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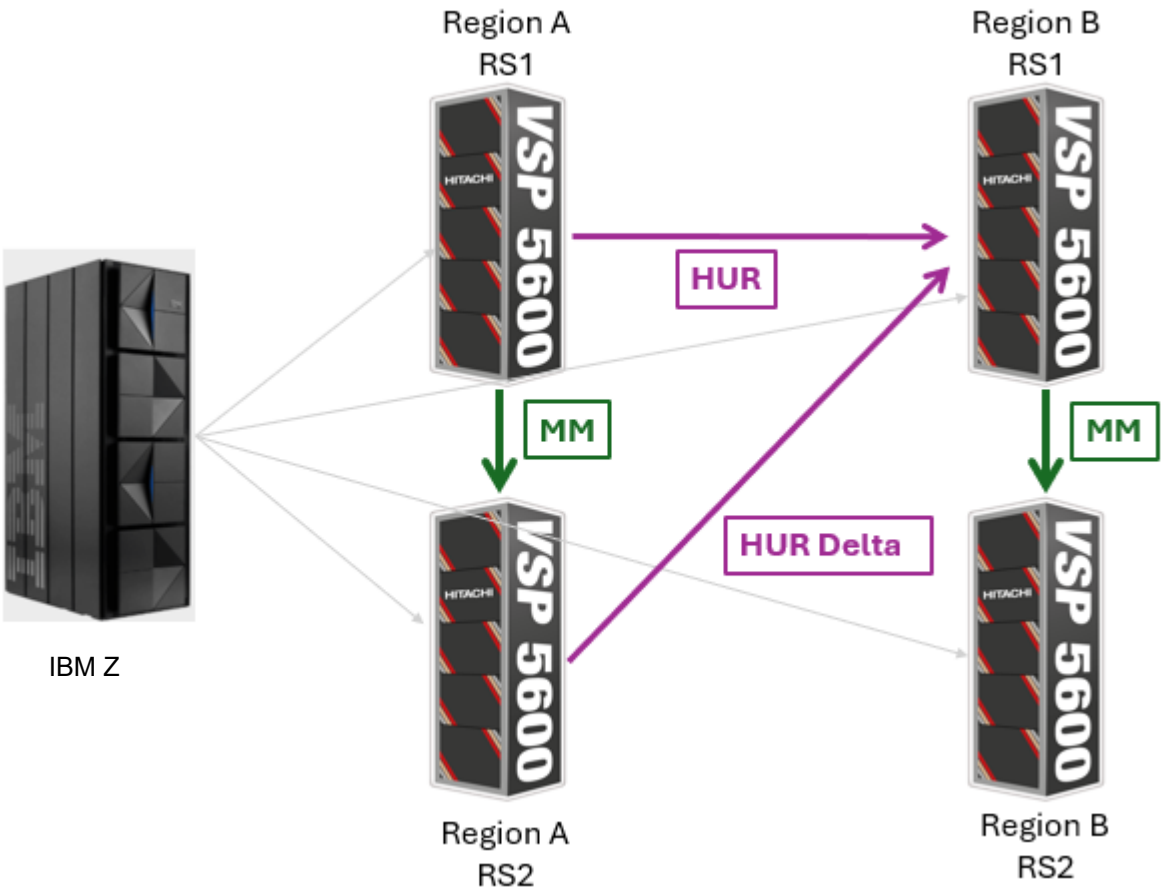
Report of Successful Completion of Qualification Testing

International Business Machines Corporation and Hitachi Vantara, Ltd. have successfully completed compatibility and interoperability testing Hitachi Virtual Storage Platform 5600™ at code level 90-09-26-00/70.

The 4 Data Center configuration where GDPS® Metro manages Metro Mirror across RS1 & RS2 in Region A, BCM manages HUR across Region A & Region B, and GDPS Metro manages Metro Mirror across RS1 & RS2 in Region B was tested.



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

CPU	IBM z15® Driver level:41 Bundle level: S84a
	IBM z16® Driver level:51 Bundle level: S32
OS&GDPS®	z/OS® V3.1
	GDPS Metro V4.R7.M0
Functions	GDPS Metro (single leg) • Freeze/run • Planned HyperSwap® • Unplanned HyperSwap • HyperSwap Failover/Failback • Soft Fence
Combined Functions	4 Data Center configuration with GDPS Metro (single leg), HUR with "delta resync" controlled by BCM, & GDPS Metro (single leg) • Regression test • RS1 & RS2 in Region A and RS1 & RS2 in Region B maintenance • RS1 & RS2 in Region A and RS1 & RS2 in Region B failure • Link failure (MM & HUR) Note that the region switch was performed manually.
Storage Devices	Hitachi VSP 5600 • MM volumes were assigned to Hitachi Dynamic Provisioning pool

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

No GDPS Metro FlashCopy® functions were tested, Additionally, no GDPS Metro priced features were tested (including z/OS Proxy, LCP Manager, KVM Proxy, Dual Leg Feature, and SSC Proxy).

Limitations:
The following considerations and limitations apply to the tested configurations:

- The following features are not supported at the testing time (GDPS Metro):
  - Global Copy (aka PPRC XD) mode copy processing.
  - GDPS Health Check GDPS_CHECK_SPOF indicates a false failure for the MM links host adapters as being a single point of failure.
  - Open LUN management
  - Taking non-disruptive state saves of disk subsystem
  - LCP phase 0 and phase 1 not supported
  - Easy Tier® / Heat Map Transfer not supported

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David B Petersen
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Attachment A -- Test Matrix

4 Data Center configuration:
GDPS Metro Single Leg (SL) in Region A, HUR controlled by BCM, and GDPS Metro Single Leg (SL) in Region B (note: GDPS doesn't offer procedures to automate region switch for HUR, though standard GDPS keywords and manual action was used to accommodate it).

Test Case Suite	Successfully Completed	Test Case Suite Description
• **Regression test**	✔	Basic GDPS Metro testing to verify there are no unexpected impacts due to HUR.
• **RS1 in Region A maintenance (GDPS Metro executing in Region A)**	✔	Simulation of a scheduled disruptive maintenance of RS1 by issuing a HyperSwap to RS2 in Region A without stopping application systems and initiating delta-resync to maintain small D/R RPO. After this procedure, RS2 and RS1's roles are reversed, and the same procedure can be used again to restore service back to the original RS1 after the maintenance completes.
• **RS2 in Region A maintenance (GDPS Metro executing in Region A)**	✔	Simulation of scheduled disruptive disk maintenance in RS2 by suspending the MM replica from RS1 to RS2 disks in Region A. There was no impact on the application systems running on RS1 disks in Region A and on the HUR replica from RS1 in Region A to RS1 disks in region B.
• **RS1 in Region A failure (GDPS Metro executing in Region A)**	✔	An unplanned HyperSwap moves the MM primary's from RS1 to RS2 in Region A, application systems continue running; delta resync the HUR from RS2 in region A to RS1 in Region B disks. The RS1 Maintenance procedure can be used in reverse to restore service to RS1 in Region A without stopping application systems.
• **RS2 in Region A failure (GDPS Metro executing in Region A)**	✔	The MM replica from RS1 to RS2 in Region A disks is suspended. There was no impact on the application systems running on RS1 disks in Region A and on the HUR replica from RS1 in Region A to RS1 in Region B disks.
• **RS1 in Region B maintenance (HUR from Region A to Region B)**	✔	Simulation of scheduled disruptive disk maintenance in RS1 in Region B by suspending the HUR replica from RS1 in Region A to RS1 in Region B disks (Suspend Flush). There was no impact on the application systems running on RS1 disks and on the MM replica from RS1 to RS2 disks in Region A.
• **RS1 in Region B maintenance (GDPS Metro executing in Region B)**	✔	Simulation of a scheduled disruptive maintenance of RS1 by issuing a HyperSwap to RS2 in Region B without stopping application systems and initiating delta-resync to maintain small D/R RPO. After this procedure, RS2 and RS1's roles are reversed, and the same procedure can be used again to restore service back to the original RS1 after the maintenance completes.
• **RS2 in Region B maintenance (GDPS Metro executing in**	✔	Simulation of scheduled disruptive disk maintenance in RS2 by suspending the MM replica from RS1 to RS2 disks in Region B.

Attachment A -- Test Matrix

Test Case Suite	Successfully Completed	Test Case Suite Description
Region B)		There was no impact on the application systems running on RS1 disks in Region B and on the HUR replica from RS1 in Region A to RS1 disks in region A.
• **RS1 in Region B failure (GDPS Metro executing in Region B)**	✔	An unplanned HyperSwap moves the MM primary's from RS1 to RS2 in Region B, application systems continue running; delta resync the HUR from RS2 in region B to RS1 in Region A disks. The RS1 Maintenance procedure can be used in reverse to restore service to RS1 in Region B without stopping application systems.
• **RS2 in Region B failure (GDPS Metro executing in Region B)**	✔	The MM replica from RS1 to RS2 in Region B disks is suspended. There was no impact on the application systems running on RS1 disks in Region B and on the HUR replica from RS1 in Region B to RS1 in Region A disks.
• **RS1 in Region A failure (HUR from Region B to Region A)**	✔	The HUR continues writing to the RS1 in Region B journal until it fills up, then eventually goes in track mode. There was no impact on the application systems running on RS1 disks in Region B disks and on the MM replica from RS1 to RS2 in Region B disks.
• **Links failure**	✔	RS1 to RS2 in Region A, RS1 in Region A to RS1 in Region B, and RS1 to RS2 in Region B link failure testing. There was no impact on the application systems running on RS1 disks in Region A or Region B MM or HUR replica. Eventually the links suspend, and the data is incrementally resynchronized when the links operational.