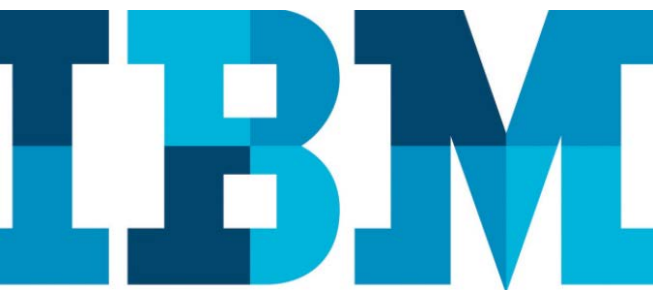


Enabling HA/DR for VM in an IBM PowerVM HMC and NovaLink coexistence environment

Using IBM VM Recovery Manager HA/DR Custom_validation and hmc_novalink scripts

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Overview

Challenge

VM Recovery Manager supports traditional Hardware Management Console and restricts IBM PowerVM NovaLink and HMC coexistence configuration.

Solution

Custom validation scripts feature of DR and HA is used to overcome this challenge. Custom validation scripts allow DR and HA operation to work seamlessly in a NovaLink HMC coexistence environment.

Business continuity is an integral part of any business operations. Almost all businesses would have recovery plans in case of disasters. Else, downtime and disruptions to business might cause not only financial losses, but also public relations and trust in the business concerned. Also, governments in many countries regulate that businesses have not only disaster recovery (DR) plans, but also demonstrate regularly that the recovery plan is tested successfully.

Business continuity plans include not only necessary technology to perform recovery, but also other aspects such as people and processes. Note that business continuity plans are important element for management to handle business data and workload during disaster recovery. Hence it is critical that all aspects of a recovery manager strategy are planned and implemented. Technology can play a key role in simplifying the recovery process so that the burden on people and processes are reduced.

This paper demonstrates how to enable the IBM® VM Recovery manager HA/DR for IBM® Power System™ solution in an environment where HMC and IBM PowerVM® NovaLink coexist.

Note: This paper demonstrates for the IBM VM Recovery Manager HA solution, but the same procedure can be followed for VM Recovery Manager DR solution also.

To get more details about VM Recovery Manager DR solution, refer <https://developer.ibm.com/articles/au-aix-gdr/>

What is VM Recovery Manager HA for Power Systems?

IBM VM Recovery Manager HA for Power Systems provides an easy way to deploy and manage a high availability (HA) solution for data centers. It enables a virtual machine (VM) restart-based high availability solution across a group of hosts (servers). VM Recovery Manager HA for Power Systems helps achieve better business continuity without the requirement for one-to-one backup hardware. Host groups allow servers to back up each other in case of

VM Recovery Manager HA operation

VMRM HA provides high availability solutions for data centers. It helps to migrate VMs from one host to another in case of planned and unplanned outage.

Basic HA operations include:

- LPM
 - Restart
 - Restore
 - Host failure
 - VM failure
 - Application failure
-

unplanned outage events. Additionally, host groups allow for planned, nondisruptive relocation of VMs through Live Partition Mobility (LPM) from one host to another within the group.

An easy-to-use graphical interface can be used to deploy, monitor, and manage high availability for the entire data center. The VM Recovery Manager HA for Power Systems environment provides a deployment wizard that can easily deploy the solution.

IBM VM Recovery Manager HA for Power Systems provides many flexible HA policies. It includes:

- Automation that integrates with IBM PowerVM® components, such as Hardware Management Console (HMC) and Virtual I/O Server (VIOS) to enable easy-to-discover-and-deploy HA for the environment.
- Easily manageable HA for many VMs: You can enable or disable HA monitoring for host, host group, and VMs.
- Automated restart, relocation, and failover of VMs during outages: Administrators can choose an advisory mode to receive failure-related alerts and perform the failovers manually.
- Priority-based restart of VMs during recovery.
- Priority-based capacity adjustment support during a recovery.
- Control failure detection times for hosts and VMs: Application failure detection is done within the VM and hence those policies are controlled by the VM administrator.
- Application HA monitoring support: Lightweight framework for IBM® AIX® and Linux® enables custom application monitoring capabilities. Control start and stop sequences of applications within a VM.

The VM Recovery HA for Power Systems solution is supported for VMs virtualized completely through PowerVM. Additionally, VM Recovery Manager HA for Power Systems uses LPM for planned HA management that includes features such as:

- Vacating a host for maintenance: All the VMs in the host are redeployed using LPM to other hosts in the host group.
- Restoring a host after repair: It is possible to bring back all the VMs that were originally part of this host. The homehost

attribute of the VM is used to search your VM list and find the VMs that truly belong to host and move them back to the repaired original host.

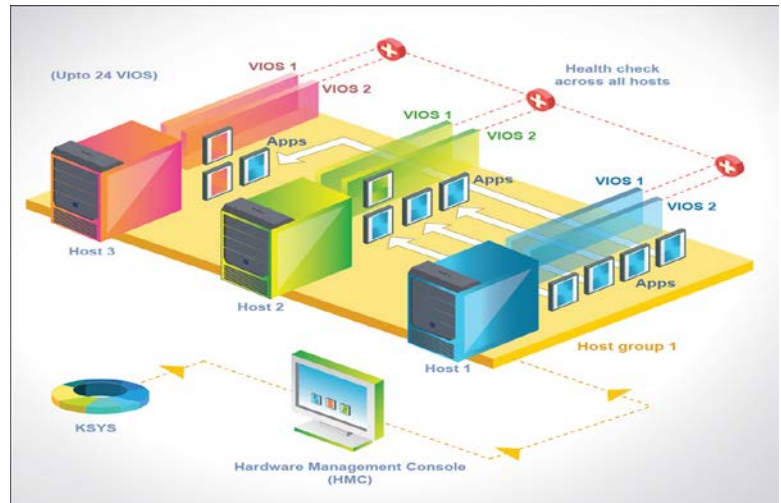


Figure 1: VM Recovery Manager HA solution architecture

What is PowerVM NovaLink?

PowerVM NovaLink is a software interface that is used for virtualization management. You can install PowerVM NovaLink on a PowerVM server. PowerVM NovaLink enables highly scalable modern cloud management and deployment of critical enterprise workloads. You can use PowerVM NovaLink to provision a large number of virtual machines on PowerVM servers quickly and at a reduced cost.

PowerVM NovaLink runs on a Linux logical partition on an IBM POWER8® processor-based server that is virtualized by PowerVM. You can manage the server through a Representational State Transfer application programming interface (REST API) or through a command-line interface (CLI). You can also manage the server by using IBM PowerVC or other OpenStack solutions. PowerVM NovaLink is available at no additional charge for servers that are virtualized by PowerVM. PowerVM NovaLink can be installed only on POWER8 or above processor-based servers.

PowerVM NovaLink provides on-host virtualization management for PowerVM. It acts as the single point of contact for all virtualization functions on the system.

Benefits of PowerVM NovaLink

PowerVM NovaLink provides the following benefits:

- Rapidly provisions many virtual machines on PowerVM servers.
- Simplifies the deployment of new systems. The PowerVM NovaLink installer creates a PowerVM NovaLink partition and VIOS partitions on the server and installs operating systems and the PowerVM NovaLink software. The PowerVM NovaLink installer reduces the installation time and facilitates repeatable deployments.
- Reduces the complexity and increases the security of your server management infrastructure. PowerVM NovaLink provides a server management interface on the server. The server management network between PowerVM NovaLink and its virtual machines is secure by design and is configured with minimal user intervention.
- Operates with PowerVC or other OpenStack solutions to manage your servers.
- PowerVM NovaLink 1.0.0.6 supports PowerVM Open I/O. Open I/O enables software-defined environments (SDEs) for software-defined networking (SDN) and storage. As the I/O is hosted by a single Linux partition, it is targeted for the cloud, development, and test environments. Production environments where the workload does not have built-in resiliency should continue to use the VIOS to host I/O.

Problem description

Currently, the VM Recovery Manager HA/DR solution works with the PowerVM environment that is configured with the traditional PowerVM HMC. You have restriction when PowerVM NovaLink and traditional HMCs are deployed together for VM management. Recovery manager cannot work directly with a HMC and NovaLink coexistence configuration. To overcome this, VM Recovery Manager includes a tool to handle such scenario.

Recommended solution

This paper explains the toggling from NovaLink to HMC and vice versa automatically with the help of customized scripts for VM Recovery manager operations to work seamlessly. User can register these scripts that can be plugged into VM Recovery Manager HA/DR. These scripts change the HMC settings to be in master mode for brief periods so that the KSYS subsystem can work with the HMC to monitor the environment for high availability.

Registering user-defined scripts

Custom validation and `hmc_novalink` tool are shipped with VM Recovery Manager file sets. After VM Recovery Manager HA/DR solution is installed on KSYS node, NovaLink scripts (`post_novalink` and `pre_novalink`) will be available at the **`/opt/IBM/ksys/samples/hmc_novalink/`** location. Custom validation user defined samples scripts will be at the **`/opt/IBM/ksys/samples/custom_validation`** location.

The following examples show about modifying `custom_validation` user defined scripts.

Example 1: PreHGVerify script for host group

Modify the PreHGVerify script by adding the `hmc_novalink` tool location. The PreHGVerify script gets triggered automatically when user trigger discovery or verify at `host_group` level. Update the script with the required NovaLink tool location as shown in example 1 code snippet. Internally `pre_novalink` script will be executed to change NovaLink to HMC.

Command to trigger discovery:

```
ksysmgr discovery host_group <host_group_name>
```

Command to trigger verify:

```
ksysmgr verify host_group <host_group_name>
```

Custom validation scripts

In VM Recovery Manager HA these scripts get triggered during discovery, verify, LPM, restart, restore, and failover scenarios.

In VM Recovery Manager DR these scripts get triggered during discovery, verify, planned move, and an unplanned move.

Prerequisite for using the `hmc_novalink` tool

All the HMCs should have a password less Secure Shell (SSH) with `ksysnode`.

```
typeset operationStep=""
typeset hostGroupName=""

operationStep=$1  # Indicates Operation Step
hostGroupName=$2  # Name of the Host Group

mkdir /home/preVerifyHG

if [ "$operationStep" = "KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_HOST_GROUP" ]
then
    echo "KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_HOST_GROUP" > /home/preVerifyHG/preverifyhg.txt
    echo "$hostGroupName" >> /home/preVerifyHG/preverifyhg.txt
    /opt/IBM/ksys/samples/hmc_novalink/pre_novalink $hostGroupName
elif [ "$operationStep" = "KSYS_PRE_DISCOVERONLY_QUICK_DISCOVERY_HOST_GROUP" ]
then
    echo "KSYS_PRE_DISCOVERONLY_QUICK_DISCOVERY_HOST_GROUP" > /home/preVerifyHG/preverifyhg.txt
    echo "$hostGroupName" >> /home/preVerifyHG/preverifyhg.txt
elif [ "$operationStep" = "KSYS_PRE_VERIFYONLY_DETAIL_DISCOVERY_HOST_GROUP" ]
then
    echo "KSYS_PRE_VERIFYONLY_DETAIL_DISCOVERY_HOST_GROUP" > /home/preVerifyHG/preverifyhg.txt
    echo "$hostGroupName" >> /home/preVerifyHG/preverifyhg.txt
fi

exit 0
```

Example 1: PreHGVerify

Note: Example 1 shows the steps for the PreHGVerify operation which uses the KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_HOST_GROUP event to trigger the NovaLink tool

Similarly, there are other scripts which are part of custom validation tools that you can use for site or host group level operations.

Scripts for site-level operations:

- postSiteOffline
- postSiteOnline
- postscript
- preSiteOffline
- preSiteOnline
- prescript

Scripts for host-group-level operations:

- PostHGOffline
- PostHGOnline
- PostHGVerify
- PreHGOffline
- PreHGOnline
- PreHGVerify

To get more details about the custom_validation tool scripts, refer [Running scripts for additional checks](#).

Example 2: Prescript for site

Modify prescript for site with the NovaLink tool location. This script gets triggered automatically when user initiates site-level discovery and verify.

Command to trigger discovery:

```
ksysmgr discover site <source_site_name>
```

Command to trigger verify:

```
ksysmgr verify site <source_site_name>
```

```
typeset operationStep=""
typeset sourceSiteName=""
typeset targetSitename=""

operationStep=$1 # Indicates Operation Step
sourceSiteName=$2 # Name of the from/source site
targetSitename=$3 # Name of the to/target site

mkdir /home/preVerifySite

if [ "$operationStep" = "KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_SITE" ]
then
    echo "KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_SITE" > /home/preVerifySite/preverifysite.txt
    echo "$sourceSiteName" >> /home/preVerifySite/preverifysite.txt
    echo "$targetSitename" >> /home/preVerifySite/preverifysite.txt
    /opt/IBM/ksys/samples/hmc_novalink/pre_novalink $sourceSiteName $targetSitename
elif [ "$operationStep" = "KSYS_PRE_DISCOVERONLY_QUICK_DISCOVERY_SITE" ]
then
    echo "KSYS_PRE_DISCOVERONLY_QUICK_DISCOVERY_SITE" > /home/preVerifySite/preverifysite.txt
    echo "$sourceSiteName" >> /home/preVerifySite/preverifysite.txt
    echo "$targetSitename" >> /home/preVerifySite/preverifysite.txt
elif [ "$operationStep" = "KSYS_PRE_VERIFYONLY_DETAIL_DISCOVERY_SITE" ]
then
    echo "KSYS_PRE_VERIFYONLY_DETAIL_DISCOVERY_SITE" > /home/preVerifySite/preverifysite.txt
    echo "$sourceSiteName" >> /home/preVerifySite/preverifysite.txt
    echo "$targetSitename" >> /home/preVerifySite/preverifysite.txt
fi

exit 0
```

Example 2: prescript for site operations

Usage to add scripts using ksysmgr

The following command is used for registering custom validation scripts at the host-group level and at the site level.

```
# ksysmgr add script -h
ksysmgr add script entity=<site|host_group>
    [pre_offline=<full path to the script file>]
    [post_offline=<full path to the script file>]
```



```
[pre_online=<full path to the script file>]
[post_online=<full path to the script file>]
[pre_verify=<full path to the script file>]
[post_verify=<full path to the script file>]
add => create, make
script => scr*
```

Note: pre_verify and post_verify are only applicable to entity=site|host_group.

Custom validation samples scripts are shipped with ksys file sets. User can use same script for HG or site level operation to customize DR operation as per their requirement.

Location of the custom_validation tool is **/opt/IBM/ksys/samples/custom_validation**.

Adding scripts for Site level operations

For discovery and verify operations:

- ksysmgr add script entity=site
pre_verify="/opt/IBM/ksys/samples/custom_validation/prescript"
- ksysmgr add script entity=site
post_verify="/opt/IBM/ksys/samples/custom_validation/postscript"

For performing a move operation when disaster occurs:

- ksysmgr add script entity=site
pre_offline="/opt/IBM/ksys/samples/custom_validation/preSiteOffline"
- ksysmgr add script entity=site
post_online="/opt/IBM/ksys/samples/custom_validation/postSiteOnline"

Adding scripts for host-group level operations

For discovery and verify operations:

- ksysmgr add script entity=host_group
pre_verify="/opt/IBM/ksys/samples/custom_validation/PreHGVerify"
- ksysmgr add script entity=host_group
post_verify="/opt/IBM/ksys/samples/custom_validation/PostHGVerify"

For disaster recovery move operation:

- ksysmgr add script entity=host_group
pre_offline="/opt/IBM/ksys/samples/custom_validation/PreHGOffline"
- ksysmgr add script entity=host_group
post_online="/opt/IBM/ksys/samples/custom_validation/PostHGOnline"

```
(0) root @ ksys206: /
# ksysmgr query script entity=host_group
User Scripts for Host Group:
PreOfflineScript:      /opt/IBM/ksys/samples/custom_validation/PreHGOOffline
PreOnlineScript:       None
PostOfflineScript:     None
PostOnlineScript:      /opt/IBM/ksys/samples/custom_validation/PostHGOnline
PreVerifyScript:       /opt/IBM/ksys/samples/custom_validation/prescript
PostVerifyScript:      /opt/IBM/ksys/samples/custom_validation/postscript
```

Figure 2: Output of registered script at host group level

Script execution and logs after DR and HA operations

This section covers about the scripts that will get triggered during specific operations.

Discovery operations for host group in HA cluster

PreHGVerify script gets triggered during discovery. It changes the NovaLink mode to HMC mode. After all the underlying process for discovery is completed, PostHGVerify script will be triggered. This again changes the normal HMC mode to the NovaLink mode. For all the pre-operations, entries get logged in the preoffline.log file as shown in Figure 3 and all post operation logs are entered in the postonline.log file as shown in Figure 4.

Command to run discovery:

```
ksysmgr discovery host_group <host_group_name>
```

Or

```
ksysmgr discovery site <sitename>
```

Output of discovery

```
(0) root @ ksys206: /cluster
# ksysmgr discover hg HGTest
Running discovery on Host_group HGTest, this may take few minutes...
Creating HA trunk adapter for VIOS raguv1
Finished creating HA trunk adapter for VIOS raguv1
Creating HA trunk adapter for VIOS raguv2
Finished creating HA trunk adapter for VIOS raguv2
Creating HA trunk adapter for VIOS zitiv3
.....
.....
VM monitor state has moved to 'STARTED' for VM ziti014
VM monitor state has moved to 'STARTED' for VM ziti024
VM monitor state has moved to 'STARTED' for VM ziti021
VM monitor state has moved to 'STARTED' for VM ziti028
Discovery has finished for HGTest
4 out of 4 managed VMs have been successfully discovered
```

```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpreoffline-8126916.log
Pre Script called for KSYS_PRE_DISCOVERONLY_DETAIL_DISCOVERY_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ragu-9119-MME-SN106CDC7 is 0
Host ragu-9119-MME-SN106CDC7 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcmgmt -m ragu-9119-MME-SN106CDC7 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ziti_9119-MME-106CD27 is 0
Host ziti_9119-MME-106CD27 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcmgmt -m ziti_9119-MME-106CD27 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
```

Figure 3. Output of PreHGVerify script for discovery

PostHGVerify script will get triggered after completion of discovery operation and it will change the HMC mode to the NovaLink mode.

```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpostonline-11927862.log
Post Script called for KSYS_POST_DISCOVERONLY_DETAIL_DISCOVERY_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ragu-9119-MME-SN106CDC7 is 0
Return code of HMC command: chcmgmt -m ragu-9119-MME-SN106CDC7 -o relmaster is 0
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ziti_9119-MME-106CD27 is 0
Return code of HMC command: chcmgmt -m ziti_9119-MME-106CD27 -o relmaster is 0
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
```

Figure 4: Output for PostHGVerify script for discovery

Verify operation for host group in HA cluster

PreHGVerify script gets triggered during verification and the NovaLink tool changes the HMC NovaLink coexistence mode to the traditional PowerVM HMC mode. This will try to verify whether all the resources are good on the target host. After verification operation is complete, PostHGVerify script again brings back the HMC normal mode to the HMC NovaLink coexistence mode. Figure 5 shows the output of the PreHGVerify operation and Figure 6 shows the output of the PostHGVerify operation.

Command to trigger verify:

ksysmgr verify host_group <host_group_name> or ksysmgr verify site <sitename>

Output of verify

```
(0) root @ ksys206: /
# ksysmgr verify hg HGTest
Host_group verification started for HGTest
ziti024 verification has started
ziti021 verification has started
```

ziti028 verification has started
ziti014 verification has started
ziti014 verification has completed
ziti021 verification has completed
ziti024 verification has completed
ziti028 verification has completed
Verification has finished for HGTest
4 out of 4 VMs have been successfully verified

```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpreoffline-13631794.log
Pre Script called for KSYS_PRE_VERIFYONLY_DETAIL_DISCOVERY_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ragu-9119-MME-SN106CDC7 is 0
Host ragu-9119-MME-SN106CDC7 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ragu-9119-MME-SN106CDC7 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ziti_9119-MME-106CD27 is 0
Host ziti_9119-MME-106CD27 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ziti_9119-MME-106CD27 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
```

Figure 5: Output of PreHGVerify script for verification

PostHGVerify script will get triggered after the completion of the verification process and it will change the PowerVM normal HMC mode to the HMC Novalink coexistence mode

```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpostonline-16843050.log
Post Script called for KSYS_POST_VERIFYONLY_DETAIL_DISCOVERY_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ragu-9119-MME-SN106CDC7 is 0
Return code of HMC command: chcomgmt -m ragu-9119-MME-SN106CDC7 -o relmaster is 0
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ziti_9119-MME-106CD27 is 0
Return code of HMC command: chcomgmt -m ziti_9119-MME-106CD27 -o relmaster is 0
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
```

Figure 6: Output of PostHGVerify script for verification

VM restart operation

After the failure is detected PreHGOffline script gets triggered during restart and changes HMC NovaLink coexistence mode to traditional PowerVM HMC mode. All the VMs will be created on the target host and when the virtual machines are fully activated, the PostHGOnline script will be triggered which will change the mode back to Novalink coexistence.

Command to restart host or VM in VM Recovery manger HA:

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

Or,

```
ksysmgr restart vm <vm_name>
```

```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpreoffline-13631770.log
Pre Script called for KSYS_MOVE_PLANNED_PRE_OFFLINE_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ragu-9119-MME-SN106CDC7 is 0
Host ragu-9119-MME-SN106CDC7 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ragu-9119-MME-SN106CDC7 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ziti_9119-MME-106CD27 is 0
Host ziti_9119-MME-106CD27 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ziti_9119-MME-106CD27 -o setmaster -t norm is 1
HMC Command:chcomgmt -m ziti_9119-MME-106CD27 -o setmaster -t norm failed with return code 1
```

Figure 7. Output for PreHGOffline script for move operation

Output of restart

```
(0) root @ ksys206: /
# ksysmgr restart host ragu-9119-MME-SN106CDC7
Stopping HA monitoring for VM ziti021
Stopping HA monitoring for VM ziti024
HA monitoring for VM ziti021 stopped
Starting HA monitoring for VM ziti021
HA monitoring for VM ziti024 stopped
Starting HA monitoring for VM ziti024
HA monitoring for VM ziti024 started
HA monitoring for VM ziti021 started
Shutdown on ragu-9119-MME-SN106CDC7 Host has started for VM ziti024
Shutdown on ragu-9119-MME-SN106CDC7 Host has started for VM ziti021
Shutdown on ragu-9119-MME-SN106CDC7 Host has completed for VM ziti024
Shutdown on ragu-9119-MME-SN106CDC7 Host has completed for VM ziti021
Restart has started for VM ziti024
Restart has started for VM ziti021
Restart on Target host ziti_9119-MME-106CD27 has completed for VM ziti024
Restart on Target host ziti_9119-MME-106CD27 has completed for VM ziti021
Waiting for rediscovery.
2 out of 2 VMs have been successfully restarted
```

The PostHGOnline script gets triggered after completion of the restart operation and it will change the mode of HMC from traditional PowerVM HMC to NovaLink.

```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpostonline-15860100.log
Post Script called for KSYS_MOVE_PLANNED_POST_ONLINE_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ragu-9119-MME-SN106CDC7 is 0
Return code of HMC command: chcomgmt -m ragu-9119-MME-SN106CDC7 -o relmaster is 0
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ziti_9119-MME-106CD27 is 0
Return code of HMC command: chcomgmt -m ziti_9119-MME-106CD27 -o relmaster is 0
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
```

Figure 9. Output of PostHGOnline script for move operation

LPM

While performing LPM, first PreHGOffline script gets triggered and then changes the mode from NovaLink to HMC. After the VMs are migrated to the other host, PostHGOnline script is triggered and gets the console back to the Novalink mode.

Virtual machines can be moved to the target host using LPM.

Command to trigger LPM:

```
ksysmgr lpm host <host_name>
```

Or,

```
ksysmgr lpm vm <vm_name>
```

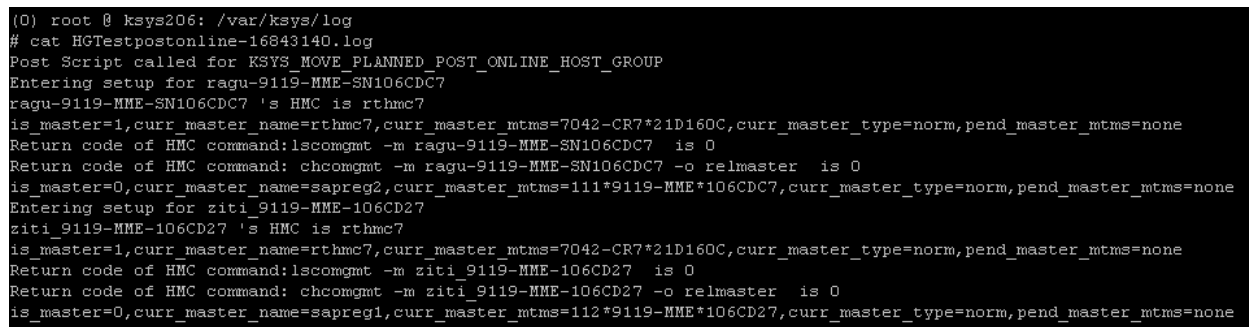
```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpreoffline-19595526.log
Pre Script called for KSYS_MOVE_PLANNED_PRE_OFFLINE_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ragu-9119-MME-SN106CDC7 is 0
Host ragu-9119-MME-SN106CDC7 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ragu-9119-MME-SN106CDC7 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ziti_9119-MME-106CD27 is 0
Host ziti_9119-MME-106CD27 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ziti_9119-MME-106CD27 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
```

Figure 10. Output of PreHGOffline script for LPM

Output of LPM

```
(130) root @ ksys206: /  
# ksysmgr lpm host ziti_9119-MME-106CD27  
Running LPM on VM(S), This May take few minutes...  
LPM has started for ziti028  
LPM has started for ziti024  
LPM has started for ziti014  
LPM has started for ziti021  
LPM has completed for ziti028 on Target host ragu-9119-MME-SN106CDC7  
LPM has completed for ziti024 on Target host ragu-9119-MME-SN106CDC7  
LPM has completed for ziti014 on Target host ragu-9119-MME-SN106CDC7  
LPM has completed for ziti021 on Target host ragu-9119-MME-SN106CDC7  
Waiting for rediscovery.  
4 out of 4 VMs have been successfully performed LPM
```

PostHGOnline script gets triggered after the completion of LPM operation and then it changes the mode from HMC to NovaLink.



```
(0) root @ ksys206: /var/ksys/log  
# cat HCTestpostonline-16843140.log  
Post Script called for KSYS_MOVE_PLANNED_POST_ONLINE_HOST_GROUP  
Entering setup for ragu-9119-MME-SN106CDC7  
ragu-9119-MME-SN106CDC7 's HMC is rthmc7  
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none  
Return code of HMC command:lscmgmt -m ragu-9119-MME-SN106CDC7 is 0  
Return code of HMC command: chcomgmt -m ragu-9119-MME-SN106CDC7 -o relmaster is 0  
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none  
Entering setup for ziti_9119-MME-106CD27  
ziti_9119-MME-106CD27 's HMC is rthmc7  
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none  
Return code of HMC command:lscmgmt -m ziti_9119-MME-106CD27 is 0  
Return code of HMC command: chcomgmt -m ziti_9119-MME-106CD27 -o relmaster is 0  
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
```

Figure 11. Output of PostHGOnline script for LPM

Virtual machine failure

Virtual machine failure can occur at any point of time. Failure can be network failure, disk failure (root vg failure), or application failure hosted on that particular virtual machine. During VM failure, KSYS generates an event in events.log and an event for script execution will be logged in events.log. Event logged can be verified at /var/ksys/events.log on the orchestrator system managing the complete VM Recovery HA setup.

The following output shows the event when PreHGOffline script is triggered during VM failure.

```
-----EVENT START-----  
SCRIPT_SUCCESS_EVENT event has occurred. Details are as follows:  
Event:          SCRIPT_SUCCESS_EVENT  
Type:           Informational Event  
Time:           Mon Oct 29 11:05:44 CDT 2018  
Entity Affected:  CUSTOMSCRIPT : /opt/IBM/ksys/samples/hmc_novalink/pre_novalink  
KSYS_MOVE_PLANNED_PRE_OFFLINE_HOST_GROUP HGTest  
Resource Affected:  SCRIPT : /opt/IBM/ksys/samples/hmc_novalink/pre_novalink  
KSYS_MOVE_PLANNED_PRE_OFFLINE_HOST_GROUP HGTest,RESULT :0  
Description:      0000-216 Info - Script Success Event result 0  
-----EVENT END-----
```

PreHGOffline script gets triggered after the `vm_failure` event and it changes the mode from NovaLink to HMC.

```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpreoffline-10813908.log
Pre Script called for KSYS_MOVE_PLANNED_PRE_OFFLINE_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ragu-9119-MME-SN106CDC7 is 0
Host ragu-9119-MME-SN106CDC7 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ragu-9119-MME-SN106CDC7 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscomgmt -m ziti_9119-MME-106CD27 is 0
Host ziti_9119-MME-106CD27 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ziti_9119-MME-106CD27 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
```

Figure 12. Output of `pre_novalink` script for VM failure triggered by `PreHGOffline` script

Output of VM failure

```
(0) root @ ksys206: /cluster
# ksysmgr q system status monitor=yes
Restart in progress for Host_group HGTest
Stopping HA monitoring for VM ziti014
HA monitoring for VM ziti014 stopped
Shutdown on ziti_9119-MME-106CD27 Host has started for VM ziti014
Shutdown on ziti_9119-MME-106CD27 Host has completed for VM ziti014
Restart has started for VM ziti014
Starting HA monitoring for VM ziti014
HA monitoring for VM ziti014 started
Restart on Target host ragu-9119-MME-SN106CDC7 has completed for VM ziti014
Configuration cleanup started for VM ziti014
VM monitoring for VM ziti014 started
Configuration cleanup completed for VM ziti014
1 out of 1 VMs have been successfully restarted
```

PostHGOnline script gets triggered after the migration and changes the mode from HMC to NovaLink.


```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpostonline-8454620.log
Post Script called for KSYS_MOVE_PLANNED_POST_ONLINE_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ragu-9119-MME-SN106CDC7 is 0
Return code of HMC command:chcomgmt -m ragu-9119-MME-SN106CDC7 -o relmaster is 0
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ziti_9119-MME-106CD27 is 0
Return code of HMC command:chcomgmt -m ziti_9119-MME-106CD27 -o relmaster is 0
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
```

Figure 13. Output of post_novalink script for VM failure triggered by PreHGOnline script

The following output shows the event for postscript execution when VM failure is detected by the orchestrator system.

```
-----EVENT START-----
SCRIPT_SUCCESS_EVENT event has occurred. Details are as follows:
Event:          SCRIPT_SUCCESS_EVENT
Type:           Informational Event
Time:          Mon Oct 29 11:08:42 CDT 2018
Entity Affected:  CUSTOMSCRIPT : /opt/IBM/ksys/samples/hmc_novalink/post_novalink
KSYS_MOVE_PLANNED_POST_ONLINE_HOST_GROUP HGTest
Resource Affected:  SCRIPT : /opt/IBM/ksys/samples/hmc_novalink/post_novalink
KSYS_MOVE_PLANNED_POST_ONLINE_HOST_GROUP HGTest,RESULT :0
Description:     0000-216 Info - Script Success Event result 0

-----EVENT END-----
```

Host failure

Host failure is automatically detected by the VM Recovery manger HA orchestrator system. PreHGOffline script gets triggered during migration and it changes the mode from NovaLink to HMC.

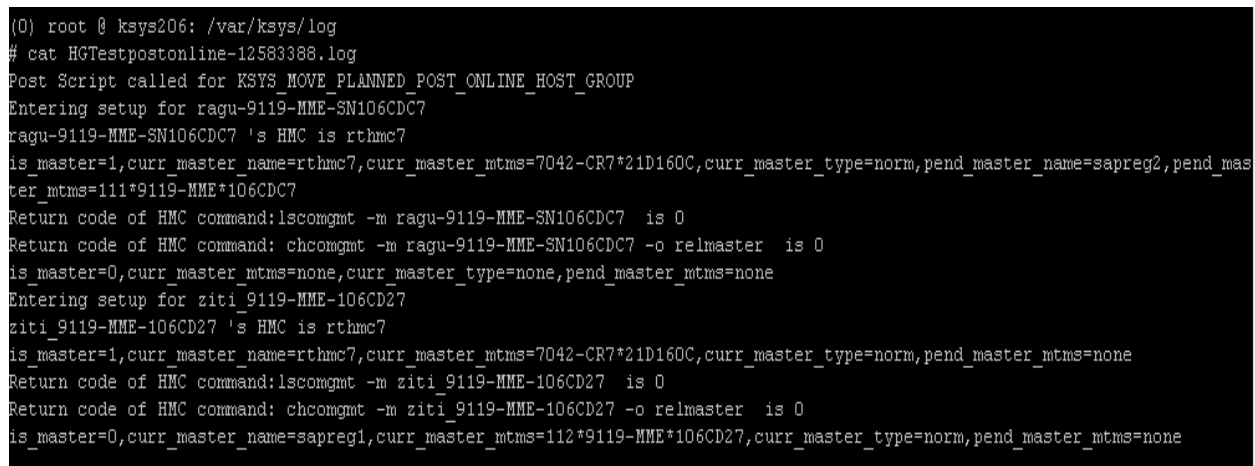
```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpreoffline-7012768.log
Pre Script called for KSYS_MOVE_PLANNED_PRE_OFFLINE_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=0,curr_master_name=sapreg2,curr_master_mtms=111*9119-MME*106CDC7,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ragu-9119-MME-SN106CDC7 is 0
Host ragu-9119-MME-SN106CDC7 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ragu-9119-MME-SN106CDC7 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_name=sapreg2,pend_mas
ter_mtms=111*9119-MME*106CDC7
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command:lscmgmt -m ziti_9119-MME-106CD27 is 0
Host ziti_9119-MME-106CD27 is managed by novalink , hence need to set it hmc managed
Return code of HMC command:chcomgmt -m ziti_9119-MME-106CD27 -o setmaster -t norm is 0
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
```

Figure 14. Output of pre_novalink script for host failure triggered by PreHGOffline script

Output of host failure

```
(0) root @ ksys206: /cluster
# ksysmgr q system status monitor=yes
Restart in progress for Host_group HGTest
Stopping HA monitoring for VM ziti014
HA monitoring for VM ziti014 stopped
Shutdown on ragu-9119-MME-SN106CDC7 Host has started for VM ziti014
Shutdown on ragu-9119-MME-SN106CDC7 Host has completed for VM ziti014
Restart has started for VM ziti014
Starting HA monitoring for VM ziti014
HA monitoring for VM ziti014 started
Restart on Target host ziti_9119-MME-106CD27 has completed for VM ziti014
Starting VM monitoring for VM ziti014
1 out of 1 VMs have been successfully restarted
```

PostHGOnline script gets triggered after migration and it changes the mode from HMC to Novalink.



```
(0) root @ ksys206: /var/ksys/log
# cat HGTestpostonline-12583388.log
Post Script called for KSYS_MOVE_PLANNED_POST_ONLINE_HOST_GROUP
Entering setup for ragu-9119-MME-SN106CDC7
ragu-9119-MME-SN106CDC7 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_name=sapreg2,pend_mas
ter_mtms=111*9119-MME*106CDC7
Return code of HMC command: lscomgmt -m ragu-9119-MME-SN106CDC7 is 0
Return code of HMC command: chcomgmt -m ragu-9119-MME-SN106CDC7 -o relmaster is 0
is_master=0,curr_master_mtms=none,curr_master_type=none,pend_master_mtms=none
Entering setup for ziti_9119-MME-106CD27
ziti_9119-MME-106CD27 's HMC is rthmc7
is_master=1,curr_master_name=rthmc7,curr_master_mtms=7042-CR7*21D160C,curr_master_type=norm,pend_master_mtms=none
Return code of HMC command: lscomgmt -m ziti_9119-MME-106CD27 is 0
Return code of HMC command: chcomgmt -m ziti_9119-MME-106CD27 -o relmaster is 0
is_master=0,curr_master_name=sapreg1,curr_master_mtms=112*9119-MME*106CD27,curr_master_type=norm,pend_master_mtms=none
```

Figure 15. Output of post_novalink script for host failure triggered by PostHGOnline script

Note: After the move operation is complete, activate the hosts manually in the HMC mode and then let auto cleanup complete. Then manually change back to the Novalink mode from the HMC mode. In case of a DR cluster during an unplanned move, activate the hosts in the HMC mode, perform a manual cleanup, and change the HMC mode back to the Novalink mode.

Conclusion

The content mentioned in this paper has been tested in lab and works as per user expectations. We have prescripts and postscripts which can be registered directly on ksysnode at site or host group which depends on the type of cluster. These scripts are easy to register and ksys invokes them internally during discovery, verify, and move operations. Any configuration or data center, which has virtual machine management with HMC and PowerVM Novalink Coexistence mode, can be supported using VM Recovery Manager custom validation tool.

Get more information

- [Knowledge center for PowerVM NovaLink](#)
- [Installing PowerVM NovaLink](#)
- [IBM VM Recovery Manager HA for Power System documentation](#)
- [Deployment Guide for IBM VM Recovery Manager DR \(GDR\) for Power Systems](#)

About the authors

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