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**Report of Successful Completion of Qualification Testing**

International Business Machines Corporation and Hitachi, Ltd. have successfully completed compatibility and interoperability testing of Hitachi Virtual Storage Platform™ (Hitachi VSP) series products at code level 70-03-34 in the following IBM System zEnterprise 196 and IBM System z10® environments:

IBM and Hitachi hereby confirm that testing for the support of FICON® and FCP connectivity of the following has been successfully completed:

<b>CPU</b>	<b>IBM zEnterprise® System 196 2817-M15 Driver 93 MCL</b>
	<b>IBM System z10 Enterprise Class (z10 EC™) at Driver 86 MCL</b>
<b>OS&amp;GDPS®</b>	<b>z/OS V1.13</b>
	<b>GDPS 3.9</b>
<b>Functions</b>	<b>GDPS/PPRC HyperSwap™ Manager</b> <ul style="list-style-type: none"> <li>• Freeze/run</li> <li>• Planned HyperSwap</li> <li>• Unplanned HyperSwap</li> <li>• HyperSwap Failover/Failback</li> </ul>
	<b>GDPS/PPRC</b> <ul style="list-style-type: none"> <li>• Freeze/run</li> <li>• Planned HyperSwap</li> <li>• Unplanned HyperSwap</li> <li>• HyperSwap Failover/Failback</li> <li>• FlashCopy® V2, FlashCopy Space Efficient and Remote Pair FlashCopy</li> </ul>
	<b>GDPS/XRC</b> <ul style="list-style-type: none"> <li>• FlashCopy Zero suspend for FlashCopy V2 and FlashCopy Space Efficient</li> <li>• SDM clustering</li> </ul>

<b>Combined Functions</b>	<b>GDPS/PPRC+HUR with “delta resync” controlled by BCM</b> <ul style="list-style-type: none"> <li>• <b>Regression tests</b></li> <li>• <b>Site 1, Site 2, and Site 3 maintenance</b></li> <li>• <b>Site 1, Site 2, and Site 3 failure</b></li> <li>• <b>Link failure</b></li> </ul>
<b>Storage Devices</b>	<b>Hitachi Virtual Storage Platform (Hitachi VSP)</b> <ul style="list-style-type: none"> <li>• <b>PPRC and XRC volumes were assigned to Hitachi Dynamic Provisioning pool</b></li> <li>• <b>FlashCopy V2 and FlashCopy Space Efficient volumes were assigned to Hitachi Dynamic Provisioning pool</b></li> </ul>

More detailed testing results are available from IBM or Hitachi on request.

**Limitations:**

The following considerations and limitations apply to the tested configurations:

- The following features are not supported at the testing time (GDPS/PPRC):
  - Open LUN management
  - Global Copy (aka PPRC XD) mode copy processing
  - Summary Event Notification for PPRC Suspends
  - Storage Control Health Message
- Floating Utility devices are not supported at the testing time (GDPS/XRC).
- The Query Storage Controller Status and combined PPRC+HUR tests have been performed at code level 70-04-01.

IBM does not make any representations or warranties of any kind regarding the Hitachi products and is not liable for such products or any claims made regarding such products. The fact that the listed Hitachi products passed the enumerated IBM tests does not imply that the products will operate properly in any particular customer environment.

Hitachi retains sole responsibility for its products, the performance of such products and all claims relating to such products, including without limitation its products’ compliance to product specifications, safety requirements, regulatory agencies requirements and industry standards.

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IBM Distinguished Engineer  
System z Platform  
Systems and Technology Group  
International Business Machines  
Corporation

## Attachment A -- Test Matrix

<b><u>GDPS/PPRC HyperSwap Manager</u></b>		
<b>Test Case Suite</b>	<b>Successfully Completed</b>	<b>Test Case Suite Description</b>
<ul style="list-style-type: none"> <li>• <b>Initial Tests</b></li> </ul>	✓	Basic remote copy operations using panels Basic Freeze tests (GO/STOP/COND)
<ul style="list-style-type: none"> <li>• <b>Planned Actions</b></li> </ul>	✓	Remote copy operations using HYPERSW command Simulate Site maintenance (Site 1) and (Site 2)
<ul style="list-style-type: none"> <li>• <b>Unplanned Actions</b></li> </ul>	✓	GDPS reacts to a failure, depending on the FREEZE option (GO / STOP / COND / SWAP&GO / SWAP & STOP) Test failures were generated by PPRC links unplug, Chpid unplug, DASD control Unit power off and elongated I/O response times
<ul style="list-style-type: none"> <li>• <b>Disruptive Testing (aka Config Testing)</b></li> </ul>	✓	GDPS reacts to a failure, depending on the FREEZE policy. Failures were generated by Control Unit Emergency power off and control unit internal failures
<ul style="list-style-type: none"> <li>• <b>HyperSwap Stress test</b></li> </ul>	✓	Run a planned HyperSwap, with the application systems and the controlling system having CPU contention
<ul style="list-style-type: none"> <li>• <b>Miscellaneous</b></li> </ul>	✓	HyperSwap extension (checking of secondary PPRC status – failure, XRC session, Concurrent Copy, etc.)

## Attachment A -- Test Matrix

<b><u>GDPS/PPRC</u></b>		
<b>Test Case Suite</b>	<b>Successfully Completed</b>	<b>Test Case Suite Description</b>
<ul style="list-style-type: none"> <li>• <b>Initial Tests</b></li> </ul>	✓	Basic remote copy operations using panels Basic Freeze tests (GO/STOP/COND)
<ul style="list-style-type: none"> <li>• <b>Planned Actions</b></li> </ul>	✓	Remote copy operations using scripts (START/STOP SECONDARY, Flashcopy, HyperSwap (Resync & Suspend), etc.) Simulate Site maintenance (Site 1) and Site 2)
<ul style="list-style-type: none"> <li>• <b>Unplanned Actions</b></li> </ul>	✓	GDPS reacts to a failure, depending on the FREEZE option (GO / STOP / COND / SWAP&GO / SWAP & STOP) Failures were generated by PPRC links unplug, Chpid unplug, DASD control Unit power off and elongated I/O response times
<ul style="list-style-type: none"> <li>• <b>Disruptive Testing (aka Config Testing)</b></li> </ul>	✓	GDPS reacts to a failure, depending on the FREEZE policy. Failures were generated by Control Unit Emergency power off and control unit internal failures
<ul style="list-style-type: none"> <li>• <b>HyperSwap Stress test</b></li> </ul>	✓	Run a planned HyperSwap, with the application systems and the controlling system having CPU contention
<ul style="list-style-type: none"> <li>• <b>Miscellaneous</b></li> </ul>	✓	HyperSwap extension (checking of secondary PPRC status – failure, XRC session, Concurrent Copy, etc.)
<ul style="list-style-type: none"> <li>• <b>FlashCopy</b></li> </ul>	✓	Prior FlashCopy limitations (Space Efficient, Remote Pair) are removed. Note that the traditional FlashCopy testcases are executed as part of Planned Actions and Unplanned Actions.

<b><u>GDPS/XRC</u></b>		
<b>Test Case Suite</b>	<b>Successfully Completed</b>	<b>Test Case Suite Description</b>
<ul style="list-style-type: none"> <li>• <b>Initial Tests</b></li> </ul>	✓	Basic remote copy operations using panels. Tests using single SDM and coupled SDMs
<ul style="list-style-type: none"> <li>• <b>Planned Actions</b></li> </ul>	✓	Remote copy operations using scripts (START/STOP, SUSPEND session, etc.) Simulate Site maintenance (Site 1) and Site 2) Simulate Site 1 failure and restart Production in recovery site.
<ul style="list-style-type: none"> <li>• <b>FlashCopy</b></li> </ul>	✓	Prior FlashCopy limitation (Space Efficient) is removed. Note that the traditional FlashCopy testcases are executed as part of Planned Actions.

## Attachment A -- Test Matrix

<b><u>GDPS/PPRC with HUR controlled by BCM</u></b>		
<b>Test Case Suite</b>	<b>Successfully Completed</b>	<b>Test Case Suite Description</b>
<ul style="list-style-type: none"> <li>• <b>Regression test</b></li> </ul>	✓	Basic GDPS/PPRC testing to verify there are no unexpected impacts due to HUR.
<ul style="list-style-type: none"> <li>• <b>Site 1 maintenance</b></li> </ul>	✓	Simulation of disruptive disk maintenance in Site 1 by stopping the application systems followed by performing the HyperSwap Suspend to the Site 2 disks (note: the application systems must be stopped for the delta resync to correctly work) and delta resync the HUR from Site 2 to Site 3 disks. Additionally, the application systems must be stopped to restore the original configuration.
<ul style="list-style-type: none"> <li>• <b>Site 2 maintenance</b></li> </ul>	✓	Simulation of disruptive disk maintenance in Site 2 by suspending the PPRC replica from Site 1 to Site 2 disks. There was no impact on the application systems running on Site 1 disks and on the HUR replica from Site 1 to Site 3 disks.
<ul style="list-style-type: none"> <li>• <b>Site 3 maintenance</b></li> </ul>	✓	Simulation of disruptive disk maintenance in Site 3 by suspending the HUR replica from Site 1 to Site 3 disks (Suspend Flush). There was no impact on the application systems running on Site 1 disks and on the PPRC replica from Site 1 to Site 2 disks.
<ul style="list-style-type: none"> <li>• <b>Site 1 failure</b></li> </ul>	✓	An unplanned HyperSwap moves the PPRC primary's from Site 1 to Site 2 disk, application systems continue running; delta resync the HUR from Site 2 to Site 3 disks. Additionally, the application systems must be stopped to restore the original configuration.
<ul style="list-style-type: none"> <li>• <b>Site 2 failure</b></li> </ul>	✓	The PPRC replica from Site 1 to Site 2 disks is suspended. There was no impact on the application systems running on Site 1 disks and on the HUR replica from Site 1 to Site 3 disks.
<ul style="list-style-type: none"> <li>• <b>Site 3 failure</b></li> </ul>	✓	The HUR continues writing to the Site 1 journal until it fills up, then eventually goes in track mode. There was no impact on the application systems running on Site 1 disks and on the PPRC replica from Site 1 to Site 2 disks.
<ul style="list-style-type: none"> <li>• <b>Links failure</b></li> </ul>	✓	Site 1 to Site 2, Site 1 to Site 3, and Site 2 to Site 3 link failure testing. There was no impact on the application systems running on Site 1 disks, PPRC or HUR replica. Eventually the links suspend and the data is incrementally resynchronized when the links operational.