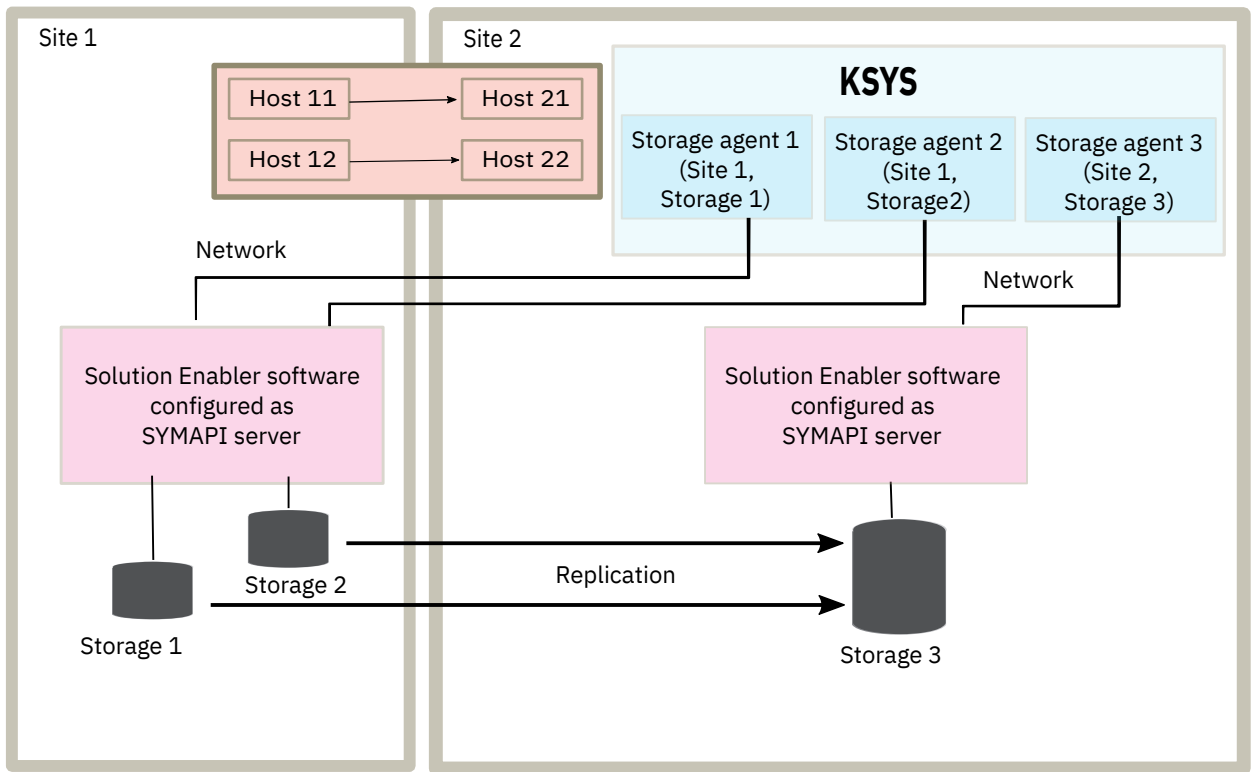


Figure 12. Relationship between storage agents and storage disks

Related information

[EMC Solution Enabler CLI User Guide](#)

SAN Volume Controller system and Storwize system

Beginning with VM Recovery Manager DR version 1.1 Service Pack 1, the VM Recovery Manager DR solution supports the IBM SAN Volume Controller (SVC) storage system and IBM Storwize® storage system. Both SVC system and Storwize storage systems follow the same host programming model for mirror management. Hence, the VM Recovery Manager DR solution supports both these storage subsystems by using the same configuration and management interfaces.

The SAN Volume Controller storage system integrates hardware and software components to control the mapping of storage data into volumes in a SAN environment. The SVC storage system includes the rack-mounted hardware components called *nodes*. Nodes are always installed in pairs. Each node pair is called an *I/O group*. A single node pair handles the I/O requests on a specific volume. A clustered system contains 1 - 4 I/O groups. A clustered system can have a maximum of eight nodes. When you set up the SVC system across multiple sites, the configuration is called *stretched system*. When you configure Metro Mirror or Global Mirror mode for data replication across sites, each site must have a separate SVC cluster.

A storage array consists of various physical drives that are logically grouped into Redundant Arrays of Independent Disks (RAID). Each storage system manages a set of logical unit numbers (LUNs) that correspond to storage arrays. The LUNs are mapped to the SVC system as groups of managed disks, which are assigned to a pool of virtual storage. The I/O groups convert the managed disks into storage pools, and then the storage pools are converted into one or more volumes. The volumes are assigned to hosts.

For more information about installation of the SVC system and Storwize system components, see the documentation from the storage vendor.

Notes:

- The VM Recovery Manager DR solution supports IBM SVC version 6.1.0, and later, and IBM Storwize V7000 7.1.0, and later.

- The VM Recovery Manager DR solution supports only a single SVC or Storwize cluster per host group because the SVC and Storwize storage systems do not support consistency groups across multiple storage systems within a host group. The SVC or Storwize cluster can contain a maximum of eight nodes.
- The following replication modes of data mirroring are supported:
 - Metro Mirror (synchronous)
 - Global Mirror (asynchronous)
 - Global Mirror with Change Volumes
- Each host that is associated with the SVC system and the Storwize system must have an installation of VIOS 2.2.5.20, or later. Additionally, the SVC or Storwize storage system requires HMC Version 8 Release 8.6.0 Service Pack 1.
- When you configure the SVC storage system, create the replication by using the **mkrcrelationship** command.
- When you add a virtual machine to be managed by the KSYS subsystem, you must ensure that the new virtual machine is associated with the storage volumes that have the same relationship type as the other existing virtual machines. That is, the relationship between the master disks and the auxiliary disks of the new virtual machine must be created to match the relationship between the master disks and auxiliary disks of other virtual machines. You can check the existing relationship information by using the **lsrcrelationship** command in the SVC storage system. After a relationship is created between the master disks and auxiliary disks, the storage administrator must start data consistency of the relationship before you add the virtual machine to be managed by the KSYS subsystem. To start data consistency, run the **startrcrelationship** command.
- **>|** The volume protection attribute must be disabled before starting the DR-test operation.

Run the following command in the command-line interface (CLI) of the SVC systems to check the state of the volume protection attribute.

```
svcinfolssystem | grep vdisk_protection_enabled
```

If the volume protection attribute is enabled, complete the following procedure to disable the volume protection attribute:

1. Run the following command in the command-line interface (CLI) of the SVC systems to disable the volume protection attribute at the system level::

```
svctask chsystem -vdiskprotectionenabled no
```

2. Run the following command in the command-line interface (CLI) of the SVC systems to disabled the volume protection attribute at the pool-level:

```
svctask chmdiskgrp -name <name> -vdiskprotectionenabled no
```

For more information, see [Changing volume protection settings](#).



Warning: When you use the **-sync** option, the SVC storage system does not sync the backup site disks with the active site disks completely. Therefore, a disaster recovery operation from the active site to the backup site might fail. Also, the KSYS subsystem cannot check whether you used the **-sync** option. Hence, you must not use the **-sync** option to prevent unpredictable results.

The VM Recovery Manager DR solution manages disaster recovery across sites by grouping all the disks in a site and establishing a consistency group for the disks in the SVC or Storwize storage systems. During the discovery phase, the KSYS subsystem interacts with the HMC and the VIOS to fetch the storage disk information that is used by the virtual machines. The KSYS then creates a consistency group for each site and enables data consistency across the sites. The KSYS subsystem uses this consistency group to change the replication direction during a planned recovery operation. The KSYS subsystem also checks whether the disks on the storage subsystem are part of any existing consistency groups. If the disk is part

of any existing consistency group, the discovery operation fails. In this case, you must ensure that the storage disks are not part of any consistency groups and then run the discovery operation again.

The KSYS subsystem uses a Secure Shell (SSH) application to communicate to the SVC or Storwize command-line interface (CLI). You must configure this connection such that the authentication is established without entering the password so that the KSYS subsystem can communicate to the SVC or Storwize storage system without any intervention.

In the VM Recovery Manager DR solution, the storage agents, which are added to the KSYS configuration, interact with the corresponding storage devices in each site. The following figure shows the storage agent configuration for the SVC storage in the VM Recovery Manager DR solution.

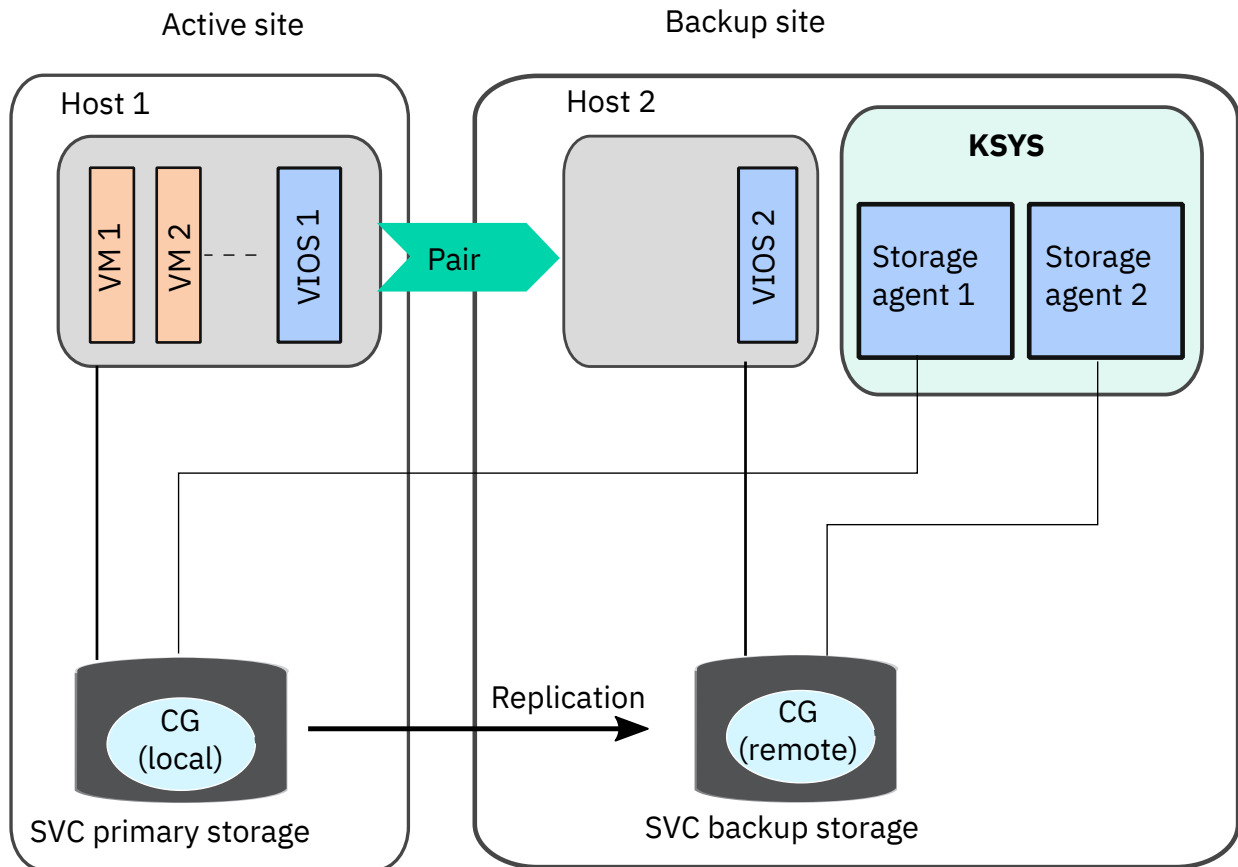


Figure 13. Relationship between storage agents and SAN Volume Controller storage systems

Related information

[IBM SAN Volume Controller](#)

[IBM Storwize V7000](#)

[mkrcrelationship command](#)

[lsrcrelationship command](#)

[Setting up an SSH client in SVC storage system](#)

DS8000 storage system

Beginning with VM Recovery Manager DR version 1.1 Service Pack 1, the VM Recovery Manager DR solution supports the IBM System Storage® DS8000® series storage system for storage management.

IBM System Storage DS8000 series is a high-performance and high-capacity series of disk storage that supports continuous operations. The DS8000 series that are supported by the VM Recovery Manager DR solution include the following models:

DS8700

The DS8700 storage system uses IBM POWER6® server technology, which provides high-performance and high-capacity for disk storage systems. The DS8700 storage system also provides improved performance by upgrading the processor and I/O interconnection technology.

DS8800

The DS8800 storage system is an advanced high-performance and high-capacity disk storage system. The DS8800 storage system supports IBM POWER6+ processor technology to provide higher performance.

All DS8000 series models consist of a storage unit and one or two management consoles depending on high availability configuration settings. You can use the graphical user interface (GUI) or the command line interface (CLI) to logically divide storage and use the built-in Copy Services functions.

Notes:

- The VM Recovery Manager DR solution supports only Global Mirror (asynchronous) mode of data replication across sites.
- The VM Recovery Manager DR solution supports only a single DS8000 storage system per site, which means that all storage devices must be configured as a single DS8000 cluster per site.
- Each host that is associated with the DS8000 series of storage devices must have VIOS 2.2.5.20, or later, installed. Additionally, the DS8000 storage system requires HMC Version 8 Release 8.6.0 Service Pack 1.

A *session* is a collection of disk volumes across multiple storage systems that are managed together to create consistent copies of data. All storage operations in the VM Recovery Manager DR solution are performed on a session ID that is a logical group of disks that are associated with the DS8000 series of storage array. During the discovery phase, the KSYS interacts with the HMC and the VIOS to fetch the storage disk information that is used by the virtual machines. The KSYS then creates a session in each site and adds all the disks to this session. The KSYS uses sessions to change the replication direction during a planned or unplanned recovery operation.

The VM Recovery Manager DR solution uses the DS8000 Series Command Line Interface (DSCLI) client to interact with the DS8000 storage array.

The following restrictions and limitations apply to the Global Mirror session in the DS8000 series of storage devices:

- If the disk volumes that are replicated span across multiple DS8700 Logical Sub Systems (LSS), the same Global Mirror session identifier must be used for all LSS.
- The Hardware Management Console (HMC) associated with the IBM DS8700 storage system that is used with the VM Recovery Manager DR solution, must be accessible by using TCP/IP on the KSYS node and both sites.
- Latest DSCLI client must be installed on the KSYS node. The VM Recovery Manager DR solution supports DSCLI version 7.7.51.48, and later.

For more information about the installation and configuration of the DS8000 series of storage devices, see the documentation from the storage vendor.

Related information

[IBM DS8000 Series](#)

[IBM DS8000 series migration information](#)

Hitachi storage systems

The VM Recovery Manager DR solution supports disaster recovery (DR) for third-party vendor storage from Hitachi. The VM Recovery Manager DR solution supports both synchronous and asynchronous data replication by using Hitachi TrueCopy remote replication and Hitachi Universal Replicator (HUR) technologies.

Notes:

- VM Recovery Manager DR supports the following models of the Hitachi storage system:
 - Hitachi Virtual Storage Platform (VSP) G200
 - Hitachi VSP G400
 - Hitachi VSP G600
 - Hitachi VSP G800
 - Hitachi VSP G1000
- VM Recovery Manager DR supports both synchronous and asynchronous modes of storage replication.

The setup of VM Recovery Manager DR disaster recovery for Hitachi mirrored storage system involves the following steps:

1. Plan the storage deployment and replication necessary for your environment. This process is related to the applications and middleware that must be deployed in the environment that you want to include in the recovery management by the VM Recovery Manager DR solution.
2. Use the storage configuration tools that are provided by Hitachi to configure the storage devices you have defined in [step 1](#), and deploy the devices. For more details on setting up your environment for Hitachi storage systems, see [“Setting up VM Recovery Manager DR for Hitachi storage systems” on page 21](#)
3. Use the **ksysmgr** interface to discover the deployed storage devices and to define the disaster recovery policies for the applications or virtual machines that are using the mirrored storage.

Hitachi storage management uses Command Control Interface (CCI) operations from the AIX® operating system and VM Recovery Manager DR environment. The KSYS subsystem uses CCI to discover and integrate the Hitachi storage replication into the disaster recovery framework of VM Recovery Manager DR. This integration manages disaster recovery for applications that use the mirrored storage. In the VM Recovery Manager DR solution, the storage agents, which are added to the KSYS configuration settings, interact with the corresponding CCI software in each site.

Hitachi Command Control Interface (CCI)

The remote and in-system replication software from Hitachi requires the following CCI components to manage the disk pairs:

Command device

The command devices are located in storage systems. CCI uses the command device as the interface to the storage system from the host. The command device accepts commands from the host and executes them on the storage system. The command device is a dedicated logical volume.

Hitachi Open Remote Copy Manager (HORCM)

The HORCM is located in the CCI server. The HORCM operates as a daemon process. When activated, the HORCM refers to CCI configuration definition files that are also located on the CCI server. The HORCM instance communicates with the storage system and remote servers.

HORCM definition files describe the storage systems, pair volumes, and data paths. When you run a command, CCI uses the information in the HORCM files to identify target volumes of the command.

Two HORCM files are required for each pair. One file describes the primary volumes (P-VOLs), and the other file describes the secondary volumes (S-VOLs). The following figure shows an example setup of Hitachi storage configuration with two HORCM instances.

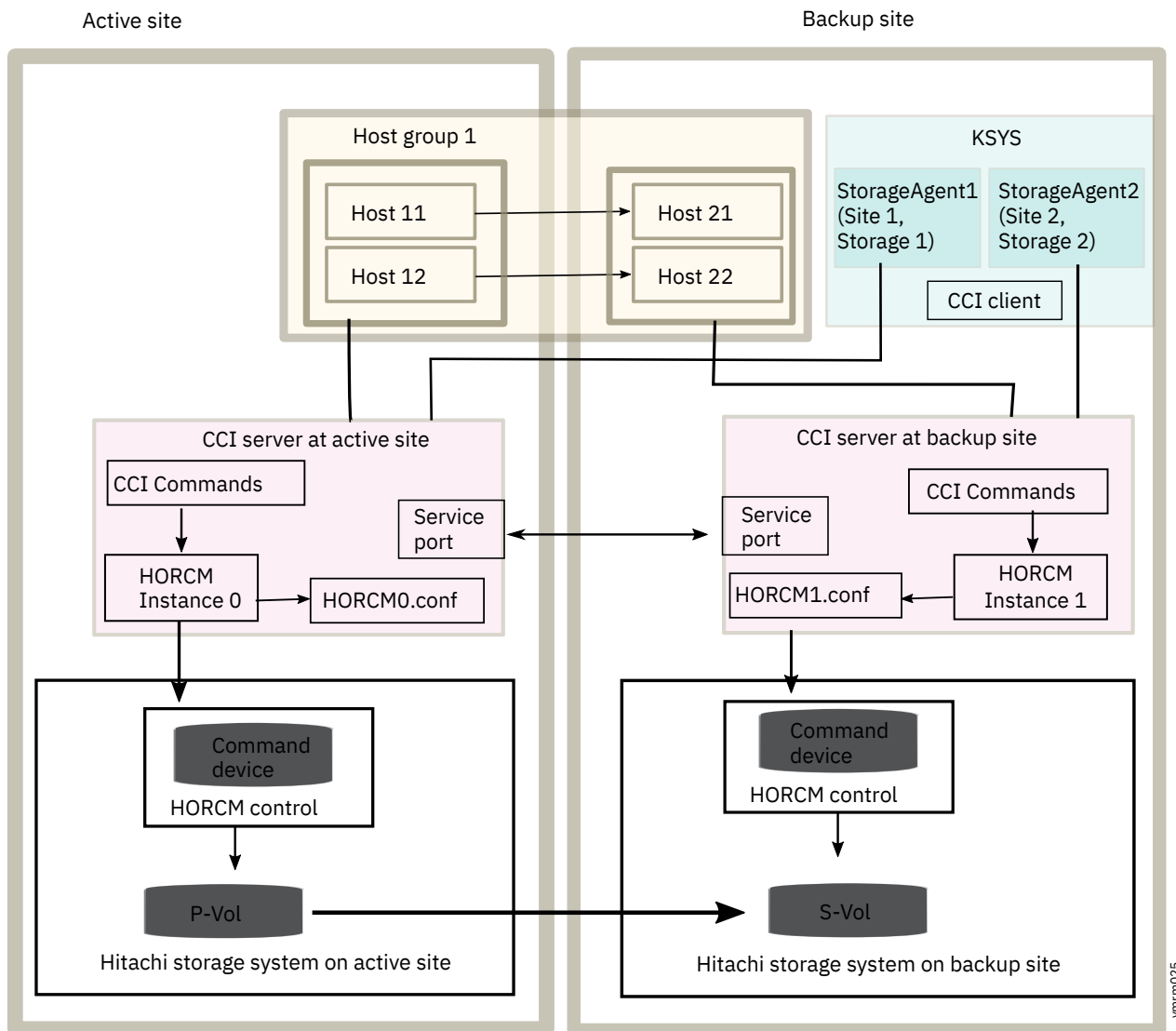


Figure 14. Relationship between storage agents and storage disks

Requirements

The VM Recovery Manager DR solution requires the following components for Hitachi storage configuration:

- Command Control Interface (CCI) software for AIX. For more information about CCI, see Hitachi Command Control Interface (CCI) documentation that is maintained by Hitachi. The CCI software must also be installed on the KSYS LPAR to communicate with the CCI server.
- The VM Recovery Manager DR solution requires CCI version 01-39-03/04 with model RAID-Manager/AIX.

Limitations

Consider the following limitations when you use the Hitachi storage systems in the VM Recovery Manager DR solution:

- The device names (`dev_name` attributes) must map to logical devices and the device groups (`dev_group` attributes) must be defined under the `HORCM_LDEV` section in the `horcm.conf` file.
- The VM Recovery Manager DR solution uses the `dev_group` attribute for any basic operation that is related to the Hitachi storage systems. Some examples of basic operations are **pairresync**, **pairevwait**, and **horctakeover**. If several device names exist in a device group, the device group must be consistency-enabled.

- For command devices, the **Security** option in the **Command Device Attributes** panel must be disabled and the **User Authentication** option must be enabled. Otherwise, the required information, such as logical device (LDEV) ID, journal volume ID, consistency group ID, and volume type, are not displayed in any command output. The KSYS subsystem needs this information to monitor the state of storage subsystem disks.
- The HUR technology requires journal groups. Each pair relationship in a journal group is called mirror. A mirror ID is required for the 3-data-center (3DC) configuration. In a 3DC configuration, two or more restore journal groups can be set for one master journal group. The VM Recovery Manager DR supports 2-data-center (2DC) configuration currently that does not require a mirror ID. The VM Recovery Manager DR configuration uses 0 mirror ID for synchronous (TrueCopy) and asynchronous (Universal Copy) configuration.
- The VM Recovery Manager DR solution does not trap Simple Network Management Protocol (SNMP) notification events for HUR storage. If an HUR link goes down when the hosts are functional and later the HUR link is repaired, you must manually resynchronize the disk pairs.
- The KSYS subsystem does not control the creation of disk pairs. You must create the disk pairs before you start the KSYS partition.
- Dynamic manipulation of disk groups is not supported for Hitachi storage systems. The KSYS subsystem might break the grouping of the disks in a disk group during the group manipulation operation. When a disk is removed from a disk group, the disk moves into simplex state.

The following cases result in disk removal from a disk group. In these cases, the Hitachi storage subsystem removes the pair relationship.

- Removing disks from a virtual machine
- Performing Live Partition Mobility operation or Remote Restart operation across host groups
- Restoring a snapshot
- Unmanaging a virtual machine from the KSYS subsystem
- Removing a host from host group and adding the host to another host group
- Removing a virtual machine from workgroup
- Removing a cluster

You must recreate the disk pair explicitly before you add the same disk or virtual machine to the VM Recovery Manager DR management.

- Hosts that are managed by the VM Recovery Manager DR solution cannot contain volume groups with both HUR-protected and non-HUR-protected disks. A host must contain an HUR-protected disk.
- All hosts within a site that are managed by the VM Recovery Manager DR solution must use the same HORCM instance.
- All disks within a site must belong to the same journal volume.
- You must not add any special character to the HORCM configuration file. You must use only spaces to segregate all the fields in the HORCM file.

Related information

[Hitachi Universal Replicator User Guide](#)

Setting up VM Recovery Manager DR for Hitachi storage systems

To set VM Recovery Manager DR for Hitachi storage systems, complete the following steps:

1. Ensure that the storage systems and hosts are zoned separately. The paired hosts must be connected to each other by using mutually exclusive storage area network (SAN) switches from the VIOS. This configuration is important because VIOS checks the SAN fabric by logging in to the connected SAN switches. If the paired hosts are connected to the same SAN switch, the login operation causes conflicts, and the verification of the configuration might fail.

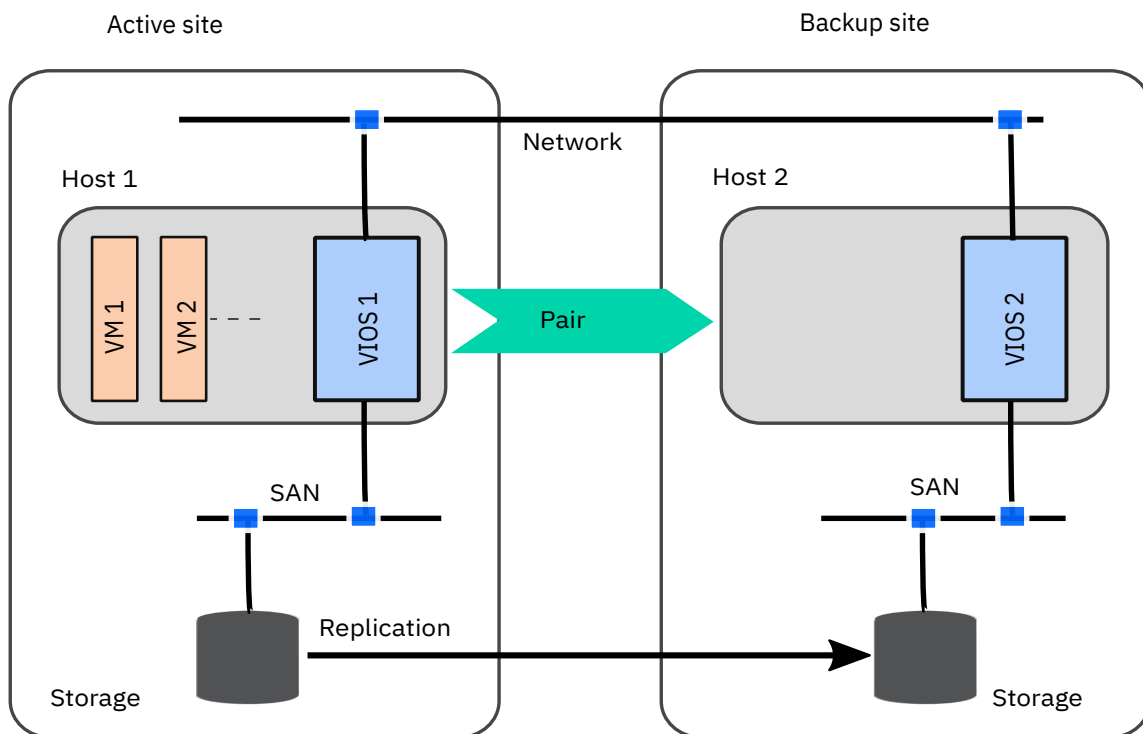


Figure 15. SAN connection between storage systems and hosts

2. Ensure that storage disks from both the sites are correctly mapped to the host worldwide node name (WWNN) in the corresponding host group and to the correct port.

To fetch information about the port to which the storage disk is attached, run the following commands in the KSYS node:

```
# raidcom get ldev -ldev_id 216 -IH14 | grep -i Port
NUM_PORT : 2
PORTs : CL3-A-5 0 r5r3m11 : CL3-A-6 0 r5r3m12

# raidcom get hba_wwn -port CL3-A-5 -IH14
PORT  GID GROUP_NAME  HWWN  Serial#  NICK_NAME
CL3-A  5 r5r3m11      c05076aa00010026  357558 r5r3m11_fcs0
CL3-A  5 r5r3m11      c05076aa00010024  357558 r5r3m11_fcs3
CL3-A  5 r5r3m11      c05076aa00010028  357558 r5r3m11_fcs2
CL3-A  5 r5r3m11      c05076aa00010022  357558 r5r3m11_fcs1
```

3. Verify the mapping information of storage disks in the VIOS for all LPAR client adapters by running the following commands. The following command shows the mapping information of virtual Fiber Channel adapters:

```
lsmmap -all -npiv
```

The following command shows the mapping information of virtual Fiber Channel host to the LPAR and to the VIOS.

```
lsmmap -all for vscsi
```

4. Validate that source and target Command Control Interface (CCI) servers are running properly by completing the following steps:

- a. Ensure that Hitachi Open Remote Copy Manager (HORCM) configuration files are updated with correct information in the source and target CCI servers and the KSYS LPAR.

Sample HORCM configuration file of the CCI server

```
# Created by mkconf.sh on Fri mmm dd hh:mm:ss CST yyyy
HORCM_MON
```

```
#ip_address      service      poll(10ms)      timeout(10ms)
9.3.18.127      horcm2      1000            3000

HORCM_CMD
#dev_name      dev_name
#UnitID 0 (Serial# 357558)
/dev/rhdisk53
```

Sample HORCM configuration file at the KSYS node

```
# cat /etc/horcm14.conf
HORCM_CMD
\\.\IPCMD-9.3.18.127-99999

HORCM_MON
#ip_address      service      poll(10ms)      timeout(10ms)
9.3.207.43      Source      1000            3000

HORCM_LDEV
VOL_DUMMY1 VOL_DUMMY_DISK_1 357558 310 0
VOL_DUMMY1 VOL_DUMMY_DISK_2 357558 314 0
VOL_DUMMY1 VOL_DUMMY_DISK_3 357558 318 0
VOL_DUMMY3 VOL_DUMMY_DISK_4 357558 313 0

HORCM_INST
#dev_group      ip_address      service
VOL_DUMMY1      9.3.207.43      Target
VOL_DUMMY3      9.3.207.43      Target
```

Note:

- You must not add any special character to the HORCM configuration file. You must use only space characters to segregate all the fields in the HORCM file.
- >It is recommended to set a lower time-out duration such as 120 seconds for the Hitachi CCI server in the horcmX.conf configuration file.<

- b. Verify the /etc/services file with port information by running the following command in the KSYS node:

```
# cat /etc/services | grep -i hamon
hamon2      99996/udp
```

The CCI daemon server accepts the CCI client request on the port that is specified in the horcmX.conf configuration file.

Refresh the **inetd** daemon for the file changes to take effect by running the following command:

```
refresh -s inetd
```

To access the Hitachi group information and to export the port information of the HORCM daemons in both the source and target sites, update the /etc/services file by running the following command in the KSYS node:

```
# cat /etc/services | grep -i hamon
Source      99991/udp
Target      99992/udp
```

- c. Validate the status of HORCM instance by running the following command in the KSYS node:

```
# ps -ef | grep -i horcm
root 5898644 13042102 0 02:21:24 pts/1 0:00 grep -i horcm
root 6488538 1 0 06:12:35 - 0:00 horcmd_015
root 12583174 1 0 06:12:32 - 0:00 horcmd_014
```

- d. Check communication status between the KSYS node HORCM instance and both CCI servers by running the following commands:

```
# raidqry -l -IH14
No Group      Hostname      HORCM_ver      Uid      Serial#      Micro_ver      Cache(MB)
1 ---      r5r3m22      01-39-03/04      0      357558      80-05-44/00      120832
```

```
(0) root @ r5r3m22: /HORCM/usr/bin
# raidqry -l -IH15
No Group      Hostname      HORCM_ver    Uid  Serial#      Micro_ver    Cache(MB)
1 ---        r5r3m22      01-39-03/04  0    441108      83-04-44/00  88320
```

- e. Validate that the configuration file is synced with the currently running daemons by running the following commands:

```
/HORCM/usr/bin/horcmstart.sh XX (XX Instance Number)
/HORCM/usr/bin/horcmshutdown.sh XX (XX Instance Number)
```

You can check the Hitachi log files at the following location for any errors messages:

```
/var/ksys/log/ksys_cci.log
```

- f. For asynchronous replication mode, check for an array in the available journal volume by using the following command:

```
# /HORCM/usr/bin/raidcom get journalt -IH15
JID MU CTG  JNLS  AP  U(%)  Q-Marker  Q-CNT  D-SZ(BLK)  Seq# DOW PBW APW
000 - -  SMPL  -  -  -  -  44642304  441108 - - -
001 0 4  PJNN  1  0  00016003  0  101584896  441108 60 300 40
002 0 5  SJNN  1  0  0003c006  0  101584896  441108 60 300 40
```

In this example, note the following items:

- 000 journal volume is not used for asynchronous replication (Universal Replicator).
 - 001 journal volume is used as the source journal volume.
 - 002 journal volume is used as the target journal volume.
- g. To create Hitachi pair group, complete the following steps:

- i) Check the volume group name, volume disk names, and logical devices in the HORCM configuration files:

Source configuration file

```
# cat /etc/horcm14.conf
HORCM_CMD
  \\.IPCMD-9.3.18.127-99999

HORCM_MON
#ip_address      service      poll(10ms)      timeout(10ms)
9.3.207.43      Source      1000      3000

HORCM_LDEV
VOL_DUMMY1 VOL_DUMMY_DISK_1 357558 310 0
VOL_DUMMY1 VOL_DUMMY_DISK_2 357558 314 0
VOL_DUMMY1 VOL_DUMMY_DISK_3 357558 318 0

HORCM_INST
#dev_group      ip_address      service
VOL_DUMMY1      9.3.207.43      Target
```

Target configuration file

```
# cat /etc/horcm15.conf
HORCM_CMD
  \\.IPCMD-9.3.207.17-99999

HORCM_MON
9.3.207.43      Target      1000      3000

HORCM_LDEV
VOL_DUMMY1 VOL_DUMMY_DISK_1 441108 341 0
VOL_DUMMY1 VOL_DUMMY_DISK_2 441108 342 0
VOL_DUMMY1 VOL_DUMMY_DISK_3 441108 344 0

HORCM_INST
VOL_DUMMY1 9.3.207.43 Source
```

In this example output, note the following items:

- v) In the CCI servers and the CCI client GUI, set the **Command Device Attribute** option to the following values:

```
User Authentication: Enabled
Security: Disable
```

Note: If the **Command Device Attribute** option is not configured properly, Hitachi CCI commands might fail.

- vi) Assign disks to the hosts and create a host group by completing the following steps:
- In the **Explorer** pane of the Hitachi CCI server GUI dashboard, select **Logical Devices**.
 - Click **Create LDEVs**.
 - In the **Create LDEVs** window, specify a disk name and follow the on-screen wizard to create logical devices.
 - In the Explorer pane, list the existing logical devices to verify that the logical devices are created successfully.
 - In the **Explorer** pane, expand **Ports/Host Groups/iSCSI Targ** and select the port group to which the host VM is connected.
 - Click **Create Host Groups** and enter the details in the **Create Host Groups** wizard. Add details about the host (name and worldwide name (WWN)). Select the host and the port that you want to use in the host group.

XIV Storage System

Beginning with VM Recovery Manager DR Version 1.3 Service Pack 2, or later the VM Recovery Manager DR solution supports the IBM XIV Storage System.

The XIV Storage System provides grid architecture and copy functions that can be used for various data protection scenarios, such as disaster recovery, data migration, and online backup. These functions provide point-in-time copies, known as *snapshots* or full volume copies. The XIV Storage System also includes remote copy capabilities in either synchronous or asynchronous mode. In the VM Recovery Manager DR solution, you can configure both synchronous and asynchronous mirroring for the XIV Storage System.

The VM Recovery Manager DR solution creates a mirror snapshot group on the source site. The mirror copy of the snapshot group has the same name as the consistency group. With each discovery operation, the VM Recovery Manager DR solution deletes older snapshot groups and creates another set of snapshot groups.

Requirements

- The XIV Storage System and IBM FlashSystem A9000 are supported only with VIOS Version 3.1.0.20, or later.
- The XIV Storage System and IBM FlashSystem A9000 require HMC Version 9 Release 9.1.0, or later.
- The XIV Storage System is supported only with XIV Storage System command-line interface (XCLI) Version 4.8.0.6, or later.

Limitation

- You cannot modify the snapshot disk on the target storage system.
- After you change any configuration settings for asynchronous mirroring, you must run the DR discovery operation, and then run the DR test-discovery operation. The configuration changes do not take effect if you do not run DR discovery operation operation before the DR test-discovery.
- XIV Storage System supports up to 128 VMs per host group.
- Based on the version of XIV Storage System firmware, a maximum 128 to 512 of the disks can be added to a consistency group.
- For a VM that is configured with vSCSI disks, before performing asynchronous failover rehearsal, run the `cfgmgr` command.

- For asynchronous mirroring in a VM that is configured with vSCSI disk, after first DR-test (DR rehearsal) you must manually map snapshot logical number units (LUNs) from the target SAN to the target VIOS.

The following figure shows the IBM XIV Storage System architecture with the VM Recovery Manager DR solution.

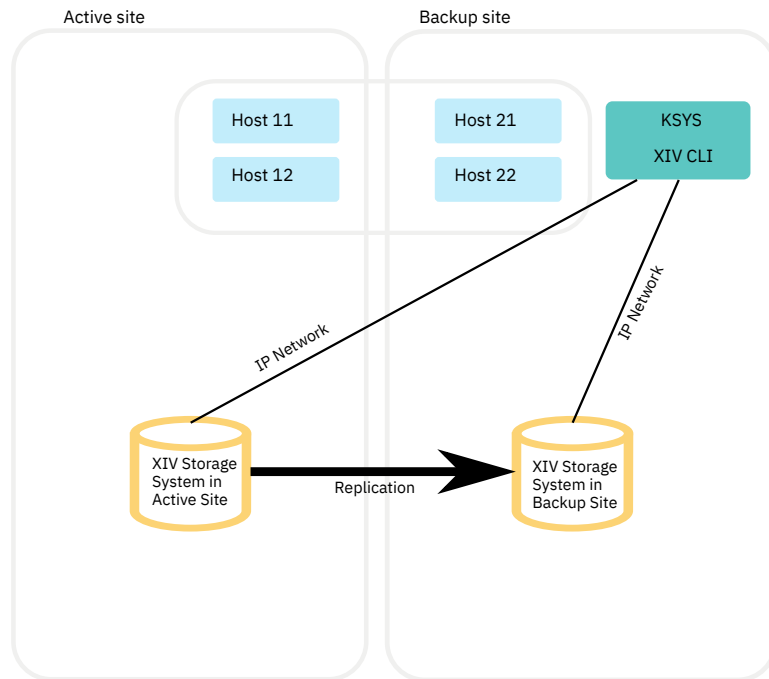


Figure 16. IBM XIV Storage System architecture

Network

The network in your environment must already be configured for the existing resources that include hosts, HMCs, VIOS, and storage devices. The VM Recovery Manager DR solution requires that the KSYS node be directly connected to the HMCs and the storage controllers in both the sites. The KSYS uses the HMC to interact with the hosts and VIOS, and the KSYS uses the storage controller to interact with the storage subsystem.

You can modify the KSYS system properties to enable or disable the network mapping function globally across the sites. By using the network mapping function, you can create VLAN ID or virtual switch mapping policies that contain a mapping of VLAN IDs or virtual switches that are assigned to the virtual machines when the virtual machines are moved from the active site to the backup site.

The recovery operation is not easy with the default settings that are used in the AIX operating system because of following issues:

Table 2. AIX default setting issues for recovery of the virtual machines from the active site to the backup site

Issue	Resolution	Related information
<p>Data, which includes the AIX root volume group, is replicated from the active site to the backup site. The AIX root volume group contains information about the disk, adapters, network, and other system-specific items. The data also includes the storage area network (SAN) World Wide Names (WWNs) that identify each SAN disk. Although the target disks are exact copies of the source disks, the disks are different. Therefore, the AIX operating system creates new devices when it starts. For example, if the source virtual machine has 10 devices, hdisk0 - hdisk9, when the virtual machine is moved to the backup site, the hdisk0 - hdisk9 devices are marked as defined and the hdisk10 - hdisk19 storage devices are marked as available. In this case, the original disks, hdisk0 - hdisk9, are called ghost disks. These renamed disks might cause issue, especially when some scripts or tools depend on the original disk names.</p>	<p>On the source LPAR, set the AIX ghostdev parameter to yes to clean up the ghost devices.</p>	<p>For more information about setting this parameter, see “Configuring VM Recovery Manager DR” on page 57.</p>
<p>The naming convention of the disks that are used by the recovered virtual machine (hdisk0, hdisk1, and so on) might not match with the names of disks of the source virtual machine for various reasons. For example, the hdisk5 disk in the source site might be displayed as hdisk7 on the target site. This mismatch can cause difficulties in a disaster situation because the disks that were part of that volume group must be known to import any of the AIX volume groups.</p>	<p>On the recovered virtual machine in the backup site, run disaster recovery scripts that address the following issues:</p> <ul style="list-style-type: none"> • Set the local host name • Set the network IP addresses • Customize the host bus adapters (HBAs) • Import the volume groups 	<p>For more information about the disaster recovery scripts, see “Running the disaster recovery scripts” on page 133.</p>

Planning VM Recovery Manager DR

To implement the VM Recovery Manager DR solution, you must review your current disaster recovery plan and consider how the VM Recovery Manager DR solution can be integrated into your current environment. The VM Recovery Manager DR solution can coexist with some of the existing product offerings with a few exceptions. Therefore, planning the implementation prevents issues in the configuration and disaster recovery operations.

Requirements for the VM Recovery Manager DR solution

Before you plan the implementation of the VM Recovery Manager DR solution, you must understand the other entities and resources that the VM Recovery Manager DR solution requires for disaster recovery operations.

The following requirements must be met before you can install the VM Recovery Manager DR solution:

- [“Software requirements” on page 29](#)
- [“Configuration requirements” on page 30](#)
- [“Network requirements” on page 31](#)
- [“Administrative requirements” on page 31](#)
- [“Storage requirements” on page 32](#)
- [“GUI requirements” on page 33](#)
- [“Licensing considerations” on page 33](#)

Software requirements

- The KSYS logical partition must be running IBM AIX 7.2 with Technology Level 1 Service Pack 1 (7200-01-01), or later.
- You must install the OpenSSL software version 1.0.1.516, or later for the AIX operating system. You can download the OpenSSL software from https://www.ibm.com/marketing/iwm/iwm/web/reg/download.do?source=aixbp&lang=en_US&S_PKG=openssl&cp=UTF-8&dmethod=http.

Note: The latest version of the OpenSSL software is also included on the AIX base media.

- The VM Recovery Manager DR solution requires HMC Version 9 Release 9.1.0, or later.
 - To display the ongoing logical partition movement progress (LPM), HMC Version 9 Release 9.3.0, or later is required.
- The VM Recovery Manager DR solution requires VIOS Version 2.2.6.30, or later, with all the subsequent patches. >|The following table displays the minimum VIOS version requirements for various components and features of the VM Recovery Manager DR|<.

SNo	Component/feature	VIOS version
1	XIV storage systems	3.1.0.21, or later
2	Unmanaged disk	3.1.1.21, or later
3	HADR	3.1.1.0, or later
4	HADRHA	3.1.2.10, or later

- Each LPAR in the host must have one of the following operating systems:
 - AIX Version 6.1, and later

- PowerLinux
 - Red Hat Enterprise Linux® (little endian, big endian) Version 7.2, or later
 - SUSE Linux Enterprise Server Version 12.1, or later
 - Ubuntu Linux distribution Version 16.04, or later
- IBM i Version 7.1, and later

Note: The IBM i operating system is supported only with VIOS Version 2.2.5.20, or later.

When multiple target VIOSes host virtual machines during the DR move operation, it is mandatory that each VIOS must have enough number of NPIV ports to host all virtual machines. If each target VIOS needs to serve a different virtual machine, then update the store area network (SAN) zoning so that virtual machines must be distributed across target VIOSes during the DR move operation.

- Ensure that the OpenSSL version 1.0.2.1801, or later is present in the KSYS node.
- >| This release requires the IJ29125m0a.201110.epkg.Z KSYS efix. You can download and install the efix from the following location:
<https://aix.software.ibm.com/aix/efixes/IJ29125m/IJ29125m0a.201110.epkg.Z> | <
- >| This release requires a VIOS interim fix. You must download this interim fix from the following location and then install it before installing the VM Recovery Manager DR for Power Systems Version 1.5.
<https://aix.software.ibm.com/aix/efixes/IJ28933/IJ28933m1a.201106.epkg.Z> | <
- >| For VIOS version 3.1.1.0, the following VIOS efix is required. You must download the efix and install it before installing the VM Recovery Manager DR for Power Systems Version 1.5:
<https://aix.software.ibm.com/aix/ifixes/IJ21043/IJ21043m1b.200218.epkg.Z> | <
- >| For VIOS versions 3.1.1.21 and 3.1.1.25, the following VIOS efix is required. You must download the efix and install it before installing the VM Recovery Manager DR for Power Systems Version 1.5:
<https://aix.software.ibm.com/aix/efixes/ij25165/IJ25165m2c.200727.epkg.Z> | <
- >| For VIOS version 3.1.2.10, the following VIOS efix is required. You must download the efix and install it before installing the VM Recovery Manager DR for Power Systems Version 1.5:
<https://aix.software.ibm.com/aix/efixes/IJ28933/IJ28933m1a.201106.epkg.Z> | <

Configuration requirements

- You can configure only two sites: an active site that is also called home site, and a backup site. These sites can be separated by unlimited distance between them.
- You can configure only one KSYS logical partition (LPAR). The KSYS LPAR must be placed in the backup site or outside of the KSYS configuration.
- The KSYS LPAR must have at least 1 core CPU and 8 GB memory. These requirements can be higher if you have a large environment of more than 100 LPARs in the data center.
- The virtual machines, which must be recovered during disaster situation, must be running on POWER7® processor-based server, or later, that are PowerVM-based systems managed by HMCs.
 - For HADR and HADRHA support, Power7+ processor-based server is required.
- The VM Recovery Manager DR solution supports the following storage devices:

EMC storage system

The VM Recovery Manager DR solution supports storage devices for the EMC VMAX family (VMAX1, VMAX2, and VMAX3). The EMC storage devices must be Symmetrix Remote Data Facility (SRDF)-capable. The EMC storage must have Solutions Enabler SRDF family Version 8.1.0.0 installed, or later. Both SRDF/S (Synchronous) and SRDF/A (Asynchronous) replication modes are supported. The SYMCLI interface on the KSYS node must be the same version, or later as the version of the SYMCLI interface on the storage agent.

IBM SVC and Storwize storage systems

The VM Recovery Manager DR solution supports IBM SVC Version 6.1.0, and later, and IBM Storwize V7000 7.1.0, and later. Both Metro Mirror (synchronous) and Global Mirror (asynchronous) modes of data replication are supported across sites.

IBM System Storage DS8000 series

The VM Recovery Manager DR solution supports DS8700 or later DS8000 storage systems with DSCLI version 7.7.51.48, and later. Only Global Mirror (asynchronous) mode of data replication is supported across sites.

Hitachi storage systems

The VM Recovery Manager DR solution supports the Hitachi Virtual Storage Platform (VSP) G1000 and Hitachi VSP G400 with CCI version 01-39-03/04 and model RAID-Manager/AIX. Both synchronous and asynchronous modes of data replication is supported across sites.

IBM XIV Storage System and IBM FlashSystem A9000

The VM Recovery Manager DR solution supports IBM XIV Storage System and IBM FlashSystem A9000. Both Metro Mirror (synchronous) and Global Mirror (asynchronous) modes of data replication are supported across sites.

Note: The SVC, Storwize, and DS8000 storage systems are supported only with VIOS Version 2.2.5.20, or later and HMC Version 8 Release 8.6.0 Service Pack 1, or later. The Hitachi storage systems are supported with VIOS Version 2.2.6.00, or later and HMC Version 9 Release 9.1.0, or later. The IBM XIV Storage System and IBM FlashSystem A9000 are supported with VIOS Version 3.1.0.20, or later and HMC Version 9 Release 9.1.0, or later.

Network requirements

- All virtual machines (VMs) that are managed by the VM Recovery Manager DR solution must use virtual I/O resources through VIOS. The VMs must not be connected to a physical network adapter or any dedicated devices.
- The VIOS must have a Shared Ethernet Adapter (SEA) configuration to bridge to the same Ethernet network between the hosts located in the same site.
- The same virtual LAN (VLAN) must be configured across the site. If a different VLAN is required on the target site, you must update the KSYS configuration for the different VLAN ID on the backup site.
- Ensure redundant connection from the KSYS to HMC and from HMC to VIOS logical partitions. Any connectivity issues between KSYS, HMC, and VIOS logical partitions can lead to disruption in the regular data collection activity and disaster recovery operations.

Administrative requirements

If you are an administrator, ensure that the following prerequisites are met before you implement the VM Recovery Manager DR solution:

- The KSYS must be connected to all the HMCs across sites through the HTTPS connection.
- All the VIOS partitions and disk pairs must be deployed correctly across sites.
- Storage replication must be set up correctly for various disks that are used in the VM Recovery Manager DR managed environment.
- Storage area network (SAN) connectivity and zoning must be configured so that VIOS can access the disks that are relevant to the hosts across the host pairs. For example, a disk D1 that is connected to the VIOS of a host must have a mirror disk D1_M that is connected to the VIOS of the paired host in the backup site. Any connectivity issues can cause the VM Recovery Manager DR verification to fail.
- SAN connectivity must be performed such that the SAN fabrics of VIOS on the paired hosts do not connect with each other as shown in the following figure. The following figure shows such a configuration that meets the VM Recovery Manager DR requirement. The paired hosts, Host 1 and Host 2, have VIOS 1 and VIOS 2 that have mutually exclusive SAN switches. You must have exclusive SAN switches because VIOS checks the SAN fabric that involves logging in to the connected

switches. If VIOS from both sites are connected to the same switches, the login operation creates conflicts and verification of the configuration might fail.

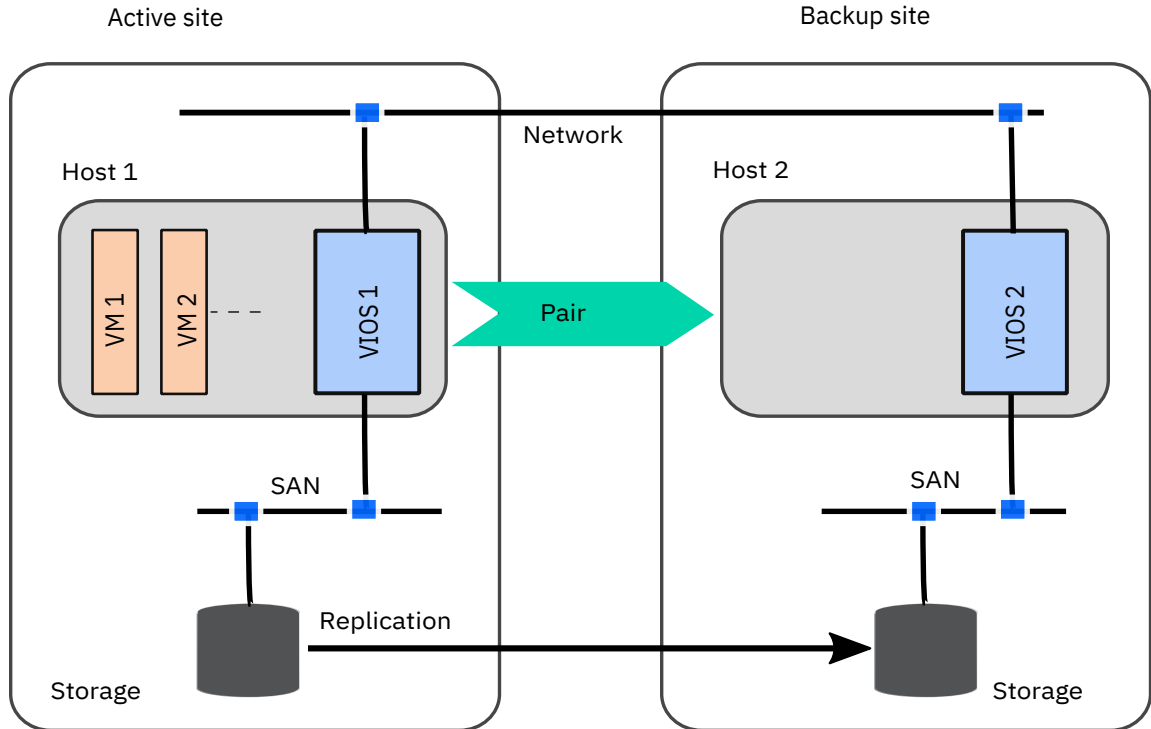


Figure 17. SAN zoning requirement

Mapping NPIV for VM Recovery Manager DR

To map the N-Port ID Virtualization (NPIV) for VM Recovery Manager DR, complete the following steps:

1. Create a storage area network (SAN) zone in a switch that comprises of NPIV World Wide Port Number (WWPN) of the virtual machine and the WWPN of the source SAN subsystem.
2. In the source SAN subsystem, mask both the logical unit numbers (LUNs) and the WWPN of the NPIV client.
3. Create a SAN zone in a switch that comprises of both the NPIV WWPN and the WWPN of the target SAN.
4. In the target SAN subsystem, mask both the mirrored LUNs and the WWPN of NPIV client.

Mapping vSCSI for VM Recovery Manager DR

To map the virtual Small Computer System Interface (vSCSI) for VM Recovery Manager DR, complete the following steps:

1. Create a SAN zone in a switch that comprises of both the source VIOS WWPN and the WWPN of the source SAN.
2. In the source SAN subsystem, ensure that the LUN is masked with the WWPN of the source VIOS.
3. Create a SAN zone in a switch that comprises of both the target VIOS WWPN and the WWPN of the target SAN.
4. In the target SAN subsystem, ensure that the mirrored LUN is masked with the WWPN of the target VIOS.

Storage requirements

- Ensure that all the prerequisite software is installed on the same logical partition in which the KSYS software is installed. The prerequisite software includes the storage controller software that must be installed on the KSYS LPAR. The storage controller is the software component that you receive from the storage vendor that allows KSYS to contact storage devices and perform storage-specific operations.

- Irrespective of the type of storage, the disk size in the active and backup sites must be same.
- Ensure that the disks that belong to the virtual machines of an added host have mirror relationship with corresponding disks across the sites.
- Verify that the disks that are used for the virtual machines that are managed by the VM Recovery Manager DR solution must not be managed by any other disaster recovery solutions.
- For virtual Small Computer System Interface (vSCSI) disk mapping, ensure that you do not use Logical Volume Manager (LVM)-based disk partition management from VIOS.

GUI requirements

- The logical partition (LPAR), in which you want to install the GUI filesets, must be running IBM AIX 7.2 with Technology Level 2 Service Pack 1 (7200-02-01), or later. You can choose to install the GUI server fileset on one of the KSYS nodes.
- The LPAR in which you are installing the GUI server must run in Enhanced Korn shell that uses the `/usr/bin/ksh93` shell script.
- The LPAR in which you are installing the GUI server fileset must have at least 1 core CPU and 8 GB memory.
- Google Chrome and Mozilla Firefox web browsers are supported to access the GUI for the VM Recovery Manager solution.

Licensing considerations

- With the VM Recovery Manager DR solution, the virtual machines (VMs) that must be replicated or managed by the solution are hosted on the production system processor cores. These managed VMs do not determine the licensing count, but the count of processor cores that are hosting these managed VMs determines the licensing cost. This means that the count of whole number of processor cores that are hosting the VMs that are being replicated or managed by the VM Recovery Manager DR solution determines the license count.
- The VM Recovery Manager DR licenses are installed on an AIX partition that is designated to be the partition that is hosting the KSYS orchestrator. The VM Recovery Manager DR license enables the KSYS orchestrator.
- The AIX partition that is hosting the VM Recovery Manager DR solution can be located anywhere in proximity to the HMCs and storage servers that the VM Recovery Manager DR solution is managing. For instance, if you are implementing the VM Recovery Manager DR solution, you can install the KSYS subsystem in an AIX partition of a system in the disaster recovery site. The system can also be a system other than the VM Recovery Manager primary or secondary system.
- The VM Recovery Manager DR solution conforms to the active/inactive technology, which includes Live Partition Mobility (LPM) in your high availability configuration. Therefore, the entire VM is restarted on an alternate logical partition. You do not need to install the production licenses in the target system because the VM is restarted along with the corresponding workload.
- VM Recovery Manager DR product requires PowerVM Enterprise Edition to be installed on all the hosts configured for DR management

VM Recovery Manager DR limitations

Consider the restrictions that are described in the topic for the VM Recovery Manager DR solution.

Limitations

- The status of a host must be consistent across the HMC in which the host is connected and added to the KSYS configuration.
- While adding a host to the KSYS configuration, the Resource Monitoring Control (RMC) connection between the configured HMCs of the host and the virtual machines must be in the active state.
- The Virtual I/O Servers in the cluster that are in the unhealthy state must be unmanaged.

- If the universal unique identifier (UUID) of a storage agent has changed, remove the storage agent from the KSYS subsystem and add the storage agent again for the UUID change to take effect in the KSYS configuration.
- Each VIOS on the target site must have equal number of virtual Fibre Channels (vFC) that can be assigned to single or multiple virtual machines in the source host.
- The source and destination hosts must have at least one logical memory block (LMB) of free space. This free space is used by the `dstartlpar` command during the move operation.
- The VM Recovery Manager DR does not support sharing a managed disk or unmanaged disk between virtual machines of two different Workgroups or host groups.
- The site-level cleanup operation might not show proper results when the previous move operation has failed because of restarting the KSYS daemon or the KSYS subsystem.
 - Workaround: Run the cleanup operation on the host group.
- Removing a consistency group in the Hitachi storage system takes a longer time. Therefore, the KSYS cluster deletion might also take a longer time depending on the number of workgroups in the KSYS subsystem.
- Do not perform the Live Partition Mobility (LPM) operation across host groups. All LPM operations must be performed within a host group. If the LPM operation is initiated across host groups, and if the virtual machine is part of a workgroup, the site-level discovery operation might not complete because of an error.
- On VIOS nodes, if the disks of a shared storage pool (SSP) are not accessible after the system is reactivated because it was shutdown or rebooted, the state of the disks continues to be down. This does not start the SPPR correctly and requires a quorum to come back online. Choose one of the following workaround options.
 - Workaround option 1: If you don't want to reboot the VIOS, complete the following procedure:
 1. Restore the disk connectivity.
 2. To make the disks available to the system, run the `cfgmgr` command as a root user.
 3. Run the following commands:


```
- padmin: clstartstop -stop -m <node>
- padmin: clstartstop -start -m <node>
```
 - Workaround option 2: If you want to restart the VIOS, complete the following procedure:
 1. Restore the disk connectivity.
 2. Reboot the VIOS node.
- If a VM is migrated from host1 to host2, and the applications are stable in the virtual machines that are on the host2. At a later time, if the VM from the host2 needs to be migrated because of an application failure, the host1 will not be considered as a backup host for application failure migration because the VM had previously failed on host1. If host1 needs to be considered as a backup host for a future application failure, use the following workaround.
 - Workaround: After the VM is stable on host2, clear the `FailedHostList` list of the VM by running the following command:


```
chrsic -s 'Name="VMName"' IBM.VMR_LPAR VmRestartFailedCeecs='{""}'
```
- If you want the system to ignore the unmanaged Virtual I/O Servers in the HMC during a discover operation, disable the storage area network (SAN) zones from the selected VIOS before performing the DR operation.
- The cleanup operation on a VM with vSCSI disk fails in the local database mode.
 - Workaround: Bring the SSP cluster back to the global mode.
- The `ksysmgr` command fails to start or stop applications that belong to an application dependency setup if Virtual I/O Servers are in local database mode.

- The discovery operation or the KSYS restart operation automatically starts the dependent applications that are part of an application dependency setup and that were stopped manually.
 - Workaround: Consider one of the following workaround options:
 - Do not perform the discovery operation after stopping the dependent application.
 - Disable the auto-discover and the quick discovery features.
 - Do not restart the KSYS subsystem after you stopped the dependent application.
- The reboot operation of the VMs that are running on the Linux VM agent might take a longer time than expected, and the discovery operation might fail and display the following message:

```
Restart has encountered error for VM <vm_name>.
```

- Workaround: Re-run the discovery operation.
- The VM Recovery Manager DR solution cannot be used if the Live Partition Mobility (LPM) features is disabled at firmware level.
- In the HADR cluster type, when the DR-test discovery operation or the move operation is in progress, the KSYS subsystem does not migrate virtual machines automatically when the host fails. The KSYS subsystem only generates a host failure event.
 - Work around: You must manually recover virtual machines by running the `ksysmgr restart` command.
- When temporary I/O errors occurs at the VIOS cluster-level, the migration process of the virtual machines after the host failure is not triggered automatically.
 - Workaround: You must initiate the host-level restart operation by using GUI or command-line interface. To initiate the host-level restart operation, run the following command:

```
ksysmgr restart host <host_name>
```

- If a virtual machine is migrated across host groups, you must run the discovery operation on the source host group and the target host group, respectively. After running the discovery operation on both host groups, the KSYSNODE node reflects the migration status of the virtual machine.
- The backup and restore LPAR control blob (LCB) feature is not supported for virtual machines that are part of an asymmetric host-group configuration.
- > If a VM profile exists on multiple hosts, the command `ksysmgr query vm host=<hostname>` might not display the VM details properly.
 - Work around: Run the command with another host that has the same VM profiles.

|<

- If a current repository disk is down, automatic replacement does not occur on previously used repository disk that has the same cluster signature. If no other free backup repository disk is available the automatic replacement operation fails.
 - Workaround: Run the following command to clear the previous cluster signatures:

```
cleandisk -r <diskname>
```

- Configuration changes like remove and add hosts are not supported in the user defined Shared Storage Pool (SSP).
 - Workaround: Reconfigure the KSYS cluster. Otherwise, use the KSYS controlled VIOS cluster.
- As part of the HA verification operation, the KSYS subsystem verifies configuration of each VM against all backup hosts within a site. In a scalable environment, when the KSYS subsystem sends parallel verification requests, if HMC is busy with already received requests, the new request can lead to exceeding the maximum supported requests, then the verification operation fails with the following error:

HSCLB401 The maximum number of partition migration commands allowed are already in progress.

- Workaround: Re-run the verify operation on the host group.
- The move operation fails when all NPIV ports of a physical Fibre Channel (FC) port are used by VMs, and none of the NPIV ports on the FC adapters are free.
 - Workaround: You must keep at least 20% of NPIV ports free on each Fibre Channel (FC) port.

GUI limitations



- The VM Recovery Manager DR GUI does not support multiple sessions that are originating from the same computer.
- The VM Recovery Manager DR GUI does not support duplicate names for the host group, HMC, host, VIOS, and VMs. If a duplicate name exists in the KSYS configuration, the GUI might encounter an error during the host group creation or while displaying the dashboard data.
- The VM Recovery Manager DR GUI refreshes automatically after each topology change (for example, VM migration operation and host migration operation). After the refresh operation of VM Recovery Manager DR GUI is complete, the default KSYS dashboard is displayed. You must expand the topology view in the Activity window to view the log information for a specific entity.
- Any operation performed by a user from the command-line interface of VM Recovery Manager DR is not displayed in the activity window of the VM Recovery Manager DR GUI.
- The VM Recovery Manager DR GUI does not support failover rehearsal for IBM XIV vSCSI disks. Failover rehearsal for IBM XIV vSCSI disks can be performed only by using the command-line interface (CLI) of the VM Recovery Manager DR for Power Systems solution.
- GUI reports only show details about operations triggered from GUI. The operations triggered from the command-line interface are not displayed in the GUI reports.



SCSI reservations

If the virtual machines in the active site are using Small Computer System Interface (SCSI)-2 or SCSI-3 persistent reservations to control access to a shared storage device (for example, if the value of the **reserve_policy** attribute is set to PR_shared in the AIX operating system), and a virtual machine is moved to the backup site, all the reservations are lost and policies are set to default reservation policies according to the storage and operating system associated with the virtual machine. It happens because the storage subsystems do not transfer reservations across mirror copies of data. In addition, the host or storage adapter identities, which are part of reservation management, also change across the active site and the backup site during the disaster recovery move operation.

Example: A PowerHA® SystemMirror® cluster is established across a set of virtual machines and disk fencing is enabled on the active site. In this case, PowerHA SystemMirror performs disk fencing by using SCSI-3 persistent reservations. Therefore, in the active site, each virtual machine must have stored its own key for disk fencing. When the VM Recovery Manager DR solution moves these virtual machines to the backup site, all these virtual machines start in the backup site, a cluster is established, reservation is enabled, and the keys are stored back into the storage subsystem.

Date and time of virtual machines

When virtual machines are moved from the active site to the backup site, the date and time in the virtual machine depends on the backup site environment in the following ways:

- For POWER7 and POWER8® processor-based systems: If time reference is set up for the system, for example, you set the reference of all virtual machines in the host based on a single source like a Virtual I/O Server (VIOS), and the move operation is performed, the virtual machines acquire the time and date information of the reference VIOS on the target host.

- For POWER8 processor-based systems: If simplified remote restart option is enabled for a virtual machine, and the virtual machine is moved to a target POWER8 processor-based system, the virtual machine retains its original time and date value from the active site.

Change of disk names and disk queue depth values

After the disaster recovery operation, the disk names are not sustained on the backup site. In case of replicated disks, the disk identifier changes when the virtual machines are started on the backup site and the disks are renamed based on the disk identifiers. Therefore, disk names are not sustained across sites. However, you can create customized scripts to be run after the disaster recovery operation and the disks can be renamed based on predefined information.

Similarly, as the disk identifier changes during the disaster recovery operation, the disks are added to the backup sites as new disks are plugged in. Therefore, custom queue depth values change on the backup site. The AIX operating system provides a tunable parameter in the **chdef** command to manage the queue depth as a global policy that works only for EMC storage systems and DS8000 series of storage systems. By using the **chdef** command, you can set the value of a predefined attribute for the entire AIX environment. Any new disks that are added after you run this command, can inherit the value from the specified global policy. For more information about the **chdef** command, see the **chdef** command in the IBM Knowledge Center.

Dependency on VMR daemon

If you stop the VMR daemon (IBM.VMR subsystem) forcefully for some reason and then start it again, the VMR daemon might take up to 2 minutes to become stable and perform any operations depending on the number of hosts and virtual machines in the KSYS configuration settings.

Miscellaneous

- If a specific VM profile already exists on the target site, during the DR restart operation, the KSYS subsystem does not restart the specific VM on the target site.
- The `skip power` on feature is supported only for the move operation from the home site to the backup site.
- After each `manage` or `unmanage VIOS` operation, you must run the discovery operation.
- The flex capacity policy for host is ignored.
- You cannot add more than 10 scripts to the `ksysmgr add notify` command.

Prerequisites for implementing the VM Recovery Manager DR solution

Before you start implementing the VM Recovery Manager DR solution, you must plan the resources and corresponding details for your production and backup sites. Identify the following information and have it available when you plan for the VM Recovery Manager DR implementation.

KSYS node

Identify the host and the logical partition in which you plan to create the KSYS node. The host must be located preferably in the backup site during the normal (non-disaster) conditions that is not managed under the KSYS subsystem. You must create the LPAR in the identified host that has IBM AIX 7.2 with Technology Level 1 Service Pack 1 (7200-01-01), or later, installed.

The KSYS node must be able to perform HTTPS-based communication to all HMCs on both sites. In addition, the KSYS node must be able to communicate to the storage subsystems on both sites by using the storage vendor methods.

KSYS cluster

Identify a name for your one-node KSYS cluster.

Sites

Identify names for your active and backup sites.

HMC

Identify the HMCs that you want to add in your active and backup sites. You can add two Hardware Management Consoles for a dual HMC configuration in your sites that ensures enhanced availability when one of the HMCs is down or unreachable.

Ensure that you have the following information available for each HMC that you plan to include in the VM Recovery Manager DR implementation:

- HMC name or IP address
- User name
- Password

Hosts

Identify all the managed hosts in your production site that you want to add to the VM Recovery Manager DR implementation. Ensure that you plan to include the corresponding managing HMCs in the VM Recovery Manager DR solution. In addition, identify a corresponding managed host in the backup site that can be paired to each host in the active site. You must have the name of the host or the UUID of the host available for each host that you are planning to include in the VM Recovery Manager DR implementation.

LPAR

Identify the LPARs that you want to include in the VM Recovery Manager DR implementation and install your applications as required. You can exclude the LPARs that you do not want to include in the VM Recovery Manager DR solution. You must have the LPAR name available for each LPAR that you are planning to include in the VM Recovery Manager DR implementation.

Note: The virtual machines must not be scheduled to restart automatically if the virtual machine is included in the VM Recovery Manager DR disaster recovery management.

Virtual I/O Server (VIOS)

The VIOS configuration in the active site hosts must ideally match across the backup site hosts that are paired together.

Note: For multiple VIOS configuration in virtual Small Computer System Interface (vSCSI) disk-mapping, ensure that the Virtual I/O Servers do not have any backend disk reservation.

During the verification phase, the VM Recovery Manager DR solution displays a warning message about any VIOS issues. For example, if any of the VIOS partitions is down, a warning message is displayed. The VM Recovery Manager DR solution skips this check if you use the

lose_vios_redundancy attribute persistently. For more information about this option, see [“Managing the system attributes” on page 115](#).

Even after you use this option, the source virtual machines can be moved to the backup host only when the VIOS in the target host can accommodate all the virtual adapters of the virtual machine. Problems might occur during the disaster recovery operation if one of the VIOS or Fiber Channel adapters are down. Review the following scenarios to determine the VIOS configuration issues:

Note: The VM Recovery Manager DR for Power Systems solution requires VIOS Version 3.1.1.21, or later, with all the subsequent patches for the unmanage disk functionality.

Scenario 1

The following figure shows an N_Port ID virtualization (NPIV)-based VIOS configuration in which the source host contains 2 VIOS partitions that use 2-port Fibre Channel (FC) adapters. If the target host does not contain dual VIOS configuration or if one of the Virtual I/O Servers in the target host is not functioning, the virtual machine can be moved from the source host to the target host only when the VIOS in the target host uses 4-port FC adapter.

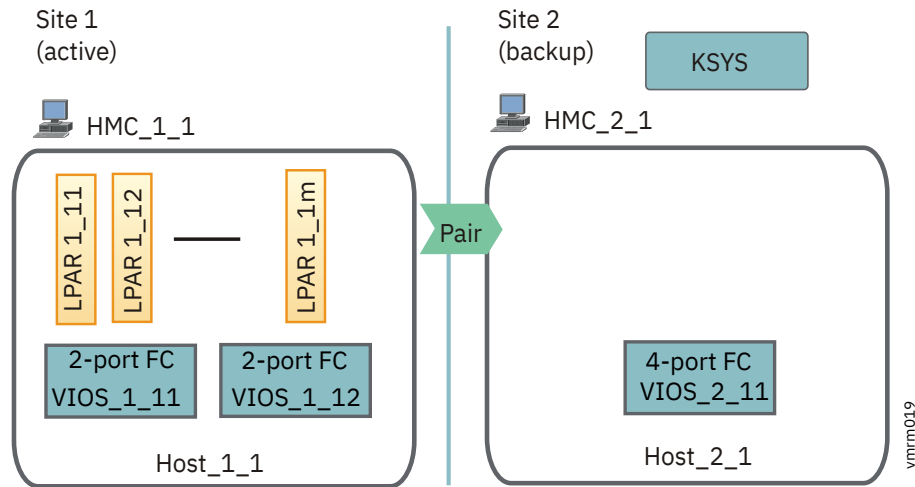


Figure 18. VIOS configuration during disaster recovery: Scenario 1

Scenario 2

The following figure shows an NPIV-based VIOS configuration in which the source host contains a VIOS partition (VIOS_1_11) that uses 2-port FC adapter. In this example, 70 virtual machines are running in the Host_1_1, where 64 VMs are mapped to the fcs0 adapter and the remaining 6 VMs are mapped to the fcs1 adapter.

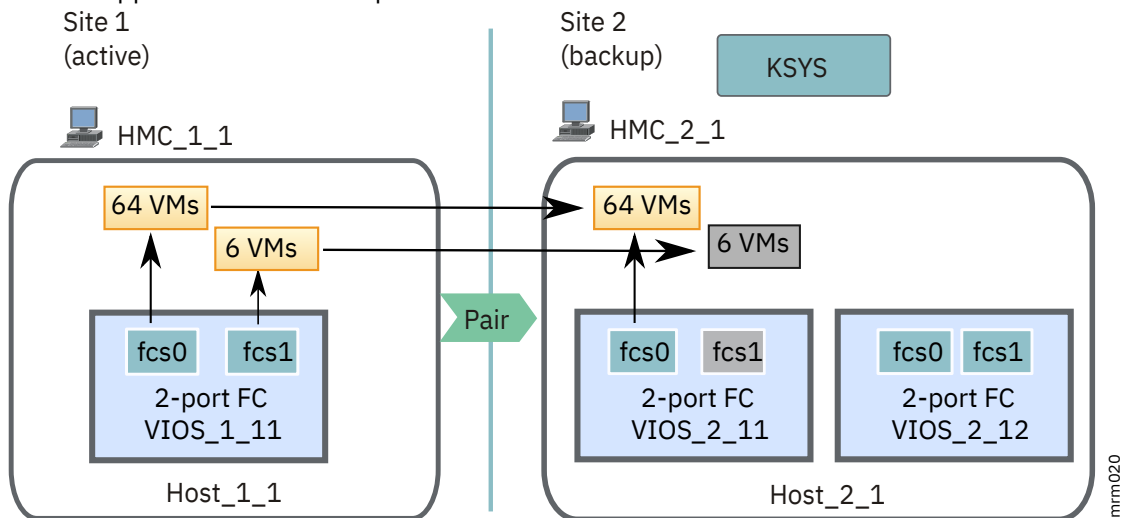


Figure 19. VIOS configuration during disaster recovery: Scenario 2

If the active site fails, the 70 virtual machines must be moved from the source host to the target host. The recovered virtual machines in the target host must ideally be using the VIOS partition (VIOS_2_11) that uses the 2-port FC adapter in the target host. However, if one of the adapters of the VIOS partition is not functional, the virtual machines that must be mapped to the nonoperational adapter are moved to the target host but remain inactive. Even when you have a dual VIOS configuration in the target host, the inactive virtual machines are not mapped to other available VIOS adapters.

In this case, the administrator must manually resolve the issues in the adapter and activate the virtual machines.

Storage

- Allocate the primary storage based on the current storage requirements.
- Map primary storage logical unit numbers (LUNs) to appropriate virtual machines and VIOS as required (vSCSI or NPIV).
- Allocate backup or mirror LUNs at the backup site.

- Identify the storage agent count and storage agent names based on the current storage configuration. The storage controller software that interacts with the storage subsystem must be installed on the KSYS node.
- Configure the physical connectivity and zoning of backup storage LUNs to appropriate adapters. It ensures the storage availability when virtual machines are started in the backup site.
- Set up replication relationships between primary storage LUNs and backup storage LUNs. Ensure to include virtual machine operating system LUNs in the replication. You do not need to set up consistency groups. The KSYS subsystem performs those operations.
- Have the storage administrative information ready to specify in the KSYS configuration settings (for example, storage agent count and name, user name, password, serial number of the storage disks, IP address of the storage controller server.)
- For EMC storage, review the existing SRDF composite groups. Verify that the storage disks, which are planned to be included in the VM Recovery Manager DR implementation, are not part of any existing composite groups.

Email or contacts for notification

Identify the contacts that must receive the notification if any failures or disaster occurs. You can have the following type of notifications:

- Email
- SMS
- Pager email

Prerequisite for virtual machines that run on the Linux operating system

When a logical partition runs on the Linux operating system (SUSE or Ubuntu Linux distributions), the Linux operating system uses the Small Computer System Interface (SCSI) ID as the device ID for some file systems during installation. However, the SCSI ID might change when you recover the virtual machine from the active site to the backup site. In this case, the virtual machine cannot start in the backup site because of the change in SCSI ID. Therefore, you must replace the SCSI ID with the Universal Unique Identifier (UUID) in the `/etc/fstab` file and the `Boot loader` option after you install the Linux operating system in the virtual machine.

To replace the SCSI ID with UUID in the Linux virtual machine after installing the operating system, complete the following steps:

1. Identify the UUID of the required disk by running the following commands:
 - a. Identify the disk that contains the Linux operating system by running the following command:

```
linux:/usr/bin # fdisk -l
```

An output that is similar to the following example is displayed:

```
Disk /dev/sda: 107.4 GB, 107375493120 bytes
255 heads, 63 sectors/track, 13054 cylinders, total 209717760 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0xbac70600

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1  *           2048         2854        403+    41  PPC PReP Boot
/dev/sda2             417792       4626431     2104320    82  Linux swap / Solaris
/dev/sda3       4626432     209717247    102545408    83  Linux

Disk /dev/sdb: 107.4 GB, 107375493120 bytes
255 heads, 63 sectors/track, 13054 cylinders, total 209717760 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0xbac70600

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1  *           2048         2854        403+    41  PPC PReP Boot
/dev/sdb2             417792       4626431     2104320    82  Linux swap / Solaris
/dev/sdb3       4626432     209717247    102545408    83  Linux

Disk /dev/mapper/360000970000196800508533033323741: 107.4 GB, 107375493120 bytes
255 heads, 63 sectors/track, 13054 cylinders, total 209717760 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```



```
Disk identifier: 0xbac70600
```

	Device	Boot	Start	End	Blocks	Id	System
/dev/mapper/360000970000196800508533033323741_part1	*		2048	2854	403+	41	PPC PReP Boot
/dev/mapper/360000970000196800508533033323741_part2			417792	4626431	2104320	82	Linux swap / Solaris
/dev/mapper/360000970000196800508533033323741_part3			4626432	209717247	102545408	83	Linux

In this example, the /dev/sda3 boot device is the disk that contains the Linux operating system.

- b. List the corresponding UUID of the disks by running the following command:

```
linux:/dev/disk/by-id #
```

An output that is similar to the following example is displayed:

```
/dev/sda2: UUID="2d6e8edb-cc0e-4db1-9125-7d4ec8faf58d" TYPE="swap"  
/dev/sda3: UUID="6187ca4a-1589-4f57-8c3e-33a4043450b8" TYPE="ext3"  
/dev/sdb2: UUID="2d6e8edb-cc0e-4db1-9125-7d4ec8faf58d" TYPE="swap"  
/dev/sdb3: UUID="6187ca4a-1589-4f57-8c3e-33a4043450b8" TYPE="ext3"  
/dev/mapper/360000970000196800508533033323741_part2: UUID="2d6e8edb-cc0e-4db1-9125-7d4ec8faf58d" TYPE="swap"
```

In this example, you can identify the UUID of the /dev/sdb3 disk.

2. Open and edit the /etc/fstab file to replace the SCSI ID of the disk with the UUID of the disk. For example:

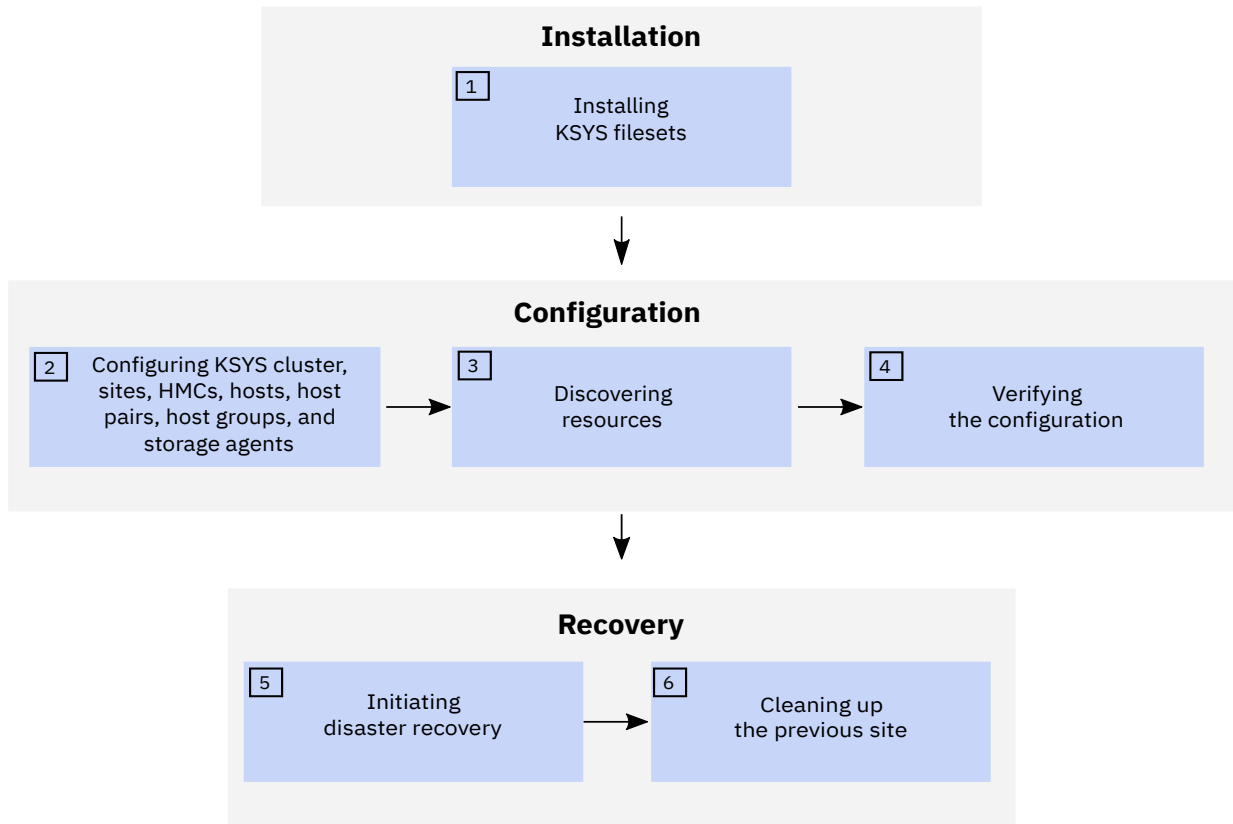
```
linux:~ # cat /etc/fstab  
/dev/mapper/360000970000196800508533033323741_part2 swap swap defaults  
0 0  
#/dev/disk/by-id/scsi-360000970000196800508533033323741-part3 / ext3  
acl,user_xattr  
1 1  
/dev/disk/by-uuid/6187ca4a-1589-4f57-8c3e-33a4043450b8 /boot ext3  
acl,user_xattr  
1 1 =====> Replace SCSI ID with UUID  
proc /proc proc defaults 0 0  
sysfs /sys sysfs noauto 0 0  
debugfs /sys/kernel/debug debugfs noauto 0 0  
devpts /dev/pts devpts mode=0620,gid=5 0 0
```

3. Change the Boot loader option in the Linux virtual machine by using the Linux operating system setup and configuration tool, YaST. Go to **YaST > System > Boot loader**. Edit the root device and replace the SCSI ID with the UUID of the disk.

Disaster recovery mechanism for the VM Recovery Manager DR solution

After you plan the details about how the VM Recovery Manager DR solution can integrate into your current environment, review the following flow chart that contains the high-level steps that are involved in the VM Recovery Manager DR implementation.

The following flow chart provides a summary of the entire VM Recovery Manager DR mechanism for disaster recovery:



vmm015

Figure 20. VM Recovery Manager DR solution: Disaster recovery mechanism

1. Installation

The controlling system (KSYS) is the fundamental component in the VM Recovery Manager DR solution. Therefore, the KSYS filesets must be installed first.

The KSYS runs in an AIX 7.2.1 (or later) logical partition in the disaster recovery site. It controls the entire cloud environment for the VM Recovery Manager DR solution.

To manage the servers and data replication, the KSYS must be connected to all the managed servers through the HMC and out-of-band storage sub-system connectivity to all associated primary and secondary disks.

2. Configuration

After the KSYS is installed and a one-node KSYS cluster is set up, you must configure all the other entities by using the KSYS interface.

You must complete the following procedures by using the **ksysmgr** command:

1. Create a one-node cluster for the KSYS node.
2. Create sites.
3. Add HMCs to the corresponding sites.
4. Add hosts to the corresponding sites.
5. Identify host pairs across the sites.
6. Create host groups.
7. Add storage agents to the corresponding sites.
8. Add contacts details for error notification.

3. Discovery

After the initial configuration is complete, the KSYS discovers all the hosts from all the host groups that are managed by the HMCs in both sites and displays the status.

During discovery, the KSYS subsystem monitors the discovery of all logical partitions (LPARs) or virtual machines (VMs) in all the managed hosts in the active site. The KSYS collects the configuration information for each LPAR, and displays the status, and also logs the status in the log files at the `/var/ksys/log/` directory.

The KSYS discovers the disks of each VM and checks whether the VMs are configured currently for the storage devices mirroring. If the disks are not configured for mirroring properly, KSYS notifies you about the volumes that are not mirrored. All volumes of a VM must be mirrored. Disks can be virtualized by using N_Port ID virtualization (NPIV), virtual SCSI (vSCSI), or combination of all these modes.

The KSYS subsystem collects information about the hosts, VIOS, and logical partitions that can be managed from the HMC during the discovery phase. For example, the KSYS subsystem collects information about the system processor, system memory, hardware, and worldwide port name (WWPN) of the physical Fibre Channel adapter. The KSYS subsystem also checks for the VIOS capability for disaster recovery operations. The KSYS subsystem also collects the dynamic information about the host state, LPAR state, VIOS state, and IP addresses of the host, VIOS, and LPAR.

Note: After change in the configuration, run the discovery operation to reflect the change in the configuration.

4. Verification

In addition to the configuration validation that you initiated, the KSYS verifies and validates the environment periodically. The KSYS also verifies the configuration as part of the recovery process. In the verification phase, the KSYS fetches information from the HMC to check whether the backup site is capable to host the VMs during a disaster. The KSYS also verifies storage replication-related details and accessibility of the target disks. The verification is successful only if the storage area network (SAN) zones are configured properly on the target side.

If the verification fails as a part of the recovery process, the failure is considered as recovery failure.

5. Recovery

When any planned or unplanned outages occur, you must manually initiate the recovery by using the **ksysmgr** command that moves the virtual machines to the backup site. If you initiate a planned recovery, the storage replication direction is reversed from the current active site to the previously active site. If you initiate an unplanned recovery, the storage is failed over to the backup site and you must manually resynchronize the storage after the previously active site becomes operational.

6. Cleanup

After the disaster recovery phase, when the virtual machines have been moved to the target site, you must clean up the source site. The site cleanup process is different for planned recovery operation and unplanned recovery operation. In case of a planned recovery, the KSYS automatically cleans up the

source site of all the disk mapping and adapter information. In the case of an unplanned recovery, the source site components such as HMC and storage subsystems might not be operational. So, you must manually clean up the source site when the HMC and hosts in the previously active site have become operational.

Note: If the VMs in the previously active site are still in active state, the VMs are first powered off, and then the cleanup operations are performed in the source site.

Installing VM Recovery Manager DR

After you plan the details about the VM Recovery Manager DR implementation, you can install the VM Recovery Manager DR software. The VM Recovery Manager DR software contains the KSYS package that you must install on a logical partition in the backup site to manage the disaster recovery environment. The VM Recovery Manager DR solution uses other subsystems such as HMC, VIOS, and storage controllers that must exist in your current environment. You must understand concepts and planning information about the VM Recovery Manager DR solution before you install the VM Recovery Manager DR solution.

The VM Recovery Manager DR disaster recovery is enabled by using the following subsystems:

KSYS or controller system

The KSYS software is installed in an AIX LPAR. The KSYS monitors the entire environment and enables disaster recovery operations, if required.

HMCs

HMCs in the active site and the backup site manage the IBM Power Systems servers.

VIOS partitions

Various VIOS partitions within hosts of the active site and the backup site virtualize and manage storage resources for the hosts' virtual machines.

Storage controllers

Storage systems in the active site and the backup site enable storage for the various virtual machines and the replication between the sites.

The following figure shows the deployment diagram of the VM Recovery Manager DR solution:

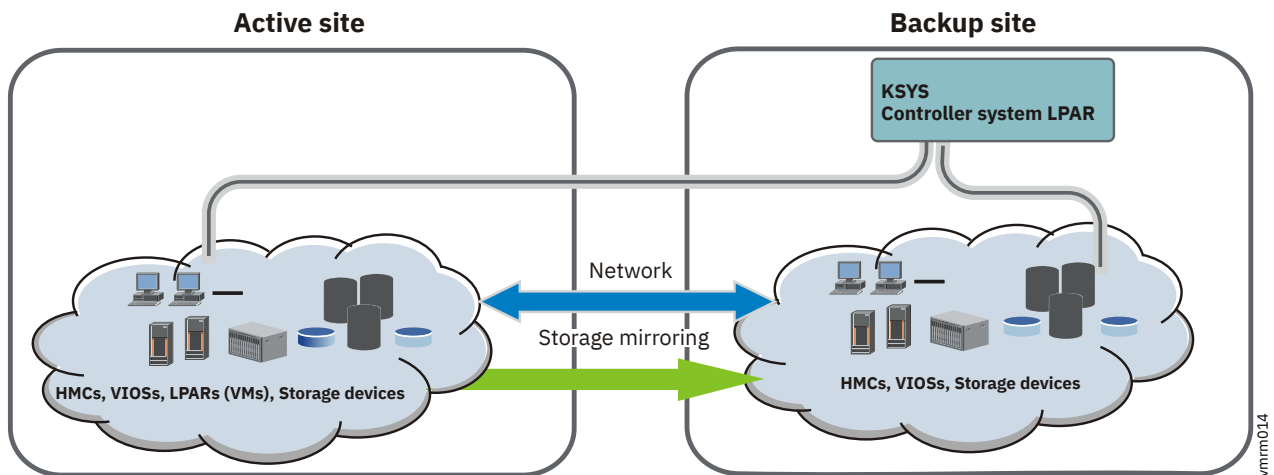


Figure 21. VM Recovery Manager DR deployment diagram

For more information about the installation and configuration of the HMC, VIOS, and storage subsystems, refer to the documentation of each of the subsystems.

The following section explains the packaging information and installation for the KSYS software. The KSYS software can be installed in any AIX LPAR.

- You must have already created an LPAR in the identified host that has IBM AIX 7.2 with Technology Level 1 Service Pack 1 (7200-01-01), or later, installed.

When you install the KSYS software on a logical partition, the logical partition is referred to as the *KSYS node* that controls the entire environment for disaster recovery. To support disaster recovery for the VM Recovery Manager DR solution, the KSYS handles discovery, monitoring, notification, recovery, and verification aspects that are associated with the disaster recovery.

KSYS package

The KSYS package consists of the file sets that can be installed on any AIX LPAR.

The KSYS package consists of the following filesets:

- `ksys.main.rte`
- `ksys.main.cmds`
- `ksys.mirror.emc.rte`
- `ksys.mirror.svc.rte`
- `ksys.mirror.ds8k.rte`
- `ksys.mirror.hitachi.rte`
- `ksys.mirror.xiv.rte`
- `ksys.main.msg.en_US.cmds`
- `ksys.license`
- `ksys.ha.license`
- `ksys.hautils.rte`
- `ksys.ui.agent`
- `ksys.ui.common`
- `ksys.ui.server`
- `ksys.vmmon.rte`
- `ksys.drutils.rte`
- `ksys.mirror.unity.rte`
- `./RPMS/linux/vmagent-1.5.0-1.0.e17.ppc64le.rpm`
- `./RPMS/linux/vmagent-1.5.0-1.0.suse123.ppc64le.rpm`

Installation directories

When you install the KSYS filesets, all the necessary configuration and binary files are installed in the designated directories. Some of the important files and corresponding directories are listed in the following table.

Type of file	File name	Directory where the files are installed
KSYS administration command: ksysmgr binary file	<code>ksysmgr</code>	<code>/opt/IBM/ksys/</code>
CPU and memory capacity management command: ksysrppmgr binary file	<code>ksysrppmgr</code>	<code>/opt/IBM/ksys/</code>

Table 4. Installation directories for configuration and binary files (continued)

Type of file	File name	Directory where the files are installed
Storage scripts	Multiple storage scripts	/opt/IBM/ksys/ storages/EMC/ /opt/IBM/ksys/ storages/SVC/ /opt/IBM/ksys/storages/ ds8k/ /opt/IBM/ksys/storages/ Hitachi /opt/IBM/ksys/ storages/XIV/ /opt/IBM/ksys/storages/ Unity
Sample files for configuration	<ul style="list-style-type: none"> • 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_via_config_file 	/opt/IBM/ksys/samples/ site_specific_nw/AIX/
	<ul style="list-style-type: none"> • postscript • prescript • PostHGOffline • PostHGOnline • PostHGVerify • PreHGOffline • PreHGOnline • PreHGVerify • postSiteOffline • postSiteOnline • postscript • preSiteOffline • preSiteOnline • prescript 	/opt/IBM/ksys/samples/ custom_validation/
	event_script_template	/opt/IBM/ksys/samples/ event_handler/

Type of file	File name	Directory where the files are installed
Snap script directory	vmsnap	/usr/lib/ras/snapscripts/
Log directory	events.log	/var/ksys/
	<ul style="list-style-type: none"> • ksysmgr.log • ksys.log • ksys_srdf.log • ds8k.log • svc.log • ksys_ccl.log • hitachi.log • ksys_xiv.log 	/var/ksys/log/

Package size requirements

Most of the KSYS software is installed in the /opt file system. However, the KSYS creates multiple log files and trace files as part of first failure data capture (FFDC) information. The minimum disk space that is required for various file systems and directories are listed in the following table.

Note: The administrator must monitor and maintain the space required for the pre-installation and post-installation requirements.

Pre-installation or update

File system or directory	Required disk space
/opt	30 MB

Post-installation or update

File system or directory	Required disk space
/var	200 MB

Installing VM Recovery Manager DR

The KSYS filesets must be installed on the identified logical partition (LPAR), which is preferably in the backup site. You can run the **installp** command or use the System Management Interface Tool (SMIT) panel to install the filesets on the LPAR.

Before you install the filesets, ensure that the following prerequisites are met:

- You must have root authority to perform the installation tasks.
- Identify the host that you will use to create the KSYS node. The host must be preferably in the backup site during the normal (non-disaster) conditions.
- You must have already created an LPAR in the identified host that has IBM AIX 7.2 with Technology Level 1 Service Pack 1 (7200-01-01), or later, installed.
- Ensure that you have enough space in this LPAR so that KSYS filesets can be installed successfully. You might want to have 30 MB of disk space in the /opt directory and 200 MB of disk space in the /var directory.

Installing the KSYS filesets

To install the KSYS filesets in the identified LPAR, complete the following steps:

1. Ensure all the prerequisites that are specified in the [Requirements](#) topic are complete.
2. Download the VM Recovery Manager DR software components from Entitled Systems Support (ESS) website: <http://www.ibm.com/servers/eserver/ess/index.wss>
3. Copy the filesets to any location from where you want to install the filesets.
4. Uncompress the filesets as per the guidelines that are provided with the package.
5. Install the filesets by running the following command:

```
installp -acFXyD fileset_location -V2 [-e filename.log] ksys.*
```

The **-V2** flag enables the verbose mode of installation. Alternatively, you can use the `smit installp` command with the `all_latest` option to install all filesets in the directory.

6. Verify whether the installation of filesets is successful by running the following command:

```
lslpp -l ksys.*
```

7. Run the `/opt/IBM/ksys/ksysmgr` command to check the command line utility of the KSYS subsystem. The KSYS subsystem might take a few minutes to run the command for the first time. You can add the `/opt/IBM/ksys` directory to your `PATH` environment variable so that you can access the `ksysmgr` command easily.
8. After successful installation of KSYS filesets, enter the following command to check whether the class IDs are reserved:

```
cat /usr/sbin/rsct/cfg/ct_class_ids
IBM.VMR_HMC      510
IBM.VMR_CEC      511
IBM.VMR_LPAR     512
IBM.VMR_VIOS     513
IBM.VMR_SSP      514
IBM.VMR_SITE     515
IBM.VMR_SA       516
IBM.VMR_DP       517
IBM.VMR_DG       518
IBM.VMR_KNODE    519
IBM.VMR_KCLUSTER 520
IBM.VMR_HG       521
IBM.VMR_APP      522
IBM.VMR_CLOUD    523
```

9. If the `IBM.VMR_HG`, `IBM.VMR_APP`, or `IBM.VMR_CLOUD` class and its ID is not available in the output, contact IBM support to obtain a fix for APAR IJ29360.

Installing GUI server filesets

To use the VM Recovery Manager DR by using the graphical interface, you must install the GUI server fileset on a system to manage KSYS nodes by using the GUI. The logical partition, in which you want to install the GUI filesets, must be running IBM AIX 7.2 with Technology Level 2 Service Pack 1 (7200-02-01), or later. You can choose to install the GUI server fileset on one of the KSYS nodes. You must install the following GUI server filesets before you start the graphical interface. The GUI agent filesets are automatically installed along with the KSYS filesets. To install the GUI server filesets, complete the following steps:

1. Ensure all the prerequisites that are specified in the [Requirements](#) topic are complete.
2. Install the GUI server fileset based on the following scenarios:
 - If you are installing the GUI server filesets on one of the KSYS nodes, run the following command:

```
installp -acFXyD fileset_location -V2 [-e filename.log] ksys.ui.server
```

- If you are installing the GUI server filesets on a separate system that manages all the KSYS nodes, run the following command:

```
installp -acFXyD fileset_location -V2 [-e filename.log] ksys.ha.license ksys.ui.server
ksys.ui.common
```

3. Install the open source software packages, which are not included in the installed filesets, based on the following scenarios:

- If the GUI server LPAR is connected to the internet, run the following command in the GUI server LPAR:

```
/opt/IBM/ksys/ui/server/dist/server/bin/vmruinst.ksh
```

This command downloads and installs the remaining files that are not included in the filesets because these files are licensed under the General Public License (GPL).

- If the GUI server LPAR is configured to use an HTTP proxy to access the internet, run the following command in the GUI server LPAR to specify the proxy information:

```
/opt/IBM/ksys/ui/server/dist/server/bin/vmruinst.ksh -p
```

You can also specify the proxy information by using the `http_proxy` environment variable.

- If the GUI server LPAR is not connected to the internet, complete the following steps:
 - a. Copy the `vmruinst.ksh` file from the GUI server LPAR to a system that is running the AIX operating system and that has internet access.
 - b. Run the `vmruinst.ksh -d /directory` command where `/directory` is the location where you want to download the remaining files. For example, `/vmruinst.ksh -d /tmp/vmruirpms`.
 - c. Download the following packages that are prerequisite packages for GUI server:
 - `info-4.13-3.aix5.3.ppc.rpm`
 - `cpio-2.11-2.aix6.1.ppc.rpm`
 - `readline-6.2-2.aix5.3.ppc.rpm`
 - `libiconv-1.13.1-2.aix5.3.ppc.rpm`
 - `bash-4.2-5.aix5.3.ppc.rpm`
 - `gettext-0.17-6.aix5.3.ppc.rpm`
 - `libgcc-4.9.2-1.aix6.1.ppc.rpm`
 - `libgcc-4.9.2-1.aix7.1.ppc.rpm`
 - `libstdc++-4.9.2-1.aix6.1.ppc.rpm`
 - `libstdc++-4.9.2-1.aix7.1.ppc.rpm`
 - d. Copy the downloaded files to a directory in the GUI server LPAR.
 - e. In the GUI server LPAR, run the `vmruinst.ksh -i /directory` command where `/directory` is the location where you copied the downloaded files.

After the GUI filesets have been installed, a message displays the URL of the GUI dashboard. To use the VM Recovery Manager DR GUI, open a web browser and enter the following URL:

HTTP://<hostname>:3000/login.

After you log in to the VM Recovery Manager DR GUI, you can register the KSYS and add the existing clusters to your environment.

Installing VM agents

For HADR type of deployment, you need to install VM agents.

VM agents are components that are installed in virtual machines (VMs) or logical partitions (LPARs). These optional agents offer robust monitoring of the VMs and applications that are running in VMs. You can manage HA applications in VMs through a lightweight application monitoring framework.

To install a VM agent in an AIX VM, go to [Installing a VM agent in an AIX VM](#). For setting up a VM agent in Linux, see [Installing a VM agent in a Linux VM](#).

Installing a VM agent in an AIX VM

1. Ensure all the prerequisites that are specified in the [Requirements](#) topic are complete.
2. Run the following command in the AIX virtual machine:

```
installp -acFXyd fileset_location -V2 [-e filename.log] ksys.vmmmon.rte
```

3. Perform the following steps to verify whether the installation of VM agent is successful:
 - a. Run the **ls1pp** command.
 - b. Ensure that the **ksysvmmgr** command and the binary file for the VM agent daemon exist in the following directories:
 - /usr/sbin/ksysvmmgr
 - /usr/sbin/ksys_vmmd
 - c. Run the **lssrc -s ksys_vmm** command to verify whether the VM agent daemon is enabled. The status of the ksys_vmm subsystem must be Active in the output of this command.

Installing a VM agent in a Linux VM

To install the VM agent Red Hat Package Manager (RPM) packages in a Linux virtual machine, complete the following steps:

1. Ensure that the following Reliable Scalable Cluster Technology (RSCT) packages are installed in the Linux VM:
 - rsct.core
 - rsct.opt.storagerm
 - rsct.core.utils
 - rsct.basic
 - DynamicRM

You can download the packages from the following link: <http://www14.software.ibm.com/webapp/set2/sas/f/lopdiags/redhat/hmcmanaged/rhel7.html>. For information about configuring the repository to easily install those packages, see [Updating RSCT packages for PowerVM® NovaLink](#).

2. Install the VM agent RPM packages based on the following Linux distributions in the virtual machine.

In Red Hat Enterprise Linux (RHEL) (little endian) virtual machines, run the following command:

```
rpm -ivh vmagent-1.3.0-1.0.e17.ppc64le.rpm
```

In SUSE Linux Enterprise Server (SLES) (little endian) virtual machines, run the following command:

```
rpm -ivh vmagent-1.3.0-1.0.suse123.ppc64le.rpm
```

3. Ensure RMC connection between the VMs and HMC. If the firewall is enabled on the RHEL VM, the RMC connection might be broken. Modify the firewall on the VMs to allow the RMC connection with the HMC. For details on modifying the firewall, see [PowerLinux forum topic](#) and [Installing the PowerVM NovaLink software on a Red Hat Enterprise Linux partition topic](#).

Upgrading VM Recovery Manager DR

If you have an earlier version of the KSYS software, you can upgrade the VM Recovery Manager DR solution to VM Recovery Manager DR version 1.5 by installing the latest KSYS filesets. The latest filesets will overwrite the existing software on the KSYS logical partition.

Prerequisites:

- You must have root authority to perform the installation tasks.

- >| You can migrate from version 1.4 to VM Recovery Manager DR1.5. Also, you can directly migrate from version 1.3 to 1.5. |<
- When you install the new filesets, ensure that the existing version of the KSYS software is not running any active operations. The installation of the newer version of the KSYS software fails if the discovery, verification, or move operation is running in the existing version of the KSYS software.
- All KSYS-related operations such as discover, verification, move, and cleanup operations must be complete before you attempt to upgrade to VM Recovery Manager DR 1.5.
- If you attempted a move operation in the earlier VM Recovery Manager DR version and the move operation failed, the virtual machines might be in Recovery state. In this case, you must recover the virtual machines successfully or move the virtual machines to a proper state before upgrading the VM Recovery Manager DR version to version 1.5.
- Before upgrading to the version 1.5, ensure that all required class entries are added into the `/usr/sbin/rsct/cfg/ct_class_ids` file. The required class entries for VM Recovery Manager DR Version 1.5 are:
 - IBM.VMR_HMC 510
 - IBM.VMR_CEC 511
 - IBM.VMR_LPAR 512
 - IBM.VMR_VIOS 513
 - IBM.VMR_SSP 514
 - IBM.VMR_SITE 515
 - IBM.VMR_SA 516
 - IBM.VMR_DP 517
 - IBM.VMR_DG 518
 - IBM.VMR_KNODE 519
 - IBM.VMR_KCLUSTER 520
 - IBM.VMR_HG 521
 - IBM.VMR_APP 522
 - IBM.VMR_CLOUD 523

When you upgrade the existing VM Recovery Manager DR version to VM Recovery Manager DR Version 1.5, the KSYS configuration settings (for example, details about HMCs, hosts, host pairs, storage agents, and so on) are retained without any change. After the upgrade operation is complete, you must run a discovery operation before you add, delete, or modify any configuration settings in the KSYS subsystem.

Note: After you upgrade to the latest version of filesets in the migration path, you cannot roll back to the previous version of the VM Recovery Manager DR.

When you upgrade the existing VM Recovery Manager DR version to VM Recovery Manager DR Version 1.5, all the hosts in the KSYS configuration are added to a default host group called `Default_HG`. You can add and modify the host groups based on your requirements. If the virtual machines are moved to the backup site, and the VM Recovery Manager DR version is upgraded later, the `Default_HG` host group aligns with the new site automatically.

To upgrade the KSYS software in the existing KSYS LPAR, complete the following steps:

1. Download the VM Recovery Manager DR software components from Entitled Systems Support (ESS) website: <http://www.ibm.com/servers/eserver/ess/index.wss>
2. Copy the filesets to the location where the existing filesets are installed.
3. Decompress the filesets according to the guidelines that are provided with the package.
4. To install the filesets by using SMIT panel, complete the following steps:
 - a. To open the SMIT panel, enter the following command:

```
smit install
```

- b. In the **Install and Update Software** screen, select **Update Installed Software to Latest Level (Update All)**, and press Enter.

```
Install and Update Software

Move cursor to desired item and press Enter.

Install Software
Update Installed Software to Latest Level (Update All)
Install Software Bundle
Update Software by Fix (APAR)
Install and Update from ALL Available Software
```

- c. In the **Update Installed Software to Latest Level (Update All)** screen, change the values according to your situation. You must also accept new license agreements. Press Enter after you make all other changes.
5. Check the installation summary at the end of the installation output by scrolling to the end of the output. The output indicates whether the installation of your fileset was successful.

If trace spooling is enabled and the trace file size is large, you must wait for a few minutes before you run the **ksysmgr** command. If the installation was not successful, check the reason of failure in the output. Contact IBM support, if necessary.

Setting up the VM Recovery Manager DR GUI

To use the VM Recovery Manager DR by using the graphical interface, you must install the GUI server fileset on a system to manage KSYS nodes by using the GUI. For more information about installing the GUI fileset and setting up the GUI, see [“Installing GUI server filesets” on page 51](#).

Setting up Hitachi configuration after completing the upgrade operation

If you have upgraded from GDR 1.2 and you have Hitachi storage systems in your environment, consider the following steps after an upgrade operation:

1. Verify the KSYS cluster is online with type attribute as DR by using the following command:

```
ksysmgr query ksyscluster
```

2. Check the login and DrInstance attributes of the Hitachi storage agents by running the following command:

```
ksysmgr query storage_agent
```

3. Assign the required value to the login and DrInstance attributes by using the following command:

```
ksysmgr modify storage_agent <AgentName>
login=<Login Name>
DrInstance=<Instance Number for Shadow Image Instance>
```

Configuring VM Recovery Manager DR

After you install the KSYS filesets, you can use the **ksysmgr** command to interact with the KSYS daemon to manage the entire environment for disaster recovery.

Review the [VM Recovery Manager DR concepts](#) to understand the associated entities for the VM Recovery Manager DR solution.

Before you configure the KSYS settings, you must complete the following tasks:

- Include the /opt/IBM/ksys path to the root directory so that you need not specify this path every time you run the **ksysmgr** command. To include this path, run the following command in the KSYS node:

```
export PATH=$PATH:/opt/IBM/ksys
```

Or, you can append this command to the .profiles file in the root directory.

- Verify that the KSYS node does not have an existing KSYS configuration by running the following command:

```
lsrpdomain
```

The output must indicate that no domain exists.

- Verify that the IBM.VMR resource class exists by running this command:

```
lsrsrc | grep VMR
```

Or,

```
lssrc -a | grep VMR
```

The output must display various IBM.VMR resource classes. If the **lsrsrc** command does not display any IBM.VMR resource classes, check the existing classes by running the following command:

```
grep -i vmr /usr/sbin/rsct/cfg/ct_class_ids
```

The output must display the IBM.VMR resource class.

Note: You cannot configure the KSYS resources if all the required IBM.VMR resource classes do not exist.

- If you are using AIX LPARs as virtual machines in the active site, set the **ghostdev** parameter in the AIX kernel. Thereby, after a disaster recovery movement to the backup site, all the ghost devices associated with the recovered LPARs are removed from the backup site during the AIX boot process. To set the **ghostdev** parameter, complete the following steps:

1. Log in to the source virtual machine as a root user.
2. Modify the AIX kernel by running the following command:

```
# chdev -l sys0 -a ghostdev=1
```

3. Run the following commands:

```
# savebase  
# bosboot -ad /dev/ipldevice
```

Note: These commands must be run on the source virtual machines. Since all the data is replicated to the backup site, these changes are also propagated from the active site to the backup site.

Flow chart for KSYS configuration

After the KSYS filesets are installed, you must complete the configuration steps to use the disaster recovery feature of the VM Recovery Manager DR solution. The configuration steps involve adding resources to the KSYS configuration.

The following flow chart provides a summary of the configuration steps for DR type deployment with symmetric type of host group, without workgroup configurations:

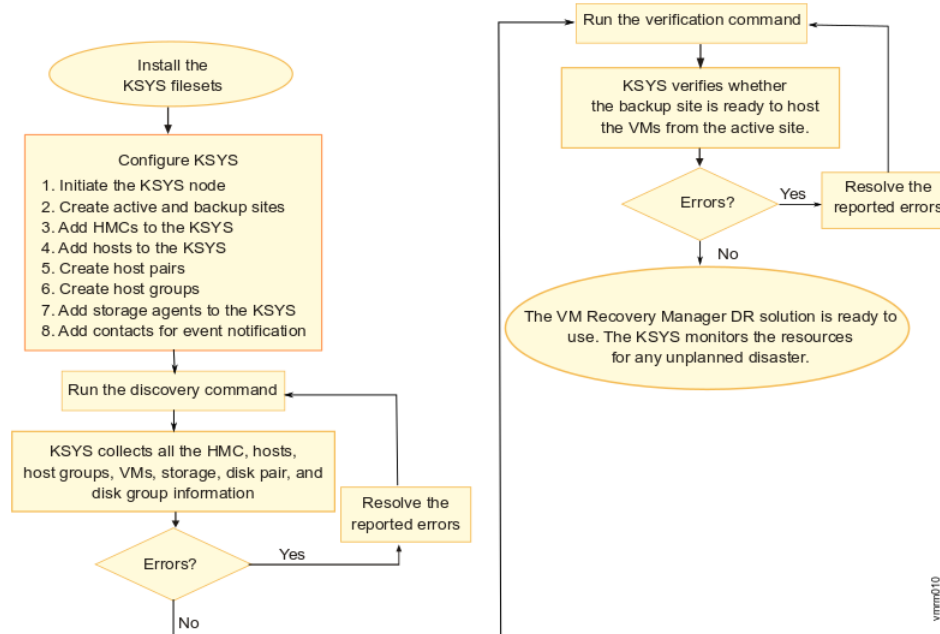


Figure 22. VM Recovery Manager DR solution: Installation and configuration

Setting up the KSYS subsystem

After the VM Recovery Manager DR software is installed, you must complete some mandatory configuration steps to start using the disaster recovery feature of the VM Recovery Manager DR solution.

Initiating the KSYS node

After the VM Recovery Manager DR software is installed on the KSYS LPAR, you must initiate and set up the KSYS environment before you configure the disaster recovery environment. The KSYS environment relies on Reliable Scalable Cluster Technology (RSCT) to create its cluster.

After you create the KSYS cluster, various daemons of RSCT and KSYS are activated. The KSYS LPAR can then process the commands that are required to configure the disaster recovery environment.

Note: In VM Recovery Manager DR, the KSYS operates as a one-node cluster.

To create and initiate a one-node KSYS cluster, complete the following steps:

1. Create a cluster and add the KSYS node to the cluster by running the following command.

```
ksysmgr add ksyscluster cluster_name
ksysnodes=ksys_nodename type=DR
```

2. Verify the KSYS cluster configuration by running the following command.

```
ksysmgr verify ksyscluster cluster_name
```

3. Deploy the one-node KSYS cluster by running the following command.

```
ksysmgr sync ksyscluster cluster_name
```

Note: You can perform steps 1 - 3 by running the following command:

```
ksysmgr add ksyscluster cluster_name ksysnodes=ksys_nodename
sync=yes type=DR
```

This command creates a cluster, adds the KSYS node to the cluster, verifies the cluster configuration, and deploys the one-node KSYS cluster. In this example, the *ksys_nodename* represents the host name of the KSYS node, not the IP address of the KSYS node.

4. Optional: Verify the KSYS cluster that you created by running the following commands:

```
ksysmgr query ksyscluster
Name:      test_ksys
State:     Online

# lsrpdomain
Name      OpState      RSCTActiveVersion  MixedVersions  TSPort  GSPort
test_ksys Online       3.2.1.1           No             12347   12348

# lssrc -a | grep VMR
IBM.VMR   rsct_rm      9961878           active
```

Note: These commands do not display any output until you run the **ksysmgr sync** command.

Creating sites

You must create sites that are used to map all the HMCs, hosts, and storage devices. You must create an active site, also referred as the home site, where the workloads are currently running and a backup site that acts as a backup for the workloads during a disaster or a potential disaster situation.

Sites are logical names that represent your sites. A site name can be any American Standard Code for Information Interchange (ASCII) string that is limited to 64 characters. A site name cannot contain any special characters or spaces.

By default, the active site is the home site. You can configure only two sites. When you create sites, the replication type of the site is asynchronous by default. After you create sites, you can change the type of storage replication to synchronous based on the replication type setting of the storage agents.

To create sites for the VM Recovery Manager DR solution, complete the following steps in the KSYS logical partition:

1. Create an active site (Site1) by running the following command:

```
ksysmgr add site Site1 sitetype=home
```

2. Create a backup site (Site2) by running the following command:

```
ksysmgr add site Site2 sitetype=backup
```

3. Optional: Verify the sites that you created by running the following command:

```
ksysmgr query site
```

An output that is similar to the following example is displayed:

```
Replication type for site(s): async
Name:      Site2
Sitetype:  BACKUP

Name:      Site1
Sitetype:  HOME
```

4. If you want to change the replication type of a site from the default async value to the sync value, enter the following command:

```
ksysmgr modify system replication_type=sync sites=Site1,Site2
```

The **replication_type** attribute supports the following values: sync, async, shared.

Adding HMCs to the KSYS

The KSYS interacts with the HMC for discovery, verification, monitoring, recovery, and cleanup operations. HMCs that are configured in both the active and backup sites provide details about the hosts and VIOS partitions that are managed by the HMCs in each site. The VM Recovery Manager DR solution cannot be implemented without configuring the HMCs. Therefore, you must provide the HMC details to the KSYS.

Note:

- The HMC user, whose user name and password details are provided to the KSYS, must have hmcsuperadmin privileges with remote access enabled.
- > If the HMC password contains any special characters, you can enter password only by using the ksysmgr command via the command-line interface (CLI). To enter a password that contains special characters, run the following command:

```
ksysmgr add hmc HMC1 login=hscroot site=Site1
```

When you run the command, the ksysmgr command prompts you to enter the password.

```
password : *****  
Re-Enter password : *****
```



To add the HMCs to a specific site, complete the following steps in the KSYS LPAR:

1. Add the HMC (for example, HMC name: Site1_HMC1, user name: hscroot, password: xyz123) that manages the host or hosts in the active site (Site1) by running the following command:

```
ksysmgr add hmc Site1_HMC1 login=hscroot password=xyz123  
hostname=Site1_HMC1.testlab.ibm.com site=Site1
```

Note: If you do not want to enter the password in the command line, you can omit the password field. In this case, the **ksysmgr** command prompts for the password later.

2. Add the HMC (for example, HMC name: Site2_HMC1, user name: hscroot, password: xyz123) that manages the host or hosts in the backup site (Site2) by running the following command:

```
ksysmgr add hmc Site2_HMC1 login=hscroot password=xyz123  
hostname=Site2_HMC1.testlab.ibm.com site=Site2
```

3. Repeat [Step 1](#) and [Step 2](#) for all the HMCs that you want to add to the KSYS.
4. Optional: Verify the HMCs that you added by running the following command:

```
ksysmgr query hmc
```

An output that is similar to the following example is displayed:

```
Name:          Site2_HMC1  
Site:          Site2  
Ip:            9.xx.yy.zz  
Login:         hscroot  
HmcTimeout:   0  
Maxjobs:      0  
ViosTimeout:  0  
SwXSDVersion: V8R8.6.0  
  
Managed Host List:  
  
Host Name          Uuid  
=====          =====  
d25m1-9179-MHB-100141P 82e8fe16-5a9f-3e32-8eac-1ab6cdcd5bcf  
d67m3_8231-E2D-068ED7H 74931f30-e852-3d47-b564-bd263b68f1b1  
kumquat_9179-MHD-105E67P c15e9b0c-c822-398a-b0a1-6180872c8518  
r5r3m1             f6cbbcda-8fec-3b6e-a487-160ca75b2b84  
rar1m3-9117-MMD-1016AAP 4ce17206-4fde-3d5a-a955-dbf222865a77  
gsk1_8233-E8B-1000ADP 346f184d-bace-36f5-97b5-3955c62a6929  
Hawk-8233-E8B-SN1000A7P a977d52e-fd3a-325d-bd02-124663066cac
```

```

rar1m6                                ae115482-3a50-32f3-935a-7ff9be433e33
rar1m5-9109-RMD-106A79R             b3880199-3b8b-3ade-b360-f76146c2d7f3
r5r3m2                                26c7c48e-3b81-363b-85d0-e110ebc43b15
=====

Name:                                Site1_HMC1
Site:                                Site1
Ip:                                  9.xx.yy.zz
Login:                               hscroot
HmcTimeout:                          0
Maxjobs:                              0
ViosTimeout:                          0
SwXSDVersion:                         V8R8.6.0

                                Managed Host List:

Host Name                            Uuid
=====                            =====
e10m4_8286-42A-21E0A7V               caffee0a-4206-3ee7-bfc2-f9d2bd3e866f
pbrazos_9119-MME-21BBC47             6ce366c5-f05d-3a12-94f8-94a3fdcf1319
orange_9179-MHD-107895P              67ff62ec-ecb5-3ad4-9b35-0a2c75bb7fe4
=====

```

Related concepts

[Requirements for the VM Recovery Manager DR solution](#)

Before you plan the implementation of the VM Recovery Manager DR solution, you must understand the other entities and resources that the VM Recovery Manager DR solution requires for disaster recovery operations.

Adding hosts to the KSYS

The KSYS monitors and manages the disaster recovery operations across sites. The KSYS requires that each host must be paired to another host across sites. This type of pairing allows the virtual machines to move from one host to another host across sites. You must plan the host pairing across sites in advance, and then implement the pairing.

Note: The VM Recovery Manager DR solution supports POWER7 processor-based server, or later.

Host pairing guidelines

- Each host in a pair must belong to different sites.
- Paired host in the backup site must always have enough resources to host the managed virtual machines from the active site. For example, if the current active site is Site_1 and the Host_1 host in that site is running 55 virtual machines that requires 100 cores CPU and 512 GB memory, you can pair the Host_1 host from the active site with the Host_2 host on the backup site only when the Host_2 host contains at least 100 cores CPU and 512 GB memory. If the capacity is not sufficient in the backup host, the validation issues warnings.
- If you use the Enterprise Pool capacity option, the Host_2 host can borrow required resources from the Enterprise Pool before the disaster recovery movement.
- You can pair the POWER8 host and the POWER7 hosts. For example, you can pair a POWER8 host on the active site with a POWER7 host on the backup site if the POWER7 system has enough resources to host the virtual machines from the POWER8 host. Same is applicable vice-versa.

After the HMCs are added to the KSYS, you can review the list of managed hosts by each HMC, and then identify the hosts that you want to add to the KSYS for disaster recovery. You must connect the source hosts and target hosts to different HMCs across sites. If you connect the source hosts and target hosts to the same HMC, it leads to an invalid configuration in the KSYS subsystem and can cause failures in disaster recovery operations.

When a host is added to a host group, all the virtual machines in the host are included by default in the disaster recovery management scope. However, the disaster recovery management starts only after you configure the subsystems and run the discovery and verification operations. Therefore, if you plan to exclude a set of virtual machines after adding the hosts, you can unmanage those virtual machines, and then run the discovery and verification operations.

You can prioritize the virtual machines within a single host or among multiple hosts such that the virtual machines that run important workloads are considered first for the move operation. You can set a priority of high, medium, or low for the virtual machines. When you run a move operation, the **ksysmgr** command initiates the operation for the virtual machines that has the highest priority.

Tip: Obtain the host name by querying the HMC. You can copy the host name and use it when you run commands.

To add the hosts to the KSYS configuration, complete the following steps in the KSYS LPAR:

1. Add the managed host (for example, host name: Site1_host1), which is running the workload, to the KSYS by running the following command:

```
ksysmgr add host Site1_host1 site=Site1
```

The Site1_host1 host, which is a managed host for the Site1_HMC1 HMC, is added in the active site.

2. Add the backup host (for example, host name: Site2_host1), which acts as a backup host, to the KSYS by running the following command:

```
ksysmgr add host Site2_host1 site=Site2
```

The Site2_host1 host, which is a managed host for the Site2_HMC1 HMC, is added in the backup site.

3. Repeat [Step 1](#) and [Step 2](#) for all hosts that you want to add to the KSYS.
4. Optional: Verify the hosts that you added by running the following command:

```
ksysmgr query host
```

An output that is similar to the following example is displayed:

```
Name:          Site2_host1
UUID:          c15e9b0c-c822-398a-b0a1-6180872c8518
FspIp:
Pair:          None
Site:          Site2
VIOS:          Site2_VIOS1
               Site2_VIOS2
HMC:           Site2_HMC1

Name:          Site1_host1
UUID:          67ff62ec-ecb5-3ad4-9b35-0a2c75bb7fe4
FspIp:
Pair:          None
Site:          Site1
VIOS:          Site1_VIOS1
               Site1_VIOS2
HMC:           Site1_HMC1
```

5. If you want to exclude some virtual machines during a recovery operation, run the following command for each virtual machine that you want to exclude:

```
ksysmgr unmanage vm name=vmname host=hostname | uuid=lparuuid |
                ALL host=hostname | ALL host_group=hg_name
```

Note: You can perform the **unmanage** operation only after creating the host pairs. For more information about host pairs, see the [“Creating host pairs”](#) on page 63 topic.

You can include the VM back in the KSYS management at any time by using the **ksysmgr manage vm vmname | lparuuid** command.

6. If you want to specify a priority for specific virtual machines for the move operation, run the following command:

```
ksysmgr modify VM name1[,name2,name3,...] | file=filepath
[uuid=uuid_value]
[host=hostname]
[priority=low|medium|high]
```

where, the **file** parameter is an XML file that contains a list of virtual machine references.

Creating host pairs

After the hosts are added to the KSYS, identify the hosts that must be paired across the active site and the backup site. Each backup host in the host pair must meet all the resource requirements so that the backup host can run the same workload in a disaster or a potential disaster situation.

To pair the hosts across the sites in the VM Recovery Manager DR solution, complete the following steps in the KSYS LPAR:

1. Pair the identified host (for example, host name: Site1_host1) in the active site to the identified host (for example, host name: Site2_host1) in the backup site by running the following command:

```
ksysmgr pair host Site1_host1 pair=Site2_host1
```

2. Repeat [Step 1](#) for all the host pairs that you want to create.
3. Optional: Verify the host pair that you created by running the following command:

```
ksysmgr query host
```

An output that is similar to the following example is displayed:

```
Name:          Site2_host1
UUID:          c15e9b0c-c822-398a-b0a1-6180872c8518
FspIp:
Pair:          Site1_host1
Site:          Site2
VIOS:          Site2_VIOS1
               Site2_VIOS2
HMC:           Site2_HMC1

Name:          Site1_host1
UUID:          67ff62ec-ecb5-3ad4-9b35-0a2c75bb7fe4
FspIp:
Pair:          Site2_host1
Site:          Site1
VIOS:          Site1_VIOS1
               Site1_VIOS2
HMC:           Site1_HMC1
```

Creating host groups

You can group a set of hosts based on your business requirements. For example, you can group the hosts that run similar type of workloads. You can also group important hosts together so that the monitoring and recovery operations can be performed for the set of hosts together and quickly. In disaster situations, you can move a host group separately to the backup site.

Guidelines to manage host groups:

- In case of symmetric host group, a host must already be added to the KSYS configuration settings and the host must have been paired with a backup host in the backup site.
- Each host in a site must be a part of a host group. If a paired host is not added to any host groups, the host is automatically added to the Default_HG host group during the discovery operation.
- If you add or remove hosts from a host group, you must run a discovery operation to manage or unmanage all the virtual machines from the recovery management. The modified host group displays the correct list of managed virtual machines only after a discovery operation.
- The corresponding hosts in the backup site that are paired with the active site hosts are grouped logically within the same host group. For example, if host1 in the active site is paired with host2 in the backup site and you create a host group hg1 with host1, then host2 is automatically added to the host group hg1.
- Each host group is associated with a separate disk group. The disks in the disk group must not be shared among different host groups. The disk groups are named in the following format:

```
VMRDG_{peer_domain_name}_{site_name}_{host_group_ID}
```

However, the disk group name must not exceed the maximum number of characters that is supported for a consistency group at storage level.

To add hosts to the KSYS configuration, complete the following steps in the KSYS LPAR:

1. To create a host group and to add the existing hosts that you want to include in this host group, run the following command:

```
ksysmgr add host_group hg1 [site=<Site_1>] hosts=Host_11,Host_12,Host_13 [mxn_pairing=<yes>]  
[workgroup_support=<no>]
```

Note:

- By default, the **mxn_pairing** attribute is set to no. You must pair the hosts before adding the hosts to the host group. Once you add one counterpart from the host-pair to a host group, the other counterpart of the host-pair will be automatically added to the respective host group in the other site. These hosts forms symmetric host group, which contains one to one paired hosts.
 - To create asymmetric host group, which contains one to many paired hosts, set the **mxn_pairing** attribute to yes. You should not pair the hosts before adding the hosts to the host group. You must specify host and host-group pair of all hosts manually.
 - All the hosts in the backup site that are paired with the specified hosts are also added to the host group.
 - By default, the **workgroup_support** attribute is set to yes. A host group is automatically created with the workgroup. To disable the workgroup support for a host group, set the **workgroup_support** attribute to no when adding the host group.
 - All VMs in the backup site will no longer be managed after the host group is created.
 - By default, the KSYS subsystem considers VMs of the home site to create a host group. To create a host group and add VMs of the backup site to the host group, use the site option in the `ksysmgr` command.
2. Repeat [Step 1](#) for all host groups that you want to create in the KSYS subsystem.
 3. Optional: To verify the host groups that you added, run the following command:

```
ksysmgr query host_group hgname
```

An output that is similar to the following example is displayed:

```
Name: hg1  
Active Site Hosts: Host_11  
                  Host_12  
                  Host_13  
Backup Site Hosts: Host_21  
                  Host_22  
                  Host_23  
cpu_capacity: none  
memory_capacity: none  
skip_power_on: No  
Site: Site_1  
Vswitchmap: Not currently set  
Vlanmap: Not currently set  
Type: symmetric
```

4. To add or remove hosts from the existing host groups, run the following command:

```
ksysmgr modify host_group hg_name add | remove  
hosts=host1,host2... | file=filepath
```


Where, the **file** parameter is an XML file that contains a list of hosts. An example of the XML file is as follows:

```
<KSYSMGR><HOST><NAME>host1</NAME></HOST></KSYSMGR>
<KSYSMGR><HOST><NAME>host2</NAME></HOST></KSYSMGR>
<KSYSMGR><HOST><NAME>host3</NAME></HOST></KSYSMGR>
```

5. To modify the capacity-related attributes for all the hosts in a host group, run the following command:

```
ksysmgr modify host_group hg_name options
[memory_capacity=(Whole Number > 1) | minimum | current_desired | none]
[cpu_capacity=(Whole Number > 1) | minimum | current_desired | none]
[skip_resource_check=yes|no]
[skip_power_on=yes|no]
```

For more information about flexible capacity policies, see [“Configuring the flexible capacity policies”](#) on page 104.

Creating asymmetric host group

The VM Recovery Manager DR solution manages an environment in which M number of hosts on the home site are configured to failover with N number of hosts on the backup site. This is one-to-many pairing.

While creating host group, you can provide custom name of the composite group that is to be created.

For EMC storage agent, the composite group name of the source storage agent and the composite group name of the target storage agent can be different. While creating a host group, you can specify a custom name for the composite group that will be created. For EMC storage agents, two different attributes, the **customcgname** and the **bsitecgname** attributes are used for the source storage agent and the target storage agents respectively. For storage systems other than the EMC storage systems, the composite group name of the source storage agent and the composite group name of the target storage agent must be the same.

- To create an asymmetric host group with EMC storage systems, run the following command:

```
ksysmgr add host_group <host_group_name>
hosts=<host1[,host2,..]> | file=filepath
[ha_disk=<ViodiskID>]
[repo_disk=<ViodiskID>]
[backup_repo_disk=<ViodiskID[,ViodiskID2..]> | backup_repo_disk=none]
[mxn_pairing=<yes>][customcgname=<CgName>] [bsitecgname=<CgName>]
add => ad*, cr*, make, mk
host_group => hg, host_g*
```

For example:

```
ksysmgr add host_group <name> hosts=<hostname separate by coma> mxn_pairing=yes
customcgname=<source_cg_name> bsitecgname=<target_site_cgname>
```

- To create an asymmetric host group with storage systems other than EMC storage systems, run the following command:

```
ksysmgr add host_group <host_group_name>
hosts=<host1[,host2,..]> | file=filepath
[ha_disk=<ViodiskID>]
[repo_disk=<ViodiskID>]
[backup_repo_disk=<ViodiskID[,ViodiskID2..]> | backup_repo_disk=none]
[mxn_pairing=<yes>][customcgname=<CgName>]
add => ad*, cr*, make, mk
host_group => hg, host_g*
```

For example:

```
ksysmgr add host_group <name> hosts=<hostname separate by coma> mxn_pairing=yes
customcgname=<source_cg_name>
```

While creating an asymmetric host group, you must specify the host names from both sites. You must not specify the hosts that are already paired. By default, the host group **type** is symmetric. For asymmetric

host group, set the value of the **mxn_pairing** attribute to yes. Similarly, if you want to use workgroup, set the **workgroup_support** attribute to yes.

Behavior of the KSYS in the asymmetric host group configuration

In an asymmetric host group configuration, the KSYS subsystem dynamically determines the target host for a virtual machine. This mapping is determined based on the resource availability on the target site during the discovery operation. You can query a virtual machine to view the target host of the virtual machine. Run the following command to query the virtual machine:

```
Ksystemgr q vm
```

An output similar to the following screen is displayed.

```
All VMs:
Name:          seh7008
UUID:          438E0912-F63C-4299-9AFF-6966D2001FDE
DRState:       INIT
HAState:       INIT
Dr Test State: INIT
Host:          seh7-8408-E8D-21E24ET
Priority:       Medium
Skip_power_on: No
VM_failure_detection_speed: normal
HA_monitor:    disable
Proactiveha:   disable
Homehost:      seh7-8408-E8D-21E24ET
VM_status:     NO_OPERATION_IN_PROGRESS
Version_conflict: No
DrTargetHost:  gelato-9119-MME-10859D7
```

The **DrTargetHost** field displays the name of the host where a virtual machine will be moved during the move operation. You can also specify the target host of a virtual machine in the **DrTargetHost** attribute when you run the **ksystemgr modify vm** command. Otherwise, the KSYS subsystem updates this attribute automatically during the discovery operation. If the target host of a virtual machine has been changed, specify an empty value for the **DrTargetHost** attribute to allow the KSYS subsystem to automatically determine the target host of the virtual machine. Run the following command to set a target host for a virtual machine in an asymmetric host group setting:

```
ksystemgr modify vm <vmname[,vmname2,...]> | ALL host=<hostname> | ALL
host_group=<host_group_name> | file=<filepath>
  [uuid=<uuid>]
  [homehost=<hostname>]
  [DrTargetHost=<hostname>]
  [priority=<Low|Medium|High>]
  [log_level=<0|1|2|3>]
  [skip_power_on=<yes|no>]
  [ha_monitor=<enable | disable>]
  [proactiveha=<enable | disable>]
  [vm_failure_detection_speed=<fast | normal | slow>]
  [blacklist_hosts=<hostname[,hostname2...]> | [policy=<add | delete>]]
modify => mod*, ch*, set
vm => lp*, vm
```

For example:

```
ksystemgr modify vm <vm_name> DrTargetHost=<host_name>
```

Note:

- You can use the `ksystemgr modify vm ALL host_group=<host_group_name>` command for the `blacklist_hosts` attribute.
- The **DrTargetHost** attribute is valid only for the asymmetric type of host group.
- The type, symmetric or asymmetric, that is set while adding the host group, cannot be modified later.

Adding storage agents to the KSYS

In the VM Recovery Manager DR solution, data is replicated from the active site to the backup site by using storage replication. The KSYS manages the storage subsystems for data mirroring as a part of the disaster recovery operations. To manage the storage subsystems, the KSYS uses the APIs that are provided by the storage subsystem. You must register the various storage devices in all sites with the KSYS as storage agents so that KSYS can monitor and manage the data replication across sites. The storage agents interact with the storage devices or the storage controller software in each site depending on the type of storage in your environment.

Note: All the prerequisite software must be installed on the same logical partition in which the KSYS software is installed. If the storage subsystem uses a storage controller software, the storage controller software must also be installed on the KSYS LPAR. The storage controller is the software component that you receive from the storage vendor that allows KSYS to contact storage devices and perform replication operations. For example, identify mirroring pairs, create disk groups, and reverse mirroring.

The VM Recovery Manager DR solution supports the following storage agents:

- EMC storage systems
- SVC and Storewize devices
- DS8000 series storage devices
- Hitachi storage devices
- IBM XIV storage systems

Related concepts

[Requirements for the VM Recovery Manager DR solution](#)

Before you plan the implementation of the VM Recovery Manager DR solution, you must understand the other entities and resources that the VM Recovery Manager DR solution requires for disaster recovery operations.

Registering EMC storage devices

For EMC storage, the storage agent use the SYMAPI commands to interact with the EMC Solution Enabler software to manage the EMC storage devices. You can use the SYMAPI commands (for example, **symcfg list**) to determine the 12-digit serial number and the IP address of the storage device. For information, see

To add the storage agents in the VM Recovery Manager DR solution, complete the following steps in the KSYS LPAR:

1. Add the storage agent (for example, name: Site1_storage1, user name: abc, password: 123, serial number: 000196800508, IP address: 10.xx.yy.zz) to the active site by running the following command:

```
ksysmgr add storage_agent Site1_storage1 login=abc password=123 site=Site1
serialnumber=000196800508 storagetype=emc ip=10.xx.yy.zz
```

2. Add the storage agent (for example, name: Site2_storage1, user name: abc, password: 123, serial number: 000196800573, IP address: 10.xx.yy.zz) to the backup site by running the following command:

```
ksysmgr add storage_agent Site2_storage1 login=abc password=123 site=Site2
serialnumber=000196800573 storagetype=emc ip=10.xx.yy.zz
```

3. Repeat [Step 1](#) and [Step 2](#) for all storage arrays that you want to add to the KSYS. For example, if a site contains two storage arrays, you must add two storage agents to the KSYS for that site.
4. Optional: Verify the storage agents that you added by running the following command:

```
ksysmgr query storage_agent
```

An output that is similar to the following example is displayed:

```

Name:          Site2_storage1
Serialnumber:  196800573
Storagetype:   EMC
Site:          Site2
Ip:            10.xx.yy.zz
Login:         abc

Name:          Site1_storage1
Serialnumber:  196800508
Storagetype:   EMC
Site:          Site1
Ip:            10.xx.yy.zz
Login:         abc

```

Related concepts

[“EMC storage subsystem” on page 13](#)

The VM Recovery Manager DR solution implements disaster recovery with Symmetrix Remote Data Facility (SRDF) storage devices by using the EMC supplied Symmetrix command-line interface (SYMCLI). The VM Recovery Manager DR solution uses the Symmetrix application program interface (SYMAPI) server that runs on the EMC Solution Enabler server node for the SYMCLI operations.

Registering SVC and Storwize storage devices

For IBM SAN Volume Controller (SVC) storage system and Storwize storage system, the storage agent uses specific storage scripts and their corresponding interfaces to interact with the storage devices. When you add a storage agent to the KSYS subsystem, you must specify the cluster ID, storage login user name, and the IP address of the storage subsystem.

You can use the SVC or Storwize GUI or the following command to get the cluster ID of storage disks:

```
ssh usrid@ipaddr svcinfo lscluster
```

To add the storage agents in the VM Recovery Manager DR solution, complete the following steps in the KSYS LPAR:

1. Add the storage agent (for example, name: Site1_storage1, user name: abc, cluster ID: 007, IP address: 10.xx.yy.zz) to the active site by running the following command:

```
ksysmgr add storage_agent Site1_storage1 login=abc site=Site1
clusterid=007 storagetype=svc ip=10.xx.yy.zz
```

Note: The value of the **storagetype** attribute must be svc for both the SVC system and the Storwize system.

2. Add the storage agent (for example, name: Site2_storage1, user name: abc, cluster ID: 008, IP address: 10.xx.yy.zz) to the backup site by running the following command:

```
ksysmgr add storage_agent Site2_storage1 login=abc site=Site2
clusterid=008 storagetype=svc ip=10.xx.yy.zz
```

3. Optional: Verify the storage agents that you added by running the following command:

```
ksysmgr query storage_agent
```

An output that is similar to the following example is displayed:

```

Name:          Site2_storage1
Clusterid:     008
Storagetype:   SVC
Site:          Site2
Ip:            10.xx.yy.zz
Login:         abc

Name:          Site1_storage1
Clusterid:     007
Storagetype:   SVC
Site:          Site1
Ip:            10.xx.yy.zz
Login:         abc

```

Related concepts

[“SAN Volume Controller system and Storwize system” on page 15](#)

Beginning with VM Recovery Manager DR version 1.1 Service Pack 1, the VM Recovery Manager DR solution supports the IBM SAN Volume Controller (SVC) storage system and IBM Storwize® storage system. Both SVC system and Storwize storage systems follow the same host programming model for mirror management. Hence, the VM Recovery Manager DR solution supports both these storage subsystems by using the same configuration and management interfaces.

Registering DS8000 series storage devices

For DS8000 series storage system, the storage agent uses specific storage scripts and their corresponding interfaces to interact with the storage devices. When you add a storage agent for the DS8000 storage system, you must specify the serial number or the storage ID, storage login user name, password, and the IP address of the storage subsystem.

To plan for the deployment of the IBM DS8000 series across two sites, complete the following prerequisites:

- Add the path name of the `dsccli` client to the PATH environment variable for the root user on the KSYS node.
- Identify the disk volumes on the DS8000 storage system that contain the application data that you want to be included for disaster recovery.
- Ensure that sufficient number of disk volumes and Fibre Channel ports are available on the storage systems for the active site and backup site to allow a mirror path or PPRC path between the storage units.
- Verify that a FlashCopy® relationship is established for each disk volume on the backup site.
- Verify that all the data volumes that need to be mirrored are accessible to all relevant hosts. The DS8000 disk volumes must be zoned so that the FlashCopy volumes cannot be accessed by the KSYS node.
- Ensure that the KSYS node can access all HMCs by using the Internet Protocol network.

To add the storage agents in the VM Recovery Manager DR solution, complete the following steps in the KSYS LPAR:

1. Add the storage agent (for example, name: `Site1_storage1`, user name: `abc`, serial number: `IBM.2107-75LY981`, IP address: `10.xx.yy.zz`) to the active site by running the following command:

```
ksysmgr add storage_agent Site1_storage1 login=abc site=Site1
serialnumber=IBM.2107-75LY981 storagetype=ds8k ip=10.xx.yy.zz
```

2. Add the storage agent (for example, name: `Site2_storage1`, user name: `abc`, serial number: `IBM.2107-75LY982`, IP address: `10.xx.yy.zz`) to the backup site by running the following command:

```
ksysmgr add storage_agent Site2_storage1 login=abc site=Site2
serialnumber=IBM.2107-75LY982 storagetype=ds8k ip=10.xx.yy.zz
```

3. Optional: Verify the storage agents that you added by running the following command:

```
ksysmgr query storage_agent
```

An output that is similar to the following example is displayed:

```
Name:                Site2_storage1
Serialnumber:        IBM.2107-75LY982
Storagetype:         DS8K
Site:                Site2
Ip:                  10.xx.yy.zz
Login:               abc

Name:                Site1_storage1
Serialnumber:        IBM.2107-75LY981
```

```
Storagetype: DS8K
Site: Site1
Ip: 10.xx.yy.zz
Login: abc
```

Related concepts

[“DS8000 storage system” on page 17](#)

Beginning with VM Recovery Manager DR version 1.1 Service Pack 1, the VM Recovery Manager DR solution supports the IBM System Storage® DS8000® series storage system for storage management.

Registering Hitachi storage devices

For Hitachi storage systems, the storage agents use the Command Control Interface (CCI) to interact with the CCI server to manage the storage devices.

For Hitachi storage systems, the KSYS subsystem requires the Hitachi Open Remote Copy Manager (HORCM) instance for each storage agent. You must specify the instance parameter to indicate the storage agent for the HORCM instance. You must also specify a separate instance for shadow image for the backup site.

To add the storage agents in the VM Recovery Manager DR solution, complete the following steps in the KSYS LPAR:

1. Add the storage agent to the active site by entering the following command:

```
ksysmgr add storage_agent SITE1_Storage1 site=Site1
storagetype=Hitachi
ip=10.xx.yy.zz
serialnumber=441108
login=fvtadmin
password=XXXXX
instance=12
```

2. Add the storage agent to the backup site by entering the following command:

```
ksysmgr add storage_agent Site2_storage2
site=Site2
storagetype=Hitachi
ip=10.x1.yy.zz
serialnumber=57558
login=fvtadmin
password=passw0rd
instance=11
drinstance=14
```

3. Optional: Verify the storage agents that you added by entering the following command:

```
ksysmgr query storage_agent
```

An output that is similar to the following example is displayed:

```
# ksysmgr query storage_agent
Name: G400
Serial: 441108
Storagetype: Hitachi
Site: Site1
Ip: 10.xx.yy.zz
Login: fvtadmin
Instance: 12
DrInstance: default

Name: G1000
Serial: 57558
Storagetype: Hitachi
Site: Site2
Ip: 10.x1.yy.zz
Login: fvtadmin
Instance: 11
DrInstance: 14
```

Related concepts

[“Hitachi storage systems” on page 18](#)

The VM Recovery Manager DR solution supports disaster recovery (DR) for third-party vendor storage from Hitachi. The VM Recovery Manager DR solution supports both synchronous and asynchronous data replication by using Hitachi TrueCopy remote replication and Hitachi Universal Replicator (HUR) technologies.

Adding storage agents to the IBM XIV Storage System

Specify the serial number or the storage ID, login username and password of the storage, and the IP address of the storage system when adding the IBM XIV storage systems.

To add storage agents to the IBM XIV Storage System in the VM Recovery Manager DR solution, complete the following steps in the KSYS LPAR:

1. Add the storage agent to the active site by entering the following command:

```
ksysmgr add storage_agent Site1_Storage1 site=Site1
storagetype=XIV
ip=10.xx.yy.zz
serialnumber=441108
login=fvtadmin
password=XXXX
```

Note: You can specify multiple IP addresses so that communication is established on a different port and the IP address if one of the ports or the customer Ethernet network fails. When running a command, the IBM XIV Storage System command-line interface (XCLI) receives these multiple IP addresses and tries to connect with each of the IP addresses until communication with one of the IP addresses is successful. For example:

```
ksysmgr add storage_agent ip=ip_add1,ip_add2,ip_add3
```

2. Add the storage agent to the backup site by entering the following command:

```
ksysmgr add storage_agent Site2_storage2
site=Site2
storagetype=XIV
ip=10.x1.yy.zz
serialnumber=57558
login=fvtadmin
password=passw0rd
```

3. Optional: Verify the storage agents that you added by entering the following command:

```
ksysmgr query storage_agent
```

An output that is similar to the following example is displayed:

```
# ksysmgr query storage_agent
Name:           Site1_storage1
Serial:         441108
Storagetype:    XIV
Site:           Site1
Ip:             10.xx.yy.zz
Login:          fvtadmin

Name:           Site2_storage2
Serial:         57558
Storagetype:    XIV
Site:           Site2
Ip:             10.x1.yy.zz
Login:          fvtadmin
```

Related concepts

[“XIV Storage System” on page 26](#)

Beginning with VM Recovery Manager DR Version 1.3 Service Pack 2, or later the VM Recovery Manager DR solution supports the IBM XIV Storage System.

Setting up contacts for event notification

The KSYS tracks various events that occur in the environment, analyzes the situation, and notifies you about any issues or potential disaster through the registered contacts. You must provide the contact details to the KSYS so that you can receive notifications about any situation that might need your action.

You can add the following contact details for a specific user:

- Email address
- Phone number with phone carrier email address

You can add multiple email addresses for a specific user. However, you cannot add multiple email addresses simultaneously. You must run the command multiple times to add multiple email addresses.

You must specify the phone number along with the phone carrier email address to receive a short message service (SMS) notification. To find your phone carrier email address, contact your phone service provider.

Note: The logical partition, in which the KSYS software is installed, must have a public IP address to send the event notifications successfully.

To register contact details for notification from the KSYS, run the following commands in the KSYS LPAR:

- To add an email notification for a specific user, enter the following command:

```
ksysmgr add notify user=username contact=email_address
```

For example,

```
ksysmgr add notify user=John contact=john.doe@testmail.com
```

- To add an SMS notification for a specific user, enter the following command:

```
ksysmgr add notify user=username contact=10_digit_phone_number@phone_carrier_email_address
```

For example,

```
ksysmgr add notify user=John contact=1234567890@tmomail.net
```

- To add a pager notification for a specific user, enter the following command:

```
ksysmgr add notify user=username contact=pager_email_address
```

For example,

```
ksysmgr add notify user=John contact=1234567890@SKYTEL.COM
```

Configuring VIOS

When you add hosts to the KSYS subsystem, all Virtual I/O Servers in the hosts are also added to the KSYS subsystem. The VM Recovery Manager DR solution monitors the hosts and virtual machines by using Virtual I/O Servers in the host.

The VM Recovery Manager DR solution requires at least two Virtual I/O Servers per host. You can have a maximum of 24 Virtual I/O Servers, spread across different hosts, in a single host group. If a host has more than 2 Virtual I/O Servers, you can exclude specific VIOS partitions from the DR management.

- To exclude specific VIOS partitions from the DR management, run the following command:

```
ksysmgr unmanage vios <viosname[,...]> | <viosuuid[,...]>  
unmanage => unman*, umg  
vios => vios*
```


For example:

```
ksysmgr unmanage vios Site2_VIOS1,Site2_VIOS2
```

- To include specific VIOS partitions for the DR management, run the following command:

```
ksysmgr manage vios <viosname[...]> | <viosuuid[...]>  
  manage => man*, mg  
  vios => vios*
```

For example:

```
ksysmgr manage vios Site2_VIOS1,Site2_VIOS2
```

Customizing consistency group name

You can customize the consistency group name of the storage subsystems.

>|Custom consistency group (CG) name for EMC storage subsystem|<

>|You can customize the consistency group names of the EMC storage subsystems at both home and backup sites, and assign two different custom consistency group names at the home site and the backup site. The option `customcgname` is used to set the custom consistency group name for the home site storage, and the option `bsitecgname` is used to set custom consistency group name at the backup site. The options to set up or modify the custom consistency group names for both home site and the backup site can be used only before the first discovery of the host group or the workgroup. After the first discovery, setting up or modifying the custom consistency group name is not allowed. Also, setting up or modifying the custom consistency group name is not allowed when an operation is in progress in the host group or in the workgroup.

- To create a host group with custom consistency group name at the home site and at the backup site, run the following command:

```
ksysmgr add hg <host_group_name> hosts=<host1[,host2,...]> customcgname=<CgName>  
bsitecgname=<CgName>
```

An output similar to the following example is displayed:

```
Host_group <host_group_name> added successfully
```

- To modify a host group with custom consistency group name at the home site and at the backup site, run the following command:

```
ksysmgr modify host_group <host_group_name> options customcgname=<CgName> bsitecgname=<CgName>
```

An output similar to the following example is displayed:

```
For Host_group <host_group_name> attribute(s) 'customcgname', 'bsitecgname' was successfully  
modified.
```

- To view the details of a custom consistency group name, run the following command:

```
ksysmgr q hg <host_group_name>
```

An output similar to the following example is displayed:

```

Name: <host_group_name>
Home Site Hosts: none
Backup Site Hosts: none
Workgroups: none
Memory_capacity: Priority Based Settings
                  low:100
                  medium:100
                  high:100
CPU_capacity: Priority Based Settings
              low:100
              medium:100
              high:100
Skip_power_on: No
sriov_override: No
Site:
Vswitchmap: Not currently set
Vlanmap: Not currently set
DrVswitchmap: Not currently set
DrVlanmap: Not currently set
Type: symmetric
Custom CG Name: <host_group_name>_HSITECG
Backup Site CG Name: <host_group_name>_BSITECG

```

- To create a workgroup with custom consistency group name at the home site and at the backup site, run the following command:

```
ksysmgr add workgroup <name> vm=<vmname1[,vmname2...]> [customcgname=<CgName>]
[bsitecgname=<CgName>]
```

- To modify a workgroup with custom consistency group name at the home site and at the backup site, run the following command:

```
ksysmgr modify workgroup <name>
{ [policy=<add | delete> vm=<vmname1|vmuuid1[,vmname2|vmuuid2...]>]
  [customcgname=<CgName>]
  [bsitecgname=<CgName>] }
```

- To view the details of a custom consistency group name in a disk group, run the following command:

```
ksysmgr query disk_group
```

An output similar to the following example is displayed:

```

Name: VMRDG_appy_DR_America_3
Site: America
Hosts: night_9179-MHD-1081BA6
Storages: saremote_emc
CG: DWG2_Bsite_cg

Name: VMRDG_appy_DR_India_3
Site: India
Hosts: d66crimea-8246-L2T-1006D4A
Storages: salocal_emc
CG: DWG2_Hsite_cg

```

Note:

- If the custom consistency group name is not provided for the EMC storage subsystem for the backup site or the home site, the KSYS subsystem automatically provides a default consistency group name for the EMC storage subsystems.
- If the workgroup feature is enabled for the host group, the custom consistency group name cannot be assigned at the host group level. In such cases, you must assign the custom consistency group name for each workgroup separately.



> Custom consistency group (CG) name for IBM XIV, IBM SAN Volume Controller (SVC), and Hitachi storage systems <

> You can customize the consistency group names of the IBM XIV, IBM SAN Volume Controller (SVC), and Hitachi storage systems. The consistency group name can be customized during the creation or modification of a host group or a workgroup. You can customize the consistency group name only before the first discovery of the host group or the workgroup. After the first discovery, setting up or modifying the custom consistency group name is not allowed. Also, setting up or modifying the custom consistency group name is not allowed when an operation is in progress in the host group or in the workgroup. The same customized consistency group name of a storage system is used for both the home site and the backup site.

- To create a host group with custom consistency group name, run the following command:

```
ksysmgr add host_group <host_group_name> hosts=<host1[,host2,...]> [customcgroupname=<CgName>]
```

Note: The SVC storage system considers only 15 characters for the consistency group name. If the input name (**customcgroupname**) consists of more than 15 characters, only the first 15 characters are considered for the consistency group name and the other characters are ignored during consistency group creation on storage. Similarly, each storage system type has its own criteria for the maximum length for the consistency group name. So, ensure that the consistency group name is in accordance with the respective storage system.

- To modify a host group with custom consistency group name, run the following command:

```
ksysmgr modify host_group <name> options [customcgroupname=<CgName>]
```

An output similar to the following example is displayed:

```
For host_group <name> attribute(s) 'customcgroupname' was successfully modified.
```

- To create a workgroup with custom consistency group name, run the following command:

```
ksysmgr add workgroup <name> vm=<vmname1[,vmname2...]> [customcgroupname=<CgName>]
```

- To modify a workgroup with custom consistency group name, run the following command:

```
ksysmgr modify workgroup <name>
{ [policy=<add | delete> vm=<vmname1|vmuuid1[,vmname2|vmuuid2...]>]
  [customcgroupname=<CgName>]}
```

- To view the details of a custom consistency group name in a host group, run the following command:

```
ksysmgr query hg [<host_group_name>]
```

An output similar to the following example is displayed:

```

Name: <hostgroup_name>
Home Site Hosts: none
Backup Site Hosts: none
Workgroups: none
Memory_capacity: Priority Based Settings
                  low:100
                  medium:100
                  high:100
CPU_capacity: Priority Based Settings
              low:100
              medium:100
              high:100
Skip_power_on: No
sriov_override: No
Site:
Vswitchmap: Not currently set
Vlanmap: Not currently set
DrVswitchmap: Not currently set
DrVlanmap: Not currently set
Type: symmetric
Custom CG Name: Hg2_customCg
Backup Site CG Name: Hg2_customCg

```

- To view the details of a custom consistency group name in a workgroup, run the following command:

```
ksysmgr query wg [<WGName>]
```

An output similar to the following example is displayed:

```

Name: DWG2
VMs: x66xxxxx005
      x66xxxxx004
Host_group: HG1
Site: Austin
Custom CG Name: DWG2_CUSTOMCG
Backup Site CG Name: DWG2_CUSTOMCG

```

- To view the details of a custom consistency group name in a disk group, run the following command:

```
ksysmgr query disk_group [<disk_group_name>]
```

An output similar to the following example is displayed:

```

Name: VMRDG_appy_DR_America_2
Site: America
Hosts: night_9179-MHD-1081BA6
Storages: saremote_svc
CG: Hg2_customCg

Name: VMRDG_appy_DR_India_2
Site: India
Hosts: d66crimea-8246-L2T-1006D4A
Storages: salocal_svc
CG: Hg2_customCg

```

Note: If the workgroup feature is enabled for the host group, the custom consistency group name cannot be assigned at the host group level. In such cases, you must assign the custom consistency group name for each workgroup separately.

⏪

Configuring the site-specific IP address

➤ If the home site and the backup site have different network configuration, the KSYS subsystem uses sample scripts to configure the network configuration provided by the user at the backup site. ⏪

You can find the sample script at the `/opt/IBM/ksys/samples/site_specific_nw` location. The sample script is placed at this location during the installation process.

Note: The site-specific IP address script is different for AIX virtual machines and Linux virtual machines. You must copy the script to the respective virtual machines and follow the instruction that is provided in the README file.

>| These sample scripts are used during the migration operation for the DR-only environment. For AIX environment, you must update the latest configuration file `site_specific_ip_config.cfg` with network configuration details for both source site and target site before migration operation starts. The `site_specific_ip_config.cfg` file helps you to avoid manual updates of the network configuration details for each migration. |<

For the Linux environment, follow the instructions in the readme file, `README_NW_IP_LINUX` to manually update the network configuration at the DR site.

For AIX environment, follow the procedure that is provided in the readme file in the AIX folder.

Configuring Single-Root I/O Virtualization (SR-IOV) override feature

>| You can enable the Single-Root I/O Virtualization (SR-IOV) override feature at the host group level and the site level. The Single-Root I/O Virtualization (SR-IOV) override feature is used during the restart operation. By default, the status of Single-Root I/O Virtualization (SR-IOV) override feature is not set for the site, and the status is disabled for the host group. |<

For more information about Single-Root I/O Virtualization (SR-IOV) override, see [IBM Power Systems SR-IOV Technical Overview and Introduction](#).

Setting up the Single-Root I/O Virtualization (SR-IOV) override flag status

>|

- To set up the Single-Root I/O Virtualization (SR-IOV) override flag status for a host group, run the following command:

```
ksysmgr modify host_group <HGNAME> options sriov_override=yes/no
```

- To set up the Single-Root I/O Virtualization (SR-IOV) override flag status for a site, run the following command:

```
ksysmgr modify site <SITENAME> sriov_override=yes/no
```

The following table displays the final effect of Single-Root I/O Virtualization (SR-IOV) override flag status:

Site SR-IOV Override flag	Host Group SR-IOV Override flag	Effective SR-IOV Policy for Host Group flag
Disabled/Unset	Enabled/Disabled/Unset	Enabled
Enabled	Disabled	Disabled
Enabled	Enabled/Unset	Enabled

|<

Discovering resources

After you add the various HMCs, hosts, host groups, and storage subsystems to the KSYS subsystem for disaster recovery management, you must run the `ksysmgr discover` command to discover all the hosts that are managed by the HMCs in both the home and the backup sites. During the discovery process, the

KSYS subsystem captures the configuration information of the home site and its relationship with the backup site and prepares the backup site to perform disaster recovery operations later.

During the initial discovery operation, the KSYS subsystem uses this configuration information to gather the list of VMs from all the host groups across sites and the corresponding disks for disaster recovery management. During any subsequent discovery operations, the KSYS subsystem scans the environment for any changes to the environment (for example, addition of a new VM, addition of a disk to VM, Live Partition Mobility (LPM) movement of a VM from one host to another host, and so on) and adapts to the modified environment.

The KSYS subsystem interacts with the HMC to retrieve the details about the disks of each VM and to check whether the VMs are currently set up for the storage devices mirroring. If the disks are not set up for mirroring properly, the KSYS subsystem notifies you about the volume groups that are not mirrored. All volume groups of a VM must be mirrored. Disks can be available over N-Port ID Virtualization (NPIV), virtual SCSI (vSCSI), and combination of both these modes.

The KSYS subsystem identifies and stores the Universally Unique Identifier (UUID) of the boot disk for each virtual machine during the discovery operation. The KSYS subsystem also stores the information about the corresponding replicated boot disks in the backup site. When you initiate a disaster recovery operation, the KSYS subsystem uses this information to boot the virtual machines with the corresponding boot disks on the paired host in the backup site. For example, if a virtual machine in the home site has multiple bootable disks, the KSYS subsystem restarts the virtual machine by using the corresponding boot disk in the backup site.

Note: The VM Recovery Manager DR 1.1 Service Pack 1, and later, identifies and stores the boot disk information only for POWER8 processor-based servers. The VM Recovery Manager DR solution requires HMC Version 8 Release 8.6.0 Service Pack 1, or later to support this feature. If your production environment contains an older version of host or HMC, the KSYS subsystem cannot store boot disk information and the virtual machines will restart in the backup site by using the first disk in the System Management Services (SMS) menu.

If the configuration is modified, for example, if a logical partition or a storage device is added, the KSYS subsystem rediscovers the home site, identifies the changes in the configuration, and marks the changes in its registries. The KSYS subsystem monitors this new environment for any disaster situations.

Note: For EMC storage subsystem, the Gatekeeper and Access Control Logix (ACLX) devices are ignored by the KSYS node during the discovery operation.

By default, the KSYS subsystem automatically rediscovers sites once in every 24 hours. You can change this period by modifying the **auto_discover_time** attribute. However, if you modified the configuration by adding or removing any resource, and you want the KSYS subsystem to rediscovers the resources immediately, you can manually run the **ksysmgr discover** command. If you run the discovery operation for a site, the KSYS subsystem might take a few minutes to discover all virtual machines from all the host groups across both the sites and to display the output. To save time, you can run the discovery operation for a specific host group that contains the hosts that you modified.

After a virtual machine migrated within a site or across the sites, and multiple disk is used, you must run the discovery operation manually. If you do not run the discovery operation manually, the periodic discovery suffices for the need of running discover manually.

Tip: To avoid configuration information loss on the KSYS node because of any node failure events, back up your current configuration settings as a snapshot after you complete the initial configuration of sites, hosts, host pairs, host groups, HMCs, and storage devices.

To discover resources in the KSYS configuration settings, complete one of the following steps in the KSYS LPAR:

- To discover all the resources across both sites, run the following command:

```
ksysmgr discover site site_name
```

The KSYS subsystem discovers all the hosts and virtual machines from all the host groups across both the sites. Therefore, it might take a few minutes to discover all the hosts and to display the output.

- To discover all the hosts in a specific host group, run the following command:

```
ksysmgr discover host_group hg_name
```

- To discover all VMs in a specific workgroup, run the following command:

```
ksysmgr discover workgroup workgroup_name
```

Note:

- To obtain boot disk information, which is used in multiple boot disk support during the verification and the move operations, the RMC connection of a virtual machine must be in active state.

VM auto-discovery

VM auto-discovery is a system-level property. You can disable or enable this property. By default, this property is enabled.

By default, the KSYS subsystem manages all VMs automatically. The VM auto-discovery property allows the KSYS subsystem to manage or unmanage the newly created VMs and undiscovered VMs.

If the VM auto-discovery property is enabled, all VMs are managed automatically. If the auto-discovery property is disabled, all the newly created VMs on the KSYS managed hosts and the undiscovered VMs (existing VMs that are not yet discovered by the KSYS subsystem) will not be managed by the KSYS subsystem.

- To check whether the VM auto-discovery property is enabled or disabled to discover the resources across the site, run the following command:

```
ksysmgr -a vm_auto_discovery query system
```

An output that is similar to the following example is displayed:

```
System-Wide Persistent Attributes
vm_auto_discovery: enable
```

- To enable the VM auto-discovery property, run the following command:

```
ksysmgr modify system vm_auto_discovery=enable
```

- To disable the VM auto-discovery property, run the following command:

```
ksysmgr modify system vm_auto_discovery=disable
```

Limitations

Consider the following limitations when you work with multiple boot list:

- For DR rehearsal operations, the multiple boot disk feature is not supported.

Related concepts

Saving and restoring snapshots

Use the **ksysmgr** command to save the configuration snapshots. The snapshots are saved in an XML format. When you create a snapshot, the **ksysmgr** command appends the date and time to the specified file name to follow the *filename.DateTime* name convention. By default, the snapshot files are saved in the `/var/ksys/snapshots` directory. However, you can specify the path where the snapshot files must be saved.

Related reference

Managing the system attributes

After you synchronize the KSYS cluster by using the **ksysmgr sync ksyscluster** command, the KSYS subsystem sets up the default system-wide persistent attributes. The KSYS subsystem uses these

system-wide persistent attributes for activities such as automatic rediscovery of the resources, notification of critical events, removal of duplicate notification.

Verifying the configuration

After the KSYS subsystem discovers the resources, it monitors the entire environment for any disaster situations and verifies whether the configuration setting is valid for both sites. This verification is required to ensure that the backup site is ready to host the workloads of the virtual machines from the home site during a site switch for disaster recovery operation. If you have set a priority to specific virtual machines, the verification operation is initiated for the virtual machines that have the highest priority.

To validate the configuration setting in both sites, complete one of the following steps in the KSYS node:

- To validate the configuration in the home site, run the following command:

```
ksysmgr verify site home_site_name
```

The KSYS subsystem validates the configuration settings on all the hosts and virtual machines from all the host groups across both sites. You can perform both the discovery and verification operations by running the following command:

```
ksysmgr discover site site_name verify=yes
```

- To validate the configuration for a specific host group, run the following command:

```
ksysmgr verify host_group hg_name
```

or,

```
ksysmgr discover host_group hg_name verify=yes
```

- To validate the configuration for a specific workgroup, run the following command:

```
ksysmgr verify workgroup workgroup_name
```

or,

```
ksysmgr discover workgroup workgroup_name verify=yes
```

If an error occurs during the verify operation, the ksysmgr command-line interface displays the error message. You can also run the `ksysmgr query system status` command to view the status of the virtual machine.

Daily checks by KSYS

The KSYS subsystem checks the active site in the VM Recovery Manager DR environment daily to ensure that any change in the configuration setting or resources is discovered and verified by the KSYS subsystem. The daily verification checks ensure that the workloads are always ready to be moved to the backup site if any disaster occurs.

The following table lists the checks that are performed by the KSYS subsystem:

Table 8. Checks performed by KSYS

Check type	Description
<p>Check the capacity of the backup host to host a disaster recovery failover</p>	<p>In the VM Recovery Manager DR solution, the backup hosts must be in the standby mode. The backup hosts must have enough capacity (CPU cores and memory) to host all the virtual machines from the partner host in the active site.</p> <p>The KSYS subsystem adds all the CPU and memory that are consumed by the virtual machines in the active site and compares the amount to the capacity of the host in the backup site. If the backup site does not have enough capacity, the KSYS subsystem generates the HOST_CAPACITY_CHECK event notification. Therefore, you must ensure that the backup host has enough capacity available.</p>
<p>Pre-verification and post-verification scripts</p>	<p>If you configure scripts by using one of the following commands, the KSYS subsystem executes these scripts during daily validation:</p> <ul style="list-style-type: none"> • <code>ksysmgr add script entity=site pre_verify=script_path</code> • <code>ksysmgr add script entity=site post_verify=script_path</code> <p>These customized scripts are run before or after the discovery and verification processes depending on how you specified the scripts to be run. For more information about scripts, see “Running scripts for additional checks” on page 130</p>
<p>Disk space check for the /tmp and /var directories</p>	<p>The KSYS operations require enough space in the /var directory to log the background daemon and storage messages. The KSYS operations also uses the /tmp directory to add or delete temporary files.</p> <p>The KSYS checks whether the space usage in the /var and /tmp directories has reached or exceeded 90%. If the space usage in the /var or /tmp directories exceeds 90%, the KSYS generates the TMP_USAGE_CROSSED_90PERCENT or VAR_USAGE_CROSSED_90PERCENT event notification.</p>

Table 8. Checks performed by KSYS (continued)

Check type	Description
EMC storage validation	<p>During storage agent verification, the KSYS subsystem queries EMC storage devices on both the active and backup sites, and checks for the composite groups and the disks that are associated with the composite groups.</p> <p>The KSYS subsystem checks whether the composite group exists. It also checks the composite group state, the composite group disk, the RDF group disk, and the replicated disk size. In addition, the KSYS also pings the local storage devices. If any discrepancy in the storage validation is detected, the KSYS generates the STORAGE_UNREACHABLE event notification.</p>
Disaster recovery verification	<p>The KSYS subsystem performs this verification daily to check the overall health of the active and backup sites if a disaster recovery operation is required at any time.</p> <p>This verification consists of the following checks:</p> <ul style="list-style-type: none"> • Logical partition validation to check whether the backup hosts are capable of running the workloads. • CPU and memory resources validation to check whether the backup hosts have required amount of CPU cores and memory resources. • Storage validations • Network validations

Related concepts

Notification for the KSYS events

The KSYS subsystem tracks various events that occur in the environment and saves the information in log files. The KSYS subsystem also sends emails and text notifications to the administrator if the contact information is registered on the KSYS configuration by using the **ksysmgr add notify** command.

High availability features

This section describes the features that are available in the HADR type of deployment of the IBM VM Recovery Manager DR for Power Systems solution and HADRHA type of deployment of the IBM VM Recovery Manager DR for Power Systems.

> The high availability features are available across sites, and within the same site. For example, you can back up a failed virtual machine and restart a virtual machine within the same site, or move the failed virtual machine to other site. The failover operations for disaster recovery can be performed from one site to another site.<

VM Recovery Manager DR high availability features for HADR type of deployment

The important high availability features of the HADR type of deployment of the VM Recovery Manager DR solution includes the following features:

- Live Partition Mobility (LPM) support within site

- Support for VM failure and host failure within site
- Application failover support within site
- Fibre Channel (FC) adapter failure within site
- Network adapter failure within site
- Monitoring CPU and memory usage within site
- Move operation and failover rehearsal operation across site and within a site
- >|Disaster recovery support from one site to another site|<

VM Recovery Manager DR high availability features for HADRHA type of deployment

>|The important high availability features of the HADRHA type of deployment of the VM Recovery Manager DR solution includes the following features:

- Live Partition Mobility (LPM) support both in home site and backup site
- Support for VM failure and host failure in both home site and backup site
- Application failover support in both home site and back site
- Fibre Channel (FC) adapter failure within site
- Network adapter failure within site
- Monitoring CPU and memory usage within site
- Move operation and failover rehearsal operation across the site
- Disaster recovery support from one site to another

<

File system usage monitoring

You can configure a specific LPAR and VIOS such that during each discovery operation, the KSYS subsystem fetches the size of the VIOS file system and the current file system usage in the VIOS. When the percentage of file system usage reaches the threshold value of 80%, the KSYS subsystem notifies you with a warning message so that you can make necessary updates to the VIOS file system.

The host monitor monitors the following file systems: /, /tmp, /usr, /var, /home. When the KSYS subsystem requests for the file system usage details, the host monitor responds with the details about the file system usage, which includes information about each file system and its usage. An event is generated when the file system usage surpasses the threshold value of the file system usage, also an event is generated when the file system usage moves under the threshold value.

ProactiveHA option

The ProactiveHA option monitors every managed VM in the host group, the CPU utilization, and network packet loss during virtual machine or host monitor communication. When a VM's CPU utilization exceeds 90% or when network packet loss is detected on each of the VM's adapters during virtual machine or host monitor communication, an event is generated. The threshold for CPU utilization is predefined. By default, the ProactiveHA option is enabled.

Fibre channel (FC) adapter failure detection

The KSYS subsystem monitors Fibre Channel (FC) adapter status. An event is generated if adapter failure is detected. To use this feature, the ProactiveHA feature must be enabled. The following events display the status of Fibre Channel (FC) adapter.

- SFW_ADAP_DOWN
- SFW_ADAP_UP
- SFW_PORT_DOWN

- SFW_PORT_UP

Configuring network isolation events

The KSYS subsystem uses the network isolation feature to configure the VIOS netmon file, which is used by IBM Reliable Scalable Cluster Technology (RSCT) to monitor the network status. The KSYS subsystem generates the NETWORK_ISOLATION_SUCESS and the NETWORK_ISOLATION_ERROR events depending on whether the configuration of the VIOS netmon file succeeded. You can use the ksysmgr command to configure the IP addresses for the VIOS netmon file. After the discovery operation completes, the KSYS subsystem checks the configured IP addresses at site remote copy program (RCP) and generates a put message request for the host monitor to configure the VIOS netmon file. To add the IP addresses for network isolation detection feature, run the following command:

```
>|ksysmgr modify system network_isolation=[IP1,IP2,IP3|ALL] action=add|<
```

To delete the IP addresses from the network isolation detection features, run the following command:

```
>|ksysmgr modify system network_isolation=[IP1,IP2,IP3|ALL] action=delete|<
```

Automatic replacement of repository disk

The HADR type of deployment of the VM Recovery Manager DR solution supports automatic replacement of the repository disk. To automatically replace the repository disk, you must provide the details about the backup repository disk. A maximum of six backup repository disks can be added for automatic replacement. When the storage framework detects failure of a repository disk, the KSYS subsystem sends an event notification. Then, the KSYS subsystem searches each disk on the backup repository list and locates a valid and active backup repository disk, and replaces the failed repository disk with the backup repository disk without any interruption. The failed repository disk will then be placed as the last backup repository disk in the backup repository disk list. The failed backup repository disk can be reused after the disk failure is fixed and it becomes valid and active.

Setting up KSYS high availability through PowerHA SystemMirror

The KSYS subsystem is a major component in VM Recovery Manager DR, which monitors and manages the complete environment health. Hence, setting up high availability for the KSYS subsystem will be helpful to handle any scenario where the KSYS daemon hanged or the KSYS node went down. This high availability can be set up by managing the KSYS daemon by using PowerHA SystemMirror software. To manage the KSYS daemon through PowerHA SystemMirror software, PowerHA SystemMirror must be configured to monitor and manage the KSYS daemon by using custom scripts.

Prerequisite

- PowerHA SystemMirror 7.2.1, or later must be installed
- VM Recovery Manager DR 1.4, or later must be installed
- The hostname and the IP address of the KSYS node must have entry in the /etc/hosts file. Only the IP address of the PowerHA node must have entry in the /etc/cluster/rhosts file.
- The variable `CT_MANAGEMENT_SCOPE=2` must be defined in the .profile file for all nodes, and must be exported by running the `export` command
- When two-node PowerHA SystemMirror is integrated with the KSYS subsystem, the rootvg file system must have minimum 30 GB space on each PowerHA node
- The repository disk must be shared across all KSYS nodes, and must have minimum 5 GB space
- All nodes of the PowerHA cluster must have connectivity to the storage agents that are to be added to the KSYS cluster

Concept

When the PowerHA SystemMirror cluster is created, Reliable Scalable Cluster Technology (RSCT) cluster is also created. The RSCT cluster creates the resource manager (RM) framework and allocates resources (including KSYS RM resources) to the KSYS subsystem. Hence, the KSYS subsystem can use the RSCT cluster and the resource manager framework instead of creating a new RSCT cluster. This ensures that the configuration settings and saved data or modifications to the data in one KSYS node reflects in the other KSYS node. The KSYS daemon can be monitored by custom scripts of the PowerHA SystemMirror resource group. The resource group remains online on one node at a time. If the KSYS node goes down, the resource group moves to a different node. The KSYS node, to which the resource group has moved, starts monitoring and managing the environment. This ensures high availability between KSYS nodes.

KSYS high availability through PowerHA SystemMirror

Complete the following procedures to set up the KSYS subsystem's high availability through PowerHA SystemMirror:

1. [“Configuring PowerHA SystemMirror in VM Recovery Manager DR solution” on page 85](#)
2. [“Configuring the KSYS subsystem for high availability through PowerHA SystemMirror” on page 85](#)

Configuring PowerHA SystemMirror in VM Recovery Manager DR solution

To create a PowerHA SystemMirror cluster in KSYS nodes, complete the following steps.

Note: Before starting the configuration procedure, ensure that the setup (hardware, VIOS, node, etc.) is ready and PowerHA SystemMirror and the KSYS subsystem is installed on your KSYS nodes.

1. Run the `phaksyssetup` setup script that is located at `/opt/IBM/ksys/samples/pha/`.
2. In the menu option of the script, select the **Linked cluster (DR)** option for the DR cluster, the **Linked Cluster (HADR)** option for the HADR cluster, the **Linked Cluster (HADRHA)** option for the HADRHA cluster, or the **Standard Cluster (HA)** option for the HA cluster.
3. Specify the KSYS node names and the shared disk name for the repository.
4. Run the `clcmd lssc -ls clstrmgrES | grep STABLE` command to check the stability state of the PowerHA cluster. The PowerHA cluster must be in the stable state.
5. Check the state of the resource group. The resource group state must be online on one PowerHA node and offline on the other PowerHA node.

After you have provided the required details, the sample script creates a Linked cluster.

The setup script creates the following PowerHA SystemMirror resources:

- Resource group: `ksysRG`
- Startup monitor: `ksysmonstartup`
- Startup monitor script: `/opt/IBM/ksys/samples/pha/startupmonksys`
- Long running monitor: `ksysmonlongrun`
- Long running monitor script: `/opt/IBM/ksys/samples/pha/longrunmonksys`
- Start script: `/opt/IBM/ksys/samples/pha/startksys`
- Stop script: `/opt/IBM/ksys/samples/pha/stopksys`
- File collection: `ksysfiles`

For more information about the configuration, see <https://www.ibm.com/downloads/cas/EDYPDYGJ>.

Configuring the KSYS subsystem for high availability through PowerHA SystemMirror

After the PowerHA SystemMirror cluster and PowerHA SystemMirror configuration is stable, you must add the KSYS resources to the KSYS configuration.

Before setting up the KSYS configuration, ensure that the following prerequisites are met:

- If you run the `ksysmgr query cluster` command in the KSYS nodes, it must display the cluster name and the cluster type.
If the `ksysmgr query cluster` command does not display the correct cluster name and the correct cluster type, the `/var/ksys/config/ksysmgr.xml` file might have errors.
- On all KSYS nodes, IBM.VMR must be in an active state.
To check the state of the IBM.VMR daemon, run `clcmd lssrc -s IBM.VMR` command from the PowerHA SystemMirror node.
- PowerHA SystemMirror resource group must be online on the group leader node.
To view the group leader node, run the `lssrc -ls IBM.ConfigRM | grep -w "Group Leader"` command in the KSYS node.

After the prerequisites are met, you can add KSYS resources such as sites, HMC, host, host group, and storage agents and perform regular operations.

Deleting the KSYS subsystem configuration and PowerHA SystemMirror cluster

To delete the KSYS subsystem configuration and PowerHA SystemMirror cluster, complete the following steps:

1. Set the PowerHA SystemMirror cluster to an offline state by running the `clmgr offline cl` command. After running the command, wait until the state of the PowerHA cluster turns to INIT. You can check the state of the PowerHA cluster by running the `lssrc -ls clstrmgrES | grep State` command.
2. Delete all host groups from the KSYS configuration using the `ksysmgr delete host group` command.
3. Delete the PowerHA SystemMirror cluster by running the `clmgr del cl` command.

Limitations

Consider the following limitations for the KSYS subsystem's high availability through PowerHA SystemMirror:

- To sync configuration settings between KSYS nodes, the IBM.VMR daemon must be active on both KSYS nodes.
- If a current group leader KSYS node fails, the next available KSYS node resumes control only after the IBM.VMR daemon is stopped and restarted.
- Only two KSYS nodes are supported in a PowerHA SystemMirror cluster for the KSYS subsystem's high availability.

Recovering the virtual machines during a disaster

After the verification phase, the KSYS continues to monitor the active site for any failures or issues in any of the resources in the site. When any planned or unplanned outages occur, if the situation requires disaster recovery, you must manually initiate the recovery by using the **ksysmgr** command that moves the virtual machines to the backup site.

Failover rehearsal of the disaster recovery operation

The KSYS subsystem can perform a failover rehearsal at the backup site in the disaster recovery environment, without disrupting the production workloads or the storage replication from the active site to the backup site.

The failover rehearsal feature is supported for the following storage subsystems:

- EMC SRDF family of storage systems (for example, VMAX)
- SAN Volume Controller (SVC) and Storwize family of storage systems
- DS8000 storage systems
- Hitachi storage systems
- IBM XIV Storage System

Notes:

- The DR failover rehearsal feature is supported only for disaster recovery and not high availability.
- The DR failover rehearsal feature is not supported for heterogeneous storage systems and shared storage model of deployment.

The failover rehearsal feature is useful to rehearse the disaster recovery operation without performing a real DR failover and to test the readiness of the entire environment. It provides you the flexibility to perform DR testing more frequently. These failover rehearsal operations allow you to perform various workload-related tests that include write operations in the virtual machines (VMs) for a longer period of time.

You can test the disaster recovery operation at host group level or at the entire site level. In a test disaster recovery operation, the virtual machines in the active site continue to run the existing workloads and are not shut down. The storage replication between the storage devices in the active site and the backup site is also not impacted by the test disaster recovery operation.

Since the VMs continue to run in the active site when duplicate test VMs are started on the backup site as part of the failover rehearsal operation, you must ensure network isolation between the active site VMs and the test VMs that are started on the backup site. You can change the VLANs of the test VMs by using the network attribute of the **ksysmgr modify** command that helps to isolate the network on the backup site or you can use some other method to achieve network isolation between the sites.

The following figure shows a high-level flow diagram for a DR failover rehearsal as compared to a regular DR failover operation.

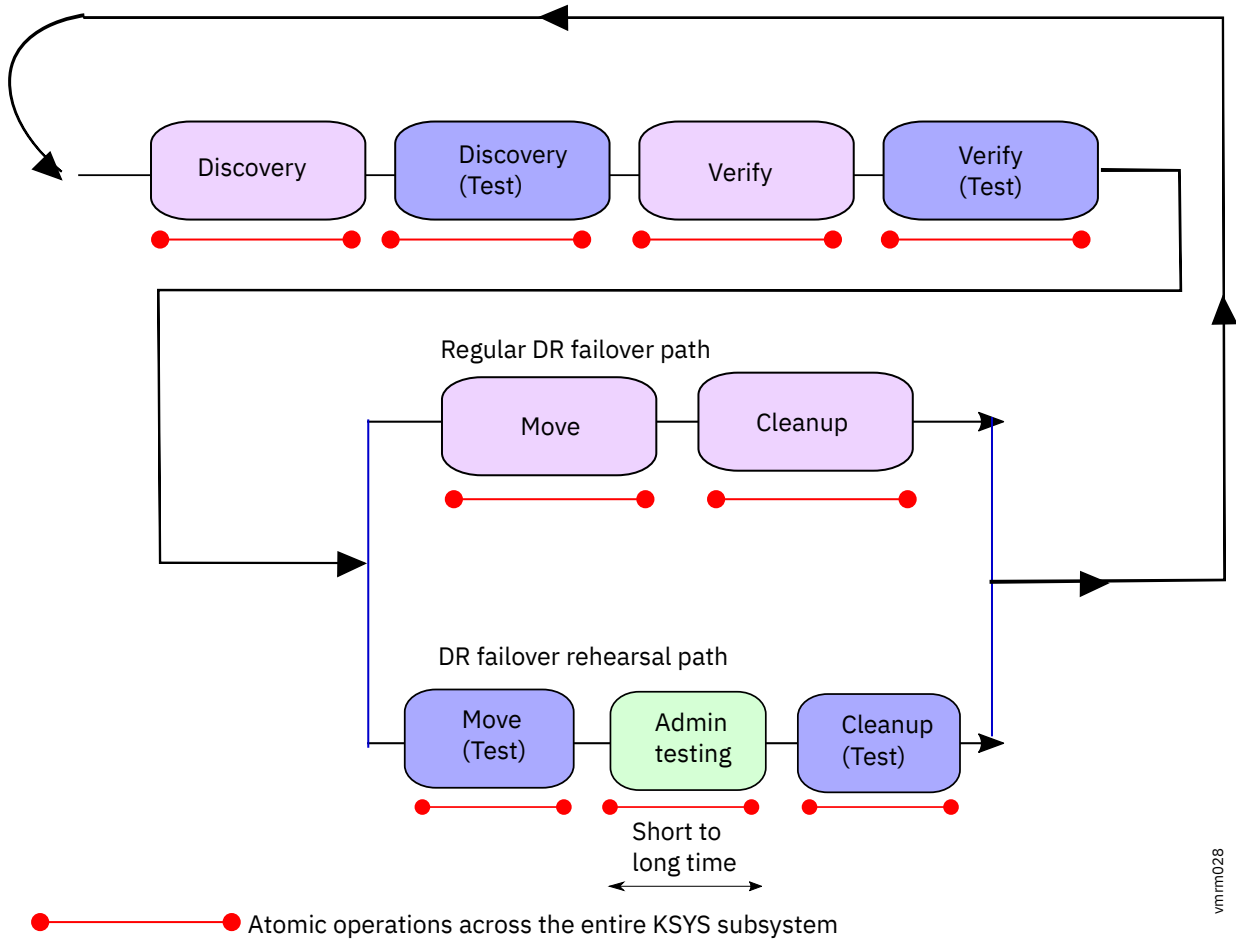


Figure 23. DR failover rehearsal flow

Notes:

- You can perform DR failover rehearsal for a single host group, multiple host groups, single workgroup, all workgroups in host group or the entire site. If you are running the failover rehearsal operation at host group level, you must start the operation sequentially for each host group. Similarly, if you are running the failover rehearsal operation at workgroup level, you must start the operation sequentially for each workgroup in a host group. If you are running the failover rehearsal operation at site level, all the host groups are handled in parallel.
- After the DR failover rehearsal starts for a host group or a workgroup, you cannot perform regular move operations on the same host group or the same workgroup, or on the entire site for the entire duration of DR failover rehearsal time.
- You must not perform Live Partition Mobility operation of virtual machines into or out of the host group or the workgroup that is under the test operation for the entire duration of DR failover rehearsal. When the LPM operation is started directly through the HMC, the KSYS subsystem cannot stop those operations. Therefore, if a host group or a workgroup is under DR failover rehearsal and a VM is moved into or out of the host group or workgroup as part of the LPM activity, the results are unpredictable.
- You cannot change the configuration settings for host groups or the workgroups within a host group that are under DR failover rehearsal operation.
- For periods of time that are marked as atomic operation in the figure, you cannot start DR failover rehearsal operation or a regular move operation for any other host group, workgroup, or site.
- You can perform regular move operation for the other host groups and workgroups other than the host groups and workgroups that are in DR failover rehearsal mode. Thereby you can recover host group HG1 while simultaneously testing host group HG2, and you can recover workgroup WG1 while simultaneously testing workgroup WG2.

- If a real disaster occurs during a planned DR test time and you want to perform a real recovery related to a disaster, you can quit the DR failover rehearsal mode by executing the cleanup step.
- The cleanup step in regular DR move operation is different than the DR test move operation. If failover rehearsal operation is performed, you must manually perform the cleanup steps.
- For a regular unplanned DR move operation, the cleanup step is mandatory. The cleanup step must be performed after the move operation is complete at the earlier-active site.
- When the test-cleanup operation is in progress, you cannot perform any other operations on the KSYS subsystem. You cannot work on the test VMs also because the test VMs are deleted as part of the cleanup process.
- When you perform the rehearsal cleanup operation, the VM console that is opened in the HMC must be closed.
- If you want to save a snapshot of the current configuration settings of your KSYS environment, you must save a detailed snapshot so that the tertiary disk values are also retained in the snapshot. If you want to know the tertiary disk information after restoring a basic snapshot, you must run the discovery operation with the **dr_test** flag.
- The error messages for any failover rehearsal operations are displayed only in the output message of the operation. The error messages are not displayed in the output of the **ksysmgr query system status** command.
- >| The command `ksysmgr -t verify site site_name dr_test=yes` verifies the disk mapping status at the storage level. This command does not start the regular verify operation. |<
- >| During the failover rehearsal operation, the quick-discovery feature is blocked until the failover rehearsal operation is completed. Also, the event notification is blocked. |<

The following figure shows an example of failover rehearsal of all the virtual machines in a host:

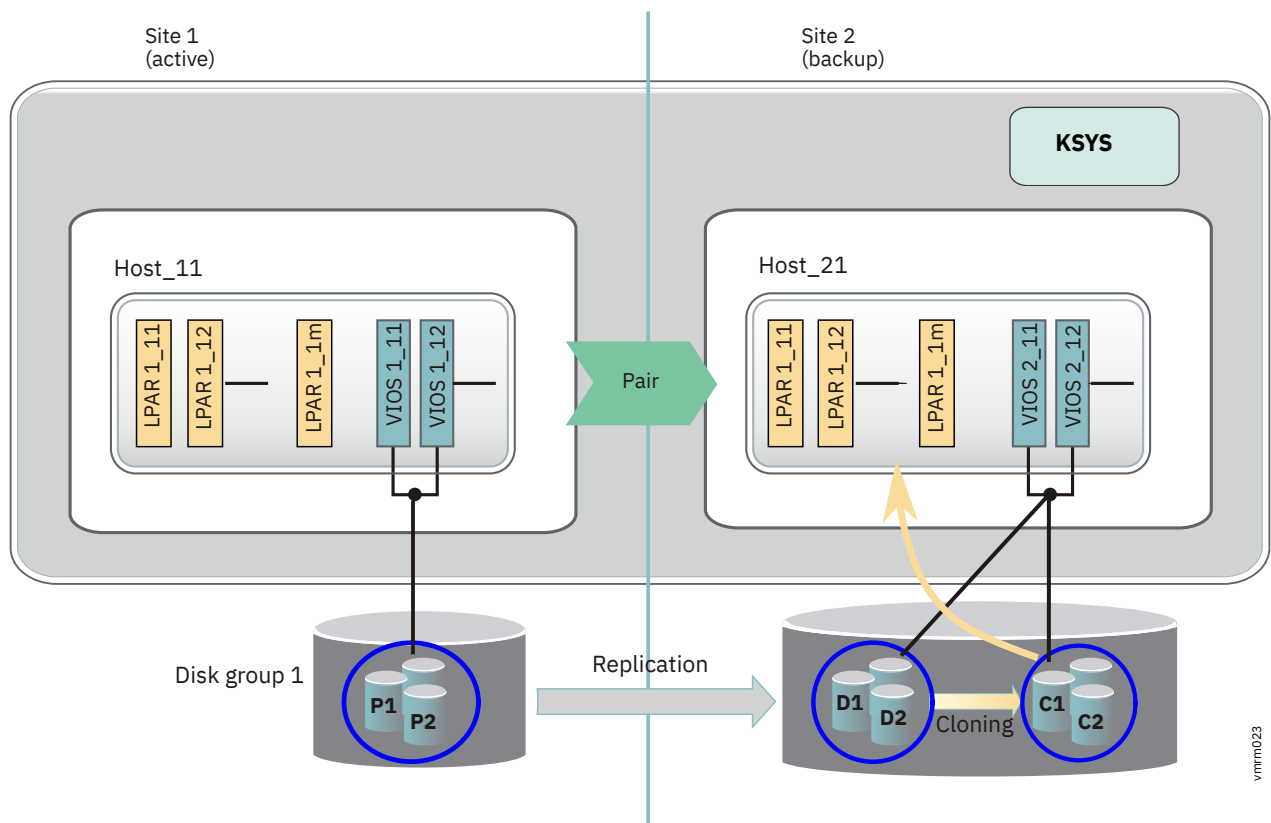


Figure 24. Example for failover rehearsal of the disaster recovery operation

Storage prerequisite

The storage administrator must have mapped all the hosts in the backup site to the backup storage disks (D1, D2, and so on). The storage administrator must also have created a set of clone disks (C1, C2, and so on) that are of the same number and size as the active site storage disks (P1, P2, and so on) and backup storage disks (D1, D2, and so on). The cloning (D1-C1, D2-C2, and so on) must be started from the backup storage disks to the clone disks. The storage administrator can set up the cloning relationship by using interfaces (command-line or graphical user interface) that are provided by specific storage vendors. Refer to documentation from the storage vendor for more details about allocation of storage disks and establishing relationship with secondary copy of data on the backup site. The following table lists the tools that are necessary for establishing cloning relationship for various storage systems.

<i>Table 9. Storage vendors and the corresponding cloning feature</i>			
Storage vendor	Clone feature	Sample command	Reference
EMC SRDF family of storage system (for example, VMAX)	symclone	<pre>symclone -sid <sid> -f clone create -diff -nop -force symclone -sid <sid> -f clone activate -nop - force</pre>	EMC Solutions Enabler CLI User Guide
SAN Volume Controller (SVC) and Storwize family of storage systems	Flashcopy	<pre>svctask mkfcmap - cleanrate 0 - copyrate 0 - source <D1> - target <C1></pre>	Managing Copy Services in SVC
DS8000 storage system	Flashcopy	<pre>dscli -user <user_name>- passwd <password> -hmc1 <ds8k_ip> mkflash -persist -dev <serial_number> <D1>:<C1></pre>	Redbook: IBM System Storage DS8000 Copy Services Scope Management and Resource Groups
IBM XIV Storage System	Snapshot	<p>For sync type of replication:</p> <pre>xcli -u <user_name> -p <password> -m <XIV_IP> snapshot_create vol=<D1> name=<flash_disk></pre> <p>For async type of replication, the KSYS subsystem creates the clone disks automatically.</p>	

Table 9. Storage vendors and the corresponding cloning feature (continued)

Storage vendor	Clone feature	Sample command	Reference
Hitachi Storage Systems	Shadow image	<ol style="list-style-type: none"> 1. Create the Hitachi Open Remote Copy Manager (HORCM) configuration file with the DR instance in the KSYS node. Ensure that the DR instance configured in the HORCM is in active state. 2. In the GUI of the target storage, create a dummy host on the port which has the target host. Note: Do not assign worldwide port name (WWPN) in this stage. 3. Create a Logical Device (LDEV) with the size equal to the size of the target logical disk. The LDEV will be used as the shadow image of the target logical device. 4. Map the path of the logical unit number (LUN) to the dummy host you created in the earlier steps. 5. To create a clone, navigate to Replication > Local replication > Create SI. 6. Once the shadow image is created, resync the shadow image. To resync the pair, navigate to Replication > Local replication > Select the replication > Resync Pair 	

Performing the DR failover rehearsal operation

The disaster recovery (DR) failover rehearsal operation contains the steps described in the topic.

Table 10. DR failover rehearsal flow

Step	Administrator action	KSYS operations
Pre-test environment setup (must be performed only once)	<ol style="list-style-type: none"> 1. Configure the disks that are required for cloning and will be used as third copy of disks. 2. Ensure correct disk connectivity and mappings on the backup site. 3. Establish clone relationships between second and third copies of disks on the backup site. 4. Ensure network isolation for VMs that are started on the backup site and for VMs on active site. 	None.

Table 10. DR failover rehearsal flow (continued)

Step	Administrator action	KSYS operations
<p><u>Discover the DR test environment</u></p>	<p>Run the ksysmgr discover command in test mode by entering the following command:</p> <pre>ksysmgr discover workgroup host_group site name dr_test=yes</pre>	<p>The KSYS subsystem discovers the test environment and prepares the environment for the test move operation.</p> <p>During this step, data from the second copy of disks is copied to third copy of disks. After you run this step, you must run commands that are provided by the specific storage vendor to check the completion of the copy operation. You can start the failover test operation only after the copy operation is complete.</p>
<p><u>Verify the test environment</u></p>	<p>Run the ksysmgr verify command in test mode by entering the following command:</p> <pre>ksysmgr verify workgroup host_group site name dr_test=yes</pre>	<p>This step checks the test environment and confirms that the environment is ready for the test-move operation. You can perform this step any number of times, if required.</p>
<p><u>Start the VMs in the DR test environment</u></p>	<p>Run the ksysmgr move command in test mode by entering the following command:</p> <pre>ksysmgr move workgroup host_group site name dr_test=yes</pre>	<ul style="list-style-type: none"> • This step starts the VM on the backup site systems by using the third (test) copy of disks. The KSYS subsystem displays any issues and error messages. • The move operation changes storage level mapping. The move operation maps third copy of disks to target VIOS and unmaps the secondary disks. The cleanup operation unmaps the third copy of disks and maps the secondary disks to target VIOS.
<p><u>Perform testing activities</u></p>	<ul style="list-style-type: none"> • Access the newly started VMs and perform all the read or write tests in the VMs. • Ensure that network traffic is isolated during this period of test. 	<p>None.</p>
<p><u>Cleanup of DR test environment</u></p>	<p>Run the ksysmgr cleanup command:</p> <pre>ksysmgr cleanup workgroup host_group site name dr_test=yes</pre>	<ul style="list-style-type: none"> • Deletes all the test VMs and configures the storage settings in VIOS to map back to secondary disks. • Retains the clone relationships so that DR test can be performed again, if required, after performing a new discovery in test mode. • If the test move operation fails, you must run the test cleanup operation to correct the configuration settings for the next DR operation. Some failures might need manual intervention and troubleshooting.

The detailed description of DR failover rehearsal flow follows:

1. Pre-test environment setup (must be performed only once)

Before you enable the DR test mode, you must set up the following prerequisites once:

1. Ensure that disks that are related to third clone copy exist on the backup storage subsystem. Establish clone relationship between the second copy disks and the third copy (test) disks. You can perform this step once and retain disks for any future testing.
2. Ensure that connectivity to all the relevant disks (second and third copy disks) exist to the VIOS on the backup site systems because the backup site hosts and Virtual I/O Servers cannot access the active site disks. Poor connectivity can cause problems during the boot operation of test VMs.
3. Ensure proper network isolation of the DR test environment from the active site VMs. If network is not isolated, the DR rehearsal operation can impact the production environment. The KSYS subsystem supports specific VLANs for setting up the DR test environment. You can plan and predefine the VLANs that must be deployed with test VMs when the DR testing is performed.

Note:

- The clone disks configuration is required on both sites if you intend to perform DR testing on any of the two sites. The KSYS subsystem enables the DR failover rehearsal mode only on the backup site. But backup site can be any one of the two sites, depending on the previous failover operation.
- Virtual switches and VLAN IDs that are specific to DR failover rehearsal operation are created on the target site based on mapping details as a part of the DR test operation. Network issues that are related to these fields are not validated in the verification operation. Therefore, you must specify VLAN IDs that have proper physical connectivity.
- Only a single clone relationship must exist for each secondary disk during the test-discovery operation. The secondary disk cannot have a multiple-clone relationship with any other disks.

For DS8000 storage system, the FlashCopy clone copies are already created for Global Mirror type of data replication that are used internally within the storage system. The KSYS subsystem differentiates the clone copy disks with Global Mirror FlashCopy disks by using the **TargetWriteEnabled** field.

Use the following command to create the FlashCopy clone relation between secondary disks and clone disks:

```
mkflash -persist -dev sid LUN1:LUN2
```

2. Discover the objects and relationships that are specific to the test environment

In this step, you request the KSYS subsystem to discover and enable the DR failover rehearsal or DR test mode. The KSYS subsystem displays information about the DR test mode when you run various reporting commands.

To discover and initialize the backup environment in the DR failover rehearsal mode, enter the following command:

```
ksysmgr discover workgroup|host_group|site name dr_test=yes
```

Note:

- During this step, some of the setup activities are also performed. The KSYS subsystem requests the storage subsystem to copy secondary disk data (D2) to third disk (D3). Because the copy operations can take few minutes, depending on the number of disks and sizes of the disks, you must use commands that are provided by the specific storage vendors to check the completion of the copy operation. The following table lists some command examples for various storage systems.

Storage vendor	Command example
EMC SRDF family of storage system (for example: VMAX)	<code>symclone verify -f file_with_pairs</code>

Table 11. Storage vendors and corresponding command examples (continued)	
Storage vendor	Command example
SAN Volume Controller (SVC) and Storwize family of storage systems	<code>svcinfolsfmap grep disk_UUID</code>
DS8000 storage system	<code>lsflash -l 1023:1024 ...</code>

- The KSYS subsystem also identifies all the necessary objects for the test environment and indicates whether the environment is ready for the test-verify or test-move operation. If any failure occurs, you must correct the issue and retry the discovery operation.
- The test-discovery step initiates the disk copy operation. Therefore, the test-discovery step must be repeated if there is long elapsed time between previous test-discovery operation and the test-move operation.
- Any configuration changes after a test-discovery operation invalidates the previous discovery operation. If configuration settings are changed after a test-discovery operation, you must perform another test-discovery operation.
- You can run the test-discovery operation as many times as needed.

For information about how to troubleshoot common problems in the test-discovery step, refer to the following sections:

- [“The test-discovery step in the DR failover rehearsal operation is failing with the error message: Tertiary storage copy is missing.” on page 188](#)
- [“The test-discovery step in the DR failover rehearsal operation is failing with the error message: Storage agent is not accessible.” on page 188](#)

3. Verify the test environment readiness for test-move operation

Validate the backup environment for DR test mode by entering the following command:

```
ksysmgr verify workgroup|host_group|site name dr_test=yes
```

This step checks the test environment and confirms that the environment is ready for the test-move operation. If any failure occurs, you must correct the issue and retry the verify operation. You can perform this step any number of times, if required.

Notes:

- The test-verify operation validates the configuration settings only at storage level. Issues, such as target VIOS down and other resource gaps are not detected as a part of this operation. Hence, you must invoke a regular verify operation for verification of the entire environment. You can also refer to the periodic automatic validations that occur once in every 24 hours.
- You must validate the VLAN and virtual switch network mapping policies and attributes across both the sites. If the specified configuration is not valid in the backup site, the disaster recovery rehearsal operation fails.

4. Start the VMs in the DR test environment

The KSYS subsystem restarts all VMs for the entire site, a specific host group, a specific workgroup, or all workgroups in a host group within the test environment. The KSYS subsystem attempts to restart the VMs on the backup hosts in the backup site. To start the VMs on the backup hosts in DR test mode, enter one of the following commands:

```
ksysmgr move workgroup|host_group nameto=backup_site_name dr_test=yes
```

or,

```
ksysmgr move site from=nameto=backup_site_name dr_test=yes
```

The KSYS subsystem initiates the test-move operation by breaking the cloning relationship (D1-C1, D2-C2, and so on) in the storage subsystem. The cloned storage disks are mapped to the newly started virtual machines. The storage replication between the active site storage disks and the backup site storage disks (P1-D1, P2-D2, and so on) is retained.

The KSYS subsystem displays any errors that occur while starting the virtual machines. The KSYS subsystem restarts the VMs according to the various policies that are configured for the regular DR environment. For example, if you configured for flexible capacity, the VMs are started by using the flexible capacity policies. Similarly, if you have configured the network mapping policy, the VMs will be started with the configured test VLANs.

After the VMs are started in the backup site, you must manage the test environment. Because the backup systems are used for failover test, regular move operation cannot be performed for the host group or the site that is undergoing the test operation. You can perform regular planned or unplanned DR failover only after the test VMs are cleaned up and the KSYS subsystem operates in normal mode.

5. Perform testing activities

In this step, you can use the test VMs that are started as part of the DR rehearsal process. You can perform both read and write test operations on the third cloned copy disks that are mapped to the VMs. If you have ensured network isolation, you can also start the workload in VMs and run test operations as required to validate the middleware on the backup site.

There is no time limit for performing the failover rehearsal operation. However, during the DR test mode period, you cannot perform a regular DR move operation from the active site to the backup site because the backup hosts are being used up by the DR rehearsal process. You can quit the DR failover rehearsal mode, clean up the DR test environment, and then perform the regular DR move operations.

6. Cleanup of DR test environment

After your testing activities on the VMs are complete, you can request the KSYS subsystem to clean up the test environment and resume the regular DR mode for the workgroup or host group or site that is undergoing the test operation.

To clean up the DR test environment and to retain the normal DR backup state, enter the following command:

```
ksysmgr cleanup workgroup|host_group|site <backup_sitename> dr_test=yes
```

When you perform the cleanup operation in the DR failover rehearsal mode, the KSYS subsystem deletes the test VMs and resets the environment back to point to the second copy of disks and moves the environment to regular DR mode.

When you clean up the virtual machines in the backup site, the following steps are performed by the KSYS subsystem:

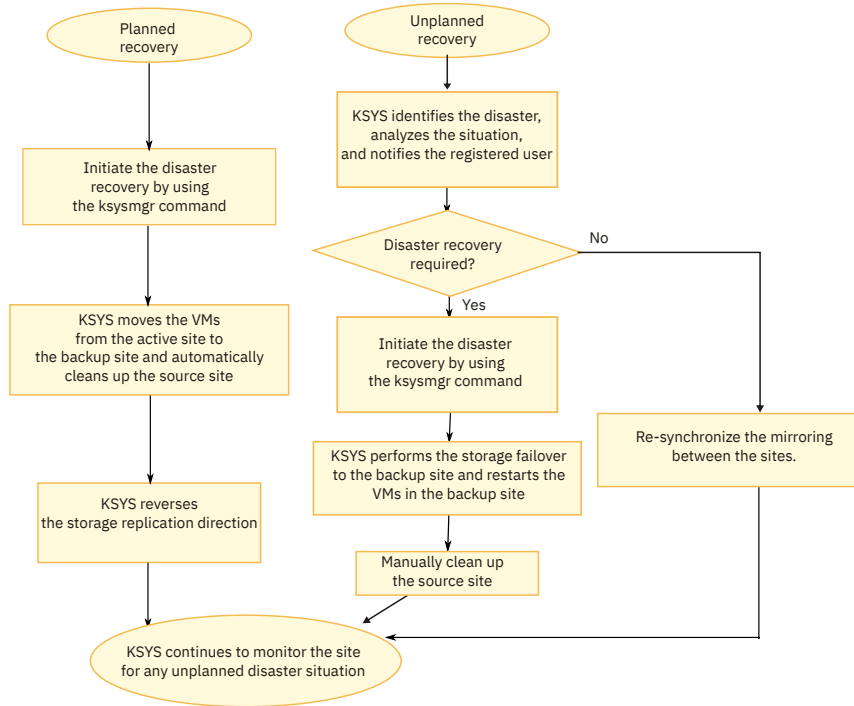
- Third copies of test disks (C1, C2, and so on) are unmapped from the virtual machines.
- The previously mapped second copies of storage disks (D1, D2, and so on) are mapped again to the virtual machines.
- The cloning is restarted between the storage disks (D1-C1, D2-C2, and so on) for future test.

After the cleanup operation is complete, the KSYS subsystem starts operating in normal mode and any other operation (for example, discovery, test-discovery, verify, test-verify) can be performed for the specific host group or workgroup.

Flow chart for disaster recovery

After the KSYS configuration is verified, the KSYS monitors the active site for any resource failures in the site and notifies you about the unplanned outage.

The following flow chart provides a summary of the disaster recovery steps:



vmm011

Figure 25. VM Recovery Manager DR solution: Disaster recovery process

Initiating the disaster recovery

In a planned recovery, you can initiate the site switch by using the **kysmgr** command. In an unplanned outage, the KSYS subsystem analyzes the situation and notifies you about the disaster or potential disaster. Based on the information about the disaster, you can determine whether a site switch is required.

When issues occur in the replication of storage subsystem, the KSYS preserves the storage consistency information and notifies you about the issue by using the specified notification method such as email, text message, or pager email. You can evaluate the health of the system by using the KSYS information, HMCs, and applicable storage vendor tools to determine whether the situation requires a true disaster recovery.

If the situation requires disaster recovery, you must manually initiate the recovery operation by running the move command via command-line interface (CLI) or graphical user interface (GUI). After the move operation completes, the virtual machines or the LPARs are restarted automatically on the corresponding target hosts.

For a planned recovery, the storage replication direction is reversed from the current active site to the earlier active site. After the site switch is complete, the KSYS automatically cleans up the source site from where the switch was initiated. For an unplanned recovery, the storage is not replicated back to the previously active storage. Therefore, after the problems in the previously active site are resolved, you must manually resynchronize the storage. A resynchronization is necessary for any subsequent planned move operation. Also, you must manually clean up the source site from where the switch was initiated after the HMC and hosts become operational.

If the virtual machines, which are moved from the active site to the backup site within the paired hosts, have multiple boot disks, the KSYS subsystem uses the stored information about the boot disk list during the discovery operation to boot the virtual machines by using the corresponding boot disks in the backup site. The boot disk information is available in the IBM.VMR_LPAR resource class for each virtual machine. Before you initiate a disaster recovery operation, ensure that the boot disks in the active site are replicated to corresponding disks in the backup site and the KSYS subsystem contains HMC Version 8 Release 8.6.0 Service Pack 1, or later. This feature is supported only for POWER8 processor-based servers. If your production environment contains an older version of host or HMC, the KSYS subsystem

cannot store boot disk information and the virtual machines will restart in the backup site by using the first disk in the System Management Services (SMS) menu.

To recover the virtual machines, complete the following steps in the KSYS node:

1. Optional: Verify whether a disk pair and disk group exist before you initiate the recovery.
 - a. To determine the relationship of disks between the active site and the backup site, run the following command:

```
ksysmgr query disk_pair
```

- b. To verify that the composite disk group exists in both the active site and the backup site, run the following command:

```
ksysmgr query disk_group
```

2. Switch the site from the active site (Site1) to the backup site (Site2) for planned or unplanned recovery by running the following command:

```
ksysmgr move site from=Site1 to=Site2  
dr_type=planned|unplanned  
cleanup=yes|no  
site_down=yes|no
```

If you do not specify the **dr_type** attribute, the **ksysmgr** command starts a planned recovery by default. The logical partitions automatically restart in the backup site.

In case of a planned recovery, the KSYS automatically cleans up the source site from where the switch was initiated. In case of an unplanned recovery, you must manually clean up the source site after the HMC and hosts become operational. However, if you specify the **cleanup=no** attribute during a planned recovery, the virtual machines are not cleaned up from the source site.

For unplanned move operations, you can set the **skip_shutdown** attribute to yes to indicate that the source site is not operational and therefore, the KSYS subsystem does not attempt operations such as shutting down the VMs on the source site. You must ensure that the source site is not operational before you use this attribute.

Note: If you start a move operation for a specific host group or workgroup, and the move operation fails, the state of the host group or workgroup becomes RECOVERY_VM_ONLINE. In this case, you cannot start the move operation for the entire site unless the failed host group or workgroup is recovered completely. Therefore, you must recover the failed host groups and workgroups in a host group before you attempt a move operation for the entire site. Otherwise, you can continue to move the other host groups and workgroups to the backup site individually.

3. For an unplanned recovery, clean up the source site (Site1) manually by running the following command:

```
ksysmgr cleanup site Site1
```

4. For an unplanned recovery, resynchronize the storage data from the active site to the backup site by running one of the following commands:

```
ksysmgr resync site active_site_name  
ksysmgr resync host_group active_hg_name  
ksysmgr resync workgroup active_workgroup_name
```

If the unplanned move operation was at site level, you must run the **ksysmgr resync** command at site level. Similarly, if a virtual machine was moved to the backup site in an unplanned move operation at host group level or workgroup level, you must run the **ksysmgr resync** command at host group level or workgroup level.

Recovering the failed virtual machines

After the site switch operation is complete, if some virtual machines were not moved successfully, you can use the **ksysmgr recover** command to move the failed virtual machines to the new active site.

When you run the **ksysmgr recover** command for a specific host group or a workgroup, the KSYS subsystem attempts to move all the failed virtual machines of that host group or workgroup from the current site to the target site.

Note: The **ksysmgr recover** command can be used only when the reverse replication of storage is successful and when the virtual machine is in the RECOVERY_VM_ONLINE state. To check the state of a virtual machine, use the **ksysmgr query vm** command. The state of the virtual machine is displayed. You can use this command only at the host group or workgroup level. For HADR and HADRHA type of deployment, the **ksysmgr recover** command is supported only at the host-group level. The **ksysmgr recover** command is not supported at the site level.

When you perform the recovery operation after a move operation of a VM has failed, the KSYS subsystem provides an option to use the current or previously saved LPAR or virtual machine (VM) profile to retry the recovery operation. The LPAR profiles of VMs are backed up regularly based on the configuration settings. Additionally, each time the administrator changes the configuration settings for an LPAR and runs the discovery operation, a backup of the LPAR profile file is created with the relevant timestamp at the `/var/ksys/tmp` location.

When you run the **ksysmgr recover** command, the KSYS subsystem attempts to recover the virtual machines by using the latest available LPAR profiles. If the virtual machine recovery fails, you will be prompted to choose if you want to recover the virtual machine to the backup site by using an LPAR profile from the backup profiles list. If you want to restart the virtual machine with a previously backed up LPAR profile, select yes, and then the command interface prompts you to select the LPAR profile file based on the time stamp. The KSYS subsystem fetches the backup profile and uses the configuration settings that are specified in the selected LPAR profile to restart the virtual machine. If you select no as the response for the command interface prompt, the virtual machine is restarted on the backup host with the existing configuration settings of the LPAR.

After the site switch operation is complete, if the storage is successfully switched to the backup site, the failed virtual machines in the previously active site are not linked to the most recent disks. Therefore, the **ksysmgr recover** command moves the virtual machine configuration without affecting the storage because the storage is already moved.

To recover the failed virtual machines after the move operation is complete, enter the following command:

```
ksysmgr recover host_group host_group_name
```

To recover the failed virtual machines of specific workgroup, enter the following command:

```
ksysmgr recover workgroup workgroup_name
```

Moving the virtual machines by using the force option

In some scenarios, when you modify the KSYS configuration, the KSYS subsystem might have discovered the configuration change as part of its daily check. However, the resources might not have been verified to check whether the virtual machines can be moved to the backup site.

To move the virtual machines to the backup site by using the force option, run the following command:

```
ksysmgr -f move from=site1 to=site2 force=true site_down=yes|no
```

Note: If a disaster occurs in the source site and the virtual machines are in the `init` state, you must initiate the disaster recovery operation with the force option by running the following command:

```
ksysmgr -f move from=site1 to=site2 force=true dr_type=planned
```

Note: If a disaster occurs in the source site when host groups or workgroups are in failover rehearsal mode, you must initiate the failover rehearsal cleanup before the unplanned move operation. To perform the failover rehearsal cleanup, run the following command:

```
ksysmgr cleanup host_group|workgroup|site <name> dr_test=yes
```

Moving the virtual machines by using other options

You can use the following options in the ksysmgr command-line interface for moving virtual machines:

```
ksysmgr [-f] move site
  from=<sitename>
  to=<sitename>
  [force=<true|false>]
  [lose_vios_redundancy=<yes|no>]
  [dr_type=<planned|unplanned>]
  [dr_test=<yes|no>]
  [cleanup=<yes|no>]
  [skip_shutdown=<yes|no>]
  move => mov*, mv, swi*
  site => sit*
  skip_shutdown => site_down
```

Note:

- The `skip_shutdown` option is supported only for unplanned move operation.
- If the `dr_test` attribute is set to `yes`, do not use the `dr_type` attribute.

Moving virtual machines without cleanup

In planned move operation, the KSYS subsystem removes the virtual machine from the source site. If you do not want to remove the virtual machine from the source site or clean up the virtual machine from the source site, set the **cleanup** attribute to `no`.

To move a virtual machine without cleanup on source site, run the following command:

```
ksysmgr -f move from=site1 to=site2 cleanup=no dr_type=planned
```

Moving the virtual machines with the skip shutdown option

You can skip the shutdown of virtual machines while moving a virtual machine from a site that is down. If you cannot shut down the virtual machines because the complete site is down and unreachable, set the **skip_shutdown** attribute to `yes` to skip the shutdown of virtual machines. This option is supported only for unplanned move operation. Use this attribute only when the virtual machines are not active. To move a virtual machine with the **skip_shutdown** option, run the following command:

```
ksysmgr -f move from=site1 to=site2 skip_shutdown=yes dr_type=unplanned
```

Relocation plan for virtual machines

In an asymmetric host group configuration, the relocation plan shows the target host, where the virtual machines will be relocated after migration.

To know the relocation plan of a virtual machine, run the following command:

```
ksysmgr report system relocation_plan vm=<vmname[,vmname2...]> | host=<hostname> |
host_group=<host_group_name> | site=<sitename>
```

The output displays the details about the relocation plan of the virtual machine on the target host based on the attribute values that are specified in the command. To know the relocation plan of a specific virtual machine, use the **vm** attribute. To know the relocation plan of all virtual machines in a host, use the **host** attribute. Similarly, use the **host_group** attribute and the **site** attribute to know the relocation plan of all virtual machines in the host group and the site respectively. However, this may differ during migration as the KSYS subsystem dynamically obtains the target hosts based on the resource availability unless you specify the target host.

Unmanaged disks

A replicated disk of the local disk that is associated with a virtual machine can be excluded in the target local host during the disaster recovery operation. The excluded disk is referred to as an unmanaged disk and will not be considered as part of DR management.

The excluded or unmanaged disks are not made available on the DR site during the disaster recovery operations. When a disk that is in the local host is unmanaged, the replicated disk of the unmanaged disk is ignored at the target host during the verification operation and move operation. Also, an unmanaged disk will not be added to any consistency group.

A disk from home site or backup site can be unmanaged.

Prerequisite

Consider the following additional requirements when using the unmanage disk feature:

- Ensure that the unmanaged disk pair's secondary disk is not accessible from the backup site, also ensure that the primary disk is accessible from the home site. The KSYS subsystem does not explicitly verify whether the primary disk can be accessed from the home site.
- Ensure that the virtual Fibre Channel (vFC) of a virtual machine contains both managed and unmanaged disks. The disaster recovery (DR) failover rehearsal operation is not supported if the virtual Fibre Channel (vFC) contains only unmanaged disks.
- Specify the worldwide name (WWN) of a disk when unmanaging a disk. You can get the WWN of a disk by running the following command:

```
lsmpio -q -l hdisk1
```

An output that is similar to the following example is displayed:

```
Device: hdisk1
       Vendor Id: <VendorID>
       Product Id: <ProductID>
       Revision:  <XYZABC>
       Capacity:  2.00GiB
       Volume Serial: <VolumeSerial>
```

The value that is displayed in the **Volume Serial** field is the WWN of the disk.

Unmanaging disks

- To unmanage a disk, run the following command:

```
ksysmgr unmanage disk diskid=<diskid1[,...]>
```

Note: The **diskid** attribute must be from the site where the host group of the unmanaged disk is created.

An output that is similar to the following example is displayed:

```
<diskid1> was successfully unmanaged. Please run discovery to apply changes
```

Now, run the discovery operation.

- To manage an unmanaged disk, run the following command:

```
ksysmgr manage disk diskid=<diskid1[,...]>
```

An output that is similar to the following example is displayed:

```
<diskid1> was successfully managed. Please run discovery to apply changes.
```

Now, run the discovery operation.

- To view all unmanaged disks, run any of the following commands:

```
- ksysmgr query disk_pair
```

An output that is similar to the following example is displayed:

```
Storage: xivsalocal_XIV<id> (<region><-> Storage: xivsaremote_XIV<id>)
=====
<disk1>                <-> <disk2>
<disk3>                <-> <disk4>                (UNMANAGED)
```

```
- ksysmgr query disk state=<unmanaged>
```

An output that is similar to the following example is displayed:

```
Unmanaged Disks:
  disk1
  disk2
  disk2
```

Limitation

- The disaster recovery (DR) failover rehearsal operation from the backup site to the home site is not supported if the operation involves unmanaged disk. The disaster recovery (DR) failover rehearsal operation is supported only from the home site to the backup site with unmanaged disks.
- The VM Recovery Manager DR does not support sharing a managed disk or unmanaged disk between virtual machines of two different Workgroups or host groups.
- The unmanage disk feature is not supported for the vSCSI disks.
- When unmanaging a disk pair at the KSYS subsystem level, use the disk identifier that's assigned to the disk in the home site.
- The unmanage disk feature is not supported if multiple DS8000 series storage agents are configured in a site.

Administering VM Recovery Manager DR

These topics provide a list of the tasks you can perform to maintain and monitor the resources in the IBM VM Recovery Manager DR for Power Systems solution.

Generating the KSYS system report

After you add all the required resources to the KSYS configuration, you can generate the KSYS system report that summarizes the entire KSYS environment.

Instead of running different commands to query each resource, you can generate a consolidated report to view all the added resources in the KSYS configuration.

To generate the KSYS system report, run the following command:

```
ksysmgr report system
```

An output that is similar to the following example is displayed:

```
This is the latest KSYS configurations, please run discover to capture any changes

KSYS is ready to be issued a command
Ksysmgr version: 1.5.0.0
Ksys version:    1.5.0.0
Status:
Current environment:
=====
Number of sites:2
Number of storage agents:2
Number of HMCs:2
Number of hosts:4
Number of host_groups:1
Number of VIOS:8
Number of VMs:34
Total managed processors: 8.00
Total managed memory: 40960.00 MB
```

You can also generate an organized report by using the verbose option:

```
ksysmgr -v report system
```

An output that is similar to the following example is displayed:

```
ksysmgr -v report system
This is the latest KSYS configurations, please run discover to capture any changes
KSYS is ready to be issued a command
Ksysmgr version: 1.5.0.0
Ksys version:    1.5.0.0
Status:
Current environment:
=====
Home Site: Austin
  Host_Group: HA_DR_HG
    Active Hosts: rt07
                  rt08
    Backup Hosts: rt09
                  rt10
HOST: rt08
  HMC:
    e17vhmc2
  VIOS:
    rt08v2
    rt08v1
  Paired Host:
    none
  Number of Managed VMs: 1
  Managed Processors: 4.00
  Managed Memory: 20480.00 MB
HOST: rt07
  HMC:
```

```

        e17vhmc2
    VIOS:
        rt07v2
        rt07v1
    Paired Host:
        none
    Number of Managed VMs: 1
    Managed Processors: 4.00
    Managed Memory: 20480.00 MB
    Storage Agent:
        storwize11
    Total Managed Processors: 8.00
    Total Managed Memory: 40960.00 MB
Backup Site: India
HOST: rt10
    HMC:
        e17vhmc3
    VIOS:
        rt10v2
        rt10v1
    Paired Host:
        none
    Number of Managed VMs: 0
    Configurable Processors: 24.00
    Configurable Memory: 1048576.00 MB
HOST: rt09
    HMC:
        e17vhmc3
    VIOS:
        rt09v2
        rt09v1
    Paired Host:
        none
    Number of Managed VMs: 0
    Configurable Processors: 19.00
    Configurable Memory: 1048576.00 MB
    Storage Agent:
        storwize21
    Total configurable Processors: 43.00
    Total configurable Memory: 2097152.00 MB

```

Configuring the flexible capacity policies

By using the flexible capacity policies, you can configure the memory and processor resources such that you can move the virtual machines (VMs) from the source host to the target host even when the target host does not have the same quantity of memory and processor resources as the source host. You can set the flexible capacity policies for the backup site.

You can use the flexible capacity option to start the virtual machines on the backup site with a different capacity as compared to the active site. The active site resources are used as reference to calculate the percentage of resources that must be assigned during recovery of virtual machines on the backup site.

The flexible capacity policies can be set at host group or site level and can be used in the following cases:

- To perform the disaster recovery operations with different amount of resources on the backup site.
- back up
- To test the disaster recovery operation by using the failover rehearsal function with fewer or more resources on the backup site.
- To pair hosts across the active site and the backup site even when the available resources for both hosts differ.

When a logical partition (LPAR) is created in HMC, a profile is created for the LPAR that includes the resource limits such as **minimum**, **desired**, and **maximum** memory and processors that you want to allocate for that LPAR. If flexible capacity policies are not specified, by default, the **desired** value of resources are used by KSYS.

Memory and CPU capacity of a virtual machine must be allocated more than or equal to the memory and CPU capacity of the virtual machine allocated at the backup site.

The following figure shows the various flexible capacity policies:

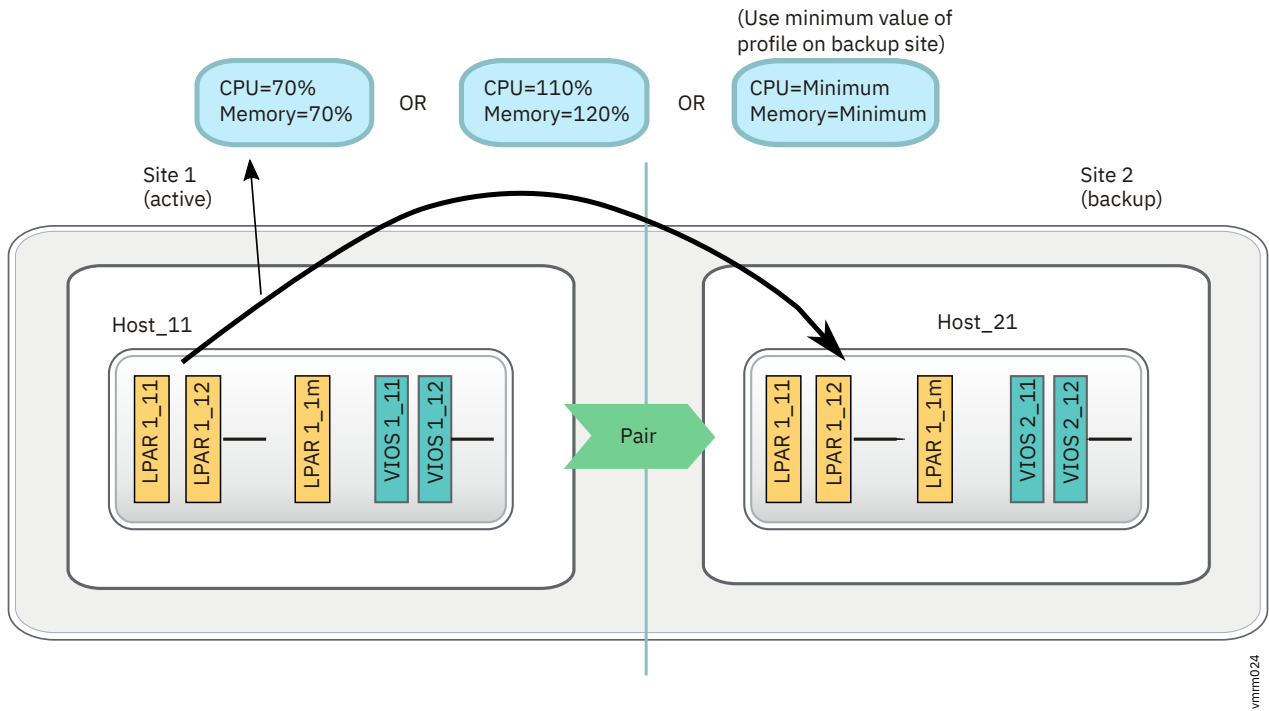


Figure 26. Flexible capacity management for backup site

The active site always uses the required resources that are defined in the LPAR profiles. You can set up flexible capacity policies only for the backup site. Various policies can be deployed by using the following tunable parameters:

Percentage of the existing capacity value

This policy specifies the percentage of resources that must be allocated to the VM after recovery on the backup site as compared to the active site.

The following examples describe the percentage based resource allocation:

- If a VM is running on the active site with 10 GB memory and 2 dedicated processors, and if you specify the flexible capacity policy with 50% CPU resource and 70% memory resource, then after the recovery of that VM on the backup site, the VM will be running with 1 processor and 7 GB memory. Memory is calculated and rounded off to the nearest multiples of memory region size of the target host. If dedicated processor is allocated to a VM, the calculated values are rounded off to the closest decimal.
- If a host is running 10 VMs, and each VM has 4 GB memory and 1.0 shared processor units each on the active site, and if you specify the flexible capacity policy with 50% CPU resource and 50% memory resource at the host level, then after the recovery of that host on backup site, all the VMs will be running with 2 GB memory and 0.5 processor units each.

Similarly, we can configure the flexible capacity values at host group level and site level also. The percentage value that you specify in this policy must always be greater than 1.

Minimum value

This value sets the resource value of backup site LPAR (when the LPAR is started on the backup site during the recovery operation) to the minimum value that is defined in the LPAR profile on the active site.

Current desired

This value sets the resource value of backup site LPAR (when the LPAR is started on the backup site during the recovery operation) to the desired value that is defined in the LPAR profile on the active site.

None

Resets the existing value. When you set the value to none, VM capacity management does not follow any flexible capacity management. CPU and memory resources across the active site and backup site match the values that are defined in the LPAR profile.

Notes:

- When you set the reduced or increased capacity value to a percentage of the existing capacity value, the resulting value must be within the range of the minimum and maximum values that are specified in the LPAR profile in the HMC. Otherwise, the **ksysmgr** command will return an error.
- The priority of virtual machine is also considered when the virtual machine is moved from the active host to the backup host with reduced capacity.
- > Flex capacity policy values are not applicable in Live Partition Mobility (LPM) operation and restore operation. |<
- > The flex capacity policy configuration must be updated only when a VM is present on home host. The KSYS subsystem takes the reference of flex capacity policy configuration from the HMC when the VM is on home host. You can change CPU and memory configuration of a VM profile when the VM is present in the home host. |<
- The flexible capacity policy of the host group takes precedence over the flexible capacity policy of the site.

For example, if you set the following value for the **memory_capacity** attribute at both the site and host group levels, the virtual machines of the Host_group1 will be restarted in the target host with a reduced memory capacity of 50%.

```
Site: memory_capacity = "none"  
Host_group1: memory_capacity="50"
```

The performance of the virtual machines might be decreased but the virtual machines can be restarted in the target host that has the reduced capacity. You can use the reduced capacity function during planned outages, where the virtual machines are temporarily moved to the target host and then moved back to the source host after the system maintenance or upgrade operation is complete. When the virtual machines are moved back to the home site, the original capacity settings of the virtual machine are retrieved and the virtual machines are run with the initial performance.

If you do not want the HMC to check and compare the resource capacity between the source host and the target host during the verify operation, you can set the **skip_resource_check** parameter to yes.

If you do not want the virtual machines to start automatically after they are moved to the target host, you can set the **skip_power_on** parameter to no.

Host group-level configuration

To configure reduced capacity settings for all the hosts in a host group, enter the following command in the KSYS LPAR:

```
ksysmgr modify host_group hgname[,hgname2,...]  
[memory_capacity=<(1-100) | minimum | current_desired | none>  
priority=<low | medium | high>]  
[cpu_capacity=<(1-100) | minimum | current_desired | none>  
priority=<low | medium | high>]  
[skip_resource_check=yes|no]  
[skip_power_on=yes|no]
```

For example:

```
# ksysmgr modify host_group Site1_HG1,Site1_HG2 memory_capacity=50 cpu_capacity=50  
skip_power_on=yes skip_resource_check=yes
```

Site-level configuration

To configure reduced capacity settings for all the virtual machines in the active site, enter the following command in the KSYS LPAR:

```
ksysmgr modify site sitename1[,sitename2,...] | file=filepath  
[name=newsitename]  
[memory_capacity=<(Whole Number > 1)> | minimum | current_desired | none]  
[cpu_capacity=<(Whole Number > 1)> | minimum | current_desired | none]  
[skip_resource_check=yes|no]  
[skip_power_on=yes|no]
```

For example:

```
# ksysmgr modify site Site_1 memory_capacity=current_desired cpu_capacity=none skip_power_on=yes
```

When you query the details about the site, an output that is similar to the following example is displayed:

```
# ksysmgr query site Site_1  
  
Name:                Site_1  
Sitetype:            ACTIVE  
cpu_capacity:        none  
memory_capacity:    current_desired  
skip_resource_check: No  
skip_power_on:      Yes
```

Configuring the network mapping policy

A virtual LAN (VLAN) is created by assigning artificial LAN identifiers (VLAN IDs) to the datagrams that are exchanged through the physical network. Hosts that are located on the same VLAN represent a subset of the hosts that are located on the physical network. Hosts that belong to the same subnet allows communication without any physical device. The subnets are separated when the hosts in a subnet have different VLAN IDs.

When a virtual Ethernet adapter is created in an HMC, a virtual Ethernet switch port is configured simultaneously. The virtual machines within a host, which need to communicate with other virtual machines for workload operations, are configured to have the same VLAN IDs. Similarly, some virtual machines in your host environment might be isolated from other virtual machines through a private network and might have different VLAN IDs.

For example, consider a host in the active site that contains two virtual machines that use the following VLAN IDs: VLAN1, VLAN12, VLAN13, and VLAN5. If you want these virtual machines to start in the backup site with VLAN IDs: VLAN1, VLAN22, VLAN23, and VLAN5, you can set a VLAN policy that modifies the VLAN ID from VLAN12 to VLAN22, and from VLAN13 to VLAN23 when virtual machines are moved from the active site to the backup site. Therefore, when you move the virtual machines across sites, the virtual machines are restarted in the target site with the assigned VLAN IDs as shown in the following figure:

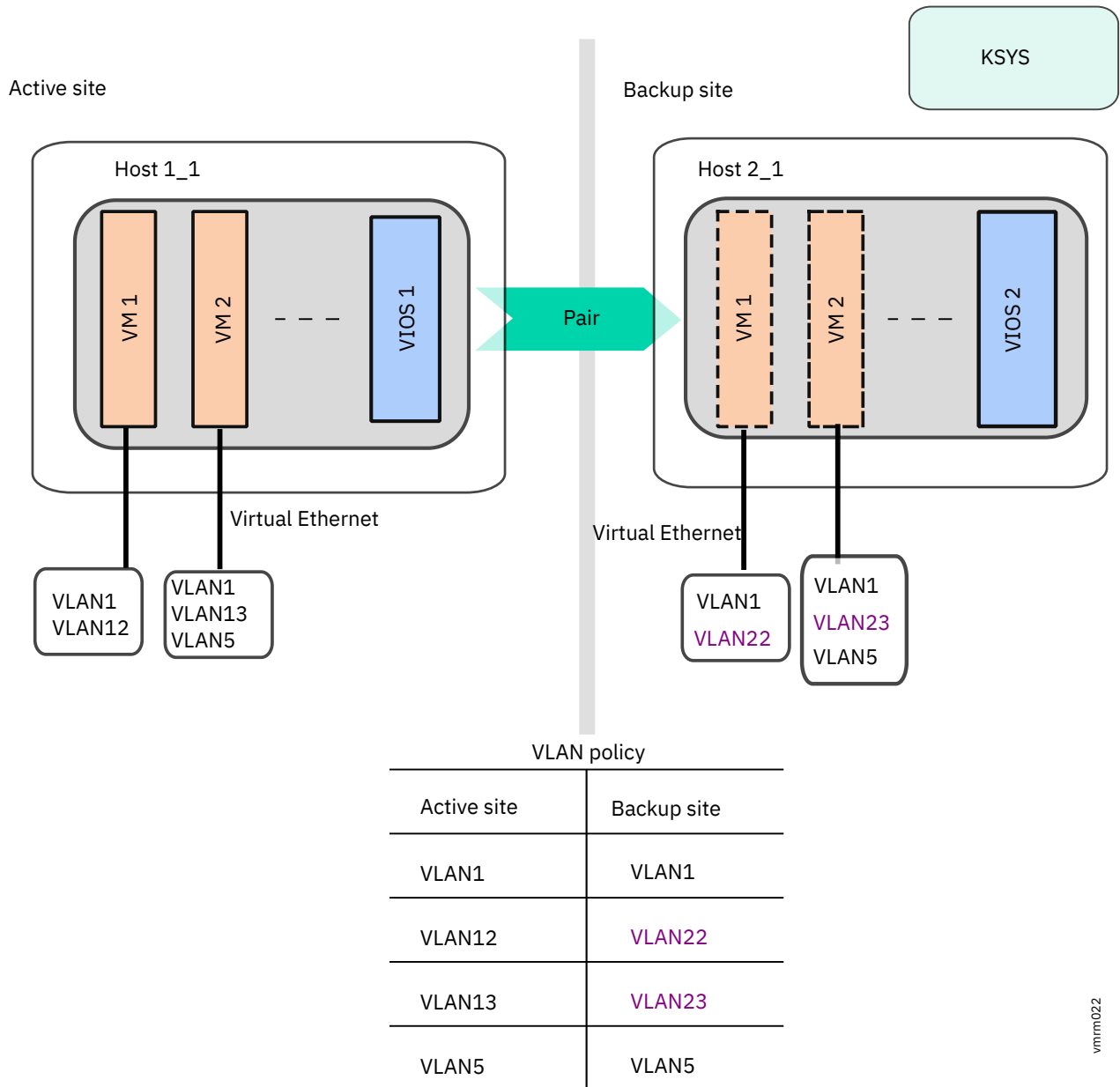


Figure 27. Example of network mapping policy configuration

Notes:

- You can modify the KSYS system properties to enable or disable the network mapping policy for all virtual machines across the sites.
- When you map VLAN IDs at host-level, the VLAN IDs are applied to all the virtual machines of that host.

You can create VLAN ID or virtual switch mapping policies that contains a mapping of VLAN IDs or virtual switches that are assigned to virtual machines when the virtual machines are moved from the active site to the backup site. These policies are useful in the following cases:

- In a disaster situation, when you move source hosts or host groups to the backup site, the hosts must have the same VLAN ID, otherwise the recovery operation fails. If the target site is configured with a different VLAN ID, you must set a VLAN policy for source hosts to acquire the same VLAN ID when virtual machines are restarted in the backup site for a successful recovery operation.
- During the test operation for the disaster recovery, when you move hosts or host groups to the backup site in the test mode, if you do not specify a VLAN ID or virtual switch, the virtual machines are started

vmm022

with the same VLAN ID or virtual switch in the backup site as the existing virtual machine in the source site. If both source and target hosts have same VLAN ID, it can result in an IP conflict.

If you start the failover rehearsal operation without configuring the virtual switch and VLAN settings, the KSYS subsystem displays a warning message to indicate that virtual switch and VLAN settings are not configured and prompts whether you want to proceed with the failover rehearsal operation.

A VLAN ID from the source site must be mapped to a single VLAN ID in the target site. Similarly, a VLAN ID from the target site must be mapped to a single VLAN ID in the source site. A virtual switch from the source site must be mapped to a single virtual switch in the target site. Similarly, a virtual switch from the target site must be mapped to a single virtual switch in the source site. In case of VLAN, the ID of the VLAN must be used in the configuration. In case of virtual switch, the name of the virtual switch must be used in the configuration.

The following figure shows an example of virtual switch mapping policy configuration:

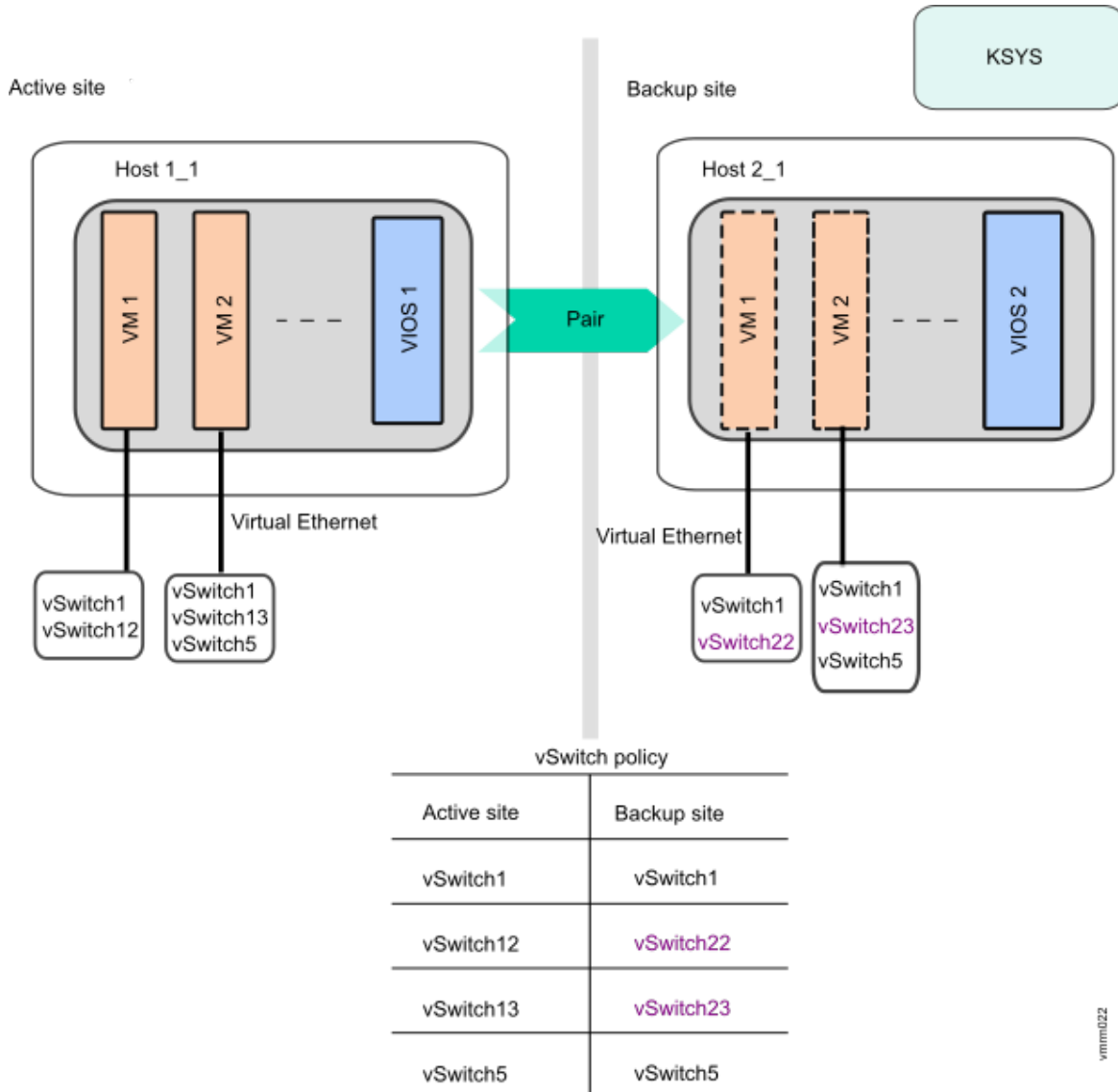


Figure 28. Example of virtual switch mapping policy configuration

System-level network mapping policy

To enable the network mapping policy and to create network mapping policy for all hosts and host groups across the active site and the backup site, enter the following command in the KSYS LPAR:

```
ksysmgr modify system network_mapping=<enable | disable>  
network=<vlanmap | vswitchmap> sites=<siteA,siteB>  
siteA=<#[#,...]> siteB=<#[#,...]>
```

For example:

```
ksysmgr modify system network_mapping=enable network=vlanmap sites=siteA,siteB  
siteA=1,12,13,5  
siteB=1,22,23,5
```

Site-level network mapping policy

To enable the network mapping policy and to create network mapping policy for all hosts and host groups in a specific site, enter the following command in the KSYS LPAR:

```
ksysmgr modify site <sitename[,sitename2,...]> | file=<filepath>  
[network=<vlanmap | vswitchmap> backupsite=siteB  
sitename=<#[#,...]> || all> siteB=<#[#,...]> || all] [dr_test=<yes|no>]
```

Example for DR:

```
ksysmgr modify site site1 network=vlanmap backupsite=site2  
site1=1,2,3 site2=4,5,6
```

Example for DR-test:

```
ksysmgr modify site site1 network=vlanmap backupsite=site2 site1=1,2,3 site2=4,5,6 dr_test=yes
```

Host-group level network mapping policy

To create a mapping policy of VLAN ID or virtual switches for all the hosts in a host group across sites, enter the following command in the KSYS LPAR:

```
ksysmgr modify host_group <name> options  
network=<vlanmap | vswitchmap> sites=<siteA,siteB>  
siteA=<#[#,...]> siteB=<#[#,...]>
```

For example:

```
ksysmgr modify host_group HG1 options  
network=vswitchmap sites=site1,site2  
site1=vswitch1,vswitch2  
site2=vswitch2,vswitch1
```

Host-level network mapping policy

To create a VLAN ID mapping policy for all virtual machines in a host across sites, enter the following command in the KSYS LPAR:

```
ksysmgr modify host <hostname[,hostname2,...]> | file=<filepath>  
network=<vlanmap | vswitchmap> sites=<siteA,siteB>  
siteA=<#[#,...]> siteB=<#[#,...]>
```

For example:

```
ksysmgr modify host host_1_2,host_2_2 network=vlanmap sites=Site1,Site2  
site1=1,12,13,5  
site2=1,22,23,5
```

Proactive monitoring for network isolation

Proactive monitoring enables continuous monitoring and reporting of network devices.

- To add a hostname or IP address to proactive monitoring, run the following command on the KSYS node:

```
ksysmgr modify system [network_isolation=<ip1,ip2,..|ALL> action=<add | delete>]
```

Modifying the KSYS configuration

Growing business requirements might need changes in your current configuration, for example, adding a specific virtual machine, adding an entire host to your environment, adding an HMC, or adding a disk in the virtual machine. After the VM Recovery Manager DR solution is implemented in your environment, the KSYS subsystem continues to monitor any changes in the KSYS configuration. If you want to modify the current configuration in your environment, you can run the **ksysmgr discover** command to discover and validate the changes in the KSYS configuration immediately.

Notes:

- If you want to add a new virtual machine to the KSYS configuration, ensure that the corresponding host and the managing HMC are also added to the KSYS configuration. Also, you must add a corresponding host and a managing HMC to the backup site so that you can create a host pair across sites for the symmetric host group.
- When you add a host to the KSYS configuration, by default all the virtual machines are included in the KSYS configuration. You can set the virtual machines that are not required as unmanaged. The unmanaged virtual machines will not be monitored and will not be considered for any operations.
- If you want to add a disk array to the KSYS configuration, you must add corresponding storage agents to the corresponding site. Also, you must add equal number of storage disks with the same disk size to the backup site so that disk pair can be created by the KSYS subsystem during the discovery operation.

To add a specific VM to the KSYS configuration after the initial KSYS subsystem setup, complete the following steps:

1. Add the managing HMC and the managed host, which contains VM, to the active site by running the following command:

```
ksysmgr add hmc Site1_HMC3 login=hscroot hostname=Site1_HMC3.testlab.ibm.com site=Site1
ksysmgr add host Site1_host3 site=Site1
```

2. Add the managing HMC and the managed host to the backup site by running the following command. These managing HMC and managed hosts can be used to create host pairs.

```
ksysmgr add hmc Site2_HMC3 login=hscroot hostname=Site2_HMC3.testlab.ibm.com site=Site2
ksysmgr add host Site2_host3 site=Site2
```

3. Create a host pair between these added hosts by running the following command:

```
ksysmgr pair host Site1_host3 pair=Site2_host3
```

4. If you want to exclude some virtual machines during a disaster recovery operation, run the following command for each virtual machine that you want to exclude:

```
ksysmgr unmanage vm name=vmname host=hostname | uuid=lparuuid |
ALL host=hostname | ALL host_group=hg_name
```

5. If the virtual machines use storage disks that are not yet added to the KSYS configuration, add the corresponding disks to the existing storage arrays in the corresponding sites.

Note: You must add a corresponding disk in the backup site also, so that the KSYS subsystem can create a disk pair across sites for replication during the discovery operation.

6. If you want to add a storage array to a site or update an attribute of the storage array, you must create or modify storage agents in the KSYS configuration by running the following command:

```
ksysmgr add storage_agent strg_agent_name
site=sitename
serialnumber=serialnumber
storagetype=emc|ds8k|svc|hitachi
[ip=new_ip]
```

7. Discover and verify these added resources by running the following command:

```
ksysmgr discover site Site1 verify=yes
```

The KSYS starts to monitor the modified configuration in the active site.

Modifying the attributes of the added resources

In addition to adding new resources, you can also modify the attributes of an existing resource in the KSYS configuration.

You can change the resource attributes as shown in the following examples:

- To update the HMC login credentials, or IP address, use the following syntax:

```
ksysmgr modify hmc hmcname  
    [login=new_username]  
    [password=new_password]  
    [hostname|ip=new_hostname|new_ip]
```

- To change the storage agent details, use the following syntax:

```
ksysmgr modify storage_agent <storage_agent_name>  
    [storage_agent_name=<new_storage_agent_name>]  
    [hostname=<hostname[,hostname2,hostname3]>]  
    [ip=<ip[,ip2,ip3]>]  
    [login=<username>]  
    [password=<password>]  
    [drinstance=<drinstance_number>]  
modify => mod*, ch*, set  
storage_agent => storage*, sta
```

Notes:

- Both login user name and password are required for some storage devices.
- The DrInstance attribute is required only for remote storage agent.
- Only the XIV storage allows registration of more than one IP address.
- To update the contact details for the KSYS notification, use the following syntax:

```
ksysmgr modify notify oldcontact=old_username newcontact=new_username  
ksysmgr modify notify oldcontact=old_email_address newcontact=new_email_address
```

For more information about the KSYS notifications, see [“Managing the KSYS notifications” on page 114](#).

- To update the system tunable attributes, use the following syntax:

```
ksysmgr modify system attribute=new_value
```

For more information about the system tunable attributes, see [“Managing the system attributes” on page 115](#).

- To update the priority of virtual machines, use the following syntax:

```
ksysmgr modify VM name1[,name2,name3,...] | file=filepath  
    [uuid=uuid_value]  
    [host=hostname]  
    [priority=low|medium|high]
```

- To update the target host of a virtual machine for the disaster recovery operation, run the following command:

```
ksysmgr modify vm <vmname,[vmname2,...]> | file=filepath DrTargetHost=<hostname|none>]
```

Note: You cannot update any attributes of an existing host in the KSYS configuration. Any modifications in the host details are registered in the HMC, and the KSYS subsystem discovers these changes during the discovery operation.

Removing resources from the KSYS configuration

If a specific resource is not required to be covered when you are using the VM Recovery Manager DR disaster recovery solution, you can remove the resource and the associated resources from the KSYS configuration.

Removing a virtual machine

When you remove a host from the KSYS configuration, all the virtual machines are removed. Therefore, if you want to remove a specific virtual machine, instead of removing the host from the KSYS configuration, you must exclude the virtual machine from the KSYS configuration so that the virtual machine is not moved to the backup site during a disaster recovery operation. You can exclude a specific virtual machine by using the `ksysmgr unmanage vm_name` command.

Note: >| Before unmanaging a virtual machine that is part of a workgroup, you must remove the virtual machine from the workgroup by using the following command:

```
ksysmgr modify workgroup workgroup_name policy=delete vm=vmname
```

|<

Removing a host

To remove a host, you must first remove the host from the host group, and then break the associated host pair by using the following command:

```
ksysmgr modify host_group hg_name remove hosts=host1  
ksysmgr pair host=host1 pair=none
```

After the host pair is broken, use the following command to remove the hosts in both the active site and the backup site:

```
ksysmgr delete host hostname
```

All the virtual machines that are running in the host are removed from the KSYS configuration. You must also remove the host in the opposite site that was paired to the removed host.

If you add or remove hosts from a host group, you must run a discovery operation to manage or unmanage all the virtual machines from the recovery management. The modified host group displays the correct list of managed virtual machines only after a discovery operation.

>| After Live Partition Mobility (LPM) operation on a VM or a HA restart of a VM, you must initiate the explicit discovery operation to update the disk mapping for a disaster recovery operation. Without explicit discovery operation, if you remove a host from host group, the KSYS subsystem removes disks from the source host. |<

Note: >|

- After removing a host from host group, run the discovery operation to update the configuration.
- You cannot remove a host from the KSYS subsystem that has a user-defined SSP cluster. To remove a host from the KSYS configuration with a user-defined SSP cluster, choose one of the following options:
 1. Reconfigure the KSYS cluster
 2. Use a KSYS controlled VIOS cluster

|<

Removing a host group

To remove a host group, you must first remove all the hosts from the host group, and then delete the host group by using the following command:

```
ksysmgr delete host_group hg_name
```

Removing an HMC

If an HMC, which is included in the KSYS configuration, is not managing any hosts in the KSYS configuration, you can remove the HMC from the KSYS configuration by using the following syntax:

```
ksysmgr delete hmc hmcname
```

Removing a storage agent

If you remove an entire storage array from a site, you must remove the host group and then remove the storage agent that is associated with that storage array. Remove the consistency group of the storage agent before deleting the storage agent. To delete a storage agent, run the following command:

```
ksysmgr delete storage_agent storage_agent_name
```

Removing a workgroup

Before removing a workgroup, you must remove the associated hosts from the workgroup by using the `ksysmgr modify wg` command. To remove a workgroup, run the following command:

```
ksysmgr delete workgroup workgroup_name
```

Managing the KSYS notifications

After you add the contact details to the KSYS configuration for the first time, you can modify the contact details later depending on the changing requirements.

To modify the contact information, use the following commands:

```
ksysmgr modify notify oldcontact=old_username newcontact=new_username  
ksysmgr modify notify oldcontact=old_email_address newcontact=new_email_address
```

For example, to change the user name of John to Dave, and to change the email address, enter the following command:

```
ksysmgr modify notify oldcontact=John newcontact=Dave  
ksysmgr modify notify oldcontact=john@gmail.com newcontact=dave@gmail.com
```

To delete all the contact information for a specific user, use the following command:

```
ksysmgt delete notify user=username
```

For example,

```
ksysmgt delete notify user=John
```

To query all the registered contact details, use the following command:

```
ksysmgr query notify contact
```

The output might be similar to the following example:

```
User:           Mark Smith  
Contact:       mike@mike.com
```

```
User:      joe
Contact:   joe@gmail.com
```

Running scripts for specific events

You can create scripts for specific events. When an event occurs, you can enable the script to be run as part of the event. By using scripts, you not only get notified for a specific event, but you can also collect details about the event, take corrective actions, and handle the processes after the event completion. For more information about scripts, you can refer to the event script samples that are located in the `/opt/IBM/ksys/samples/event_handler/event_script_template` directory.

You must specify the full path of the script to add a script for notification configuration. When the event occurs, the KSYS subsystem validates the existence and the authorization of the scripts.

To add a script, use the following command:

```
ksysmgr add notify script=script_file_path_name events=event_name
```

For example,

```
ksysmgr add notify script=/tmp/script.sh events=HMC_DOWN
```

To modify a script, use the following command:

```
ksysmgr modify notify oldscript=old_script_file_path_name newscript=new_script_file_path_name
```

For example,

```
ksysmgr modify notify oldscript=/tmp/script.sh newscript=/tmp/newscript.sh
```

To remove a script, use the following command:

```
ksysmgr delete notify script=script_file_path_name
```

For example,

```
ksysmgr delete notify script=/tmp/script.sh
```

To query a script, use the following command:

```
ksysmgr query notify script
```

Notification message

Even if you set the KSYS configuration to not receive any event notifications, the messages are logged in the `/var/ksys/events.log` notification log file. An example of the notification message follows:

```
HMC_DOWN event has occurred. Details are as follows:
Event:      HMC_DOWN
Type:       Critical Error Event
Time:       Tue Jul 19 00:35:32 CDT 2016
Entity Affected: HMC
Resource Affected: vmhmc1
Description: 0000-132 Error - HMC x.x.x.x is down.
Suggestion: Please try to restart.
```

Managing the system attributes

After you synchronize the KSYS cluster by using the **ksysmgr sync ksyscluster** command, the KSYS subsystem sets up the default system-wide persistent attributes. The KSYS subsystem uses these system-wide persistent attributes for activities such as automatic rediscovery of the resources, notification of critical events, removal of duplicate notification.

By default, the KSYS subsystem sets up the following system attributes:

auto_discovery_time

Specifies the time for daily discovery at which the KSYS subsystem rediscovers the environment automatically for any new or modified resources. By default, the value of this attribute is 00:00, which means the KSYS subsystem discovers the resources and updates its database about the virtual machines every 24 hours at 00:00 hour.

The HMC and VIOS are also involved in the rediscovery process to update information about the virtual machines. Therefore, if your environment is large (for example, hundreds of logical partitions in the data center), you might want to set this to a time with minimal load on the HMC, VIOS, and the underlying I/O subsystems. Any configuration changes to the hosts, virtual machines, disks, and any other entities (for example, addition of new disks to a virtual machine) are captured when the rediscovery occurs. This attribute also specifies the time during which any changes in the configuration setting can be lost if a disaster occurs before the rediscovery.

lose_vios_redundancy

Specifies to start the virtual machines in another site without the dual VIOS setup in the target host. By default, this attribute is set to no, which means that the dual VIOS setup is maintained during the disaster recovery operation.

If your currently active site, which has dual VIOS configuration, fails, and one of the VIOS in the target host of the backup site is not functioning, you might want to recover the virtual machines with only one VIOS on the backup site and continue the workloads that are running in the active 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 if you want to move the virtual machines back to the previous site that has a dual VIOS configuration, you must manually add the second VIOS into the configuration. For more information, see [Configuring VIOS partitions for a dual setup](#).

auto_reverse_mirror

Resets the storage data mirroring after a site recovery operation.

Currently, this attribute is always set to no. You must resynchronize the storage data mirroring manually by using the **ksysmgr resync** command.

notification_level

Enables or disables the notification for different types of events. This parameter supports the following values:

low (default)

Only critical error events are notified.

medium

Critical and warning error events are notified.

high

All events, which include informational events, are notified.

disable

None of the events are notified.

dup_event_processing

Reduces duplicate event notifications. The email and script notifications that are related to the duplicate events are also disabled. This parameter can have the following values:

yes (default)

Notifies about only those events that are not repeated in the last 24 hours.

no

Notifies all the messages.

replication_type

Specifies the storage replication mode across the sites. This parameter can have the following values:

async

Specifies the asynchronous replication mode in which data is transferred across sites in predefined timed cycles or in delta sets.

sync

Specifies the synchronous replication mode in which the storage subsystem acknowledges to the host that it has received and checked the data.

shared

Specifies a shared mode in which a single storage system is connected to multiple sites.

You must also specify the source and the target sites that are associated with the storage replication operation.

network_mapping

Enables or disables the network mapping policies for all hosts and host groups across the active site and the backup site.

network

Creates network mapping policy for all hosts and host groups. This attribute can be specified only when the **network_mapping** attribute is set to enable.

You can create either a VLAN mapping policy or a virtual switch mapping policy. This attribute must be specified as follows:

```
[network=<vlanmap|vswitchmap> sites=<siteA,siteB>
siteA=<#,[#,...]> siteB=<#,[#,...]>
```

Quick discovery

You can enable or disable the quick discovery property.

Quick discover interval

You can set time interval in minutes for quick discovery operation.

Customer script timeout

You can configure the timeout duration for a custom script. If the custom script is unable to complete the execution within the configured timeout duration, the KSYS subsystem terminates the execution of the custom script and proceeds with the next execution.

To query the information or status related to system-wide attributes, use the following command:

```
ksysmgr query system [properties | status [monitor=<no|yes>]]
```

Examples for querying system properties and status

- To query the existing values of the system attributes, run the following command:

```
ksysmgr query system properties
```

An output that is similar to the following example is displayed:

```
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"
replication_type      ="Asynchronous"
network_mapping       ="enable"
network               =vlanmap sites=siteA,siteB
siteA= VLAN1,VLAN12,VLAN13,VLAN5
siteB= VLAN1,VLAN22,VLAN23,VLAN5
```

- To query the system status, run the following command:

```
ksysmgr query system status
```

The output might look similar to the following sample:

```
Discovery is in progress for Site Site1.
Discovery is in progress for Site Site2.
Please use "ksysmgr query system status monitor=yes " to track the progress of the operation.
```

If you specify the **monitor=yes** parameter, the KSYS monitors and displays all the current actions on the KSYS node. The actions include discovery, verification, movement, and recovery operations, which continue to progress even when the command is killed or when you close the command window. The **monitor** parameter also displays the encountered errors that are logged by the virtual machines, hosts, disk pairs, and disk groups. For example:

```
ksysmgr query system status monitor=yes
Discovery is in progress for Site Site1.
Discovery is in progress for Site Site2.
Monitoring status..
Running discovery on entire site, this may take few minutes...
...
```

To modify the system-wide attributes, use the following command:

```
ksysmgr modify system <attribute>=<new_value>
```

Examples for modifying the system-wide attributes

- To enable the KSYS subsystem to automatically rediscover the resources at 04:00 every day, run the following command:

```
ksysmgr modify system auto_discovery_time=04:00
```

- To change the notification level of your system to receive notification for all critical errors and warnings for all events, run the following command:

```
ksysmgr modify system notification_level=medium
```

- To change the duplicate event processing option to receive notification for all events, even if the events are duplicated, run the following command:

```
ksysmgr modify system dup_event_processing=no
```

- To change the storage replication mode between two sites from asynchronous mode to synchronous mode, run the following command:

```
ksysmgr modify system replication_type=sync sites=SiteA,SiteB
```

Managing the shared storage configuration

The VM Recovery Manager DR solution manages disaster recovery across two sites based on storage replication across the sites. However, the VM Recovery Manager DR solution also supports a mode of deployment in which disks are shared across sites. In this case, the KSYS subsystem does not manage any storage subsystems. The disks can be shared across sites that are separated by short distances (0 - 100 km). The storage technologies (for example, Storwize HyperSwap®) perform synchronous mirroring across sites and abstract the mirroring from the hosts. These storage technologies provide shared disk type of deployment for hosts across sites.

Restriction:

- Because the storage is shared, the N_Port ID virtualization (NPIV) and other similar ports are visible to VIOS on both sites. It might cause problems that are related to SAN login and disk validations. Hence, HMC and VIOS-related checks are not performed in the shared deployment mode. Therefore, the administrator must set up the sites appropriately, considering the storage, network, and so on, and must maintain the configuration settings. Any misconfiguration might result in errors during a disaster recovery.
- The DR failover rehearsal operation is not supported for shared storage deployments.

Shared storage without replication management

When the storage device in your environment is a single storage system that is split or separated by distance in two different sites as stretched systems, the storage replication management is hidden from the hosts and VIOS partitions. The storage subsystem is displayed as a single shared storage across the two sites. In this case, the storage recovery and replication are performed entirely by the storage platform. You do not need storage agents in the KSYS subsystem to interact with the storage devices. Therefore, you do not need to consider the disk pair and disk group mappings for the shared storage configuration.

When you move the virtual machines from the active site to the backup site, the KSYS subsystem considers the storage subsystem as unmirrored shared storage and starts the virtual machines on the backup site. If the disaster recovery operation is unplanned, the storage subsystem performs the entire storage recovery.

Notes:

- The VM Recovery Manager DR solution supports this type of shared storage only for sites that are spanned across short distances. Also, the storage subsystem must provide shared storage characteristics.
- The VM Recovery Manager DR solution does not support heterogeneous storage systems for this type of shared mode configuration. You must deploy same type of storage systems across the sites in your environment.

The following figure shows an example of shared storage configuration with Storwize HyperSwap based technology:

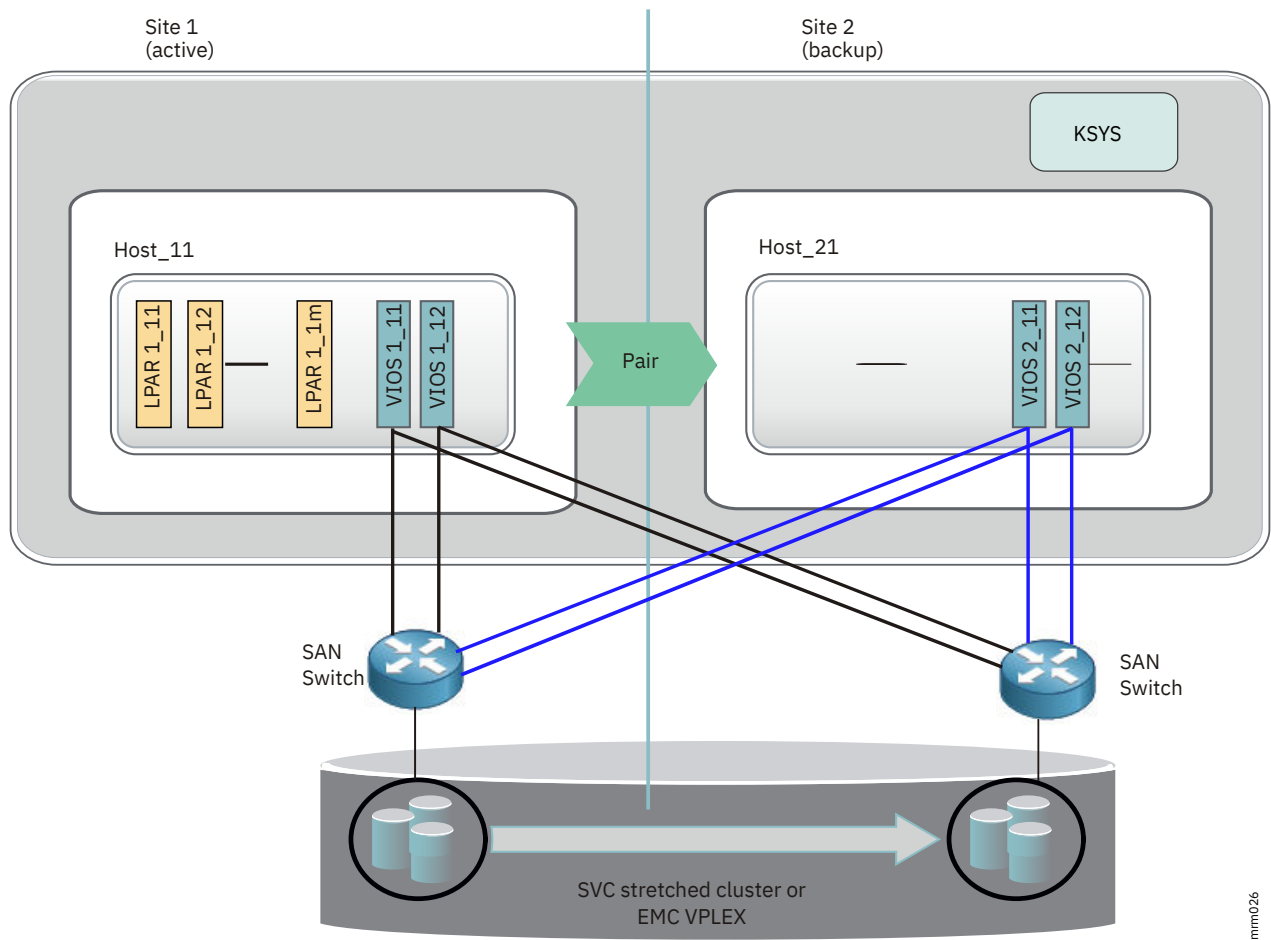


Figure 29. Shared storage configuration without KSYS-based replication management

Shared storage with SSP mirror management

VIOS can manage storage efficiently across multiple hosts in an environment by using the Shared Storage Pool (SSP) technology. Shared storage provides various features that support mirroring. Mirroring enables continuous storage availability across sites against storage failure in the site. If your environment is managed entirely by SSP for both system (for example, rootvg) and data disks, then you can spread the SSP cluster across two buildings and achieve protection against storage failures. This type of deployment is suited for short distances (less than 1 km).

SSP-based deployments belong to the shared storage category. That is, the KSYS subsystem does not manage the storage replication. Because the SSP-based storage exhibits the shared storage model, you do not need to consider the disk pair and disk group mappings for storage configuration.

When you move the virtual machines from the active site to the backup site, the KSYS subsystem does not perform any storage-specific preparation (unlike the conventional replicated storage systems) and starts the virtual machines on the backup site.

Note: The VM Recovery Manager DR solution supports shared storage with SSP mirror management only for sites that are spanned across short distances.

The following figure shows an example of shared storage configuration with mirror management by SSP.

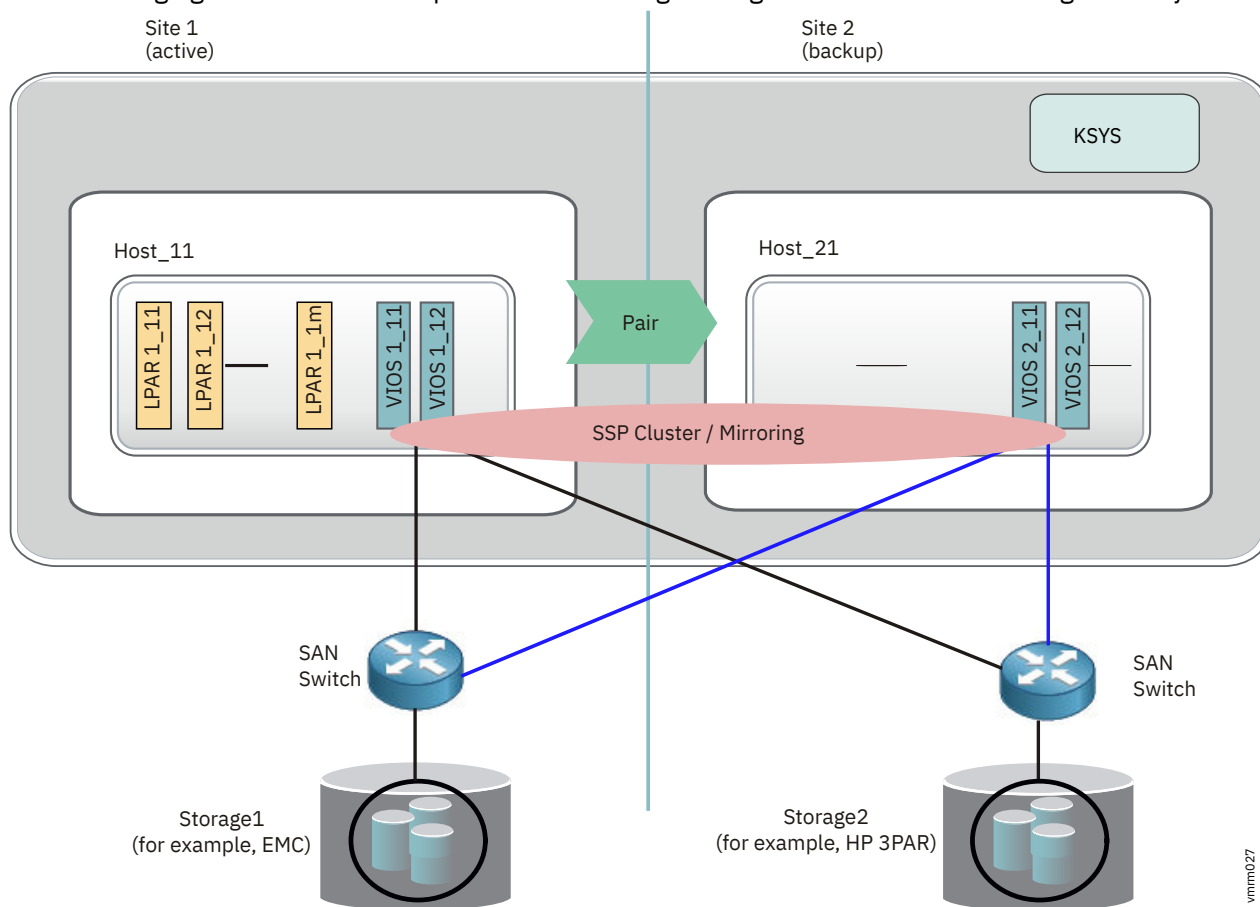


Figure 30. Shared storage configuration with SSP mirror management

Backing up and restoring the configuration data

You can back up all the current configuration settings of your KSYS environment as a snapshot. A *snapshot* preserves the configuration details of the KSYS environment at a specific point in time. For example, a snapshot file contains the information about the existing sites, details about the managing HMCs and the managed hosts in a specific site, and the storage device details in the site. You should back up your current configuration settings after you configure the sites, hosts, HMCs, and storage devices initially.

If you save a snapshot of the current KSYS configuration settings, you can restore the configuration settings later by applying the snapshot on the KSYS configuration. The snapshots are useful during node upgrades or environment malfunctions because snapshots eliminate the need to reconfigure the sites, hosts, HMCs, and storage devices. For example, if the KSYS node must be reinstalled, you can use a snapshot and do not have to re-create sites, hosts, and other resources.

You can save the following types of snapshots:

Cluster configuration data

Backs up the core KSYS deployment data that is used to create the KSYS cluster. The cluster configuration snapshot contains the following information:

- Cluster name
- KSYS node name
- Cluster type

Basic configuration data

Backs up the cluster configuration data along with the data to configure sites, hosts, HMCs, and storage agents. It also includes information about the LPARs in a host that are excluded from the configuration. However, it does not include detailed information about disk pairs and disk groups for each LPAR.

The basic configuration snapshot contains the following information:

- Sites
 - Site name
 - Site type
- Storage agent
 - Name
 - IP address
 - Storage host name
 - User name
 - Password
 - Site name
 - Site ID
 - Storage type
 - Serial number
- HMCs
 - User name
 - Password
 - IP address
 - Name (logical name)
 - Site ID
 - Site name
- Hosts
 - Name
 - UUID
 - FSP ID
 - FSP host name
 - Host's partner's UUID

Detailed configuration data

Backs up all the basic configuration data along with the detailed LPAR data that is determined by discovering resources in a site such as disk pairs and disk groups. The detailed configuration snapshot contains information about sites, storage agents, HMCs, hosts, disk pairs, and disk groups. If you had configured tertiary disk in the backup site for failover rehearsal of disaster recovery operation, the detailed configuration snapshot contains the tertiary disk values.

If you capture a snapshot on VM Recovery Manager DR Version 1.1.0.1, and you want to restore the configuration settings on VM Recovery Manager DR version 1.2.0, you can restore only **cluster** and **basic** type of snapshots. To restore **detailed** type of snapshot, the VM Recovery Manager DR version must be the same as the version it was captured.

Saving and restoring snapshots

Use the **ksysmgr** command to save the configuration snapshots. The snapshots are saved in an XML format. When you create a snapshot, the **ksysmgr** command appends the date and time to the specified file name to follow the *filename.DateTime* name convention. By default, the snapshot files are saved in the `/var/ksys/snapshots` directory. However, you can specify the path where the snapshot files must be saved.

Notes:

- You must ensure that the `/var` file system has enough space for the snapshot files before you back up the configuration data.
- If the KSYS node must be reinstalled, you must save the snapshot files in a different location so that the snapshot files can be used later for restoring the configuration settings by using the **ksysmgr** command. You can use the **ftp** command to copy the snapshot files to another system and to copy the snapshot files from another system to the KSYS node after the installation is complete.
- You cannot restore a snapshot file that is captured in a different site. To restore a snapshot file, the snapshot file must be captured on the same site.
- If you want to know the tertiary disk information after restoring a detailed snapshot, you must run the discovery operation with the **dr_test** flag.
- If you connect the source hosts and target hosts to the same HMC, it leads to an invalid configuration in the KSYS subsystem. If you had saved a snapshot of such an invalid configuration, the restore operation fails.

You can perform the following snapshot operations:

- To save a snapshot, use the following command syntax:

```
> | ksysmgr add snapshot filepath=full_file_prefix_path|file_prefix | <
```

> | For example, to back up configuration data of your KSYS environment once in a week such that no more than 5 backup files exist, run the following command: | <

```
> | ksysmgr add snapshot filepath=/home/ksysdir/myksysbackup | <
```

The **ksysmgr** command saves the snapshot after archiving and compressing the file.

- To view an existing snapshot, use the following command syntax:

```
ksysmgr query snapshot filepath=full_file_prefix_path
```

For example:

```
ksysmgr query snapshot filepath=/var/ksys/snapshots/  
ksys6002detailsnap_DETILED_2019-12-12_04:07:52.xml.tar.gz
```

An output that is similar to the following example is displayed:

```

File:      /var/ksys/snapshots/ksys6002detailsnap_DETAILED_2019-12-12_04:07:52.xml
Type:      DETAILED
VMMR Version:1.5.0.0
Date:      2019-12-12
Time:      04:07:52
-----
Cluster:
-----
Name:      DR_TEST
Node:      ksys6002.aus.stglabs.ibm.com
Type:      DR
-----

```

Before you restore a saved snapshot on a KSYS node, in which the operating system is reinstalled, or on another logical partition that must be used as KSYS LPAR, you must ensure that the *HOST* variable is set. You can set the *HOST* variable as shown in the following example:

```
# export HOST=host_name
```

- To restore the configuration data on a KSYS node, use the following command syntax:

```
ksysmgr restore snapshot filepath=full_file_prefix_path
```

For example:

```
ksysmgr restore snapshot filepath=/home/ksysdir/myksysbackup_2016_06_23_04:54:30.xml.tar.gz
```

This command decompresses and unarchives the snapshot file, and then applies the configuration settings to the KSYS node.

Related reference

[ksysmgr command](#)

Managing the CoD resources

If you use capacity management solutions in your environment to reduce the capacity on the backup hosts during non-disaster times, you can use the VM Recovery Manager DR solution to manage the resource allocations during a disaster recovery failover operation.

To manage the resource allocations in a disaster recovery environment, the VM Recovery Manager DR solution provides a resource pool provisioning (RPP) command that is called the **ksysrppmgr** command. The **ksysrppmgr** command optimizes available resources on the managed hosts. This command also minimizes your resource costs by optimizing the local consumption of pool resources.

Before you run the **ksysrppmgr** command to allocate resources to a managed host, you can run the **ksysrppmgr** command in check mode to simulate the execution and analyze the results.

The VM Recovery Manager DR solution can manage resource allocation for the following capacity management solutions:

- POWER® Enterprise Pool
- Elastic (On/Off) Capacity-on-Demand

Related reference

[ksysrppmgr command](#)

VM Recovery Manager DR and Power Enterprise Pool

Power Enterprise Pool provides flexibility to hosts that operate together as a pool of resources. Mobile activations can be assigned to any host in a predefined pool and the resources can be reassigned within a pool.

If you use Power Enterprise Pool in your environment for capacity management, review the following scenarios to determine how you can manage the resource allocations by using the VM Recovery Manager DR solution:

Scenario 1: Using Enterprise Pools across sites

In this scenario, the Enterprise Pool is shared across sites as shown in the following figure:

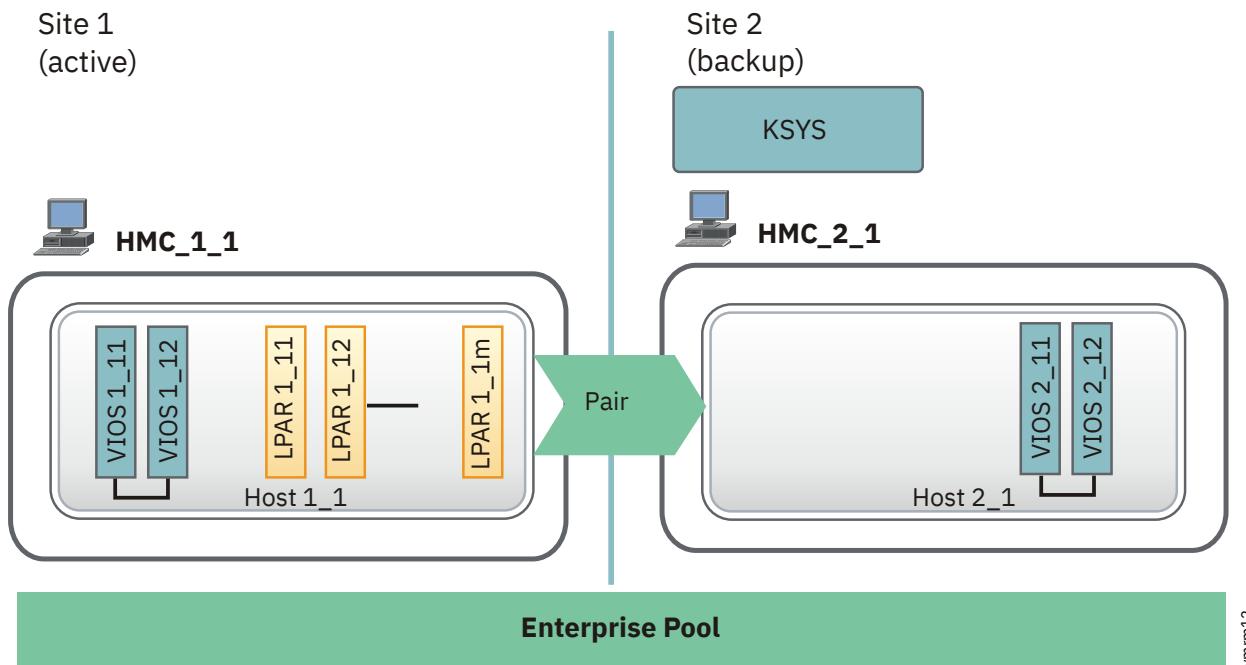


Figure 31. Power Enterprise Pool usage across the sites

When the active site fails, complete the following steps before you initiate the site-switch operation:

1. In the KSYS node, authenticate all the HMCs by running the **hmcauth** command:

```
hmcauth -u hmcuser -p password -a HMC_1_1
hmcauth -u hmcuser -p password -a HMC_2_1
```

2. Check whether the required number of processors and memory can be available in the backup host that does not use Elastic (On/Off) CoD by running the following command:

```
ksysippmgr -o check -h :HMC_1_1:hmcuser -h :HMC_2_1:hmcuser \
-m Host_2_1:set:n:<memory_amount>:<no_of_processors> -i
```

If the return code of the command is 0, all the requests can be fulfilled. If the return code is 1, at least one request has failed.

3. If the resource requests are not fulfilled, release the resources that are used by the virtual machines of Site_1, and return the resources to the Enterprise Pool either by using the HMC or by running the following command in the KSYS node:

```
ksysippmgr -o execute -h :HMC_1_1:hmcuser -m Host_1_1:set:n:0:0
```

For more information about the steps to release or allocate resources by using HMC, see [Using Power Enterprise Pools](#).

4. Allocate the required amount of resources to the hosts in the Site_2 site by using the HMC or by running the following command in the KSYS node:

```
ksysippmgr -o execute -h :HMC_2_1:hmcuser \
-m Host_2_1:set:n:<memory_amount>:<no_of_processors> -i -v
```

The target host on the backup site now contains all the required resources to host the recovered virtual machines.

5. Verify whether the virtual machines can be moved to the backup site by running the following command:

```
ksysmgr verify site Site_2
```

Note: If the backup site does not have sufficient processors and memory, the verify operation fails with a warning message. You can use the force (**-f**) option to move the virtual machines to the backup site with the existing configuration.

6. Initiate the disaster recovery by switching the site from Site_1 to Site_2 by running the following command in the KSYS node:

```
ksysmgr move from=Site_1 to=Site_2 dr_type=planned
```

Scenario 2: Using Enterprise Pool within the backup site

In this scenario, the Enterprise Pools are shared across hosts within the backup site. In the example, as shown in the figure, Host_1_1 in the active site is paired to Host_2_1 in the backup site. Host_2_2 is another host in the backup site that is running low priority virtual machines. When the active site fails, you can allocate some resources from the Host_2_2 to the Host_2_1 to run the recovered virtual machines.

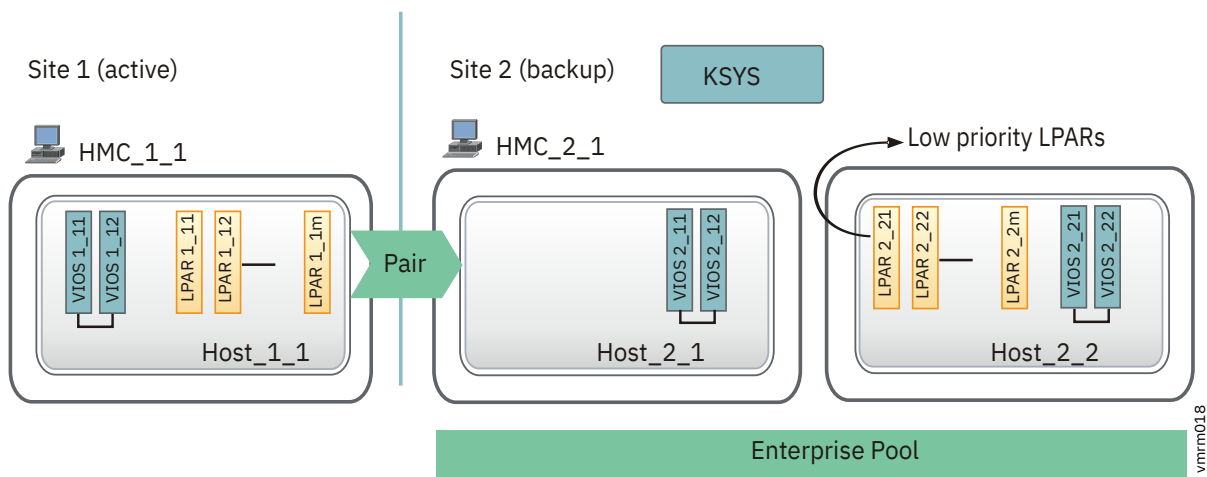


Figure 32. POWER Enterprise Pool usage within the backup site

Before you initiate the site-switch operation, complete the following steps:

1. In the KSYS node, authenticate all the HMCs by running the **hmcauth** command:

```
hmcauth -u hmcuser -p password -a HMC_1_1
hmcauth -u hmcuser -p password -a HMC_2_1
```

2. Check whether the required number of processors and memory can be available in the backup host that does not use Elastic (On/Off) CoD by using the HMC or by running the following command in the KSYS node:

```
ksysppmgr -o check -h :HMC_1_1:hmcuser -h :HMC_2_1:hmcuser \
-m Host_2_1:set:n:<memory_amount>:<no_of_processors> -i -v
```

If the return code of the command is 0, all the requests can be fulfilled. If the return code is 1, at least one request has failed. For more information about the steps to release or allocate resources by using HMC, see [Using Power Enterprise Pools](#).

3. If the output indicates that the request cannot be fulfilled, reduce the resources that are allocated to Host_2_2 that runs low priority virtual machines and return the resources to the Enterprise Pool either by using HMC or by running the following command in the KSYS node:

```
ksysppmgr -o execute -h :HMC_2_1:hmcuser \
-m Host_2_2:set:n:<memory_amount>:<no_of_processors>
```

- Allocate the resources to the Host_2_1 host by running the following command:

```
ksysippmgr -o execute -h :HMC_2_1:hmcuser \
-m Host_2_1:set:n:<memory_amount>:<no_of_processors>
```

- Verify whether the virtual machines can be moved to the backup site by running the following command:

```
ksysmgr verify site Site_2
```

Note: If the backup site does not have sufficient processors and memory, the verify operation fails with a warning message. You can use the force (**-f**) option to move the virtual machines to the backup site with the existing configuration.

- Initiate the disaster recovery by running the following command:

```
ksysmgr move from=Site_1 to=Site_2 dr_type=planned
```

VM Recovery Manager DR and Elastic (On/Off) CoD

Elastic Capacity-on-Demand (formally known as On/Off CoD) provides short-term CPU and memory activation capability for fluctuating peak processing requirements.

If the resource requirements are not met even after you allocate maximum number of resources from the Enterprise Pool, you can allow the Elastic (On/Off) CoD usage that activates temporary resources for a specified number of days. The following figure shows an example of Elastic (On/Off) CoD usage within a site:

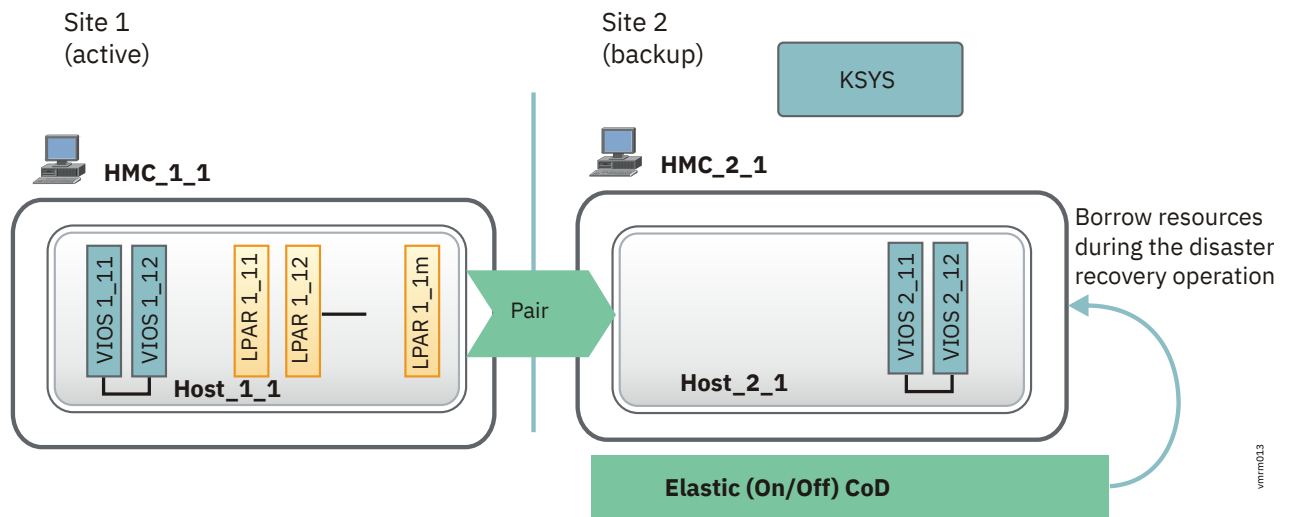


Figure 33. Elastic (On/Off) CoD usage for a host

When the active site fails, complete the following steps to allow Elastic (On/Off) CoD to manage the resources before you initiate a site-switch operation:

- Authenticate all the HMCs by running the **hmcauth** command:

```
hmcauth -u hmcuser -p password -a HMC_1_1
hmcauth -u hmcuser -p password -a HMC_2_1
```

- Identify the amount of available processor and memory units that are required by the backup hosts and determine whether you want to authorize the use of Elastic (On/Off) CoD to achieve the request.
- If the resource requests are not met by using Enterprise Pool, allow the use of Elastic (On/Off) CoD. For example, to request 2.5 CPUs and 10500 MB memory for the Host_2_1 host and to use Elastic (On/Off) CoD for 5 days, enter the following command:

```
ksysippmgr -o execute -h :HMC_1_1:hmcuser -h :HMC_2_1:hmcuser -m Host_2_1:set:y5:10500:2.5 -r
```

4. Verify whether the virtual machines can be moved to the backup site by running the following command:

```
ksysmgr verify site Site_2
```

Note: If the backup site does not have sufficient processors and memory, the verify operation fails with a warning message. You can use the force (**-f**) option to move the virtual machines to the backup site with the existing configuration.

5. Initiate the disaster recovery operation by running the following command in the KSYS node:

```
ksysmgr move from=Site_1 to=Site_2 dr_type=planned
```

VM Recovery Manager DR coexistence with other products and offerings

Review the following scenarios that explain how the VM Recovery Manager DR solution coexists with other solutions that are deployed in the same environment.

Live Partition Mobility and VM Recovery Manager DR coexistence

The Live Partition Mobility (LPM) allows a running LPAR to be relocated from one host to another host within a site. If the VM Recovery Manager DR solution is implemented in your environment, when you relocate a virtual machine from a host to another host within a site by using the LPM feature, the KSYS subsystem detects this change as part of its daily check. A discovery operation is required for the modified virtual machine to ensure its successful recovery during a disaster situation.

Note: The KSYS can identify this movement as an LPM operation only when the source host and the target host for the LPM operation are already added to the KSYS configuration. If one of the source or target hosts are not part of the KSYS configuration, the KSYS detects this movement as an addition or deletion of a virtual machine.

An LPM operation within a single host group does not result in any storage-level changes. An LPM operation across multiple host groups removes the LPAR disks from the source storage group and adds the disks into the target storage group.

By default, any changes in the KSYS configuration are discovered in the span of 24 hours. However, if a disaster recovery operation is required before the discovery operation runs, the movement of this newly-moved virtual machine from the active site to the backup site might fail. Therefore, you must run a discovery and verification operation in the site after the LPM operation is completed.

Related concepts

Discovering resources

After you add the various HMCs, hosts, host groups, and storage subsystems to the KSYS subsystem for disaster recovery management, you must run the `ksysmgr discover` command to discover all the hosts that are managed by the HMCs in both the home and the backup sites. During the discovery process, the KSYS subsystem captures the configuration information of the home site and its relationship with the backup site and prepares the backup site to perform disaster recovery operations later.

IBM PowerVC and VM Recovery Manager DR coexistence

IBM Power® Virtualization Center (PowerVC) is a virtualization management offering that is used to create and manage virtual machines on IBM Power Systems servers by using PowerVM or PowerKVM hypervisor. The PowerVC offering can coexist with the VM Recovery Manager DR solution. This information lists the areas where resource conflicts might occur and how the VM Recovery Manager DR solution handles the conflicts.

The PowerVC solution can trigger the following features as part of its regular or disaster recovery operations:

Live Partition Mobility (LPM)

A running virtual machine is moved from a source host to a target host.

Remote restart

A running virtual machine is moved from a faulty source host and restarted in a target host.

Maintenance mode switchover

All virtual machines are moved from a host to another host for maintenance purpose on the source host.

Capacity management

Memory or CPU core resources can be reassigned to a host within a pool.

Note: All these resource changes do not cause a conflict for the VM Recovery Manager DR solution because any such movements are discovered by the KSYS in the next scheduled discovery. You can also manually run a discovery operation after any such modification is complete.

Storage area network (SAN) zoning

You can use the PowerVC solution to perform the SAN zoning for your environment. However, you must ensure that the SAN is connected according to the VM Recovery Manager DR requirement for the configuration of virtual machines and VIOS partitions.

AIX Live Update

The AIX Live Update function eliminates downtime that is associated with installing the interim fixes for the AIX operating system. This function allows workloads to remain active during a Live Update operation and the operating system can use the interim fix immediately without restarting the entire system.

The Live Update function changes the MAC address for a virtual machine after the Live Update operation is complete. The Live Update function results in a surrogate LPAR to exist in the environment for a few minutes. The Live Update function renames the original LPAR with a naming convention, `originalLparName_1ku0`.

Note: You must not perform a Live Update operation when you are running a disaster recovery operation by using the VM Recovery Manager DR solution.

For more information about the Live Update operation, see the [Live Update](#) topic.

PowerHA SystemMirror and VM Recovery Manager DR coexistence

The IBM PowerHA SystemMirror software provides cluster-based high availability (Standard Edition) and disaster recovery (Enterprise Edition) solutions. The VM Recovery Manager DR solution can operate with PowerHA SystemMirror Version 7.1.0 if you follow the guidelines that are required to deploy both the solutions together.

Disaster recovery by using PowerHA SystemMirror Enterprise Edition

If you are using the PowerHA SystemMirror Enterprise Edition to perform disaster recovery for some of the virtual machines in your environment, you do not need to deploy the VM Recovery Manager DR solution for those virtual machines. In this case, you must exclude those virtual machines from the VM Recovery Manager DR disaster recovery management. Use the `ksysmgr unmanage` command to exclude the PowerHA virtual machines from the VM Recovery Manager DR configuration before you discover resources in the VM Recovery Manager DR solution.

To use VM Recovery Manager DR with PowerHA SystemMirror, PowerHA SystemMirror must support the `CAA_AUTO_START_DR` tunable parameter and Cluster Aware AIX (CAA) must support the `CAA_AUTO_START_DR` tunable parameter.

High availability by using PowerHA SystemMirror Standard Edition

PowerHA SystemMirror Standard Edition is deployed within a site. PowerHA creates a cluster of a set of virtual machines within the active site for high availability management. If you are configuring such a cluster within the active site of the VM Recovery Manager DR environment, consider the following guidelines:

- Include all the virtual machines in the cluster to the VM Recovery Manager DR disaster recovery management.
- Perform a test failover of the cluster to the backup site to validate whether that cluster starts correctly on the backup site.

If you deployed PowerHA SystemMirror Version 7.1.0 (or later) clusters in the environment, some additional steps are required to start the cluster on the backup site by using the VM Recovery Manager DR solution after the operating system in the virtual machines are started during the recovery operation. The following disk details are required for the backup disks on each site:

- Name
- Physical volume identifier (PVID)
- Universal Unique ID (UUID)

To obtain the disk information of the cluster nodes, complete the following steps on any one of the cluster nodes in the source site immediately after the VM Recovery Manager DR solution is implemented in your environment:

1. Run the following command to obtain the name and UUID of each disk in the active site cluster:

```
/usr/lib/cluster/clras dumprepos
```

The same information is available on each node of the cluster.

2. Run the following command to obtain the PVIDs:

```
lspv -u | egrep -w "<disk1>|<disk2>|..."
```

where *disk1* and *disk2* are the disk names as displayed in the previous output.

3. Identify and differentiate the disks in the primary repository from the disks at the backup site.

To restart the PowerHA SystemMirror Version 7.1.0 or Cluster Aware AIX (CAA) clusters on the backup site after the disaster recovery operation is complete, complete the following steps on any one of recovered virtual machine that is used to start the cluster. You can use a single node to perform all the following steps:

1. If the recovered virtual machines are not active, run the following command with the identified PVIDs to get the corresponding disks:

```
lspv -u | egrep -w "<pvid1>|<pvid2>|..."
```

where *pvid1* and *pvid2* are the PVIDs that are listed in the active site.

Note: The disks in the active site and the backup site share common PVIDs.

2. Save the type (primary or backup), name, PVID, and UUID for each disk in the active and backup sites and identify the corresponding disks between sites. For example, *hdiskA* with PVID B and UUID C mirrors to *hdiskX* with PVID B and UUID Y.
3. Identify the disks that must be used as the primary repository and at the backup site.
4. Remove any CAA information from the backup site repository by using the following command:

```
CAA_FORCE_ENABLED=true imcluster -fr <backup_disk_name>
```

The *backup_disk_name* attribute is the name of disk at the backup site. This command removes only the CAA data.

5. Run the following command to write the repository disk information by using the information from the CAA repository backup file:

```
CAA_FORCE_ENABLED=true chrepos -fc <backup_disk_name>
```

6. If you were using non-native AIX Multipath I/O (MPIO) disks (for example, EMC PowerPath), run the following command to register the disks with the CAA and AIX disk drivers:

```
clusterconf -d
```

7. If a disk is configured at the backup site in the Cluster Aware AIX (CAA), run the following command for each repository disk in the previous site:

```
chrepos -x <old_backup_UUID>,<new_backup_name | new_backup_UUID>
```

For example, if the disk at the backup site `hdisk1` with PVID `X` and UUID `Y` mirrors to the disk at the backup site `hdisk5` with PVID `X` and UUID `Z`, run the following command:

```
chrepos -x Y,hdisk5
```

or,

```
chrepos -x Y,Z
```

8. Run the following command to start the cluster in the backup site:

```
clusterconf
```

Related information

[IBM PowerHA SystemMirror V7.1 for AIX documentation](#)

Running scripts for additional checks

If you want KSYS to perform some additional checks that are specific to your environment, you can add those checks as scripts. You can specify whether those scripts must be run before or after the discovery, verification, or disaster recovery operations.

For example, if you use the Enterprise Pool resource management, you can add a customized script to update the backup host capacity and revert to older capacity values after the verification is complete. To monitor the workload that is running on the virtual machines on a specific criteria, you can add scripts to check the workload before and after the verification. You can run the scripts at site, host group, and VM levels.

The sample scripts are available in the `/opt/IBM/ksys/samples/custom_validation/` directory.

Running scripts before or after discovery and verification operations

You can use the following attributes to add a script for additional checks during verification operations:

pre_verify

When you specify a script with this attribute, the script is run before any discovery and verification operations. You can add a `pre_verify` script by entering the following command syntax:

```
ksysmgr add script entity=site|host_group|vm pre_verify=script_path
```

post_verify

When you specify a script with this attribute, the script is run after any discovery and verification operations. You can add a `post_verify` script by entering the following command syntax:

```
ksysmgr add script entity=site|host_group|vm post_verify=script_path
```

Running scripts before or after the disaster recovery operations

You can use the following attributes to add a script for additional checks during disaster recovery operations:

pre_offline

When you specify a script with this attribute, the script is run before the virtual machines are shut down in the primary site. You can add a `pre_offline` script by entering the following command syntax:

```
ksysmgr add script entity=site|host_group|vm pre_offline=script_path
```

post_offline

When you specify a script with this attribute, the script is run after all the virtual machines are shut down in the primary site. You can add a `post_offline` script by entering the following command syntax:

```
ksysmgr add script entity=site|host_group|vm post_offline=script_path
```

pre_online

When you specify a script with this attribute, the script is run before the storage replication direction is reversed and before the virtual machines are restarted on the target site. You can add a `pre_online` script by entering the following command syntax:

```
ksysmgr add script entity=site|host_group|vm pre_online=script_path
```

post_online

When you specify a script with this attribute, the script is run after the virtual machines are restarted on the target site. You can add a `post_online` script by entering the following command syntax:

```
ksysmgr add script entity=site|host_group|vm post_online=script_path
```

When you register scripts, the KSYS subsystem passes the following arguments to the custom scripts that you registered. You can use these values to identify the operation that the KSYS subsystem is performing and to determine at what stage of a specific operation is your script triggered by the KSYS subsystem.

Resource class	Argument values	Additional arguments that are passed by the KSYS subsystem
Site	KSYS_MOVE_PLANNED_PRE_OFFLINE_SITE KSYS_MOVE_UNPLANNED_PRE_OFFLINE_SITE KSYS_MOVE_PLANNED_POST_ONLINE_SITE KSYS_MOVE_UNPLANNED_POST_ONLINE_SITE KSYS_PRE_DISCOVERVERIFY_QUICK_DISCOVERY_SITE KSYS_PRE_DISCOVERVERIFY_DETAIL_DISCOVERY_SITE KSYS_PRE_VERIFYONLY_QUICK_DISCOVERY_SITE KSYS_PRE_VERIFYONLY_DETAIL_DISCOVERY_SITE KSYS_PRE_DISCOVERONLY_QUICK_DISCOVERY_SITE KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_SITE KSYS_POST_DISCOVERVERIFY_QUICK_DISCOVERY_SITE KSYS_POST_DISCOVERVERIFY_DETAIL_DISCOVERY_SITE KSYS_POST_VERIFYONLY_QUICK_DISCOVERY_SITE KSYS_POST_VERIFYONLY_DETAIL_DISCOVERY_SITE KSYS_POST_DISCOVERONLY_QUICK_DISCOVERY_SITE KSYS_POST_DISCOVERONLY_DETAIL_DISCOVERY_SITE KSYS_DRTEST_PRE_ONLINE_SITE KSYS_DRTEST_POST_ONLINE_SITE KSYS_CLEANUP_PRE_OFFLINE_SITE KSYS_CLEANUP_POST_OFFLINE_SITE	Source site name and target site name

Resource class	Argument values	Additional arguments that are passed by the KSYS subsystem
Host group	KSYS_MOVE_PLANNED_PRE_OFFLINE_HOST_GROUP KSYS_MOVE_PLANNED_POST_OFFLINE_HOST_GROUP KSYS_MOVE_PLANNED_PRE_ONLINE_HOST_GROUP KSYS_MOVE_PLANNED_POST_ONLINE_HOST_GROUP KSYS_MOVE_UNPLANNED_PRE_OFFLINE_HOST_GROUP KSYS_MOVE_UNPLANNED_POST_OFFLINE_HOST_GROUP KSYS_MOVE_UNPLANNED_PRE_ONLINE_HOST_GROUP KSYS_MOVE_UNPLANNED_POST_ONLINE_HOST_GROUP KSYS_PRE_DISCOVERVERIFY_QUICK_DISCOVERY_HOST_GROUP KSYS_PRE_DISCOVERVERIFY_DETAIL_DISCOVERY_HOST_GROUP KSYS_PRE_VERIFYONLY_QUICK_DISCOVERY_HOST_GROUP KSYS_PRE_VERIFYONLY_DETAIL_DISCOVERY_HOST_GROUP KSYS_PRE_DISCOVERONLY_QUICK_DISCOVERY_HOST_GROUP KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_HOST_GROUP KSYS_POST_DISCOVERVERIFY_QUICK_DISCOVERY_HOST_GROUP KSYS_POST_DISCOVERVERIFY_DETAIL_DISCOVERY_HOST_GROUP KSYS_POST_VERIFYONLY_QUICK_DISCOVERY_HOST_GROUP KSYS_POST_VERIFYONLY_DETAIL_DISCOVERY_HOST_GRP KSYS_POST_DISCOVERONLY_QUICK_DISCOVERY_HOST_GROUP KSYS_POST_DISCOVERONLY_DETAIL_DISCOVERY_HOST_GROUP KSYS_DRTEST_PRE_ONLINE_HOST_GROUP KSYS_DRTEST_POST_ONLINE_HOST_GROUP KSYS_CLEANUP_PRE_OFFLINE_HOST_GROUP KSYS_CLEANUP_POST_OFFLINE_HOST_GROUP	Host group name
VM	KSYS_PRE_VERIFY_LPAR KSYS_POST_VERIFY_LPAR KSYS_MOVE_UNPLANNED_PRE_OFFLINE_LPAR KSYS_MOVE_PLANNED_PRE_OFFLINE_LPAR KSYS_MOVE_UNPLANNED_POST_OFFLINE_LPAR KSYS_MOVE_PLANNED_POST_OFFLINE_LPAR KSYS_MOVE_UNPLANNED_PRE_ONLINE_LPAR KSYS_MOVE_PLANNED_PRE_ONLINE_LPAR KSYS_MOVE_UNPLANNED_POST_ONLINE_LPAR KSYS_MOVE_PLANNED_POST_ONLINE_LPAR	Virtual machine name

Configuring the timeout duration for custom scripts

You can configure the timeout duration for a custom script. If the custom script is unable to complete the execution within the configured timeout duration, the KSYS subsystem terminates the execution of the custom script and proceeds with the next execution. If the value 0 is set for the timeout duration, the system waits indefinitely for the custom script to complete the execution before proceeding to the next execution. Run the following command to configure the timeout duration for a custom script:

```
ksysmgr modify system [custom_script_timeout=<sec>]
```

The custom script timeout value set in the this command is used at the site level, the host group level and the VM level. The `sec` variable is the timeout duration set in seconds for the custom script.

Note: In the HADR type of deployment, scripts are triggered for both HA and DR processes. To check whether the script is running for the HA process or the DR process, you can use persistent variables, `VerifyContext` and `FailoverContext` at the host group level. Run the following commands to check whether the script is running for the HA process or for the DR process:

```
lsrsrc -s 'Name=<NameOfHG>' IBM.VMR_HG VerifyContext
```

```
lsisrc -s 'Name=<NameOfHG>' IBM.VMR_HG FailoverContext
```

Running the disaster recovery scripts

During a disaster recovery event, when the logical partitions (LPARs) move from the active site to the backup site, the IP addresses, subnet, and other network-related attributes change. If you want the backup environment to be the same as the source environment for the LPARs, you can use the disaster recovery scripts that collect the information from the source LPARs and reconfigures the backup LPARs to match the system name, adapter configuration, network parameters, volume group information, and clustering configuration.

The disaster recovery scripts are custom scripts that are available in the KSYS package. Run these scripts in the virtual machines to collect required information about the source LPAR and to use the collected information to re-create or import the environment in the recovered LPAR.

Consider the following prerequisites before you use the disaster recovery scripts:

- The **data_collection.ksh** script must be run successfully on every LPAR in the source site.
- The **setup_dr.ksh** script must be run successfully on every LPAR in the backup site.
- All of the cluster LPARs must be running and must have network capability.

The disaster recovery scripts and sample files are described in the following table:

Disaster recovery scripts or files	Description
data_collection.ksh	<p>Collects the following information about the source environment:</p> <ul style="list-style-type: none">• System host name• Network adapter information• Host bus adapter (HBA) configuration• Domain Name System (DNS) server and domain• LPAR attributes• Volume group attributes and hard disk attributes• AIX kernel (sys0) configuration <p>Note: This script must be installed on the source LPAR in the <code>/usr/local/bin</code> directory. The data_collection.ksh script must be run on the source LPARs regularly.</p> <p>The data_collection.ksh script collects system information and places it in the following locations:</p> <p>/usr/local/dr/data directory Contains system-customized information.</p> <p>/usr/local/dr/data_default directory Contains information about the default parameters for each device.</p>

Table 12. Disaster recovery scripts and configuration files (continued)

Disaster recovery scripts or files	Description
setup_dr.ksh	<p>Reconfigures the environment of the backup LPAR to be the same as the source LPAR.</p> <p>Note: All scripts must be installed in the <code>/usr/local/bin/</code> directory of the source LPARs so that these scripts are also available in the backup LPARs during a disaster. You must run this script on the backup LPAR during a disaster recovery event.</p> <p>Consider the following prerequisites before you run this script:</p> <ul style="list-style-type: none"> • The LPAR must be started and running in the target site with the rootvg disk. • Root passwords must be acquired and used to start and log in to the backup LPARs. <p>The setup_dr.ksh script calls other scripts automatically to perform the following tasks:</p> <ul style="list-style-type: none"> • Reconfigure the HBA adapters of the backup LPAR to be the same as the source LPAR. • Reconfigure the Ethernet adapter of the backup LPAR by reading the contents of the <code>failover_config.cfg</code> configuration file and set the host name, IP address, and the base network of the backup LPAR. • Reconfigure any additional Ethernet adapters on the backup LPAR by using the appropriate IP addresses. • Import any volume groups from the source LPAR to the backup LPAR.
failover_config.cfg	<p>Contains sample configuration file for information about the backup LPAR.</p> <p>You must manually edit this file and fill appropriate information about the AIX operating system configuration in the backup LPAR that are listed as follows:</p> <ul style="list-style-type: none"> • IP address of LPAR at the source site • IP address of LPAR at the backup site • Network netmask that must be used at the backup site • DNS server that must be used at the backup site • Network domain name that must be used at the backup site • Default gateway IP address that must be used at the backup site <p>Note: The updated <code>failover_config.cfg</code> file must be placed in the <code>/usr/local/dr/data</code> directory of the source LPAR.</p>

After you complete the initial configuration on the source LPAR, complete the following steps:

1. Copy the script and sample files from the following location in the KSYS node:

```
/opt/IBM/ksys/samples/
```

2. Install these script files in the following location of the source LPARs:

```
/usr/local/bin/
```

3. Edit the `failover_config.cfg` configuration file with the appropriate LPAR information and place it in the `/usr/local/dr/data` directory.
4. Run the **data_collection.ksh** script regularly to collect the environment information. You can set your LPARs to run this script daily by using the AIX `cron` utility. For example, you can add the following line as a `crontab` entry to run this script daily at 1 AM:

```
00 01 * * * /usr/local/dr_collection
```

When you move the source LPARs to the backup site during a disaster event, you can use the disaster recovery scripts to retain the environment of the source LPARs. The procedure to run the disaster recovery steps in the backup site assumes that the following prerequisites are met:

- All the disaster recovery scripts are installed on the source LPARs.
- The `failover_config.cfg` configuration file is manually edited with the appropriate backup LPAR information.
- The **data_collection.ksh** script is successfully run on the source LPARs.
- The `failover_config.cfg` configuration file is updated with the appropriate host name, IP address, netmask, name server that corresponds to the backup LPAR.
- The disk replication and split operations copied all of the source data to the backup site.
- The disk storage is available to the appropriate LPAR on the backup site.
- A disaster occurred, and the source LPARs are moved to the backup LPARs.
- The appropriate root passwords are acquired for the backup LPARs.
- The appropriate DNS server is available at the backup location.
- The backup LPARs are identified and are accessible through the HMC.

To run the disaster recovery scripts in the backup LPARs, complete the following steps:

1. To check the `/usr/local/dr/data` directory for date and time stamps, run the following command:

```
ls -la /usr/local/dr/data
```

Verify whether the replication was complete.

2. If the console messages are large, route the output to a file by running the following command:

```
swcons /tmp/console.log
```

3. Run the **setup_dr.ksh** script to reconfigure the backup LPAR host name, network IP addresses, and HBAs, and to import the volume groups.

Note: The LPARs must be completely recovered by now.

4. Verify the LPAR configuration to confirm the changes by completing the following checks:
 - a. Run the **hostname** command to verify the LPAR host name.
 - b. Run the **ifconfig -a** command to verify the LPAR IP address.
 - c. Run the **df** or **mount** command to verify that all local file systems are mounted. Mount any unmounted file systems by using the **mount** command, if required.
 - d. Run the **lspv -a** command to display all paging spaces and their status. For unavailable paging spaces, run the **swapon** command with the appropriate paging space to set the paging space to the active state.

Commands

The following commands are commonly used to obtain information about the KSYS environment or to run a specific function.

For complete information about command's capabilities and restrictions, see the man page.

To view the man page information for a command, enter the following command:

```
man command_name
```

ksysmgr command

Purpose

The **ksysmgr** command provides a consistent interface to configure the controller system (KSYS) and to perform IBM VM Recovery Manager DR for Power Systems operations by using a terminal or script.

Syntax

```
ksysmgr [-v] [-f] [-l {low|max}] [-i]
[-a {<ATTR#1>,<ATTR#2>,...}] <ACTION> <CLASS> [<NAME>]
[-h | <ATTR#1>=<VALUE#1> <ATTR#2>=<VALUE#2> ...]

ksysmgr [-v] [-f] [-l {low|max}]
[-a {<ATTR#1>,<ATTR#2>,...}] <ACTION> <CLASS> [<NAME>]
<ATTR#1>=<VALUE#1> <ATTR#2>=<VALUE#2> ...

ACTION={add|modify|delete|query|manage|unmanage|...}\n\
CLASS={ksyscluster|site|hmc|host|...}\n\

ksysmgr {-h|-?} [-v] [<ACTION> [<CLASS>]]

ksysmgr [-v] help
```

The basic format for using the **ksysmgr** command is as follows:

```
ksysmgr ACTION CLASS [NAME] [ATTRIBUTES...]
```

Notes:

- You must have root authority to run the **ksysmgr** command.
- Help information is available for the **ksysmgr** command from the command line. For example, when you run the **ksysmgr** command without any flags or parameters a list of the available ACTIONS is displayed.
- If you enter `ksysmgr <ACTION>` in the command line without specifying any CLASS, the command results in a list of all the available CLASSES for the specified ACTION.
- Entering `ksysmgr <ACTION> <CLASS>` without specifying any NAME or ATTRIBUTES parameters is different because some ACTION and CLASS combinations do not require any additional parameters. To display help information in this scenario, you can view the help information by appending the **-h** flag to the `ksysmgr <ACTION> <CLASS>` command.
- You cannot display help information from the command line for each of the **ksysmgr** command's individual ATTRIBUTES.

Description

All **ksysmgr** command operations are logged in the `>|/var/ksys/log/ksysmgr.oplog|<` file, which includes the name of the command that was executed, start time, process ID for the **ksysmgr** operation, the command with arguments, and overall return code.

Flags

ACTION

Describes the action to be performed.

Note: The **ACTION** flags are not case-sensitive. All **ACTION** flags provide a shorter alias. For example, `rm` is an alias for `delete`. Aliases are provided for convenience from the command line and must not be used in scripts.

The following **ACTION** flags are available:

Note: The asterisk (*) in the aliases signify wildcard characters. For example, for the `modify` ACTION, the alias value is `mod*`. If you type `modd`, the command still works.

- `query` (alias: `q*`, `ls`, `get`, `sh*`)
- `add` (alias: `ad*`, `create`, `cr*`, `make`, `mk`, `bu*`, `bl*`)
- `delete` (alias: `de*`, `remov*`, `rm`, `er*`)
- `modify` (alias: `mod*`, `ch*`, `set`, `sets`)
- `verify` (alias: `ver*`)
- `sync` (alias: `syn*`, `pr*`)
- `restore` (alias: `rest*`)
- `manage` (alias: `man*`, `mg`)
- `unmanage` (alias: `unman*`, `umg`)
- `discover` (alias: `di*`)
- `help` (alias: `hel*`, `?`)
- `move` (alias: `mov*`, `mv`, `swi*`)
- `recover` (alias: `rec*`)
- `pair` (alias: `map`)
- `cleanup` (alias: `clean*`)
- `resync`
- `report`
- `refresh`
- `>|start|<`
- `>|stop|<`
- `>|trace|<`

CLASS

Specifies the type of object on which the **ACTION** is performed. The **CLASS** flags are not case-sensitive.

The following **CLASS** objects are supported:

- `ksyscluster` (alias: `cl*`, `ksyscl*`)
- `site` (alias: `sit*`)
- `hmc` (alias: `hmcs`, `hmces`)
- `host` (alias: `serv*`, `mach*`, `cec*`, `ho*`)

- host_group (alias: serv*, mach*, cec*, ho*)
- vios (alias: vi*)
- vm (alias: lp*, vm*)
- disk_pair (alias: dp, disk_p*)
- disk_group (alias: dg, disk_g*)
- storage_agent (alias: storage_a*, sta)
- version (alias: vers*)
- notify (alias: rn, remote_not*, noti*)
- snapshot (alias: snap*)
- script
- workgroup
- disk
- event
- system (alias: sys*)
- log

NAME

Specifies the particular object, of type **CLASS**, on which the **ACTION** must be performed. The **NAME** flags are case-sensitive.

ATTR=VALUE

Specifies an optional flag that has attribute pairs and value pairs that are specific to the **ACTION** and **CLASS** combination. Use these pairs to specify configuration settings or to run particular operations. Both **ATTR** and **VALUE** flags are case-sensitive.

-a {<ATTR#1>,<ATTR#2>,...}

Displays only the specified attributes. This flag must be used with the query ACTION flag. For example:

```
ksysmgr -a name,sitetype query site
```

-f

Overrides any interactive prompts and forces the current operation to be run.

-h

Displays help information.

-i

Indicates that the **ksysmgr** command must prompt for your confirmation for important operations such as move operation across sites.

-l low|max

Activates the following trace logging values for troubleshooting purposes:

low (default)

Logs basic information for every **ksysmgr** operation.

max

Performs high tracing operations such as adding the routine function and the utility function. Adds transaction ID to the function's entry messages.

Note: All trace data is written into the `ksysmgr.log` file. This flag is ideal for troubleshooting problems.

-v

Displays maximum verbosity in the output.

Exit status

RC_UNKNOWN (Exit value = -1)

Result is not known. This value is used as an initializer.

RC_SUCCESS (Exit value = 0)

No errors are detected. The operation is successful.

RC_ERROR (Exit value = 1)

An error occurred.

RC_NOT_FOUND (Exit value = 2)

The specified resource does not exist or cannot be found.

RC_MISSING_INPUT (Exit value = 3)

Required input is missing.

RC_INCORRECT_INPUT (Exit value = 4)

Detected input is incorrect.

Examples

- To get help information about the `ksyscluster` class, enter the following command:

```
ksysmgr help ksyscluster
```

An output that is similar to the following example is displayed:

```
Available actions for ksyscluster:
  add
  delete
  query
  sync
  verify
```

Cluster configuration examples

- To add a KSYS cluster:

```
ksysmgr add ksyscluster clustername
      ksysnodes=nodename
      [type=<HA|DR|HADR|HADRHA>]
      type=<DR|SHARED>
      [sync=<yes|no>]
      add => create, make
      ksyscluster => ksyscl*, cl*
```

Note: By default, the value of `type` variable is `DR` cluster type. To configure the cluster type to `HA`, enter the following command:

```
ksysmgr add ksyscluster clusterName
      ksysnodes=node1 type=HA
```

For information about HA, see <https://www.ibm.com/docs/en/vmrmha>

- To query the KSYS cluster:

```
ksysmgr query cluster
```

- To remove a KSYS cluster:

```
ksysmgr delete ksyscluster clustername
```

When you delete a KSYS cluster, the **ksysmgr** command prompts for your confirmation. The **ksysmgr** command also recommends to create a snapshot at this point. You can override these prompts by using the **-f** flag. For example,

```
ksysmgr -f delete ksyscluster SampleClusterName
```

- [▶](#) To check the version of the KSYS software:

```
ksysmgr query version
```

[|<](#)

Site configuration examples

- To create a site in the KSYS subsystem:

```
ksysmgr add site sitename sitetype=home|backup
```

No output is displayed. The command returns with the exit value of 0.

- To query the details about all existing sites:

```
ksysmgr query site
```

An output that is similar to the following example is displayed:

```
Name: SiteA
Sitetype: HOME
Active Host_groups: SampleHG
Active Workgroups: None
Name: SiteB
Sitetype: BACKUP
Active Host_groups: None
Active Workgroups: None
```

Note: Active means which site the VMs in host_group/workgroup are running, HG/WG are only active on one site at a time

By default, the replication type of the site is async.

- To query the details about a specific site:

```
ksysmgr query site sitename
```

An output that is similar to the following example is displayed:

```
# ksysmgr -v query site SiteA
Name: SiteA
Sitetype: HOME
Active Host_groups: None
Active Workgroups: None
System-level Attributes
Memory_capacity: Priority Based Settings
high:100
medium:100
low:100
CPU_capacity: Priority Based Settings
high:100
medium:100
low:100
skip_resource_check: No
skip_power_on: No
sriov_override: No
vswitchmap: Not currently set
drvswitchmap: Not currently set
vlanmap: Not currently set
drvlanmap: Not currently set
```

- To discover a site:

```
ksysmgr discover site sitename
```

The KSYS subsystem discovers all the hosts and virtual machines from all the host groups across both the sites. Discovery operation might take a few minutes to a few hours to complete depending on the scale of the environment. By using the `-t` flag with the discover, verify, or move command, you can get timestamps for every step of progress.

- To modify the configuration information of a site:

```
ksysmgr modify site <sitename> | file=<filepath>
[memory_capacity=<(1-100) | minimum | current_desired | none | default>
priority=<low | medium | high>]
[cpu_capacity=<(1-100) | minimum | current_desired | none | default>
priority=<low | medium | high>]
[skip_resource_check=<yes|no>]
[skip_power_on=<yes|no>]
[sriov_override=<yes|no>]
[network=<vlanmap | vswitchmap> backupsite=siteB
sitename=<#[,#,...] || all> siteB=<#[,#,...] || all> [dr_test=<yes|no>]
[policy=delete]]
```

- To change the replication type of a site from the default async value to the sync value:

```
ksysmgr modify system replication_type=sync sites=Site1,Site2
```

- >| To delete a site:

```
ksysmgr delete site <sitename>
```

|<

HMC configuration examples

- To add an HMC to the KSYS configuration:

```
ksysmgr add hmc hmcname
  login=username
  [ password=password ]
  hostname[ip=hostname|ip
  site=site_name
```

The following output is displayed:

```
HMC HMCNAME added successfully
```

You can also run the command without specifying the password in the command line. In this case, you can enter the password as hidden characters when the command prompts for the password. For example,

```
ksysmgr add hmc PrimaryHmcName login=hscroot ip=86.xx.xx.xx site=SiteA
Enter Password for hmc: *****
Re-Enter Password: *****
```

- To query the details about all HMCs:

```
ksysmgr query hmc
```

An output that is similar to the following example is displayed:

```
Name:          PrimaryHmcName
Site:          SiteA
Ip:            86.xx.xx.x
Login:         hscroot
              Managed Host List:
Name          Uuid
=====
cola_8286-42A-2120DEW      7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8
pepsi_8286-42A-2120DFW     21b4b05f-9b84-349c-9ce9-d03f0e78f9f7
=====

Name:          BackupHmcName
Site:          SiteB
Ip:            9.3.18.34
Login:         hscroot
              Managed Host List:
Name          Uuid
=====
```

```
pepsi_8286-42A-2120DFW          21b4b05f-9b84-349c-9ce9-d03f0e78f9f7
cola_8286-42A-2120DEW          7d35be3a-a9b3-3cdf-a31e-80958bd2b9c8
=====
```

- To query the details about a specific HMC:

```
ksysmgr query hmc hmcname
```

- To modify the details of a specific HMC:

```
ksysmgr modify hmc hmcname
  [login=new_username]
  [password=new_password]
  [hostname|ip=hostname|ip]
```

For example, to modify the login and password details of the PrimaryHmcName HMC, enter the following command:

```
ksysmgr modify hmc PrimaryHmcName login=scott password=tiger
```

- To remove an HMC from the KSYS configuration:

```
ksysmgr delete hmc hmcname
```

- To sync updated HMC information:

```
ksysmgr refresh hmc <hmcname>|<ALL>
```

Host configuration examples

- To add a host to the KSYS resource manager:

```
ksysmgr add host hostname
  site=sitename
  [uuid=uuid]
  [hostname|ip=hostname|ip]
```

For example,

```
ksysmgr add host Site1_host1 site=Site1
```

- To list details about all hosts:

```
ksysmgr query host
```

An output that is similar to the following example is displayed:

```
Name:           <Stie name_Host name>
UUID:           <Host UUID>
FspIp:          <FSP_IP>
Host_group:     <HG1>
Pair:           <Pair>
Vswitchmap:    Not currently set
Vlanmap:        Not currently set
DrVswitchmap:  Not currently set
DrVlanmap:     Not currently set
Skip_power_on: No
Site:           Hyderabad
VIOS:           hkv2
                hkv1
HMCs:           vmhmc5
MachineSerial: <Machine_serial>
```

- To list details about a specific host:

```
ksysmgr query host hostname
```

- To pair two hosts across sites, use the following command syntax:

```
ksysmgr pair host hostname pair=hostname
```

- To unpair two hosts across sites, use the following command syntax:

```
ksysmgr pair host hostname pair=none
```

- To remove a host from the KSYS resource manager, use the following command syntax:

```
ksysmgr delete host hostname
```

- To sync updated host information:

```
ksysmgr refresh host <hostname>|<ALL>
```

- To modify the details of a host:

```
ksysmgr modify host <hostname [, hostname2, ...]> | file=<filepath>  
[uuid=<uuid>] [skip_power_on=<yes|no>] [network=<vlanmap | vswitchmap> sites=<siteA, siteB>  
siteA=<#[, #, ...] || all> siteB=<#[, #, ...] || all> [dr_test=<yes|no>] [policy=<delete>]
```

Host group configuration examples

- To create a host group, add the existing hosts to the new host group: >|

- For EMC storage system:

```
ksysmgr add host_group hg_name [site=<sitename>] hosts=host1, [host2, ...] |  
file=filepath [mxn_pairing=<yes>] [workgroup_support=<no>] [customcurname=<CgName>]  
[bsitecurname=<CgName>]
```

- For storage systems other than EMC storage systems:

```
ksysmgr add host_group hg_name [site=<sitename>] hosts=host1, [host2, ...] |  
file=filepath [mxn_pairing=<yes>] [workgroup_support=<no>] [customcurname=<CgName>]
```

<| where, the **file** parameter is an XML file that contains a list of hosts.

- To add or remove hosts from the existing host groups:

```
ksysmgr modify host_group hg_name add | remove  
hosts=host1, [host2, ...] | file=filepath
```

- To modify the capacity-related attributes for all the hosts in a host group:

```
ksysmgr modify host_group hg_name options  
[memory_capacity=(Whole Number > 1) | minimum | current_desired | none]  
[cpu_capacity=(Whole Number > 1) | minimum | current_desired | none]  
[skip_resource_check=<yes|no>]  
[skip_power_on=<yes|no>]  
[sriov_override=<yes|no>]  
[customcurname=<CgName>]  
[bsitecurname=<CgName>]
```

- To create a network mapping policy of VLAN ID or virtual switches for all the hosts in a host group, across sites:

```
ksysmgr modify host_group hg_name options  
network=vlanmap | vswitchmap sites=siteA, siteB  
siteA=<#[, #, ...]> siteB=<#[, #, ...]>
```

- To discover and verify all the hosts in a specific host group:

```
ksysmgr discover host_group hg_name verify=true
```

- To delete a host group:

```
ksysmgr delete host_group hg_name
```


- To query the details about all host groups or a specific host group:

```
ksysmgr query host_group [hg_name]
```

- To enable or disable proactive HA management for VMs under the host group:

```
ksysmgr modify host_group name options proactiveha=enable/disable
```

VIOS configuration example

>|

- To query the detail about a VIOS, run the following command:

```
ksysmgr query vios [<viosname>]
```

An output that is similar to the following example is displayed:

```
Name:          VIOS1
Site:          Site1
UUID:          UUID1
Host:          Host1
Version:       VIOS 3.1.1.22
State:         MANAGED

Name:          VIOS2
Site:          Site1
UUID:          UUID2
Host:          Host1
Version:       VIOS 3.1.1.22
State:         MANAGED
```

- To unmanage or manage a VIOS, run the following command:

```
ksysmgr unmanage|manage vios <viosname>
```

|<

Workgroup configuration example

- – To create a workgroup using the EMC storage systems, run the following command from the command-line interface (CLI) of the KSYS node:

```
ksysmgr add workgroup <name> vm=<vmname1[,vmname2...]> [customcurname=<CgName>]
[bsitecurname=<CgName>]
```

- To create a workgroup using the storage systems other than the EMC storage systems, run the following command from the command-line interface (CLI) of the KSYS node:

```
ksysmgr add workgroup <name> vm=<vmname1[,vmname2...]> [customcurname=<CgName>]
```

- To add or remove the virtual machines from an existing workgroup, run the following command:

```
ksysmgr modify workgroup workgroup_name policy=<add | delete> vm=<vmname1[,vmname2...]>
```

- To move a workgroup from one site to another site, run the following command:

```
ksysmgr [-f] move workgroup <name>
to=<site_name>
[force=<true|false>]
[lose_vios_redundancy=<yes|no>]
[dr_type=<planned|unplanned>]
[cleanup=<yes|no>]
[dr_test=<yes|no>]
[skip_shutdown=<yes|no>]
move => mov*, mv, swi*
workgroup => workg*, work_g*, wg
```

- To query the details about a specific work group:

```
ksysmgr query wg
```

An output that is similar to the following example is displayed:

```
Name:           WG1
Host_group:    HG1
Site:          Austin

Name:           WG2
Host_group:    HG1
Site:          Austin
```

- To add a new workgroup:

```
ksysmgr add workgroup <name> vm=<vmname1,vmname2...>
```

- To delete an existing workgroup:

```
ksysmgr delete workgroup <name>
```

- To discover and verify all VMs in a specific work group:

```
ksysmgr discover workgroup <name> verify=yes [dr_test=<yes|no>]
```

- To modify a workgroup:

```
ksysmgr modify workgroup <name> policy=<add | delete> vm=<vmname1[,vmname2...]>
```

- To recover a workgroup:

```
ksysmgr recover workgroup name
```

- >| To clean up a workgroup:

```
ksysmgr cleanup workgroup name
```

|<

- >| To resync a workgroup:

```
ksysmgr resync workgroup name
```

|<

LPAR configuration examples

- To include or exclude a specific virtual machine from the KSYS configuration:

```
ksysmgr unmanage vm
name=<vmname> host=<hostname> | uuid=<lparuuid> | ALL host=<hostname> | ALL
host_group=<host_group_name>
```

The `ksysmgr unmanage ALL host=xyz` parameter will unmanage all virtual machines in the host xyz. The `ksysmgr unmanage ALL host_group=HG1` parameter will unmanage all virtual machines in all hosts in the host group HG1.

```
ksysmgr unmanage vm <vmname|lparuuid,...>
unmanage => unman*, umg
vm => lp*, vm
```

This works for `unmanage` and `manage`, second syntax is original and better to use for targeted VM management. The excluded virtual machine is not moved to the backup site when a site-switch operation is initiated.

Notes:

- After including or excluding a virtual machine, you must run the discovery and verification commands to rediscover the resources and validate the modified configuration setting.
 - If you use SAN Volume Controller storage system, before you include a specific virtual machine to the KSYS subsystem, you must ensure that the new virtual machine is associated with the storage volumes that have the same relationship type as the other existing virtual machines. For more information about this restriction, see [“SAN Volume Controller system and Storwize system” on page 15](#).
- To update the priority of virtual machines:

```
ksysmgr modify vm <vmname[,vmname2,...]> | file=<filepath>
[uuid=<uuid>]
[host=<hostname>]
[DrTargetHost=<hostname | none>]
[priority=<Low|Medium|High>]
[skip_power_on=<yes|no>]
modify => mod*, ch*, set
vm => lp*, vm
```

where, the **file** parameter is an XML file that contains a list of virtual machine references.

Note:

- The `DrTargetHost` attribute is valid only for an asymmetric type of host group.
 - The UUID is used if more than one virtual machines exist with the same name.
- To enable or disable the auto discovery:

```
ksysmgr modify system vm_auto_discovery=enable|disable
```

When enabled, the discovered VMs are automatically managed. In the disabled mode, the discovered VMs are unmanaged by default.

Storage configuration examples

- To add a storage agent to a site:

```
k
```

Note:

-
-

For example,

```
ksysmgr add storage_agent StorageNamePrimary
site=Site1
serialnumber=000196xxx
storagetype=emc
ip=1.2.xx.xx
```

Note:

- The login or password credentials might be needed for some storage devices.
- The instance number is required only for Hitachi storage.
- The `DrInstance` number is required only for Hitachi storage if you want to perform the DR test.
- Only the XIV storage systems supports up to three IP addresses.
- SVC storage systems:

```
ksysmgr add storage_agent <storage_agent_name> hostname | ip =<hostname | ip>
site=<sitename> storagetype=svc clusterid=<number> login=<username>
```

- EMC or SRDF storage systems:

```
ksysmgr add storage_agent <storage_agent_name> hostname | ip =<hostname | ip>
site=<sitename> storagetype=srdf serialnumber=<number>
```

- DS8000 storage system:

```
ksysmgr add storage_agent <storage_agent_name> hostname | ip =<hostname | ip>
site=<sitename> storagetype=ds8k login=<username> password=<password>
```

- Hitachi storage systems:

```
ksysmgr add storage_agent <storage_agent_name> hostname | ip =<hostname | ip>
site=<sitename> storagetype=hitachi instance=<instance_number>
[drinstance=<drinstance_number>] login=<username> password=<password>
```

- XIV storage systems:

```
ksysmgr add storage_agent <storage_agent_name> hostname | ip
=<hostname[,hostname2,hostname3] | ip[,ip2,ip3]> site=<sitename> storagetype=xiv
serialnumber=<number> login=<username> [password=<password>]
```

- To list storage agent details:

```
ksysmgr query storage_agent storage_agent_name
```

An output that is similar to the following example is displayed:

```
Name:           StorageNamePrimary
Serialnumber:   00019xxxx
Storagetype:    EMC
Site:           Site1
Ip:             1.2.xx.xx
```

- To remove a storage agent from a site:

```
ksysmgr delete storage_agent storage_agent_name
```

- To resynchronize the storage data after an unplanned recovery from the active site to the backup site:

```
ksysmgr resync site active_site_name
ksysmgr resync host_group active_hg_name
ksysmgr resync workgroup <workgroup_name>
```

If the unplanned move operation was at site level, you must run the **ksysmgr resync** command at site level. Similarly, if a virtual machine was moved to the backup site in an unplanned move operation at host group level, you must run the **ksysmgr resync** command at host group level.

- To sync updated storage system information:

```
ksysmgr refresh storage_agent <storage_agent_name>|<ALL>
```

Discovery and verification examples

- To discover the resources in a site:

```
ksysmgr discover site sitename
```

An output that is similar to the following example is displayed:

```

Running discovery on entire site, this may take few minutes...
Storage state synchronization has started for Host_group HG1
Storage state synchronization has completed for Host_group HG1
Discovery has started for VM rtXYZXY
Configuration information retrieval started for VM rtXYZXY
Configuration information retrieval completed for VM rtXYZXY
Storage information retrieval from VIOS started for VM rtXYZXY
Storage information retrieval from VIOS completed for VM rtXYZXY
Discovery for VM rtXYZXY is complete
Disk Group creation on storage subsystem started for Host_group HG1
Disk Group creation on storage subsystem completed for Host_group HG1
Discovery has finished for Site1
1 out of 1 managed VMs have been successfully discovered(0)

```

- To discover resources and to verify the KSYS configuration:

```
ksysmgr discover site sitename verify=true
```

An output that is similar to the following example is displayed:

```

Running discovery on entire site, this may take few minutes...
Storage state synchronization has started for Host_group HG1
Storage state synchronization has completed for Host_group HG1
Discovery has started for VM rtXYZXY
Configuration information retrieval started for VM rtXYZXY
Configuration information retrieval completed for VM rtXYZXY
Storage information retrieval from VIOS started for VM rtXYZXY
Storage information retrieval from VIOS completed for VM rtXYZXY
Discovery for VM rtXYZXY is complete
Disk Group creation on storage subsystem started for Host_group HG1
Disk Group creation on storage subsystem completed for Host_group HG1
Discovery has finished for Site1
1 out of 1 managed VMs have been successfully discovered
Site verification started for Site1
Default_HG verification has started
HG1 verification has started
Default_HG verification has completed
rtXY-XYZXYZ-XYA-XYZXECV verification has started
rtXY-XYZXYZ-XYA-XYZXECV verification has completed
rtXYZXY DR verification has started
rtXYZXY DR verification has completed
Disk Group verification on storage subsystem started for Host_group HG1
Disk Group verification on storage subsystem completed for Host_group HG1
HG1 verification has completed
Verification has finished for Site1
1 out of 1 VMs have been successfully verified(0)

```

Script configuration examples

- To add a script for automatic execution before or after the discovery and verification operations:

```
ksysmgr add script entity=site|host_group pre_verify|post_verify=script_path
```

Note: The `pre_verify` and `post_verify` scripts can be run only at site or host group level.

- To add a script for automatic execution before or after the disaster recovery move operation:

```
ksysmgr add script entity=site|host_group|vm
pre_offline|post_offline|pre_online|post_online=script_path
```

Events query examples

- To query the events of a specific type:

```
ksysmgr query event [type=error|warning|info]
```

- To query the events of all types, run the following command:

```
ksysmgr query event
```

An output that is similar to the following example is displayed:

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 seems to be having problems
INSUFFICIENT_HOST_CAPACITY	Backup host does not have sufficient capacity for 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

- To query the system wide persistent attribute for the **ksysmgr** command, use the following command syntax:

```
ksysmgr query system
```

An output that is similar to the following example is displayed:

```
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
replication_type:        Asynchronous
network_mapping:         Enabled
vlanmap:                 Not currently set
vswitchmap:              Not currently set
drvlanmap:               Not currently set
drvswitchmap:            Not currently set
quick_discovery_interval: 60 minutes
quick_discovery:         enable
vm_auto_discovery:       enable
custom_script_timeout:   none
trace_file_size:         1 MB
memory_capacity:         Priority Based Settings
                           low:100
                           medium:100
                           high:100
CPU_capacity:            Priority Based Settings
                           low:100
                           medium:100
                           high:100
User Scripts for Site:   None
User Scripts for Host Group: None
User Scripts for VM:
PreOfflineScript:        testscript
PreOnlineScript:         None
PostOfflineScript:       None
PostOnlineScript:        None
PreVerifyScript:         None
PostVerifyScript:        None
[network_isolation=<ip1,ip2,..|ALL> action=<add | delete>]
```

where,

auto_discovery_time

Sets time for daily discovery at each 24 hours a day.

lose_vios_redundancy

Sets the *lose_vios_redundancy* variable configuration.

notification_level

Notifies the generation of events based on severity of an event failure.

replication_type

Modifies the storage replication type.

vlanmap, vswitchmap

Sets the target site network on DR.

drvlanmap, drvswitchmap

Sets target site network on DR rehearsal

quick_discovery_interval

Sets the time duration for the quick discovery operation.

quick_discovery

Sets the *quick_discovery* variable to enable/disable.

Note: If the **network_isolation** attribute is set to ALL, the *action* attribute must have delete value. This will delete all the IP's.

- To modify the system wide persistent attribute for the **ksysmgr** command:

```
ksysmgr modify system
```

For example,

```
ksysmgr modify system
  [auto_discovery_time=<hh:mm>]
hh - hour: 00 to 23
mm - minute: 00 to 59
[quick_discovery_interval=<mm>]
mm - minute: 5 to 480
[custom_script_timeout=<sec>]
sec - seconds: Any positive integer
[quick_discovery=<enable | disable>]
[trace_file_size=<MB>]
MB - Megabyte: Between 1 and 50
[lose_vios_redundancy=<yes | no>]
[notification_level=<low | medium | high | disable>]
[dup_event_processing=<yes | no>]
[replication_type=<async | sync | shared> sites=<A,B>]
[network_mapping=<enable | disable>]
[vm_auto_discovery=<enable | disable>]
[memory_capacity=<(1-100) | minimum | current_desired | none | default>]
priority=<low | medium | high>]
[cpu_capacity=<(1-100) | minimum | current_desired | none | default>]
priority=<low | medium | high>]
[network=<vlanmap | vswitchmap> sites=<siteA,siteB>]
siteA=<#[,#,... ] | all> siteB=<#[,#,... ] | all> [dr_test=<yes|no>]
[policy=delete]]
modify => mod*, ch*, set
system => sys*
```

Quick discovery example

- To enable or disable the quick-discovery feature:

```
ksysmgr modify system quick_discovery=<enable | disable>
```

- To set the time duration for the quick-discovery operation:

```
ksysmgr modify system quick_discovery_interval = <minutes>
```

Notification configuration examples

- To add an email, pager, or SMS notification for a specific user:

```
ksysmgr add notify user=username contact=email_address
ksysmgr add notify user=username contact=10_digit_phone_number@phone_carrier_email_address
ksysmgr add notify user=username contact=pager_email_address
```

For example,

```
ksysmgr add notify user=John contact=john.doe@testmail.com
ksysmgr add notify user=John contact=1234567890@tmomail.net
ksysmgr add notify user=John contact=1234567890@SKYTEL.COM
```

- To modify an email address, pager email address, or SMS number for a specific user:

```
ksysmgr modify notify oldcontact=old_username newcontact=new_username
ksysmgr modify notify oldcontact=old_email_address newcontact=new_email_address
```

- To query all the registered contact details:

```
ksysmgr query notify contact
```

- To delete all the contact information for a specific user:

```
ksysmgr delete notify user=username
```

- To add a script for a predefined set of notifications and subsequent actions for a specific event:

```
ksysmgr add notify script=full_path_script event=event_name
```

For example,

```
ksysmgr add notify script=/tmp/script.sh events=HMC_DOWN
```

- To modify a script:

```
ksysmgr modify notify oldscript=old_file_name newscript=new_file_name
```

- To remove a script:

```
ksysmgr delete notify script=<full path script>
```

- To query a script:

```
ksysmgr query notify script
```

System-wide attributes configuration

- To query details about system-wide attributes:

```
ksysmgr query system
```

- To enable the KSYS subsystem to automatically rediscover the resources at noon every day:

```
ksysmgr modify system auto_discovery_time=12:00
```

- To change the notification level of your system to receive notification for all critical errors and warnings of all events:

```
ksysmgr modify system notification_level=medium
```

- To change the duplicate event processing option to receive notification for all events, even if the events are duplicated:

```
ksysmgr modify system dup_event_processing=no
```

- To change the storage replication mode between two sites from asynchronous mode to synchronous mode:

```
ksysmgr modify system replication_type=sync sites=SiteA,SiteB
```

- To enable the network mapping function and to create network mapping policy for all hosts and host groups across the active and the backup site:


```
ksysmgr modify system network_mapping=enable network=vlanmap|vswitchmap sites=siteA,siteB
siteA=<#, [#,...]> siteB=<#, [#,...]>
```

Disaster recovery failover rehearsal examples

- To discover, set up, and enter into DR failover rehearsal mode:

```
ksysmgr discover workgroup|host_group|site name dr_test=yes
```

- To check whether the test environment is ready for the test-move operation:

```
ksysmgr verify workgroup|host_group|site name dr_test=yes
```

- To start the VMs in the DR test environment:

```
ksysmgr move workgroup|host_group|site name from=Site1 to=Site2 dr_test=yes
```

- To clean up the DR test environment and to retain the normal DR backup state:

```
ksysmgr cleanup workgroup|host_group|site name dr_test=yes
```

Disaster recovery operation examples

- To initiate a site-switch operation:

```
ksysmgr move site|host_group|workgroup <site_name|hg_name|workgroup_name>
from=sitename
to=sitename
[force=true|false]
[lose_vios_redundancy=yes|no]
[dr_test=yes|no]
[dr_type=planned|unplanned]
[site_down=yes|no]
[cleanup=yes|no]
[skip_shutdown=yes|no]
move => mov*, mv, swi*
site => sit*
```

Where, the default value of the **force** attribute is `false`, the default value of the **lose_vios_redundancy** attribute is `no`, and the default value of the **dr_type** attribute is `planned`. The **site_down** attribute is applicable only for unplanned move operations.

For example:

```
ksysmgr move site from=Site1 to=Site2 dr_type=planned cleanup=no
```

If you do not specify the cleanup attribute, for a planned recovery, the KSYS subsystem automatically cleans up the source site from the location where the switch was initiated.

- To recover failed virtual machines after the move operation is complete:

```
ksysmgr recover host_group|workgroup name
```

- To perform cleanup operation after successful move operation:

```
ksysmgr cleanup site|host_group|workgroup name
```

For an unplanned recovery, you must manually clean up the source site after the HMC and hosts become operational.

Snapshot examples

- To save a snapshot of the KSYS cluster configuration and resources:

```
ksysmgr add snapshot filepath=full_file_prefix_path|file_prefix ]
```

For example,

```
ksysmgr add snapshot filepath=/home/ksysdir/myksysbackup
```

- To view a snapshot, use the following command syntax:

```
ksysmgr query snapshot filepath=full_file_prefix_path
```

For example,

```
ksysmgr query snapshot filepath=/home/ksysdir/myksysbackup_2016_06_23_04:54:30.xml.tar.gz
```

- To restore the configuration data on a KSYS node:

```
ksysmgr restore snapshot filepath=full_file_prefix_path
```

For example:

```
ksysmgr restore snapshot filepath=/home/ksysdir/myksysbackup_2016_06_23_04:54:30.xml.tar.gz
```

This command decompresses and unarchives the snapshot file, and then applies the configuration settings to the KSYS node.

Collecting log files for the KSYS subsystem

- To collect log files for the KSYS subsystem, run the following command:

```
snap vmsnap
```

Note: For the cluster type, DR, the HM and VM logs will not be collected.

- To print trace information from KSYS trace files to standard output:

```
ksysmgr trace logs=ksys|fde|fdelong|krest|krestlong|user|ALL
```

VM auto discovery

- To check whether the VM auto-discovery property is enabled or disabled to automatically manage discovered resources across the site, run the following command:

```
ksysmgr -a vm_auto_discovery query system
```

An output that is similar to the following example is displayed:

```
System-Wide Persistent Attributes  
vm_auto_discovery: enable
```

- To enable the VM auto-discovery property, run the following command:

```
ksysmgr modify system vm_auto_discovery=enable
```

- To disable the VM auto-discovery property, run the following command:

```
ksysmgr modify system vm_auto_discovery=disable
```

Disk pair status example

- To query status of disk pairs in the SVC storage, run the following command:

```
ksysmgr query disk_pair status=yes
```

Disk group status example

- To query status of disk groups in the SVC storage, run the following command:

```
ksysmgr query disk_group disk_group_name status=yes
```

Unmanage disk example

- To unmanage a disk, run the following command:

```
ksysmgr unmanage disk diskid=<diskid1[,...]>
```

- To manage an unmanaged disk, run the following command:

```
ksysmgr manage disk diskid=<diskid1[,...]>
```

- To view all unmanaged disks, run any of the following commands:

```
- ksysmgr query disk_pair
```

```
- ksysmgr query disk state=<unmanaged>
```

>| Custom consistency group (CG) name |<

- >| Custom consistency group (CG) name for EMC storage subsystem

- To create a host group with custom consistency group name at the home site and at the backup site, run the following command:

```
- ksysmgr add host_group hg_name  
  [site=<site_name>] hosts=host1, [host2,...] | file=filepath  
  [mxn_pairing=<yes>] [workgroup_support=<no>] [customcgname=<CGName>]  
  [bsitecgname=<CGName>]
```

- To modify a host group with custom consistency group name at the home site and at the backup site, run the following command:

```
ksysmgr modify host_group <host_group_name> options customcgname=<CGName>  
bsitecgname=<CGName>
```

- To view the details of a custom consistency group name, run the following command:

```
ksysmgr query hg <host_group_name>
```

- To create a Workgroup with custom consistency group name at the home site and at the backup site, run the following command:

```
ksysmgr add workgroup <name> vm=<vmname1[,vmname2...]> [customcgname=<CGName>]  
[bsitecgname=<CGName>]
```

- To modify a Workgroup with custom consistency group name at the home site and at the backup site, run the following command:

```
ksysmgr modify workgroup <name>  
[policy=<add | delete> vm=<vmname1|vmuuid1[,vmname2|vmuuid2...]>]  
[customcgname=<CGName>]  
[bsitecgname=<CGName>]
```

|<

- >| Custom consistency group (CG) name for IBM XIV, IBM SAN Volume Controller (SVC) and Hitachi storage systems:

- To create a host group with custom consistency group name, run the following command:

```
ksysmgr add host_group <host_group_name> hosts=<host1[,host2,...]> [customcgroupname=<CgName>]
```

- To modify a host group with custom consistency group name, run the following command:

```
ksysmgr modify host_group <name> options [customcgroupname=<CgName>]
```

- To create a Workgroup with custom consistency group name, run the following command:

```
ksysmgr add workgroup <name> vm=<vmname1[,vmname2...]> [customcgroupname=<CgName>]
```

- To modify a Workgroup with custom consistency group name, run the following command:

```
ksysmgr modify workgroup <name>  
  { [policy=<add | delete> vm=<vmname1|vmuuid1[,vmname2|vmuuid2...]>]  
    [customcgroupname=<CgName>] }
```

- To view the details of a custom consistency group name in a host group, run the following command:

```
ksysmgr query hg [<host_group_name>]
```

- To view the details of a custom consistency group name in a Workgroup, run the following command:

```
ksysmgr query wg [<WGName>]
```

|<

>|Setting up the Single-Root I/O Virtualization (SR-IOV) override flag status|<

- >|To set up the Single-Root I/O Virtualization (SR-IOV) override flag status for a host group, run the following command:

```
ksysmgr modify host_group <HGNAME> options sriov_override=yes/no
```

|<

- >|To set up the Single-Root I/O Virtualization (SR-IOV) override flag status for a site, run the following command:

```
ksysmgr modify site <SITENAME> sriov_override=yes/no
```

|<

>|Configuring HADR|<

- >|To configure the HADR cluster type, specify HADR while configuring the cluster. For example:

```
ksysmgr add ksyscluster cluster_name ksysnodes=ksysnode1 type=HADR
```

|<

- >|To create an HADR cluster, run the following command:

```
ksysmgr add ksyscluster <HADR_CLUSTER_NAME> type=HADR ksysnodes=<hostname> sync=yes
```

|<

- >|For symmetric host group, to pair an identified host (for example, host name: Host1, Host3) in the active site to the identified host (for example, host name: Host2, Host4) in the backup site, run the following commands:

```
ksysmgr pair host Host1 pair=Host2
```

```
ksysmgr pair host Host3 pair=Host4
```

|<

- >|To create a symmetric host group (for example host group name : Host_group1, ha_disk : SSP_disk1 , repo_disk :SSP_disk2), run the following command:

```
ksysmgr add host_group Host_group1 hosts=Host1,Host3 ha_disk=SSP_disk1 repo_disk=SSP_disk2
```

|<

- >|To create an asymmetric host group (for example, host group name: Host_group1, HA disk: SSP_disk1, repo_disk : SSP_disk2) and to add the existing hosts (for example, hosts: Host1, Host2, Host3) to the asymmetric host group, run the following command:

```
ksysmgr add host_group Host_group1 hosts=Host1,Host2,Host3 mxn_pairing=yes ha_disk=SSP_disk1  
repo_disk=SSP_disk2
```

|<

- >|To perform the discovery operation and the verify operation at the site level, run the following command:

```
ksysmgr discover site Austin verify=yes
```

|<

- >|Pair the identified host (for example, host name: Host1, Host3) in the active site to the identified host (for example, host name: Host2, Host4) in the backup site by running the following commands:

```
ksysmgr pair host <host1> pair=<host2>
```

```
ksysmgr pair host <host3> pair=<host4>
```

|<

- >|To set HA monitoring for an entity, run the following command:

```
ksysmgr modify system|host_group|host|vm name ha_monitor=enable|disable
```

|<

>|Configuring HADRHA|<

- >|To create an HADRHA cluster type, specify HADRHA while configuring the cluster. For example:

```
ksysmgr add ksycluster HA_DR type=HADRHA ksynodes=ksynode1 sync=yes
```

|<

Managing a virtual machine

You can manage or unmanage a virtual machine by using the `ksysmgr` command.

- To manage a virtual machine, run the following command:

```
ksysmgr manage vm <vm1, vm2, vm3>
```

- To unmanage a virtual machine, run the following command:

```
ksysmgr unmanage vm <vm>
```

ksysrppmgr command

Purpose

Manage the Power Enterprise Pool resources and the Elastic Capacity on Demand (CoD) resources, which was formerly known as On/Off CoD. The **ksysrppmgr** command adjusts available resources on the managed hosts; you do not need to check the current available resources. This command also minimizes your resource costs by optimizing the local consumption of pool resources. For example, this command can convert Elastic (On/Off) CoD resources to Enterprise Pool CoD resources automatically. The **ksysrppmgr** command can also be used if the current level of resources is sufficient for your requirements. In this case, the command might release unnecessary resources.

Syntax

```
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] [-i] [-l none|logfile_path] [-p logfile_prefix]
```

Description

Note: To use the **ksysrppmgr** command, you must authenticate to the HMCs by using the **hmcauth** command. The **ksysrppmgr** command communicates to the HMC through the REST APIs. Therefore, the APIs must be activated on the existing HMCs. At least one HMC is necessary to execute resources requests.

When you run the **ksysrppmgr** command, the HMC retrieves information about the topology of the managed hosts and resources. Then, the resource requests are processed. You do not need to check the current level of available resources to run the **ksysrppmgr** command. The **ksysrppmgr** command automatically determines whether a resource acquisition or a resource release is required to fulfill your resource request.

You can run the **ksysrppmgr** command in the following modes:

- Check mode
- Execution mode

In both the modes, you must first explore the topology and resource levels by logically connecting all the entities. When you explore the topology, you can identify the Enterprise Pools that are associated with a managed host. During the topology exploration, the REST universally unique identifier (UUID) and information about the entities are also read. For example, you can identify whether the Elastic (On/Off) CoD is enabled for a specific managed host. After you explore the topology, you can use the results to optimize the requirements of the subsequent requests.

When you run the **ksysrppmgr** command in check mode, all the execution steps are performed except that all the HMC operations are simulated after the initial processing. The initial process contains the topology exploration. During the topology exploration, the HMC reads the status of resources for all entities (pools and managed hosts) that are involved in the operation, because the current values must be used as base values for all the simulation. The command execution in the check mode might show some differences as compared to the results in the execution mode when you use Elastic (On/Off) CoD facility because the HMC might contain some information about the current day activations that are available only in execution mode.

When you run the **ksysrppmgr** command that contains multiple resource requests, the requests are executed sequentially. If you want to execute the resource requests simultaneously, you can run the **ksysrppmgr** command separately for each managed host. In this case, the topology cost must be paid for each command execution.

If you are using the Power Enterprise Pools facility, the **ksysrppmgr** command handles the conflicts in resource requests. If the same managed host has contradictory requests, the available amount of resources cannot be guaranteed but will be at least at the lowest request value, and at most at the highest request value. For example, if one CPU is available in the `host_1` host, and if you run three **ksysrppmgr** request simultaneously for the `host_1` host each requesting two CPUs, three CPUs, and five CPUs. When all the three **ksysrppmgr** commands are run, the number of available CPUs cannot be predicted. However, the number of available CPUs will be between the lowest and the highest request, that is, in the range 2 - 5. Therefore, you might avail 2, 3, 4, or 5 CPUs depending on the priority of the threads indicated by the system.

If you are using the Elastic (On/Off) CoD facility, the conflicts are handled based on resource priority and therefore, the method is thread-safe. For example, a conflict of request during a resource acquisition is retried until success and a conflict of request during a resource release is dropped immediately. In this case, the amount of resource that is released might not be as expected, but this change is not treated as an error.

You must specify the correct Enterprise Pool to decrease the topology exploration cost of Enterprise Pools. If the Enterprise Pool is not specified in the **ksysrppmgr** command, the **ksysrppmgr** command checks all the Enterprise Pools that are identified by the HMCs, which are specified in the command, to find the correct pool for the specified managed hosts. If one or more Enterprise Pools are specified in the command, only those Enterprise Pools are checked to get the required information. Therefore, the time spent in topology exploration is reduced. However, if you are not sure of which Enterprise pools can be used, you can run the command to request the resource without specifying any Enterprise Pools.

When the **ksysrppmgr** command ends successfully, and if no other command was run for the same managed host with different resource levels, the requested resources are made available to the specified host. If you specify the **-r** flag in the command, you can open the log file to check whether the requested amount of resources match the existing amount of available resources at the end of command execution.

By default, the log files for the **ksysrppmgr** command are located in the `/var/ksys/log/capmgr.log` file. You can configure the log file settings to overwrite the existing logs or delete the old log files after the log files reach a specific limit. You can also set a log file prefix to analyze the log files if more than one execution information is available in the log files.

When you use the **-r** flag to check the topology and resource status, you can filter the log files by using the following command:

```
cat logfile | grep -e "###" -e "@@" | cut -d " " -f 2-
```

Flags

-o action

Specifies the action to be performed. The following action flags are available:

execute (alias: e)

Runs the resource requests.

check (alias: c)

Simulates whether the resource requests can be completed.

-h [hmc_name]:hmc_uri:hmc_user

Specifies the HMC details.

The Unique Resource Identifier (URI) and the user name of the HMC are mandatory parameters. The `hmc_name` parameter is optional and is used only if the HMC REST API page about HMC information returns information about other HMCs too, which might not occur.

All colons (:) in this flag are required, even if the optional parameters are not filled. This flag can be specified multiple times to add multiple HMCs.

-m ms_name:ms_action:[onoff_use(n|y[nb_days])]:[mem_amount]:[proc_amount]

Specifies the name of the managed host that must be configured for CoD resources.

The host name and action parameters are mandatory. Currently, the only allowed value for the *ms_action* parameter is **s** or **set**. This parameter matches the amount of requested resource to the amount of available resource. The unit to specify the memory resource is MB.

All colons (:) in this flag are required, even if the optional parameters are not filled. This flag can be specified multiple times to add multiple hosts.

-M *ms_uuid:ms_action:[onoff_use(n|y[nb_days])]:[mem_amount]:[proc_amount]*

Specifies the universally unique identifier (UUID) of the managed host that must be configured for CoD resources.

All other parameters are similar to the parameters of the **-m** flag.

-e *enterisepool_name*

Specifies the name of the Enterprise Pool that must be monitored.

If the **-e** or **-E** flags are not specified, all the enterprise pools are monitored by default. This flag can be specified multiple times.

-E *enterisepool_uuid*

Specifies the UUID of the Enterprise Pool that must be monitored.

If the **-e** or **-E** flags are not specified, all the enterprise pools are monitored by default. This flag can be specified multiple times.

-v

Specifies that you want to display detailed processing information on your screen.

This flag displays the information about the managed host and return codes, one per line, at the end of the execution.

-r

Specifies that you want detailed report.

This flag enables logging operation that includes the overall status of topology and resources before and after execution. It also includes a timing analysis on the overall execution.

If you specify this option, more REST operations might be triggered, which require more time to complete.

-l

Specifies the log file that must be used.

By default, the `/var/ksys/log/capmgr.log` file is used for the logging operation. You can use the none value to remove all the logging operations. The `libhmc` log files are stored in the `LOGFILE.libhpp_last_rest.log` file or in the `LOGFILE.LOGPREFIX.libhpp_last_rest.log` file if the log prefix is specified. The `libhmc` log files overwrite previous log files, if the same prefix or no prefix was used.

-p

Specifies the log prefix that must be used in the log files.

This flag specifies the prefix string that is determined at the beginning of each log string, along with other prefix information. This flag can also be used to avoid overwriting the `libhmc` log files.

Return values

Because you can run the **ksysrppmgr** command on multiple hosts simultaneously, you cannot get a complete error report in the return value. For a more detailed error report for each managed host, you must run the **ksysrppmgr** command with the **-v** flag. The following error codes can be returned:

0

The operation was successful.

1

An error occurred.

2
Indicates command line parsing error

Error codes for verbose output

0
The operation was successful.

1
Conflict with other operations. The operation will be attempted again.

2
Parsable error. This error might be associated to HSCL, or REST. Check the log files for more details.

3
HSCL error. Check the report or log file for HSCL code and more information.

4
REST error. Check the report or log file for REST code and more information.

5
libhmc error. Check the report or log file for libhmc code and more information.

6
Parameter error. Check log files for more information.

7
Invalid output. Check log files for more information.

8
Check log files for more information.

9
Operation cannot be performed. Computation for resource pool provisions (RPP) determined that the operation will fail.

10
Internal RPP error. Retry the operation. If problem persists, check log files.

Examples

1. To check whether 3 CPUs can be available on the `host_1` host and whether 2 GB memory can be available on the `host_2` host while restricting the use of Elastic (On/Off) CoD, enter the following command:

```
# ksysrppmgr -o c -h :hmc1:hmcuser -h :hmc2:hmcuser -m host_1:s:n::3 -m host_2:s:n:2048: -r
```

In execution mode, if the return code of the command is 0, all the requests are successful. If the return code is 1, at least one request has failed. To view detailed information about the failure, you can either use the **-v** option for detailed printed results, or check the log file by using the filter command.

2. To request 3 CPUs from the `host_1` host and 2 GB memory from the `host_2` host, to restrict the Elastic (On/Off) CoD usage, and to print detailed information, enter the following command:

```
# ksysrppmgr -o e -h :hmc1:hmcuser -h :hmc2:hmcuser -m host_1:s:n::3 -m host_2:s:n:2048: -r -v
```

The return value of 0 indicates that all operations are successful, and the resource requests are satisfied. The **-v** flag prints a more detailed result that contains the final status for each managed host:

```
host_1:0  
host
```

3. To request 2.5 CPUs and 10500 MB memory for the `host_1` host and to allow Elastic (On/Off) CoD usage for 5 days, enter the following command:

```
# ksysrppmgr -o e -h :hmc1:hmcuser -h :hmc2:hmcuser -m host_1:s:y5:10500:2.5 -r
```

4. To release all possible resources from the host_1 host to the pool and to optimize costs by converting Elastic (On/Off) CoD into Enterprise Pool, enter the following command:

```
# ksysrppmgr -o e -h :hmc1:hmcuser -m host_1:s:y5:0:0
```

If you want to convert Elastic (On/Off) CoD facility to Enterprise Pool CoD without modifying the current level of available resources, set the currently available resources as the target levels.

5. To specify multiple Power Enterprise Pools to be monitored by the **ksysrppmgr** command, enter the following command:

```
# ksysrppmgr -o e -h :hmc1:hmcuser -m host_1:s:n:0:0 -m host_2:s:n:0:0 -e EP_1 -e EP_2
```

VM Recovery Manager DR GUI

The graphical user interface has been enhanced to support administrative functions, and to display the topology of the DR, HADR, and HADRHA KSYS configuration. The deployment wizard provides an easy way to deploy the VM Recovery Manager DR solution. The VM Recovery Manager DR GUI allows workgroup management, and workgroup support for DR cluster and asymmetric deployment support for DR/HADR type KSYS cluster. The VM Recovery Manager DR GUI now supports cluster creation from the KSYS registration page for DR and HADR KSYS clusters. The VM Recovery Manager DR GUI now supports the host group deployment for DR and HADR KSYS clusters. User can now check previous failover reports from GUI dashboard. Other enhancements include: managed/unmanaged VMs bifurcation in topology, VM status display in topology, support for policies such as flex capacity, network mappings, etc.

What's new

This section provides you with summary of the updates that are made to the VM Recovery Manager DR GUI.

The following information is a summary of the updates that are made to VM Recovery Manager DR GUI in this release.

- >|Topology and dashboard view for HADRHA type cluster |<
- >|Management of user roles and profiles |<
- >|Add/delete/modify user |<
- >|Default and custom role handling |<

Logging in to the VM Recovery Manager DR GUI

After you installed the VM Recovery Manager DR GUI, you can log in to the VM Recovery Manager DR GUI from a web browser.

To log in to the VM Recovery Manager DR GUI, complete the following steps:

1. Open a supported web browser, and enter `https://<hostname>:3000/login`, where `hostname` is the system on which you installed the `vmruiinst.ksh` GUI filesets.
2. On the login page, enter the user name and password and click **Log In**.
 - Check the **Remember me** check box. The system allows you to login without re-entering username and password for next 24 hours. If you don't check the **Remember me** check box, the system allows login without re-entering username and password for next 10 hours.

Navigating the VM Recovery Manager DR GUI

The VM Recovery Manager DR graphical user interface (GUI) provides you with a web browser interface that can monitor your VM Recovery Manager DR environment.

VM Recovery Manager DR dashboard

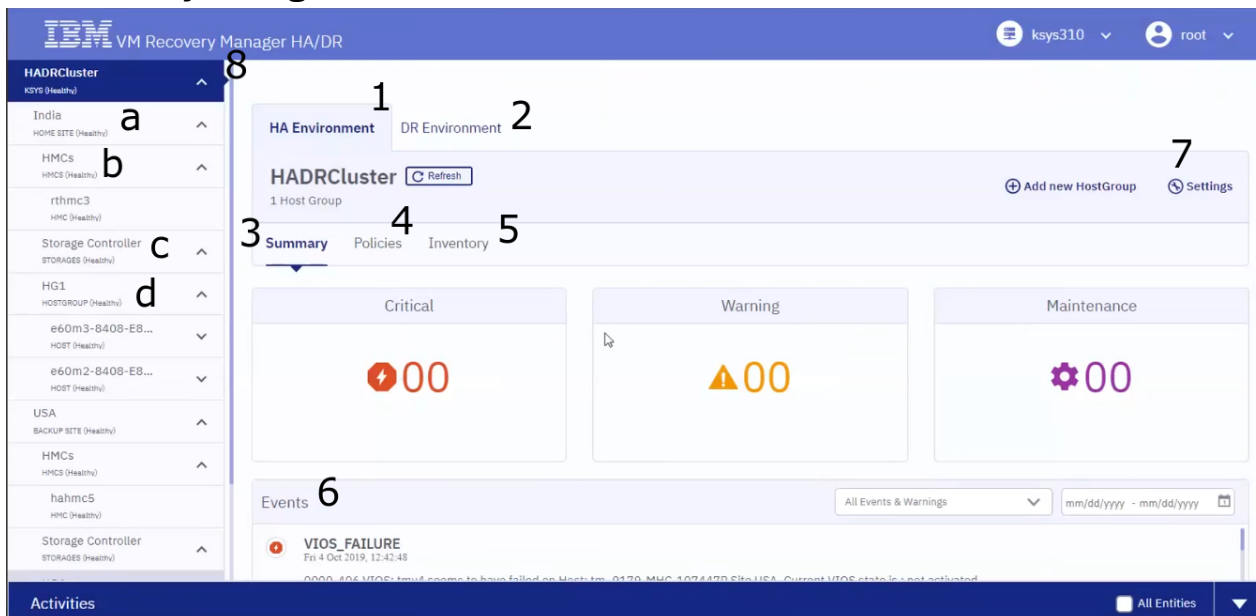


Figure 34. VM Recovery Manager GUI dashboard

1. HA environment

In this tab, you can view and work on HA environment.

2. DR environment

In this tab, you can view and work on DR environment.

3. Summary

In the summary tab, you can quickly view all events for a cluster in your environment. Ongoing issues and errors are displayed here.

4. Policy

In the policy tab, you can view and update policy.

5. Inventory

In the inventory tab, you can view inventory attached to the cluster.

6. Events

In the event tab, you view details of event, i.e. the time when each event occurred, and a description of the event. Click **View details** to see the details of the event.

7. Settings

Click setting to unregister KSYS, remove KSYS cluster and update notification process.

8. Navigation panel

In the left of the dashboard, the navigation panel displays site topology, HMCs, storage controllers, and host groups details.

a. In the **site topology** navigation, you can view details of the active site and the backup site.

b. In the **HMC** navigation, you can view summary of the HMC. You can also view details of HMC, work on managed hosts and change settings of the HMC.

c. In the **storage controller** navigation, you can view summary of the storage controller and list of the storage controller.

d. In the **host group** navigation, you can view details of the host group that is added to the KSYS configuration. The host group navigation also display the details of **managed VIOS**, **unmanaged VIOS**, and the details of **managed VMs** and **unmanaged VMs** added to the host group.

User Script

This section in the DR environment displays the user scripts present in the DR environment.

Working in the GUI

The VM Recovery Manager DR solution monitors the hosts and the virtual machines when you add information about your environment to the KSYS configuration. The GUI supports VM Recovery Manager DR, HADR, HADRHA, and VM Recovery Manager HA environments.

- In the HADR setup, there are six steps for creating a host group: Add KSYS, Add Sites, Register Storages, Register HMCs, Create Host Group, and Monitor Dashboard.
- In the VM Recovery Manager HA setup, there are only three steps: Register HMCs, Create Host Group, and Monitor Dashboard.

Adding the KSYS subsystem

If you have not added the KSYS subsystem to the HADR environment or the HADRHA environment, you will be navigated to add the KSYS subsystem page after you logged in to the GUI. To add a KSYS subsystem to your HADR environment or HADRHA environment, complete the following steps:

1. Click **Add ksys**.
2. >| Select the type of deployment from the **KSYS type** drop-down list at the top left corner of the screen. You can select DR, HADR or HADRHA type of deployment from the selection list. |<
3. Enter the KSYS subsystem details and the KSYS cluster details. Then, click **Save & Next**.

Note: >| For HADRHA cluster, ensure that the cluster is already created by using command-line interface (CLI), and the host group you want to add must exist in the configuration. |<

Adding sites to the KSYS

After adding the KSYS subsystem, you need to add home site and backup site. After adding the KSYS subsystem, the GUI navigates you to the add sites page. To add sites to your HADR environment, complete the following steps:

1. Click **Add sites**.
2. Enter **home site** and **backup site** details, and select **replication type**. Then, click **Save and Next**.

Registering storage

After adding sites to the KSYS, you need to register storage. After adding the home site and backup site, the GUI navigates you to the registering storage page. To register storage, complete the following steps:

1. Click **Add storage**.
2. Enter the storage details. Then, click **Save and Next**.

Registering HMCs

After registering storage, you need to register HMCs in your HADR environment. After registering storage, the GUI navigates you to the registering HMCs page. To register HMCs, complete the following steps:

1. Click **Register HMCs**.
2. Enter the HMCs details. Then, click **Save and Next**.

Adding host group

There are four steps in adding a new host group procedure: Add hosts, Add VIOSs, Add disks, and Add VMs. In the GUI dashboard, Click **Add new HostGroup > Create Host Group**. The system displays the deployment wizard page. To add a new host group, complete the following steps:

1. **Add hosts:**
 - a. In the deployment wizard page, select **Host group name, Pairing type**, and Policies for this host group. Then, click **Save & Next**.
 - b. Select **host** for the home site and the backup site.
2. **Add VIOSs:** Select **VIOSs** for the home site and the backup site. Then, click **Save & Next**.
3. **Add Disks:** Select **disks** for the home site and the backup site. If you have already added the SSP cluster, you are not required to select a disk in this step.
4. **Add VMs:** Select **VMs**. In this step, you can change policies for the VMs, and enable or disable the HA monitoring for the VMs. Then, click **Save & Next**.

The browser displays summary page. You can review the host group configuration in the summary page. Also, you can export the summary of the host group in the pdf format.
5. To export the summary, click **Export Summary**.
6. Click **Submit & Deploy**. The following screen displays deployment progress. After deployment, the browser displays the GUI dashboard.

Virtual machine operations in the GUI dashboard

You can perform the cleanup operation for VMs, restart a VM, and migrate a VM.

- **Clean up a VM:** In the GUI dashboard, select the **VM** from the navigation panel, then click **Cleanup**.
- **Restart a VM:** In the GUI dashboard, select the **VM** from the navigation panel, then click **Restart**.
- **Migrate a VM:** In the GUI dashboard, select the **VM** from the navigation panel, then click **Migrate**.

GUI certificate private key pairs

VM Recovery Manager DR GUI has server and agent components. The GUI agents are enabled on all managed KSYS nodes. You can deploy the GUI server on a KSYS subsystem or on a separate AIX LPAR. The GUI server subsystem and the GUI agent subsystem communicate through the network by using the secure sockets layer (SSL) protocol. This requires both the GUI server subsystem and the GUI agent subsystem to have their own certificate-private key pairs. By default, the GUI server and the GUI agent use self-signed certificate-private key pairs. These private key pairs are exchanged automatically, you do not need additional configuration for secure communication. However, if the GUI server and the GUI agent do not use the default self-signed certificate-private key pairs, you must configure the certificate-private key pairs.

To configure the certificate-private key pairs, complete the following steps:

1. In the GUI server, go to the security folder at the following location:
`/opt/IBM/ksys/ui/security/`.

The `security` folder contains all SSL certificates, private keys and certificate signing requests, which the secure sockets layer (SSL) protocol uses.

2. Stop the GUI sever by running the following command:

```
stopsrc -s vmruiserver
```

3. Stop the GUI agent by running the following command:

```
stopsrc -s vmruiagent
```

4. Open the security folder, and replace the following default certificates and default private keys with the certificate and private keys that you want.

- server.crt
- server.key
- agent.crt
- agent.key

5. Restart the GUI server by running the following command:

```
startsrc -s vmruiserver
```

6. Restart the GUI agent by running the following command:

```
startsrc -s vmruiagent
```

GUI log collection utility

If a user encounters an error while running the GUI, the log collection utility of the VM Recovery Manager DR can be used to collect log details.

The following types of logs details are collected:

- Server log details
- Agent and events log details

To view the functions of the collect log collection utility, run the following command:

```
collectlogs.sh -h
```

The directory path for this log collection utility is `/opt/IBM/ksys/ui/server/dist/server/bin`. You can use the optional arguments `[-D] [<DIRECTORY>]`.

User role management in GUI

You can add, delete, and modify a user by using GUI. You can also create with default role and custom role.

Prerequisites

The following are the prerequisite for user role management in GUI:

- User must be present in the KSYS node before you add the user to GUI.
- A root user must exist in the KSYS node. The username name of the root user must be **root**.
- After installing GUI, the root user must add a KSYS node to the GUI. After adding the KSYS node, you can configure users and roles by using the GUI dashboard.

Working in the user role management screen

1. Click **root** in the user menu at the top-left of the screen. Select **User Role Management** from the menu displayed. The web-browser displays the **User Role Management** screen.

User Role Management

Users
Roles

List of Users [Add New User](#)

User Name	Role Name	Permissions	Actions
root	root	User Roles: Register/Unregister Ksys, User Role Management. Infrastructure & Maintenance: Add/Remove Hostgroup, Add/Remove HMC, Add/Remove Host, Change HMC Password, Change Storage Password, User Scripts. HA Operations: CleanUp VM, Discover & Verify, Flex Memory & Capacity, Migrate Host/VM, Policies, Restart Host/VM, Relocate Host/VM. View: View Reports.	NA
Mike	admin	User Roles: User Role Management. Infrastructure & Maintenance: Add/Remove Hostgroup, Add/Remove HMC, Add/Remove Host, Change HMC Password, Change Storage Password, User Scripts. HA Operations: CleanUp VM, Discover & Verify, Flex Memory & Capacity, Migrate Host/VM, Policies, Restart Host/VM, Relocate Host/VM. View: View Reports.	Modify Delete

[Go to dashboard](#)

Figure 35. User role management screen

You can view username, role name, and permission granted to a user in the list displayed. You can add a user, modify a user, and delete a user.

2. To add, delete or modify a user, click **Users** in the top navigation bar.
 - To create a user, click **Add New User**.
 - To modify a user, click **Modify** in the respective row.
 - To delete a user, click **Delete** in the respective row.
3. To define a new role, modify a role, delete a role, or modify role for a user, click **Roles** in the top navigation bar.
 - To add a user role, click **Add New Role**.
 - To modify a user role, click **Modify** in the respective row.
 - To delete a user role, click **Delete** in the respective row.

Limitation

Only a root user can register or unregister the KSYS node.

Deployment with high availability (HA) features

> You can select deployment type when installing the IBM VM Recovery Manager DR for Power Systems. The VM Recovery Manager DR has three types of deployment: <

- > VM Recovery Manager DR <
- > VM Recovery Manager HADR <
- > VM Recovery Manager HADRHA <

VM Recovery Manager DR

The IBM VM Recovery Manager DR for Power Systems include all the essential and advanced features of disaster recovery. For more information about the disaster recovery features of the VM Recovery Manager DR, see the [“Overview for IBM VM Recovery Manager DR for Power Systems” on page 1](#) section.

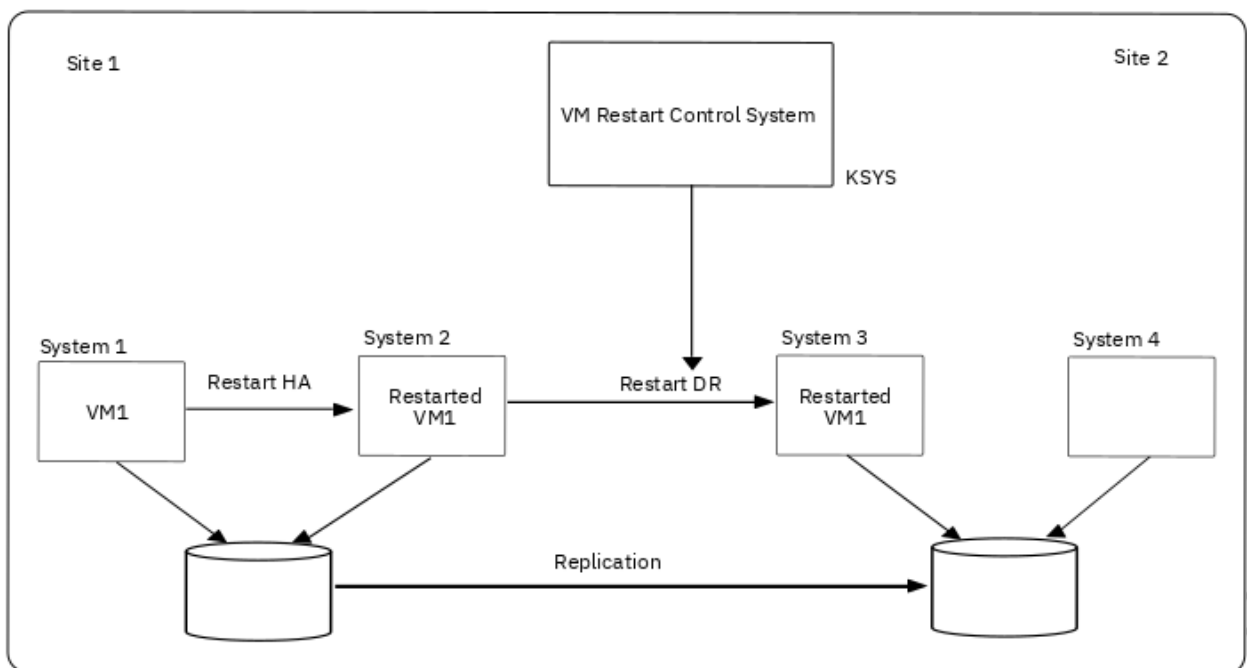
VM Recovery Manager HADR solution

> The IBM VM Recovery Manager family provides high availability (HA) and disaster recovery (DR) solutions for virtual machines (VMs) within a site and across sites using a single orchestrator. In case of down time or planned outage, user can migrate a VM from one host (server) to another host within a home site (for partial failure) or backup site (for complete failure). <

> VM Recovery Manager HADR for Power Systems support different types of failure recovery within a site and across sites. Within a site, failures can occur at application level, VM level, or host level. In case of failures within a site, the VM migrates automatically. But if the failure is across sites, which includes planned and unplanned move operation at the site level and the host group level, you must initiate a move operation manually. VM Recovery Manager HADR uses shared storage pool (SSP) cluster formed within source site's Virtual I/O Server (VIOS) instances for VM, which also monitors a host to provide the high availability solution. <

> The important features of the VM Recovery Manager HADR includes all the essential and advanced features of disaster recovery and high availability features such as Live Partition Mobility (LPM), support for VM failure and host failure recovery, and application failover support within a home site, Fibre Channel (FC) adapter failure, network adapter failure, monitoring CPU and memory usage, move operation and failover rehearsal operation across the site along with all other DR features. The workgroup feature is not supported for the HADR type of deployment. For more information about the high availability features in the VM Recovery Manager DR, see [“High availability features” on page 82](#). <

>|



|<

Figure 36. Working of the HADR type of deployment

VM Recovery Manager HADRHA

The high availability features are available within the site and supported both on home and backup sites for HADRHA type of configuration. For example, you can back up a failed virtual machine and restart a virtual machine within the same site, or move the failed virtual machine to other site. The failover operations for disaster recovery can be performed from one site to another site. The high availability features are available across sites, within the same site, and in the backup site. The workgroup feature is not supported for the HADRHA type of deployment.

Configuring HADR

After the VM Recovery Manager HADR software is installed, you must complete some mandatory configuration steps to use the disaster recovery feature and high availability feature of the HADR type of deployment of the VM Recovery Manager DR solution. You can use the `ksysmgr` command to interact with the KSYS daemon to manage the entire environment.

Prerequisite

>| The following are the hardware configuration prerequisite for the IBM VM Recovery Manager HADR cluster: |<

>|

- Two hosts at the home site and one host at the backup site are required.
- Two VIOS instances at the home site hosts are required.
- Home site VIOS instances must have at least two shared disks between them for an SSP cluster, and Cluster Aware AIX (CAA) volume group for repository. The size of the shared disks must be 5 GB, or more.
- The managed VMs must have disks on the source storage and the target storage, and replication process must run successfully between disks.



Configuring HADR

Complete the following procedures to configure the HADR type of deployment of the VM Recovery Manager DR solution.

1. [“Configuring the KSYS node” on page 171](#)
2. [“Creating sites” on page 171](#)
3. [“Adding HMCs to the KSYS subsystem” on page 171](#)
4. [“Adding hosts to the KSYS subsystem” on page 172](#)
5. [“Adding storage agent” on page 172](#)
6. [“Creating host group” on page 172](#)

Note: You can use asymmetric and symmetric host group configurations while creating and adding host groups.

Configuring the KSYS node

After the HADR type of deployment of the VM Recovery Manager DR solution is installed on the KSYS LPAR, you must configure the HADR cluster type before you set up environment for the HADR type of deployment of the VM Recovery Manager DR solution.

To configure the HADR cluster type, specify HADR while configuring the cluster. For example:

```
ksysmgr add ksyscluster cluster_name ksysnodes=ksysnode1 type=HADR
```

Creating sites

You must create sites that are used to map all the HMCs, hosts, and storage devices. You must create an active site where the workloads are currently running and a backup site that acts as a backup for the workloads during a disaster or a potential disaster situation.

Sites are logical names that represent your sites. A site name can be any American Standard Code for Information Interchange (ASCII) string that is limited to 64 characters. A site name cannot contain any special characters or spaces.

By default, the active site is the home site. You can configure only two sites. When you create sites, the replication type of the site is asynchronous by default. After you create sites, you can change the type of storage replication to synchronous.

To create sites for the HADR type of deployment of the VM Recovery Manager DR solution, complete the following steps in the KSYS logical partition:

1. Create an HADR cluster by running the following command:

```
ksysmgr add ksyscluster <HADR_CLUSTER_NAME> type=HADR ksysnodes=<hostname> sync=yes
```

2. Add the home site (Site1) by running the following command:

```
ksysmgr add site <Site1> sitetype=home
```

3. Add backup site (Site2) by running the following command:

```
ksysmgr add site <Site2> sitetype=backup
```

Adding HMCs to the KSYS subsystem

The KSYS interacts with the HMC for discovery, verification, monitoring, recovery, and cleanup operations. HMCs that are configured in both the active and backup sites provide details about the hosts and VIOS

partitions that are managed by the HMCs in each site. The HADR type of deployment of the VM Recovery Manager DR solution cannot be implemented without configuring the HMCs. Therefore, you must provide the HMC details to the KSYS.

Note: The HMC user, whose user name and password details are provided to the KSYS, must have `hmcsuperadmin` privileges with remote access enabled.

To add the HMCs to a specific site, complete the following steps in the KSYS LPAR:

1. To add the HMC (for example, HMC name: `HMC1_name`, IP of the HMC: `HMC IP1`, login: `hscroot`, password: `abc123`) that manages the host or hosts in the active site (`Site1`), run the following command:

```
ksysmgr add hmc <HMC1_name> ip=<HMC IP1> login=hscroot password=<abc123> site=<Site1>
```

2. Add the HMC (for example, HMC name: `HMC2_name`, IP of the HMC `IP2`, login: `hscroot`, password: `abc123`) that manages the host or hosts in the backup site (`Site2`), run the following command:

```
ksysmgr add hmc <HMC2_name> ip=<HMC IP2> login=hscroot password=<abc123> site=<Site2>
```

Adding hosts to the KSYS subsystem

The KSYS monitors and manages the disaster recovery operations across sites. The KSYS requires that each host must be paired to another host across sites. This type of pairing allows the virtual machines to move from one host to another host across sites. You must plan the host pairing across sites in advance, and then implement the pairing.

After the HMCs are added to the KSYS, you can review the list of managed hosts by each HMC, and then identify the hosts that you want to add to the KSYS for disaster recovery. You must connect the source hosts and target hosts to different HMCs across sites. If you connect the source hosts and target hosts to the same HMC, it leads to an invalid configuration in the KSYS subsystem and can cause failures in disaster recovery operations.

When a host is added to a host group, all the virtual machines in the host are included by default in the disaster recovery management scope. However, the disaster recovery management starts only after you configure the subsystems and run the discovery and verification operations. Therefore, if you plan to exclude a set of virtual machines after adding the hosts, you can unmanage those virtual machines, and then run the discovery and verification operations.

To add the hosts to the KSYS configuration, complete the following steps in the KSYS LPAR:

1. Add the managed host (for example, host names: `Host1`, `Host2`), which is running the workload, to the KSYS subsystem by running the following commands:

```
ksysmgr add cec <Host1> site=<Site1>
```

```
ksysmgr add cec <Host2> site=<Site1>
```

2. Add the backup host (for example, host name: `Host3`), which acts as a backup host, to the KSYS subsystem by running the following command:

```
ksysmgr add cec <Host3> site=<Site2>
```

Adding storage agent

After adding hosts to the KSYS, you must add storage agents to the KSYS subsystem. For instruction, see [“Adding storage agents to the KSYS” on page 67](#).

Creating host group

You can group a set of hosts based on your business requirements. For example, you can group the hosts that run similar type of workloads. You can also group important hosts together so that the monitoring

and recovery operations can be performed for the set of hosts together and quickly. In disaster situations, you can move a host group separately to the backup site.

Guidelines to manage host groups:

- A host must already be added to the KSYS configuration settings and the host must have been paired with a backup host in the backup site.
- Each host in a site must be a part of a host group. If a host is not added to any host groups, the host is automatically added to the Default_HG host group during the discovery operation.
- If you add or remove hosts from a host group, you must run a discovery operation to manage or unmanage all the virtual machines from the recovery management. The modified host group displays the correct list of managed virtual machines only after a discovery operation.
- If we remove all hosts from Default_HG, the disk group corresponding to Default_HG is not removed. The disk groups are retained with the removed hosts.
- The corresponding hosts in the backup site that are paired with the active site hosts are grouped logically within the same host group. For example, if host1 in the active site is paired with host2 in the backup site and you create a host group hg1 with host1, then host2 is automatically added to the host group hg1.
- Each host group must be associated with a separate disk group. The disks in the disk group must not be shared among different host groups. The disk groups are named in the following format:

```
VMRDG_{peer_domain_name}_{site_name}_{host_group_ID}
```

However, the disk group name must not exceed the maximum number of characters that is supported for a consistency group at storage level.

- For SAN Volume Controller and DS8000 series of storage systems, host groups can span across a single type of storage. Multiple host groups can use same type of storage disks but the disks must not be shared among different host groups.
1. > Identify the available disks that you can designate as the repository disk and the HA disk for the Shared Storage Pool (SSP) cluster by running the following command for the VIOsEs which are part of the host group on the home site.

```
ksysmgr query viodisk vios=VIOs1,VIOs2,VIOs3,VIOs4
```

|<

2. You can create symmetric or asymmetric host group and add the existing hosts to it.

- a. > **Symmetric host group:**

Before creating a symmetric host group, you must create host pairs. After the hosts are added to the KSYS subsystem, identify the hosts that must be paired across the active site and the backup site. Each backup host in the host pair must meet all the resource requirements so that the backup host can run the same workload in a disaster or a potential disaster situation.

Pair the identified host (for example, host name: Host1, Host3) in the active site to the identified host (for example, host name: Host2, Host4) in the backup site by running the following commands:

```
ksysmgr pair host Host1 pair=Host2
```

```
ksysmgr pair host Host3 pair=Host4
```

Now, to create a symmetric host group (for example host group name : Host_group1, ha_disk : SSP_disk1 , repo_disk :SSP_disk2), run the following command

```
ksysmgr add host_group Host_group1 hosts=Host1,Host3 ha_disk=SSP_disk1 repo_disk=SSP_disk2
```

Note: After you add one counterpart from the host-pair to a host group, the other counterpart of the host-pair will be automatically added to the respective host group in the other site. These hosts forms symmetric host group, which contains one-to-one paired hosts.



- b. **>|Asymmetric host group:** To create an asymmetric host group (for example, host group name: Host_group1, HA disk: SSP_disk1, repo_disk : SSP_disk2) and to add the existing hosts (for example, hosts: Host1, Host2, Host3) to the asymmetric host group, run the following command:

```
ksysmgr add host_group Host_group1 hosts=Host1,Host2,Host3 mxn_pairing=yes  
ha_disk=SSP_disk1 repo_disk=SSP_disk2
```

Note: By default, the **mxn_pairing** attribute is set to **no**. To create an asymmetric host group, which contains one-to-many paired hosts, set the **mxn_pairing** attribute to **yes**. You must not pair the hosts before adding the hosts to the host group. You must specify host and host-group pair of all hosts manually.



3. To perform the discovery operation and the verify operation at the site level, run the following command:

```
ksysmgr discover site Austin verify=yes
```

Configuring HADRHA

>|After the VM Recovery Manager HADRHA software is installed, you must complete some mandatory configuration steps to use the disaster recovery feature and high availability feature of the VM Recovery Manager HADRHA. You can use the `ksysmgr` command to interact with the KSYS daemon to manage the entire environment.

Complete the following procedures to configure the VM Recovery Manager HADRHA.

1. [“Configuring the KSYS node” on page 174](#)
2. [“Creating sites” on page 174](#)
3. [“Adding HMCs to the KSYS subsystem” on page 175](#)
4. [“Adding hosts to the KSYS subsystem” on page 175](#)
5. [“Adding storage agent” on page 176](#)
6. [“Creating host group” on page 176](#)

Note: You can use asymmetric and symmetric host group configurations while creating and adding host groups.

Configuring the KSYS node

>|After the VM Recovery Manager HADRHA is installed on the KSYS LPAR, you must configure the HADRHA cluster type before you set up the environment for the VM Recovery Manager HADRHA solution.

To configure the HADRHA cluster type, specify HADRHA while configuring the cluster. For example:

```
ksysmgr add ksycluster HA_DR type=HADRHA ksystnodes=ksystnode1 sync=yes
```

Creating sites



You must create sites that are used to map all the HMCs, hosts, and storage devices. You must create an active site where the workloads are currently running and a backup site that acts as a backup for the workloads during a disaster or a potential disaster situation.

Sites are logical names that represent your sites. A site name can be any American Standard Code for Information Interchange (ASCII) string that is limited to 64 characters. A site name cannot contain any special characters or spaces.

By default, the active site is the home site. You can configure only two sites. When you create sites, the replication type of the site is asynchronous by default. After you create sites, you can change the type of storage replication to synchronous.

To create sites for the VM Recovery Manager HADRHA, complete the following steps in the KSYS logical partition:

1. Create an HADRHA cluster by running the following command:

```
ksysmgr add ksyscluster HA_DR type=HADRHA ksysnodes=<ksysnode> sync=yes
```

2. Add the home site (Site1) by running the following command:

```
ksysmgr add site <Site1> sitetype=home
```

3. Add backup site (Site2) by running the following command:

```
ksysmgr add site <Site2> sitetype=backup
```



Adding HMCs to the KSYS subsystem



The KSYS interacts with the HMC for discovery, verification, monitoring, recovery, and cleanup operations. HMCs that are configured in both the active and backup sites provide details about the hosts and VIOS partitions that are managed by the HMCs in each site. The VM Recovery Manager HADRHA cannot be implemented without configuring the HMCs. Therefore, you must provide the HMC details to the KSYS.

Note: The HMC user, whose user name and password details are provided to the KSYS, must have `hmcsuperadmin` privileges with remote access enabled.

To add the HMCs to a specific site, complete the following steps in the KSYS LPAR:

1. To add the HMC (for example, HMC name: HMC1_name, IP of the HMC: HMC IP1, login: hscroot, password: abc123) that manages the host or hosts in the active site (Site1), run the following command:

```
ksysmgr add hmc <HMC1_name> login=hscroot password=<abc123> hostname=<host_name1>  
site=<site1> ip=<HMC IP1>
```

2. Add the HMC (for example, HMC name: HMC2_name, IP of the HMC IP2, login: hscroot, password: abc123) that manages the host or hosts in the backup site (Site2), run the following command:

```
ksysmgr add hmc <HMC2_name> login=hscroot password=<abc123> hostname=<host_name2>  
site=<site2> ip=<HMC IP2>
```



Adding hosts to the KSYS subsystem



The KSYS monitors and manages the disaster recovery operations across sites. The KSYS requires that each host must be paired to another host across sites. This type of pairing allows the virtual machines to move from one host to another host across sites. You must plan the host pairing across sites in advance, and then implement the pairing.

After the HMCs are added to the KSYS, you can review the list of managed hosts by each HMC, and then identify the hosts that you want to add to the KSYS for disaster recovery. You must connect the source

hosts and target hosts to different HMCs across sites. If you connect the source hosts and target hosts to the same HMC, it leads to an invalid configuration in the KSYS subsystem and can cause failures in disaster recovery operations.

When a host is added to a host group, all the virtual machines in the host are included by default in the disaster recovery management scope. However, the disaster recovery management starts only after you configure the subsystems and run the discovery and verification operations. Therefore, if you plan to exclude a set of virtual machines after adding the hosts, you can unmanage those virtual machines, and then run the discovery and verification operations.

To add the hosts to the KSYS configuration, complete the following steps in the KSYS LPAR:

1. Add the managed host (for example, host names: host1, host2), which is running the workload, to the KSYS subsystem by running the following commands:

```
ksysmgr add host <host1> site=<site1>
```

```
ksysmgr add host <host2> site=<site1>
```

2. Add the backup host (for example, host name: host3), which acts as a backup host, to the KSYS subsystem by running the following command:

```
ksysmgr add host <host3> site=<site2>
```

<

Adding storage agent

>

After adding hosts to the KSYS subsystem, you must add storage agents to the KSYS subsystem. For instructions on adding the storage agents, see [“Adding storage agents to the KSYS” on page 67](#).

<

Creating host group

>

You can group a set of hosts based on your business requirements. For example, you can group the hosts that run similar type of workloads. You can also group important hosts together so that the monitoring and recovery operations can be performed for a set of hosts together and quickly. In disaster situations, you can move a host group separately to the backup site.

Guidelines to manage host groups:

- A host must already be added to the KSYS configuration settings and the host must have been paired with a backup host in the backup site.
- Each host in a site must be a part of a host group. If a host is not added to any host groups, the host is automatically added to the Default_HG host group during the discovery operation.
- If you add or remove hosts from a host group, you must run a discovery operation to manage or unmanage all the virtual machines from the recovery management. The modified host group displays the correct list of managed virtual machines only after a discovery operation.
- If we remove all hosts from Default_HG, the disk group corresponding to Default_HG is not removed. The disk groups are retained in which hosts are removed.
- The corresponding hosts in the backup site, which are paired with the active site hosts, are grouped logically within the same host group. For example, if host1 in the active site is paired with host2 in the backup site and you create a host group hg1 with host1, then host2 is automatically added to the host group hg1.
- Each host group must be associated with a separate disk group. The disks in the disk group must not be shared among different host groups. The disk groups are named in the following format:


```
VMRDG_{peer_domain_name}_{site_name}_{host_group_ID}
```

However, the disk group name must not exceed the maximum number of characters that is supported for a consistency group at storage level.

- For SAN Volume Controller and DS8000 series of storage systems, host groups can span across a single type of storage. Multiple host groups can use same type of storage disks but the disks must not be shared among different host groups.

To create a host group, complete the following steps:

1. To identify the available disks that you can designate as the repository disk and the HA disk for the Shared Storage Pool (SSP) cluster, run the following command for the Virtual I/O Server that are part of the host group in a site.

```
ksysmgr query viodisk vios=VIO1S1,VIO1S2,VIO1S3,VIO1S4 site=sitename
```

2. You can create symmetric or asymmetric host group and add the existing hosts to it.

a. **>| Symmetric host group:**

Before creating a symmetric host group, you must create host pairs. After the hosts are added to the KSYS subsystem, identify the hosts that must be paired across the active site and the backup site. Each backup host in the host pair must meet all the resource requirements so that the backup host can run the same workload in a disaster or a potential disaster situation.

Pair the identified host (for example, host name: Host1, Host3) in the active site to the identified host (for example, host name: Host2, Host4) in the backup site by running the following commands:

```
ksysmgr pair host Host1 pair=Host2
```

```
ksysmgr pair host Host3 pair=Host4
```

Now, to create a symmetric host group (for example host group name : Host_group1, ha_disk : SSP_disk1 , repo_disk : SSP_disk2), run the following command

```
ksysmgr add host_group Host_group1 hosts=Host1,Host3 ha_disk=SSP_disk1 repo_disk=SSP_disk2
```

Note: After you add one counterpart from the host-pair to a host group, the other counterpart of the host-pair will be automatically added to the respective host group in the other site. These hosts forms symmetric host group, which contains one to one paired hosts.

⏪

- b. **>| Asymmetric host group:** To create an asymmetric host group (for example, host group name: Host_group1, HA disk: SSP_disk1, repo_disk : SSP_disk2) and to add the existing hosts (for example, hosts: Host1, Host2, Host3) to the asymmetric host group, run the following command:

```
ksysmgr add host_group Host_group1 hosts=Host1,Host2,Host3 mxn_pairing=yes  
ha_disk=SSP_disk1 repo_disk=SSP_disk2
```

Note: By default, the **mxn_pairing** attribute is set to **no**. To create asymmetric host group, which contains one to many paired hosts, set the **mxn_pairing** attribute to **yes**. You must not pair the hosts before adding the hosts to the host group. You must specify host and host-group pair of all hosts manually.

⏪

3. **>|** You can use the `modify host_group` option after creating the host group to add the backup site's SSP disks

```
ksysmgr modify host_group Host_group1 options ha_disk=Backup_site_SSP_disk1  
repo_disk=Backup_site_SSP_disk2 site=Backup_sitename
```

⏪

4. To perform the discovery operation and the verify operation at the site level, run the following command:

```
ksysmgr discover site Austin verify=yes
```

Note: > After the move operation is completed, the KSYS subsystem performs the discovery operation to enable the HA infrastructure. For HADRHA clusters, both sites need to be up to complete the discovery operation. If any site is not in a healthy state, you must resolve the errors and then rerun the discovery operation. |<

|<

Limitations

Consider the following limitations when working with HADR type deployment of VM Recovery Manager DR.

- When you shutdown or reboot a virtual machine manually, the dependent applications are not affected. The recovery of dependent applications are considered only when failure has occurred with the parent application, the virtual machine, or the host.
- Remove the default host group (Default_HG) before configuring the HADR type of deployment with PowerHA SystemMirror. To remove the default host group from the KSYS subsystem, run the following command:

```
rmrsrc -s "Name='Default_HG'" IBM.VMR_HG
```

- Disable the quick discovery feature before running the Live Partition Mobility (LPM) and the restart operations on virtual machines.

Configuring HA monitor

You can turn on or turn off the HA monitoring feature for specific entities such as site, host group, host and virtual machine. The policy that is specified for the lowest resource level is considered first for HA monitoring. If you do not specify this policy for a resource, the policy of the parent resource is applied to the resource. For example, if you enable HA monitoring for a host group, HA monitoring is enabled for all the hosts within the host group unless you disable HA monitoring for specific hosts.

You can enable HA monitoring for virtual machines only after you install the VM agent on each VM and start the VM agent successfully. For details, see the [Setting up the VM agent](#) topic. If you do not set up the VM agent, the KSYS subsystem might return error messages for HA monitoring at the VM-level.

To set HA monitoring for an entity, run the following command:

```
ksysmgr modify system|host_group|host|vm name ha_monitor=enable|disable
```

For the HA monitoring feature, the policy of the parent entity takes precedence. For example, if you disabled HA monitoring at the site level, which is a parent entity for host group, host, and LPAR, the HA monitoring will be disabled for host group, host and LPAR.

Similarly, to enable HA monitoring for a LPAR, you must enable HA monitoring at the site level and LPAR levels, as well ensure that the HA monitor features are not disabled at the host group level or the host level. If you enable HA monitoring at the site level, but you disabled HA monitoring for host group or host, the HA monitoring policy for the LPAR will be disabled.

The following table shows how HA monitoring policy of an entity takes precedence over another entity:

Table 13. HA monitoring precedence table

Site policy	Host group policy	Host policy	LPAR policy	Effective policy for LPAR
Disabled/ Unset	Enable/ Disable/ Unset	Enabled/ Disabled/ Unset	Enabled/ Disabled/ Unset	Disabled
Enabled	Disabled	Enabled/ Disabled/ Unset	Enabled/ Disabled/ Unset	Disabled
Enabled	Enabled/ Unset	Disabled	Enabled/ Disabled/ Unset	Disabled
Enabled	Enabled/ Unset	Enabled/ Unset	Disabled/ Unset	Disabled
Enabled	Enabled/ Unset	Enabled/ Unset	Enabled	Enabled

Note:

- The HA monitoring feature for the host group and host are enabled by default and defer to the site policy.
- The HA monitoring feature is disabled by default for LPARs and sites.

Local database mode

The KSYS subsystems Failure Detection Engine (FDE) performs a quick query task every 30 seconds to check the state of VIOS database. If the Shared Storage Pool (SSP) state of VIOS database comes down, the Failure Detection Engine (FDE) sends the database status to the KSYS subsystem. The KSYS subsystem modifies the VIOS database status to the local mode. When the VIOS is in the local mode, the messages about file system and health monitoring from the host monitor (HM) are written in the local file, instead of the VIOS database.

Local mode messaging (putmsg) is appended with AIX Family (AF) cluster.

> Consider the following restrictions when the VIOS is in the local database mode <:

- You cannot update HA configuration (for example, disable/enable HA monitoring feature) when the VIOS is in the local database mode.
- > The automatic cleanup feature is not supported in the local database mode because Virtual I/O Server do not have database access. You must initiate the VM cleanup operation manually. <
- > When Virtual I/O Server is in local database mode, and a new application is added, the name of the newly added application is not displayed at the KSYS subsystem level query. The other information about the application is displayed correctly. <

Troubleshooting VM Recovery Manager DR

Use this information to troubleshoot the VM Recovery Manager DR solution.

Notification for the KSYS events

The KSYS subsystem tracks various events that occur in the environment and saves the information in log files. The KSYS subsystem also sends emails and text notifications to the administrator if the contact information is registered on the KSYS configuration by using the **ksysmgr add notify** command.

You can run the following command to list all the events that can be notified:

```
ksysmgr query event
```

The events are categorized as critical errors, warning, and informational events. To query all events of a specific event type, use the following command:

```
ksysmgr query event type=error|warning|info
```

The following table lists the events that are monitored by the KSYS:

Events	Event type	Description	Suggested actions
HMC_UNREACHABLE	Critical	HMC is down or not reachable	
STG_UNREACHABLE	Critical	Storage subsystem is down or not reachable	Check the network between the KSYS node, EMC Solution Enabler, and the storage disks. Also, check whether the EMC Solution Enabler server is down.
HMC_REACHABLE	Informational	HMC recovered and is now reachable	
VIOS_RMC_STATE_DOWN	Critical	The RMC connectivity between HMC and VIOS has problems	
INSUFFICIENT_HOST_CAPACITY	Critical	Backup host does not have sufficient capacity to perform a successful disaster recovery failover	
VIOS_FAILURE	Critical	VIOS has failed	
VM_CONFIG_COLLECTION_FAILURE	Critical	Configuration data collection failed for the VM	
DAILY_VERIFY_FAILED	Critical	Daily verification has failed	

Table 14. Notification for KSYS events (continued)

Events	Event type	Description	Suggested actions
REPLICATION_FAILURE	Critical	Storage reports replication problem	Verify the replication between the local and the remote disks.
MIRROR_RELATIONSHIP_MISSING	Critical	Disk has no mirror pair	Create a mirror pair for the disk.
HOST_FAILURE	Critical	Host failure has occurred	
FILESYSTEM_SPACE_WARNING	Warning	File system is reaching full condition	Free up some space in the /var location by removing old log files or any unwanted files.
HMC_LOGIN_FAILURE	Critical	HMC login failed	
DISK_VALIDATION_FAILURE	Critical	Disk group validation failed	Investigate the disk groups and resolve the issue.
VIOS_DELETED	Warning	VIOS deletion has been detected	
VM_NOT_ACTIVE	Informational	VM is not active	
DUPLICATE_VMS	Informational	VM exists on multiple hosts	
VM_MOVE	Informational	VM has moved from one host to another	
DAILY_VERIFY_COMPLETE	Informational	Daily verification has completed successfully	
HOST_IN_INVALID_STATE	Informational	Host is in an invalid state	
VM_STORAGE_COLLECTION_FAILURE	Critical	Storage information collection has failed for the VM	Check VIOS for more details.
VM_DISCOVERED_ON_HOST	Informational	A new VM is discovered in a host	
VM_DELETED_FROM_HOST	Warning	A VM has been deleted from a host	
VM_NOT_FOUND	Critical	A VM does not exist	
VM_NOT_ACTIVE	Informational	VM is not active	

Note:

- Users might not get event notification while disaster recovery operations are in progress as the quick discovery process is blocked during the disaster recovery operation.
- >|The VM_CPU_THRESHOLD_EXCEEDED event can be ignored when VM uses shared processors in uncapped mode.<

Analyzing the log files

If you receive errors while you run the **ksysmgr** command, you can analyze the log files to diagnose the issue. Determine the software component that is causing the problem by analyzing the log files. You can find the **ksysmgr** command log files in the `/var/ksys/log/` directory.

When you run the **ksysmgr** command, the following types of log files are created:

ksysmgr.oplog

Keeps a rolling record of all the **ksysmgr** operations that you ran for a specific period. All the commands that you entered are logged in this log file along with the date, time, and the transaction ID.

ksysmgr.log

Contains the detailed processing information about each function when you run a **ksysmgr** command.

Note: The `ksysmgr.log` file contains the detailed processing information only when you specify the **-l max** flag when you run the **ksysmgr** command.

ksys_srdf.log

Contains the detailed processing information about all the EMC storage-specific functions along with the date and time.

Trace files contain the details about processes that are running as part of the operations performed by the KSYS node. If you cannot identify the cause of the error by analyzing the log files, use the trace files for problem determination. Run the following command to convert trace files to a report:

```
ksysmgr trace log=ALL | ksys | krest | krestlong | user
```

If large number of virtual machines are included in the **ksysmgr**-related operations, you can increase the size of the trace files to accommodate more log information. You can increase the size of trace file by using the `/var/ct/cfg` file as follows:

```
/var/ct/cfg
# cat trace.conf
IBM.VMR:
  pat           = /var/ct/./log/mc/IBM.VMR/.*
  spooling      = OFF
  pages        = 4
  dest         = /tmp/ksys/im/
  #size        = 8192000
  size         = 11534336
```

This example changes the size of trace files from 8 MB to 11 MB.

Example for the **ksysmgr.oplog** file and the **ksysmgr.log** file

This example shows samples for the `ksysmgr.oplog` file and the `ksysmgr.log` files.

For instance, you can run the following commands to add a KSYS cluster called `test_cluster` and then, you can run the commands to verify and sync the cluster:

```
ksysmgr add cluster test_cluster ksysnodes=xxx.xx.xx.ibm.com // Creates a cluster called
test_cluster.
ksysmgr verify ksyscluster test_cluster // Verifies the cluster.
ksysmgr -l max sync ksyscluster test cluster // To Sync the cluster.
misspelled. // However, the cluster name is
// The output displays error.
```

```
ksysmgr -l max sync ksyscluster test_cluster // Syncs the cluster.
success. // The output indicates
```

In this scenario, the contents of the `ksysmgr.oplog` file might be similar to the following sample:

```
8/3/2106 23:50:12 15401408 ksysmgr add cluster test_cluster ksysnodes=xxx.xx.xx.ibm.com
8/3/2106 23:54:35 15401222 ksysmgr verify ksyscluster test_cluster
8/3/2106 23:54:59 15401238 ksysmgr -l max sync ksyscluster test_cluster
8/3/2106 23:55:5 10551612 ksysmgr -l max sync ksyscluster test_cluster
```

The contents of the `ksysmgr.log` file might be similar to the following sample. Because the `-l max` flag was not specified in the first two commands, the details for those commands are not logged in the `ksysmgr.log` file.

```
ksysmgr_setenv()[134]: ENTERING with (ksysmgr_TRANSACTION_ID, 15401238, 809)
main()[811]: Setting ksysmgr_TRANSACTION=15401238 in the environment.
main()[855]: Processing the action input, "sync".
expand_action()[430]: ENTERING with (sync, ksysmgr -l max sync ksyscluster test_cluster)
expand_action()[472]: Converted user action "sync" to "sync" using the "exact match" alias
"sync".
main()[884]: The fully expanded action is "sync".
main()[892]: Processing the class input, "ksyscluster".
expand_class()[161]: ENTERING with (ksyscluster, ksysmgr -l max sync ksyscluster test
cluster)
expand_class()[224]: Converted user class "ksyscluster" to "ksyscluster" using the "exact
match"
alias "ksyscluster".
expand_class()[249]: Expanded class: "ksyscluster")
main()[925]: The fully expanded class is "ksyscluster".
main()[932]: Processing the "object" input, "test".
main()[944]: Processing ATTR=VALUE input, "cluster".
main()[954]: Remaining space for attributes is 3001 bytes.
sync_ksyscluster()[541]: ENTERING
sync_ksyscluster()[557]: START PROCESSING INPUTS FROM USER
-----
ksysmgr_setenv()[134]: ENTERING with (ksysmgr_TRANSACTION_ID, 10551612, 809)
main()[811]: Setting ksysmgr_TRANSACTION=10551612 in the environment.
main()[855]: Processing the action input, "sync".
expand_action()[430]: ENTERING with (sync, ksysmgr -l max sync ksyscluster test_cluster)
expand_action()[472]: Converted user action "sync" to "sync" using the "exact match" alias
"sync".
main()[884]: The fully expanded action is "sync".
main()[892]: Processing the class input, "ksyscluster".
expand_class()[161]: ENTERING with (ksyscluster, ksysmgr -l max sync ksyscluster
test_cluster)
expand_class()[224]: Converted user class "ksyscluster" to "ksyscluster" using the "exact
match"
alias "ksyscluster".
expand_class()[249]: Expanded class: "ksyscluster")
main()[925]: The fully expanded class is "ksyscluster".
main()[932]: Processing the "object" input, "test_cluster".
sync_ksyscluster()[541]: ENTERING
sync_ksyscluster()[557]: START PROCESSING INPUTS FROM USER
sync_ksyscluster()[590]: DONE PROCESSING INPUTS FROM USER
runSystemCommand()[198]: RUNNING COMMAND:/usr/bin/grep -q -F $(/usr/bin/hostname)
/var/ct/cfg/ctrmc.acls
runSystemCommand()[198]: RUNNING COMMAND:/usr/sbin/rsct/bin/mkrpdomain test_cluster
$(/usr/bin/hostname) > /dev/null 2>&1;
runSystemCommand()[198]: RUNNING COMMAND:/usr/sbin/rsct/bin/startrpdomain test_cluster>
/dev/null 2>&1;
runSystemCommand()[170]: ERROR: 1
runSystemCommand()[170]: ERROR: 1
runSystemCommand()[170]: ERROR: 1
runSystemCommand()[198]: RUNNING COMMAND:/usr/bin/stopsrc -s IBM.VMR > /dev/null 2>&1;
/usr/bin/sleep 5;
/usr/sbin/rsct/bin/rmcctrl -z > /dev/null 2>&1;
/usr/sbin/rsct/bin/rmcctrl -A > /dev/null 2>&1;
/usr/bin/startsrc -s IBM.VMR > /dev/null 2>&1;
/usr/bin/sleep 5; /usr/sbin/rsct/bin/rmcctrl -A > /dev/null 2>&1;
runSystemCommand()[198]: RUNNING COMMAND:/usr/bin/lssrc -g rsct_rm | /usr/bin/grep IBM.VMR |
/usr/bin/awk '{print $4}' | /usr/bin/grep -q -F -- 'active';
sync_ksyscluster()[663]: EXITING SUCCESSFULLY
```


Example for the ksys_srdf.log file

This example shows a sample of the ksys_srdf.log file:

For instance, you initiate a planned recovery from the active site to the backup site, and problems occur during the storage reverse replication. The output of the command displays the error. However, if you want to know the exact step where this problem occurred, you can review the ksys_srdf.log file as follows:

```
...
Wed Aug 17 04:45:03 CDT 2016 reverse_emc_srdf_cg: srdf_cg_query : Successfully Processed
/var/ksys/log/data-0-1Amy3-839-1471427099.xml
Wed Aug 17 04:45:03 CDT 2016 reverse_emc_srdf_cg: 119 : CG: VMRDG_Cheese50_vmdr_Site1 in
Asynchronous
Wed Aug 17 04:45:03 CDT 2016 reverse_emc_srdf_cg: 136 : Info: CG VMRDG_Cheese50_vmdr_Site1 in
PLAN
Wed Aug 17 04:45:03 CDT 2016 reverse_emc_srdf_cg: 150 : SID:196800573 : SOURCE for
VMRDG_Cheese50_vmdr_Site1
Wed Aug 17 04:45:03 CDT 2016 reverse_emc_srdf_cg: 161 : Info: CG VMRDG_Cheese50_vmdr_Site1 in
State:Consistent Type:RDF2
Wed Aug 17 04:45:03 CDT 2016 reverse_emc_srdf_cg: CG_DisableConsistency :
CG:VMRDG_Cheese50_vmdr_Site1
Start
Wed Aug 17 04:45:03 CDT 2016 reverse_emc_srdf_cg: srdf_cg_cmd_exec : Command Executing : 11
Wed Aug 17 04:45:04 CDT 2016 reverse_emc_srdf_cg: log_srdf_msg : Error:
All the devices in the SRDF/A session must be managed together
when the devices are in async mode
Wed Aug 17 04:45:04 CDT 2016 reverse_emc_srdf_cg: CG_DisableConsistency : CG:
VMRDG_Cheese50_vmdr_Site1
disable consistency failed:1
Wed Aug 17 04:45:04 CDT 2016 reverse_emc_srdf_cg: CG_EnableAcPMode :
CG:VMRDG_Cheese50_vmdr_Site1 Start
Wed Aug 17 04:45:04 CDT 2016 reverse_emc_srdf_cg: srdf_cg_cmd_exec : Command Executing : 13
Wed Aug 17 04:45:05 CDT 2016 reverse_emc_srdf_cg: CG_EnableAcPMode : Failed with status 1
Wed Aug 17 04:45:05 CDT 2016 reverse_emc_srdf_cg: log_srdf_msg : Error:
An RDF Set 'ACp Disk Mode ON' operation execution is in
progress for composite group 'VMRDG_Cheese50_vmdr_Site1'. Please wait...
...
```

In this example, it is clear that the issue occurred during the CG_DisableConsistency phase.

Collecting log files for VM Recovery Manager DR

You can collect the log files of the KSYS subsystem by running the `snap vmsnap` command on the KSYS node. You can use these log files to debug issues that might occur while performing KSYS operations. To run the `snap vmsnap` command successfully, the `/tmp` folder must have 2 GB or more space. The log data is recorded in the `/tmp/ibmsupt/vmsnap/ksys.pax.Z` file.

Note:

- For the cluster type DR, the host monitor and virtual machine logs will not be collected.
- **>** To collect logs of host monitor and VM monitor, you must log in to the respective VIOS and VM:
 - To collect log data from VM monitor, run the following command in the VM:

```
ksysvmmgr snap
```

- To collect log data from host monitor, run the following command in the VIOS:

```
– snap -a
```

<

To collect log files for the KSYS subsystem, run the following command:

```
snap vmsnap
```

An output similar to the following example is displayed:

```

*****Checking and initializing directory structure
Directory /tmp/ibmsupt/vmsnap already exists... skipping
Directory /tmp/ibmsupt/testcase already exists... skipping
Directory /tmp/ibmsupt/other already exists... skipping
*****Finished setting up directory /tmp/ibmsupt

Checking Space requirement for vmsnap

Checking space requirements for my product...Checking for enough free space in filesystem... done.

Gathering vmsnap data

Gathering VMRM product information...

Clearing the /tmp/ibmsupt/vmsnap of redundant files and directories...

Gathering VM/HM logs...

Collecting the VM logs for HG=0 (0 = ALL HGs)...
Collecting the HM logs for HG=0 (0 = ALL HGs)...
Successfully started VM/HM log collection...

To check the status of VM/HM log collection, please run 'ksysmgr query system status monitor=yes'

Gathering RM traces and registry...

.....
Cleaning old temporary directory at
Log directory set to /tmp/ibmsupt/vmsnap/tmpstage.12124544
tar file set to /tmp/ibmsupt/vmsnap/tmpstage.12124544/ctsnap.ksys216.1106084226.tar
Gathering information.....
Running gcore/gencore for active daemons...
.....
Completed running gcore/gencore for active daemons.
Preparing /var/ct on /tmp/ibmsupt/vmsnap/tmpstage.12124544/trclog//var/ct/

Gathering information.....
.....
Gathering trace spool files as follows:
lstrsp --node_name ksys216 --previous 1 --tar ./tmp/ibmsupt/vmsnap/tmpstage.12124544/ctsnap_out/
TRACE_SPOOL.tar --no_usage --tar_ticks
Done gathering trace spool files

Starting tar/compress process.....
copying files from /tmp/ibmsupt/vmsnap/tmpstage.12124544 to /tmp/ibmsupt/vmsnap
deleting temporary directory /tmp/ibmsupt/vmsnap/tmpstage.12124544
*****done*****
Successfully gathered RM traces and registry data...

Gathering storage and UIagent related data...

Successfully gathered storage and UIagent related data...

Gathering KSYS resource attributes...

Successfully gathered KSYS resource attributes...

Gathering KSYS class attributes...

Successfully gathered KSYS classes attributes...

Gathering General System information...

Successfully gathered general system information...

Removing existing redundant files if present in /tmp/ibmsupt/vmsnap.
Removing the extraneous files copied and compressed in the snap file ksys.pax.Z

VMRM snap data can be found in the file:/tmp/ibmsupt/vmsnap/ksys.pax.Z
VM and HM logs can be found in their corresponding VM's and HM's log location.
VM log location:/var/ksys/log/snap  HM log location:/tmp/ibmsupt/snap

```

Solving common problems

When you receive errors for any **ksysmgr** commands, the command output shows the error and the suggested resolution. However, if you are not able to determine the issue, review the following approaches to diagnose the issue.

The discovery operation failed.

If a problem occurs during the discovery steps, you must analyze the `ksysmgr.log` file for any failures. After the discovery is complete, you can query the `IBM.VMR_LPAR` resource class to confirm the successful completion of discovery operation:

```
lsrsrc IBM.VMR_LPAR
```

The output might be similar to the following sample:

```
Name                = "xxx"
LparUuid            = "59C8CFxx-4Bxx-43E2-A0CE-F028AEB5Fxxx"
LparIPList          = {}
SiteCleanupTastList = {}
ActiveSiteID        = 80708xxxx
LCB                 = { }
BootDiskList        = {}
CecUuid             = "6ce366c5-f05d-3a12-94f8-94a3fdfcxxxx"
ErrMsg              = ""
Phase               = "READY"
PhaseDetail         = 4194305
Memory              = "4352"
Processors          = "0.1"
ActivePeerDomain    = "vmdr"
```

In case of any errors in the discovery operation, the `Phase` field is set as `VERIFY` and the `ErrMsg` field indicates the error details. The `Phase` field is set as `READY` after a successful discovery operation.

The discovery operation failed with the `getlcb` error.

The cause for this error might be that the virtual machine's Fibre Channel port in the storage area network (SAN) fabric is zoned with a storage port that does not provide any logical unit numbers (LUNs) to the virtual machine. You can resolve this error by completing one of the following steps:

- Ensure that the virtual machine is zoned only with those storage ports that provide LUNs to the virtual machines.
- Run the **cfgmgr** command in the virtual machine where the `getlcb` failure occurred and then run the discovery operation again.

The discovery operation failed indicating that the storage disk was already a part of an existing composite group.

If any of the storage disks in the VM Recovery Manager DR solution are already a part of an existing composite group, the discovery operation cannot complete successfully. A storage disk in the VM Recovery Manager DR solution must be associated with a single composite group, which is asynchronously consistent. Remove the older composite groups, and run the discovery operation again.

The discovery operation failed indicating that the disk group is created in only one site.

Review the `/var/ksys/log/ksys_srdf.log` file for any consistency-enabled issue. Ensure all the disks that belong to a Remote Data Facility (RDF) group are also a part of the composite group.

The verification phase failed.

After the validation is complete, you can query the `IBM.VMR_LPAR` resource class to ensure that the virtual machines are ready to be moved during a disaster situation:

```
lsrsrc IBM.VMR_LPAR
```

The output might be similar to the following sample:

```
Name                = "xxx"
LparUuid            = "59C8CFxx-4Bxx-43E2-A0CE-F028AEB5Fxxx"
LparIPList          = {}
```

```

SiteCleanupTastList = {}
ActiveSiteID       = 80708xxxx
LCB                = { }
BootDiskList       = {}
CecUuid            = "6ce366c5-f05d-3a12-94f8-94a3fdfcxxxx"
ErrMsg             = ""
Phase              = "READY_TO_MOVE"
PhaseDetail         = 4194305
Memory             = "4352"
Processors         = "0.1"
ActivePeerDomain   = "vmdir"

```

In case of any errors in configuration validation, review the error details in the `ErrMsg` field. The `Phase` field is set as `READY_TO_MOVE` after a successful verification operation.

The test-discovery step in the DR failover rehearsal operation is failing with the error message: Tertiary storage copy is missing.

This error occurs when one or more of the third copy of disks required for cloning the backup storage data is missing. For each backup (2nd copy) disk, a corresponding tertiary (third copy) disk must exist in the backup site. Check the availability and accessibility of the tertiary disks in the storage subsystem. You can also check the status of cloning relationship by using commands that are provided by the specific storage vendor.

The test-discovery step in the DR failover rehearsal operation is failing with the error message: Storage agent is not accessible.

This error occurs because of a problem in communication between the `KSYS` subsystem and storage subsystem. Check for any hardware issues. For example, ensure proper connectivity between all the subsystems. Also, identify the issue by analyzing resource manager trace log files.

The HMC interface indicates that the LPAR has no Resource Monitoring Control (RMC) connection or the RMC is inactive.

Check whether the LPAR properties also indicate an RMC issue between the HMC and VIOS. The RMC connectivity issue can occur because of the security mode that is set in the LPAR. The security mode for both the HMC and LPAR must be set to the same value.

For example, list the security mode for LPAR by running the following command:

```
/usr/sbin/rsct/bin/lsssecmode
```

The output might look like the following sample:

```

Current Security Mode Configuration
Compliance Mode : nist_sp800_131a
Asymmetric Key Type : rsa2048_sha256
Symmetric Key Type : default

```

Similarly, list the security mode for the HMC by running the following command:

```
/usr/sbin/rsct/bin/lsssecmode
```

The output might look like the following sample:

```

Current Security Mode Configuration
Compliance Mode : none
Asymmetric Key Type : rsa512
Symmetric Key Type : default

```

In this case, the LPAR has the `nist_xxx` security mode enabled, but the HMC has no security mode. This mismatch can occur if another HMC was connected or a security mode was set before any reset operation was started.

Errors occur when you register an EMC storage agent.

Check the `/var/symapi/config/netcnfg` file to determine whether the configuration contains at least two EMC subsystems.

You want to view all the storage disks in the active site and the backup site.

Run the following command to list all the storage disks:

```
# symcfg list
```

The output might be similar to the following sample:

S Y M M E T R I X						
SymmID	Attachment	Model	Mcode Version	Cache Size (MB)	Num Phys Devices	Num Symm Devices
000196800508	Local	VMAX100K	5977	217088	65	9964
000194901326	Remote	VMAX-1SE	5876	28672	0	904
000196800573	Remote	VMAX100K	5977	217088	0	7275
000198701861	Remote	VMAX10K	5876	59392	0	255

The output of `ksysmgr query` command is not updated for hosts, HMCs, and VIOS even when the entities are updated.

Sometimes, the `ksysmgr query` command displays static information even when the hosts or HMCs are modified. To update the `ksysmgr query` command output dynamically, complete the following steps:

1. Unpair the hosts across the sites by using the following command:

```
ksysmgr pair host host_name pair=none
```

2. Remove the hosts from the site by using the following command:

```
ksysmgr remove host host_name
```

3. Add the new HMC to the site by using the following command:

```
ksysmgr add hmc hmc_name login=login_name password=login_password  
ip=ip_address site=site_name
```

4. Add the corresponding managed hosts to the site by using the following command:

```
ksysmgr add host host_name
```

The disaster recovery move operation failed.

When a disaster occurs and you initiate a move operation, the KSYS subsystem coordinates the start of the virtual machines on the backup site. During this process, LPAR profiles are created through HMCs on the backup site hosts. During the LPAR profile creation, if any errors occur such that the KSYS cannot communicate with HMCs, the move operation might fail. At that time, any virtual machines that are partially created on HMC require manual restart. For the rest of the virtual machines, you can use the `ksysmgr recover` command to recover and start the virtual machines.

An unplanned move operation from the active site to the backup site is successfully completed and the specified flexible capacity policy is followed. Later, another unplanned move operation from the backup site to the source site fails. When the virtual machines are recovered to the source site, the virtual machines are started but without any change in the processor and memory values, (that is, without following the flexible capacity policy).

This situation can happen when the active hosts and backup hosts are connected to the same HMC. You must connect the source hosts and target hosts to different HMCs to continue unplanned move operations in case of source HMC failures.

> LPM verification operation fails with error: HSCLB401 The maximum number of partition migration commands allowed are already in progress. Try again later.

In the scalability environment where the VMs are spread across the hosts of a host group, and the LPM verification operation is run on the host group, based on the type of configuration, at some point of time, many requests might go to one host and if the number of requests are more than the maximum requests that the host can handle, the verification might fail with the error: HSCLB401 The maximum number of partition migration commands allowed are already in progress. To resolve this error, re-run the verify operation on the host group. |<

> **Error message that the failed VMs are not part of the workgroup**

When a workgroup move operation fails, run the recovery command or the move command ,based on the failure state, on the failed workgroup before running a move operation on the host group that includes the workgroup. |<

> **Database access lost after VIOS upgrade**

The database access might be lost after upgrading the VIOS. In this case, stop the VIOS daemon (vio_daemon) node by node and verify whether the VIOS daemon selected a database node (DBN). If the database node (DBN) is not selected, restart the VIOS daemon on all nodes that you stopped. If the VIOS daemon still does not select a database node (DBN), restart one of the nodes and wait until the VIOS daemon selects the database node (DBN) for the restarted node. To check the status, whether the database node (DBN) is selected, run the following command:

```
cluster status -verbose
```

|<

> **VM failed during the Live Partition Mobility (LPM) process**

If a VM fails during LPM, run the LPM recovery operation to recover the failed VM. If the VM is not recovered after the LPM recovery operation, run the restart operation on the VM. |<

You cannot log in to the VM Recovery Manager DR GUI

Problem

You cannot log in to the VM Recovery Manager DR GUI.

Solution

1. Check for issues in the `/opt/IBM/ksys/ui/server/logs/uisever.log` file.
2. If you received an error message, Permission missing on Smuiauth: login will not be done, verify that the **smuiauth** command is installed correctly. Also, verify that the **smuiauth** command has the correct permissions by running the **ls -l** command from the `/opt/IBM/ksys/ui/server/lib/auth/smuiauth` directory. An example output follows:

```
-r-x----- 1 root system 21183 Jun 11 21:48
```

3. Verify that you can run the **smuiauth** command successfully by running the command along with the **-h** flag.
4. Verify that the pluggable authentication module (PAM) framework is configured correctly by locating the following lines in the `/etc/pam.conf` file:

```
smuiauth auth required pam_aix
smuiauth account required pam_aix
```

The PAM is configured when you install the `ksys.ui.server` fileset.

You cannot register a KSYS node in the VM Recovery Manager DR GUI server

Problem

You cannot register a KSYS node in the VM Recovery Manager DR GUI server.

Solution

1. Check for issues in the `/opt/IBM/ksys/ui/server/logs/uisever.log` file by performing the following steps:
 - a. If SSH File Transfer Protocol (SFTP)-related signatures exist in the log file, such as Received exit code 127 while establishing SFTP session, a problem exists with the SSH communication between the VM Recovery Manager DR GUI server and the KSYS node that you are trying to add.

- b. From the command line, verify that you can connect to the target system by using SFTP. If you cannot connect, verify that the daemon is running on the GUI server and the target node by running the `ps -ef | grep -w sshd | grep -v grep` command.
- c. Check the SFTP subsystem configuration in the `/etc/ssh/sshd_config` file and verify that following path is correct.

```
Subsystem      sftp          /usr/sbin/sftp-server
```

If the path is not correct, you must enter the correct path in the `/etc/ssh/sshd_config` file, and then restart the `sshd` subsystem.

2. Check for issues in the `/opt/IBM/ksys/ui/agent/logs/agent_deploy.log` file on the target cluster.

Node server down: GUI fails to start

Problem

The VM Recovery Manager DR GUI server is not working correctly.

Solution

If the applications are not running correctly, the node server status might be causing the issue. Run the `ps -ef | grep node` command to check the status and run the `startsrc -s vmruiserver` command to start the node server.

Unplanned system reboot causes fallover attempt to start GUI

Problem

You cannot access the VM Recovery Manager DR GUI because of an unplanned GUI server or GUI agent node reboot operation.

Solution

During the system node reboot operation, you cannot access the GUI. Run the `lssrc -s vmruiserver` command to check the status of the `vmruiserver` subsystem.

```
#lssrc -s vmruiserver
Subsystem      Group      PID      Status
vmruiserver    vmrui      12345    inoperative
```

If the status of the `vmruiserver` subsystem is displayed as `inoperative`, run the `startsrc -s vmruiserver` command to restart the UI server node from the command line. You can then access the GUI and register the agent nodes again.

Unsuccessful Deployment: Dependency file missing during installation

Problem

A dependency file is missing during the installation of the GUI server and the GUI agent filesets.

Solution

Determine the missing file from the log files that you received by using the `installp -e` flag and install that dependency file from a certified host.

You cannot stop or start the GUI server and GUI agent processes

Problem

You cannot stop or start the GUI server and agent processes.

Solution

- **GUI server:** Stop the GUI server by running the following command: `stopsrc -s vmruiserver`. Restart the GUI server by running the following command: `startsrc -s vmruiserver`. If you are starting the GUI server for the first time after installing GUI server, run the `vmruinst.ksh`

command. For information about running this command, see [“Installing GUI server filesets”](#) on page 51.

- **GUI agent:** Stop the GUI agent process by running the following command in the guest VM: `stopsrc -s vmruiagent`. This command unregisters the KSYS node from the GUI server and the KSYS node will no longer be accessible from the GUI server.

Restart the GUI agent by running the following command: `startsrc -s vmruiagent`. This command registers the KSYS node again.

Frequently asked questions (FAQs)

If you have questions about the VM Recovery Manager DR solution, review the following list of answers to some frequently asked questions.

How many sites can be configured by using the VM Recovery Manager DR solution?

Currently, only two sites can be configured. An active site and a backup site.

Which POWER servers can be included for disaster recovery by using the VM Recovery Manager DR solution?

POWER7 processor-based server, or later.

Which type of storage devices are supported by the VM Recovery Manager DR solution?

See [Configuration requirements](#).

Does this solution support Shared Storage Pool (SSP)?

Yes. The VM Recovery Manager DR solution also supports shared storage configuration. For more information, see [“Managing the shared storage configuration”](#) on page 118.

Does the VM Recovery Manager DR solution support any flexible capacity management solutions?

Yes. The VM Recovery Manager DR solution supports Enterprise Pool Capacity on Demand (CoD) and Elastic CoD (formerly known as On/Off CoD) features. The VM Recovery Manager DR solution manages the memory and processor requests before starting the disaster recovery operation. For more information, see [“Managing the CoD resources”](#) on page 123.

The VM Recovery Manager DR solution also supports flexible capacity policies by using the KSYS command interface. For more information, see [“Configuring the flexible capacity policies”](#) on page 104.

Which operation systems are supported for the virtual machines in the hosts?

- AIX Version 6.1, and later
- PowerLinux (Red Hat, SUSE, and Ubuntu Linux distributions)
- IBM i Version 7.2, and later

See [“Requirements for the VM Recovery Manager DR solution”](#) on page 29 for more information.

Can the VM Recovery Manager DR solution work in the presence of other high availability and disaster recovery solutions in the current environment?

Yes, if the cluster management of the virtual machines that are covered under other high availability and disaster recovery solutions are handled separately and outside of the KSYS subsystem. A specific virtual machine can be included in only one high availability and disaster recovery solution.

What is the minimum version of HMC that must be used for this solution?

See [“Requirements for the VM Recovery Manager DR solution”](#) on page 29.

What is the minimum version of VIOS that must be used for this solution?

See [“Requirements for the VM Recovery Manager DR solution”](#) on page 29.

What is KSYS?

The KSYS (also known as controlling system) is a controlling software for the disaster recovery operation that operates in an IBM AIX 7.2 with Technology Level 1 Service Pack 1 (7200-01-01), or later logical partition in the backup site and controls the entire cloud environment for the VM Recovery Manager DR solution. The KSYS is responsible for carrying out recovery actions if a disaster or a potential disaster occurs.

Can I test the disaster recovery operation without an actual disaster?

Yes. The VM Recovery Manager DR solution performs failover rehearsal at the backup site in the disaster recovery environment, without disrupting the production workloads or the storage replication from the active site to the backup site. For more information, see [“Failover rehearsal of the disaster recovery operation”](#) on page 87.

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Index

C

- CoD
 - Elastic CoD [126](#)
 - Enterprise Pool [123](#)
 - managing [123](#)
- commands
 - ksysmgr [137](#)
 - ksysvmmgr [158](#)

D

- disaster recovery
 - failed VMs [98](#)
 - failover rehearsal [87](#)
 - force move [98](#)
 - initiating [96](#)

E

- event notification
 - managing [114](#)
 - setting up [72](#)

F

- failover rehearsal
 - concept [87](#)
 - flow [91](#)
- flexible capacity policy [104](#)

H

- HMC
 - adding [60](#)
 - overview [7](#)
- host group
 - creating [63](#)
- host pair
 - creating [63](#)
 - overview [8](#)
- hosts
 - adding [61](#)
 - overview [8](#)

K

- KSYS
 - daily checks [80](#)
 - filesets [48](#)
 - initiating [58](#)
 - installing [50, 53](#)
 - modifying resources [111](#)
 - notification [181](#)
 - overview [5](#)
 - removing resources [113](#)

- KSYS (*continued*)
 - requirements [29](#)
 - restrictions [33](#)
 - setting up [58](#)
 - system report [103](#)

L

- log files
 - analyzing [183](#)

N

- network
 - VLAN and VSwitch mapping policy [107](#)

P

- process flow
 - installation and configuration [58](#)
 - recovery [95](#)

S

- scripts
 - disaster recovery [133](#)
 - discovery checks [130](#)
- Setting up VM Recovery Manager
 - Hitachi [21](#)
- shared storage [118](#)
- sites
 - creating [59](#)
 - overview [7](#)
- snapshots
 - overview [120](#)
 - saving and restoring [122](#)
- SSP mirror management [118](#)
- storage agent
 - adding [67](#)
 - DS8000 [17](#)
 - EMC [13](#)
 - Hitachi [18, 21](#)
 - overview [12](#)
 - registering DS8000 [69](#)
 - registering EMC [67](#)
 - registering Hitachi storage device [70](#)
 - registering Storwize [68](#)
 - registering SVC [68](#)
 - SVC [15](#)
- system attributes
 - managing [115](#)

T

- troubleshooting [187](#)

V

VIOS

- [overview 11](#)
- [prerequisites 37](#)

VM

- [prerequisite 40](#)

VM Recovery Manager DR

- [administering 103](#)
- [coexistence 127](#)
- [commands 137](#)
- [concepts 5](#)
- [configuring 57](#)
- [discovering resources 77](#)
- [FAQ 193](#)
- [installing 47](#)
- [Live Partition Mobility 127](#)
- [mechanism 43](#)
- [overview 1](#)
- [planning 29](#)
- [PowerHA 128](#)
- [PowerVC 127](#)
- [recovering 87](#)
- [troubleshooting 181](#)
- [verifying configuration 80](#)

W

Workgroup

- [overview 9](#)

