Washington Systems Center - Storage

Accelerate with IBM Storage: GDPS Technical Update

Brian Sherman, Distinguished Engineer, David Petersen, DE GDPS Architect, Paul Spagnolo, Dennis Robertson

Washington Systems Center Storage – Enterprise Disk

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October 3rd, 2017 Accelerate with IBM Storage - GDPS® Update

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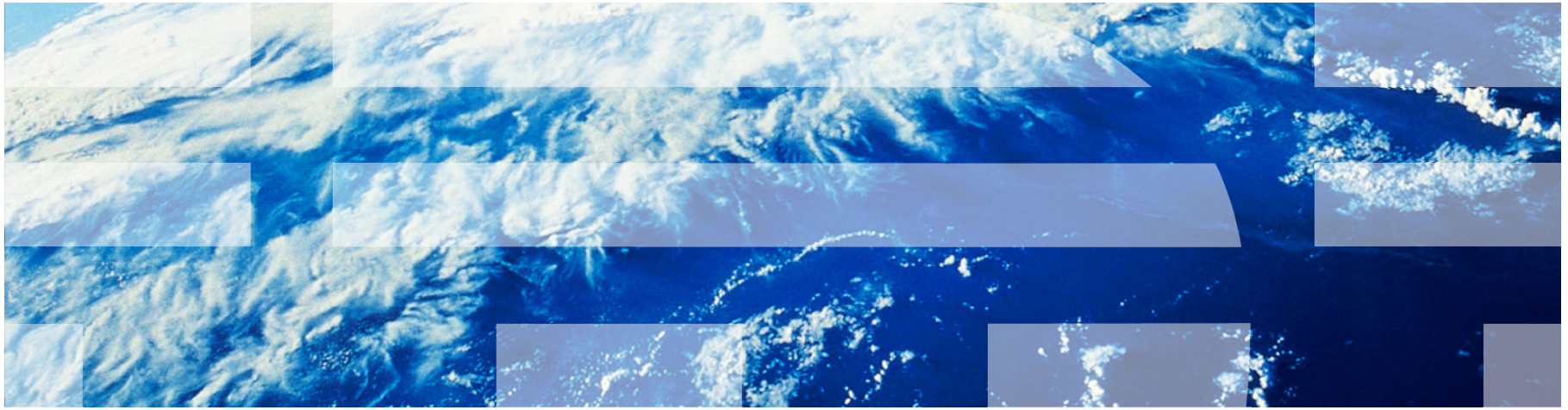

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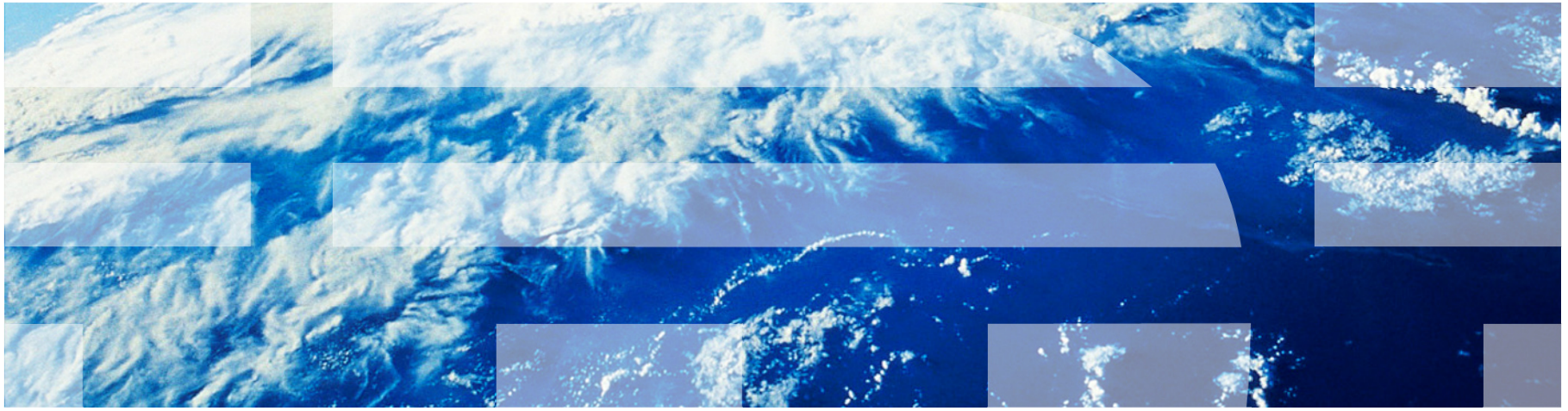
Agenda

- Concepts
- Level-set
- Overview
- GDPS 3.14
- Summary

Concepts



Aspects of Availability

High Availability
Fault-tolerant, failure-resistant infrastructure supporting continuous application processing

Continuous Operations
Non-disruptive backups and system maintenance coupled with continuous availability of applications

Disaster Recovery
Protection against unplanned outages such as disasters through reliable, predictable recovery

Protection of critical business data

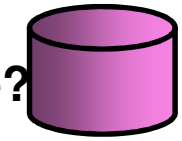
Recovery is predictable and reliable

Operations continue after a disaster

Costs are predictable and manageable

Customer Business Objectives

- **Determine business continuity objectives:**
  - **Recovery Time Objective (RTO) – How long can you afford to be without your systems?**
  - **Recovery Point Objective (RPO) – How much data can you afford to lose / recreate?**
  - **Network Recovery Objective (NRO) – How long to switch over the network?**
- **Select technology(s) to meet business objectives**



SYNCHRONOUS Remote Copy

Continuous data availability.
Use when:

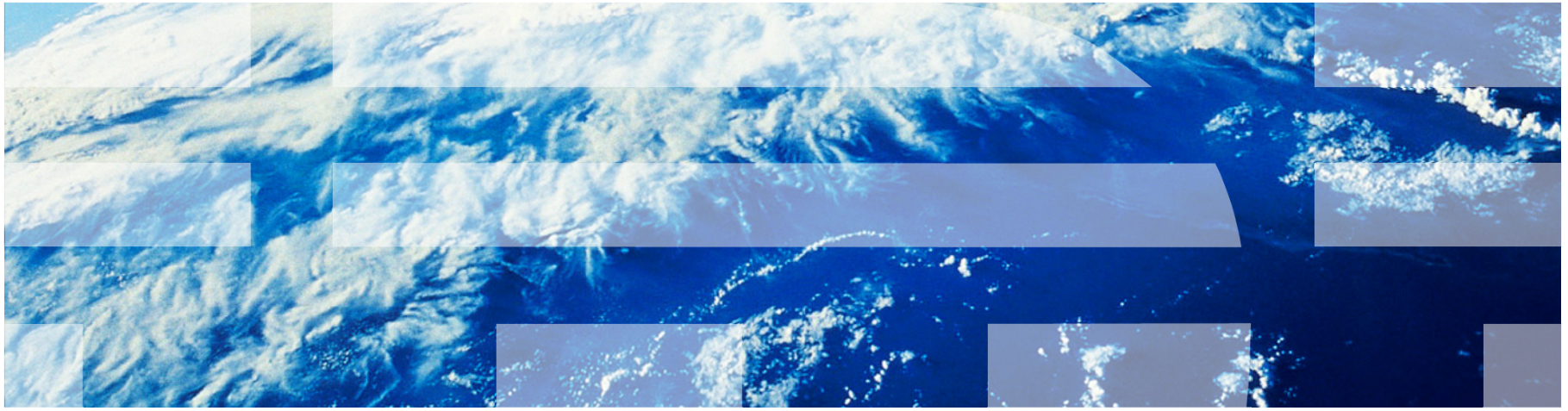
- ***Response time impact*** **is acceptable**
- **Within** ***metro distance***
- ***No data loss*** **is the objective**
- ***Fastest recovery time*** **is required**

ASYNCHRONOUS Remote Copy

Extended distance disaster recovery. Use when:

- ***Smallest response time impact*** **to applications is required**
- ***Extended distance*** **disaster recovery is the objective**
- ***Minimal data loss*** **is acceptable**

Level-set



IBM GDPS is installed in some of the largest enterprises in the world.

75% of the top **40** banks around-the-world use GDPS[1]

+95% of the new GDPS deployments are with DS8K

Over **19** years of experience

More than **870** licenses in **49** countries and dozens of references

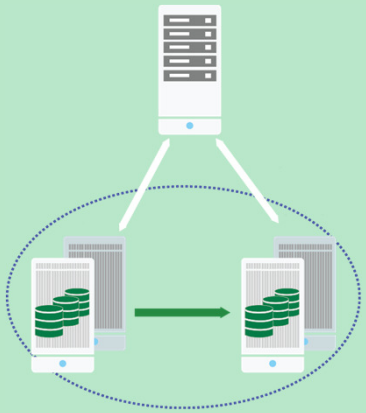
[1]Based on offering engagement data and the The Top 50 Banks in the World listing by relbanks.com, February 2016

There are many IBM GDPS service products to help meet various business requirements.

GDPS/PPRC HM[1]

Near-continuous availability of data within a data center

Single data center
Applications can remain active
Near-continuous access to data in the event of a storage subsystem outage

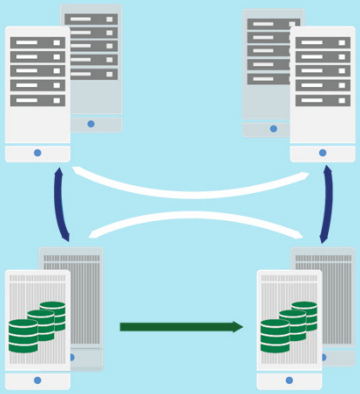


RPO equals 0 and RTO equals 0

GDPS/PPRC

Near-continuous availability (CA) and disaster recovery (DR) within a metropolitan region

Two data centers
Systems can remain active
Multisite workloads can withstand site and storage failures

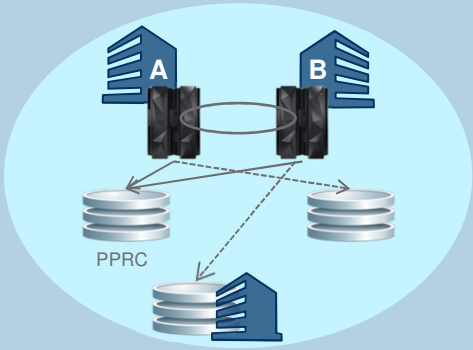


DR RPO equals 0 and RTO is less than 1 hour or
CA RPO equals 0 and RTO minutes

GDPS/MTMM[2]

Near-continuous availability (CA) and disaster recovery (DR) within a metropolitan region

Two/three data centers (2 server sites, 3 disk locations)
Systems can remain active
Multi-site workloads can withstand site and/or storage failures



DR RPO equals 0 and RTO is less than 1 hour or CA RPO equals 0 and RTO minutes

RPO – recovery point objective
RTO – recovery time objective

Synch replication
Asynch replication

[1]Peer-to-peer remote copy (PPRC) [2]Multi-Target Metro Mirror

There are many IBM GDPS service products to help meet various business requirements. (continued)

GDPS/GM[1] and GDPS/XRC[2]

Disaster recovery at extended distance

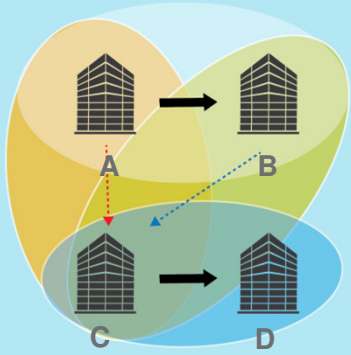
Two data centers
More rapid systems disaster recovery with "seconds" of data loss
Disaster recovery for out-of-region interruptions

RPO seconds and RTO less than 1 hour

GDPS®/MGM[3] and GDPS/MzGM[4] (3 or 4-site configuration)

Near-continuous availability (CA) regionally and disaster recovery at extended distances

Three or four data centers
High availability for site disasters
Disaster recovery (DR) for regional disasters



DR RPO equals 0 and RTO less than 1 hour or CA RPO equals 0 and RTO minutes
and RPO seconds and RTO less than 1 hour

RPO – recovery point objective
RTO – recovery time objective

Synch replication
Asynch replication

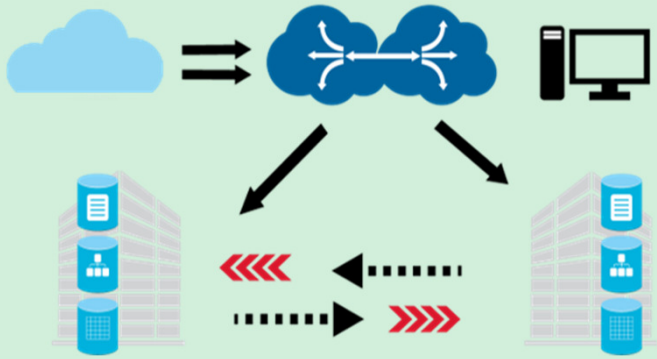
[2]Global Mirror (GM) [2]Extended Remote Copy (XRC) [3]Metro Global Mirror (MGM) [4]Metro z/OS Global Mirror (MzGM)

There are many IBM GDPS service products to help meet various business requirements. (continued)

GDPS/Active-Active

Near-continuous availability, disaster recovery and cross-site workload balancing at extended distances

Two data centers
Disaster recovery for out-of -region interruptions
All sites active

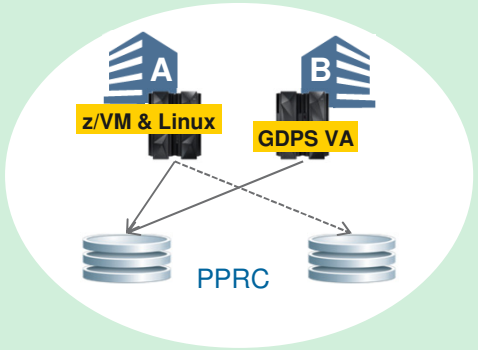


RPO seconds and RTO seconds

GDPS Virtual Appliance (VA)

Near-continuous availability and disaster recovery within metropolitan regions

Two data centers
z/VM and Linux on IBM z Systems can remain active
Near-continuous access to data in the event of a storage subsystem outage



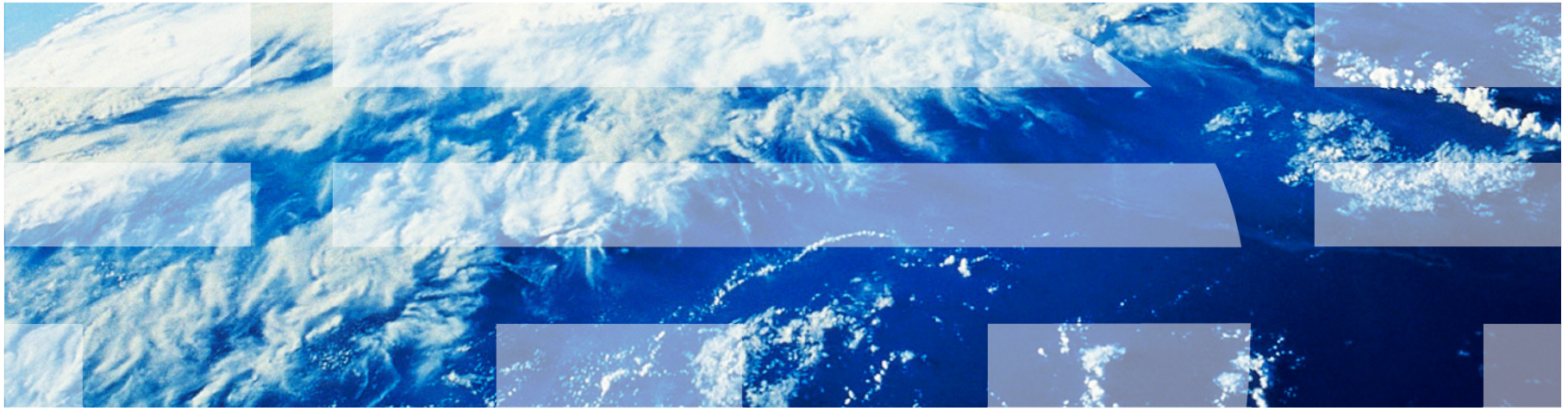
RPO equals 0 and
RTO is less than 1 hour

RPO – recovery point objective
RTO – recovery time objective

Synch replication
Asynch replication

[1]Multi-Target Metro Mirror

Overview



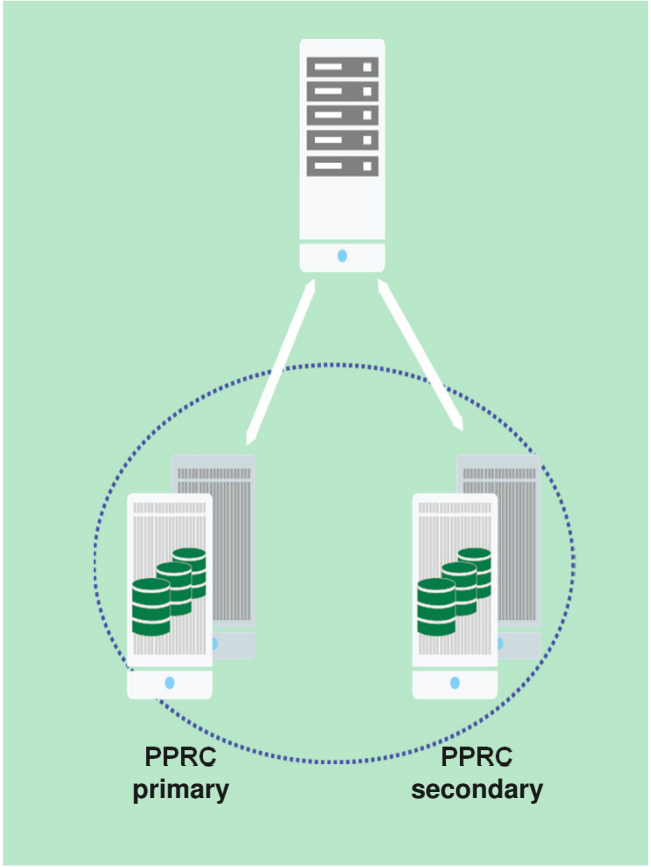
IBM GDPS/PPRC (Metro Mirror) HyperSwap Manager can provide virtually uninterrupted access to data to support near-continuous availability.

Solution features and capabilities:

- Manages remote copy environment using IBM HyperSwap® function
- Spans single or multiple subsystems and attached IBM System z®, providing high scalability
- Extends IBM Parallel Sysplex® continuous availability (CA) function to your data
- Can be easily upgradable to full GDPS/PPRC

Intended benefits:

- Provides near-continuous availability of data within a single site or across two sites
- Helps simplify and streamline data replication management
- Automates switching between two copies of data without causing an application outage
- Supports multivendor storage products, including IBM, EMC and Hitachi Data Systems
- Manages data replication for distributed servers through the open logical unit number (LUN) feature **on the IBM DS8000®**



PPRC: Peer-to-peer remote copy

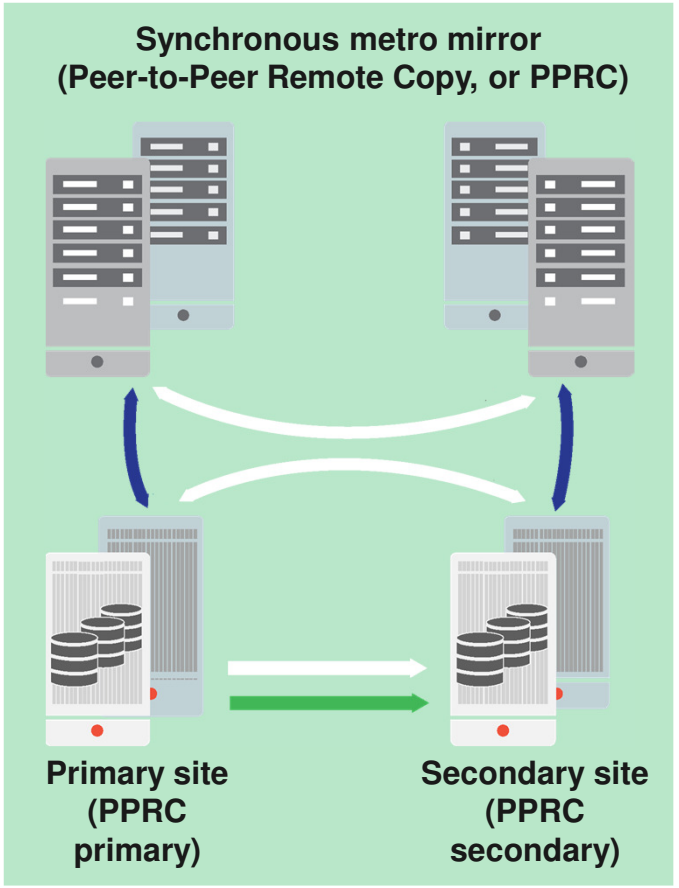
IBM GDPS/PPRC (Metro Mirror) is available for two sites: metropolitan distance continuous availability and disaster recovery solution.

Solution features and capabilities can include:

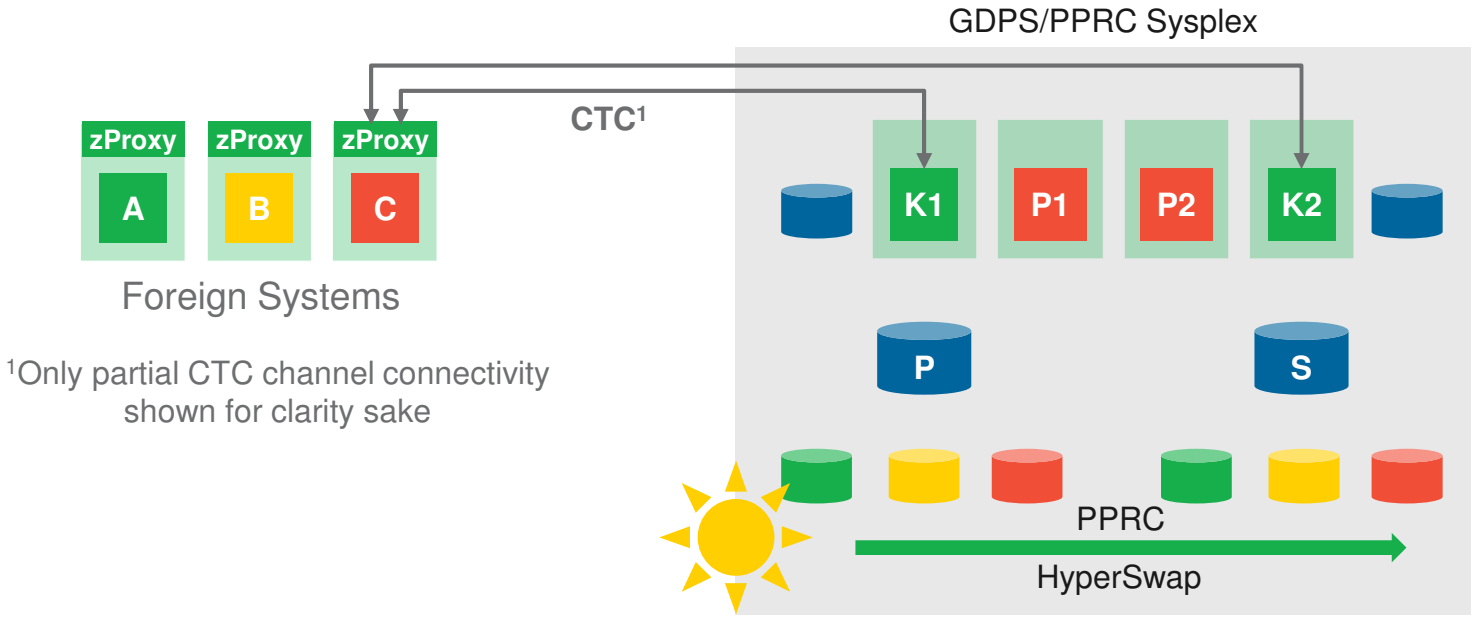
- Provides a near-continuous availability and disaster recovery (DR) solution operating within one site or across two sites separated by up to 200 kilometers (km), with near-continuous access to data
- Provides IBM FlashCopy® management for data protection and to facilitate DR testing
- Enhances data consistency across all secondary volumes for both IBM System z and distributed systems
- Supports multivendor storage products, including IBM, EMC and Hitachi Data Systems

Intended benefits:

- Facilitates faster recovery time for planned and unplanned outages
- Leverages Distributed Cluster Management (DCM) to interface with distributed environments to provide an enterprise-level disaster recovery solution
- Automates capacity backup upgrade (CBU) activation and “On/Off Capacity Upgrade on Demand” (OOCoD) activation



Extend continuous availability to “foreign” systems outside the sysplex with IBM z/OS Proxy.



- You can run z/OS® Proxy on each z/OS® Proxy-managed’ system where each foreign system is either a stand-alone system or member of a sysplex (in which case, all members must run the z/Os Proxy)
- Think of z/OS Proxy as a lightweight GDPS agent that runs as a started task
- z/OS Proxy communicates and coordinates with GDPS K-sys (which each foreign system attaches itself to via IBM FICON®)
- GDPS manages entire peer-to-peer remote copy (PPRC) configuration as a ‘single’ configuration
  - Systems in the GDPS sysplex define all disks and foreign systems define only own disks
  - Planned and Unplanned HyperSwap performed for entire configuration
  - Secondary data consistency preserved across all secondary disks (freeze)

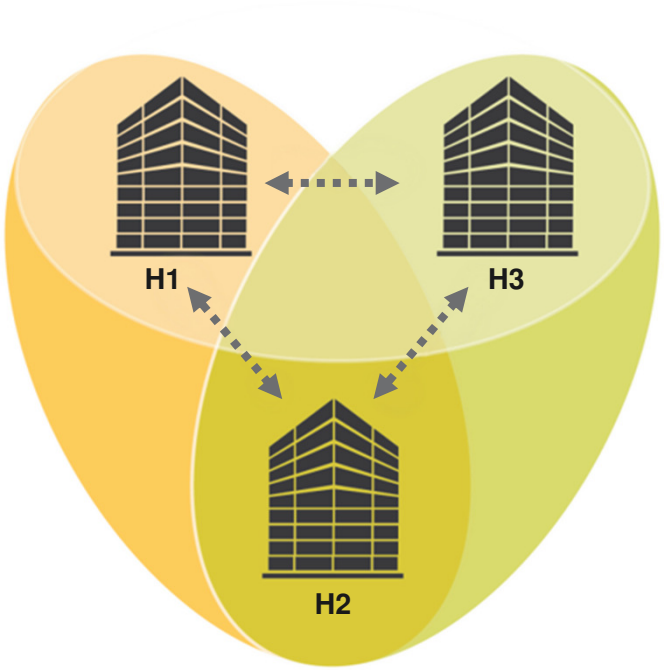
GDPS/MTMM[1] extends the benefits of GDPS/PPRC to three copies of data configurations.

Solution features and capabilities:

- Provides near-continuous availability in a two- or three-site IBM Z within Metro Mirror distances, providing up to three copies of data synchronously replicated.
- DR across metropolitan distances
- Provides IBM HyperSwap capabilities managed by between the three copies of data H1,H2 and H3
- Monitors and manages all sites from a single point of control

Intended benefits:

- Combines all the capabilities of high availability with three independent but consistent copies of data
- Supports greater scalability to help meet changing business needs
- Expand functionalities to z/VM and Linux for z Systems guests
- RTO less than an hour
- RPO of zero

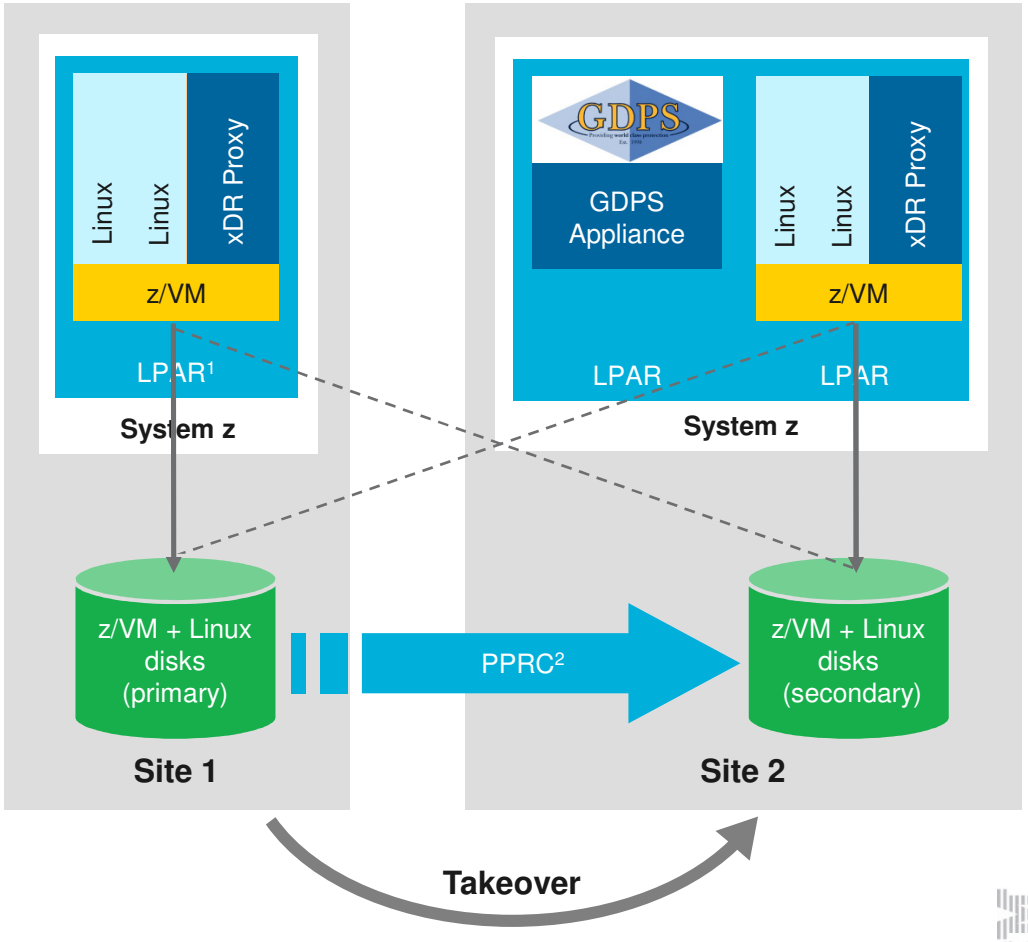


[1]Multi Target Metro Mirror (MTMM)

GDPS Virtual Appliance extends GDPS capabilities into z/VM and Linux on System z environments that do not have z/OS.

GDPS Virtual Appliance features:

- Single point of control and automation reduces the need for highly specialized skills to handle recovery and planned site switches
- Manages remote copy environment and keeps data available and consistent for operating systems and applications
- HyperSwap function protects against failures to disk subsystems
- Monitoring and automation supports more reliable and rapid recovery via automated processes
- GDPS Virtual Appliance requires:
  - A general purpose engine
  - z/VM and Linux on System z
  - ECKD Disk



[1]Logical partitioning (LPAR), [2]Peer-to-peer remote copy (PPRC)

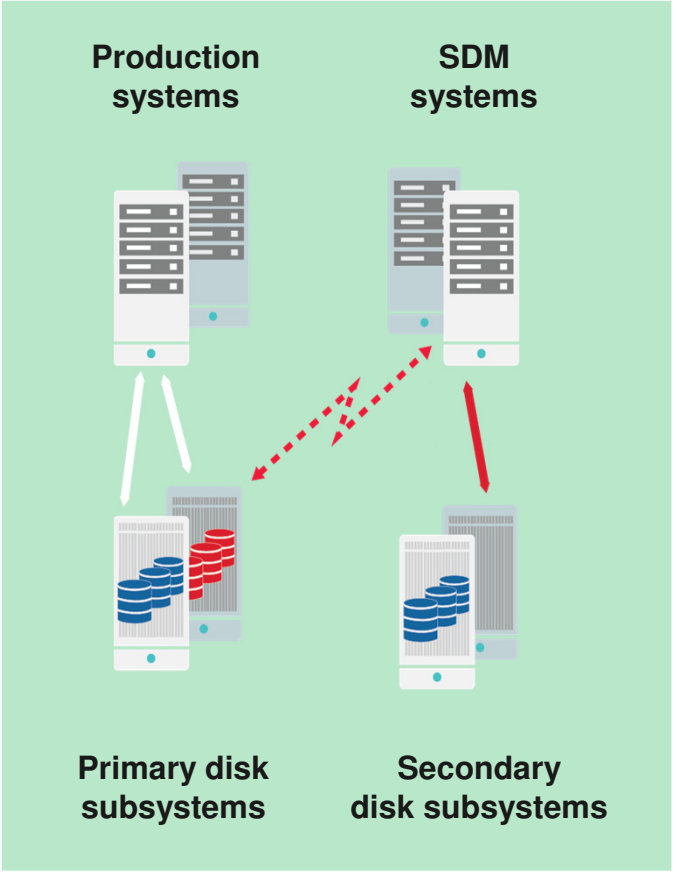
IBM GDPS/XRC (IBM z/OS Global Mirror) provides two-site, virtually unlimited distance disaster recovery using automated site takeover with reduced data loss.

Solution features and capabilities:

- Provides DR solution across two sites at virtually unlimited distances
- Offers asynchronous disk mirroring for IBM z/OS and Linux on IBM System z
- Automates and managed system data mover (SDM) environment at remote site
- Provides IBM FlashCopy management for data protection and to facilitate DR testing without reducing impact to DR position
- Manages multiple consistency groups (multiple coupled SDMs)
- Provides GDPS Distributed Cluster Management (DCM) interface to coordinate distributed systems and provide an enterprise-level disaster recovery solution

Intended benefits:

- Data loss measured in seconds
- Highly scalable
- Automates capacity backup upgrade (CBU) activation and "On/Off Capacity Upgrade on Demand" (OOCoD) activation



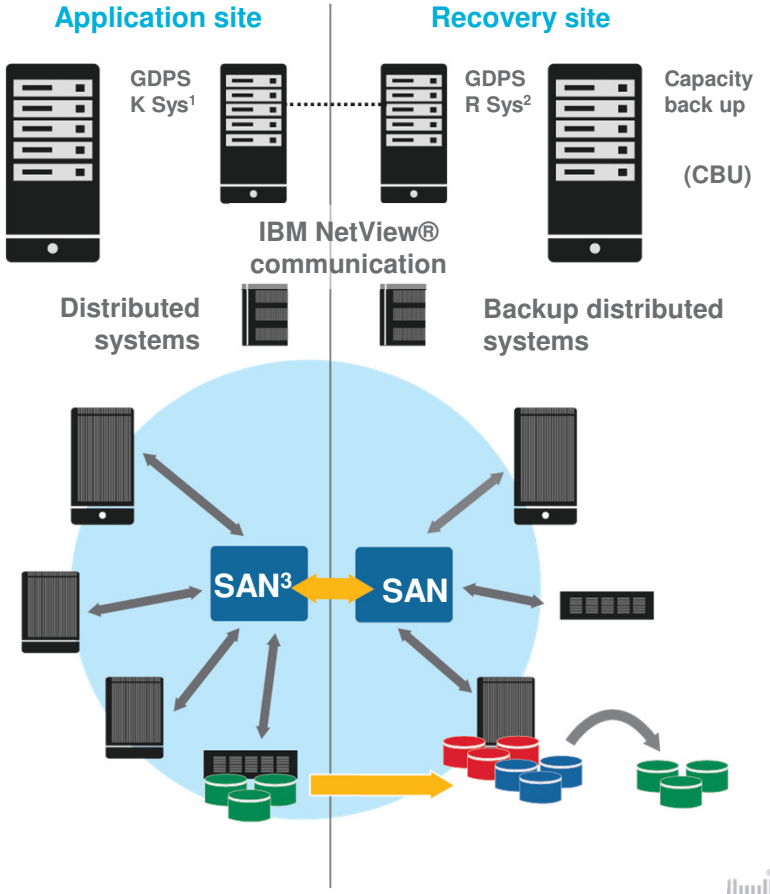
GDPS/Global Mirror for two sites: near-unlimited distance disaster recovery.

Solution features and capabilities:

- Automates management of the IBM Global Mirror Technology for both IBM z/OS and distributed systems
- Manages multiple consistency groups
- Monitors the environment and reports on events that could prevent rapid recovery
- Supports RTO of less than two hours and a RPO as low as three seconds*
- Uses IBM FlashCopy management for data protection and to facilitate data recovery testing without impacting DR position
- Automates capacity backup upgrade (CBU) activation and "On/Off Capacity Upgrade on Demand" (OOCoD) activation

Intended benefits:

- Automates management of the disaster recovery environment to help:
  - Reduce skills and time required to recover
  - Reduce resources required to maintain the environment
- Enables greater scalable: multiple consistency groups



*RPO (data loss) is workload and bandwidth-dependent. [1]Control System (K Sys), [2] Recovery System (R Sys), [3]Storage area network (SAN)

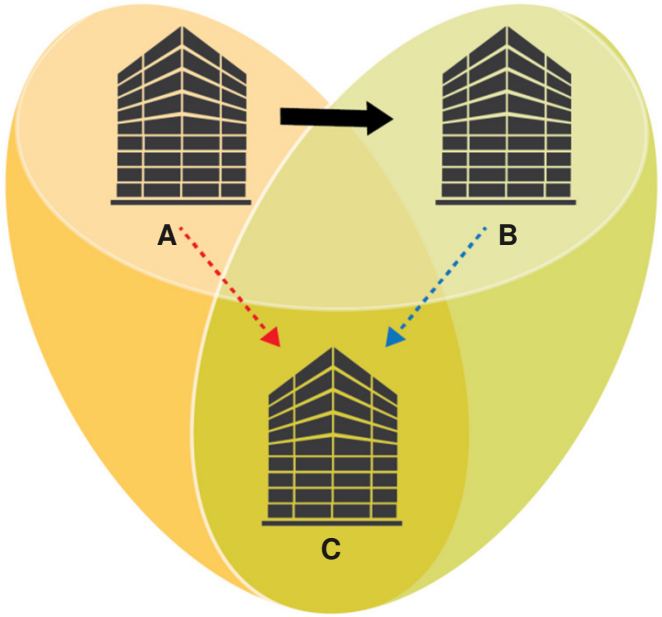
GDPS/MGM[1] and GDPS/MzGM[2] can combine metropolitan continuous availability and out-of-region disaster recovery solutions.

Solution features and capabilities:

- Provides near-continuous availability (CA) in a two- or three-site IBM System z environment and a long-distance DR solution for System z and distributed systems environments, with virtually no data loss
- Provides IBM HyperSwap capabilities managed by GDPS/Peer to Peer Remote Copy (PPRC) between sites A and B
- Monitors and manages all sites from a single point of control

Intended benefits:

- Combines all the capabilities of high availability with out-of-region disaster recovery
- Supports greater scalability to help meet changing business needs
- Measures data loss (RPO) in seconds
- Offers recovery time objective (RTO) at remote site of less than two hours



[1]Metro Global Mirror (MGM) [2] Metro z/OS Global Mirror (MzGM)

IBM GDPS four-site configurations add continuous availability to the recovery region.

GDPS / MzGM 4-site

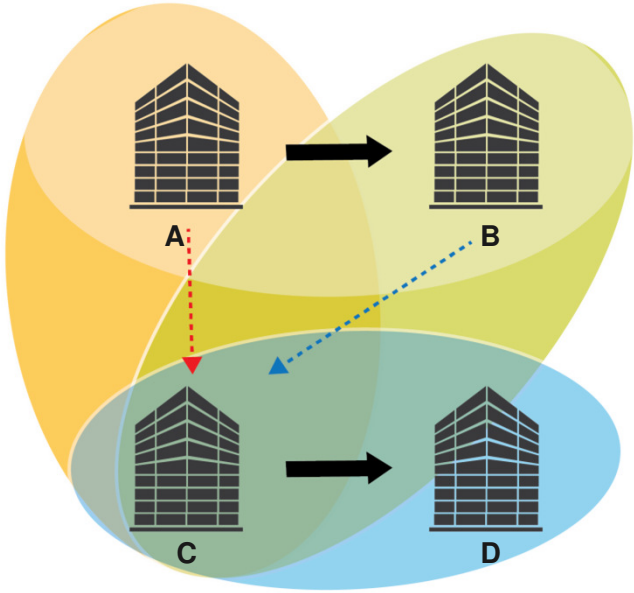
GDPS / MGM 4-site

Solution features and capabilities can include:

- Provides near-continuous availability (CA) in both the primary and recovery regions
- Provides automation to restore operations at the recovery site for IBM System z server environment
- Provides IBM HyperSwap capabilities managed by GDPS
- Managed from a single point of control

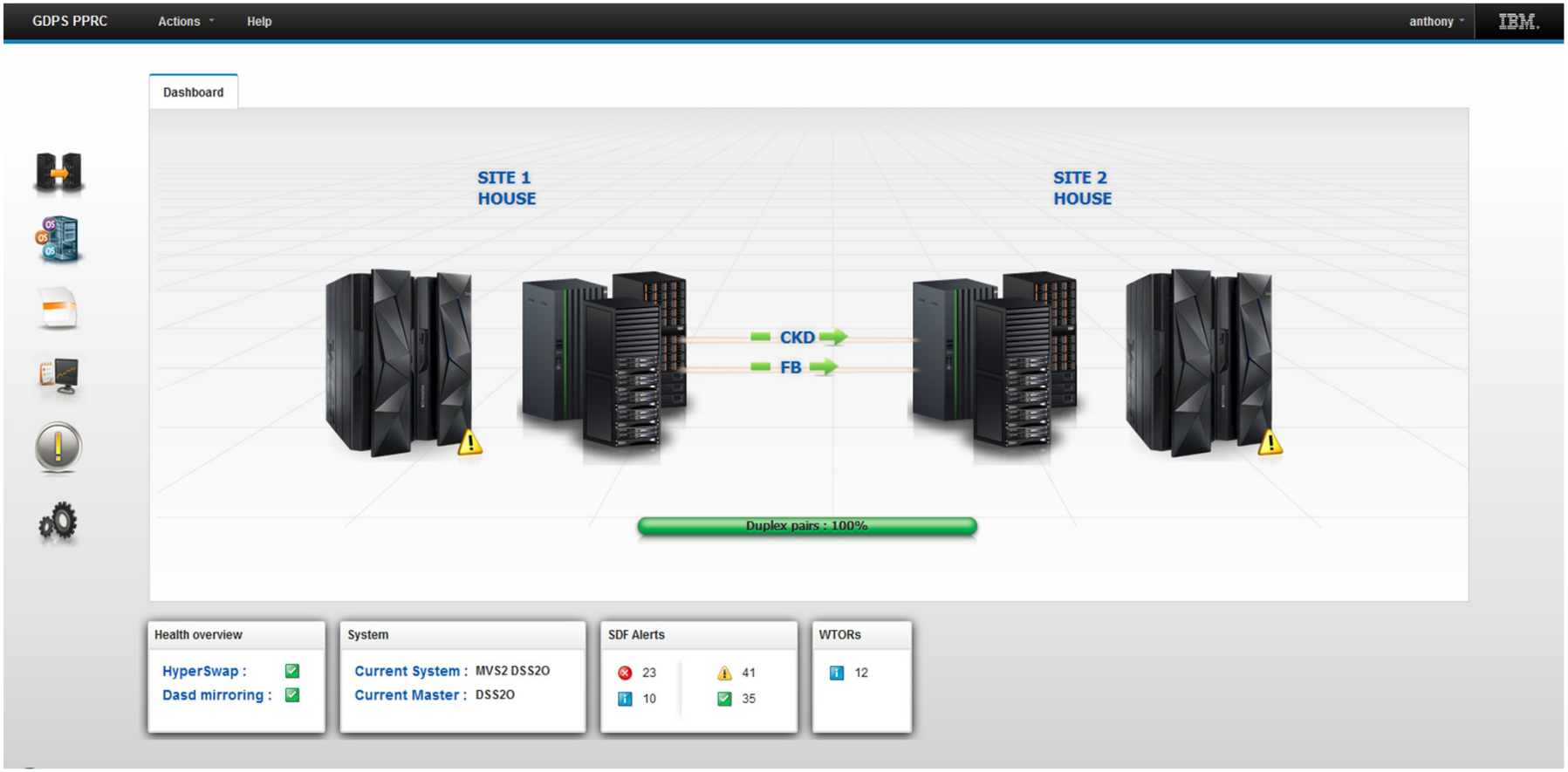
Intended benefits:

- Helps better manage regulatory requirements
- Supports greater scalability to help meet changing business needs
- Combines the best recovery time objective (RTO) and recovery point objective (RPO) attributes of both the metro distance and unlimited distance GDPS solutions



- **Same availability characteristics and operational procedures in both regions**
- **Facilitates more frequent region switching for data recovery validation**

IBM GDPS/PPRC has a new, icon-based web interface, in addition to the traditional 3270 interface.



- Available for GDPS/Appliance, GDPS/PPRC and GDPS/PPRC Hyperswap Manager
- Follow IBM OneUI standards (Tivoli,Notes,IOC)

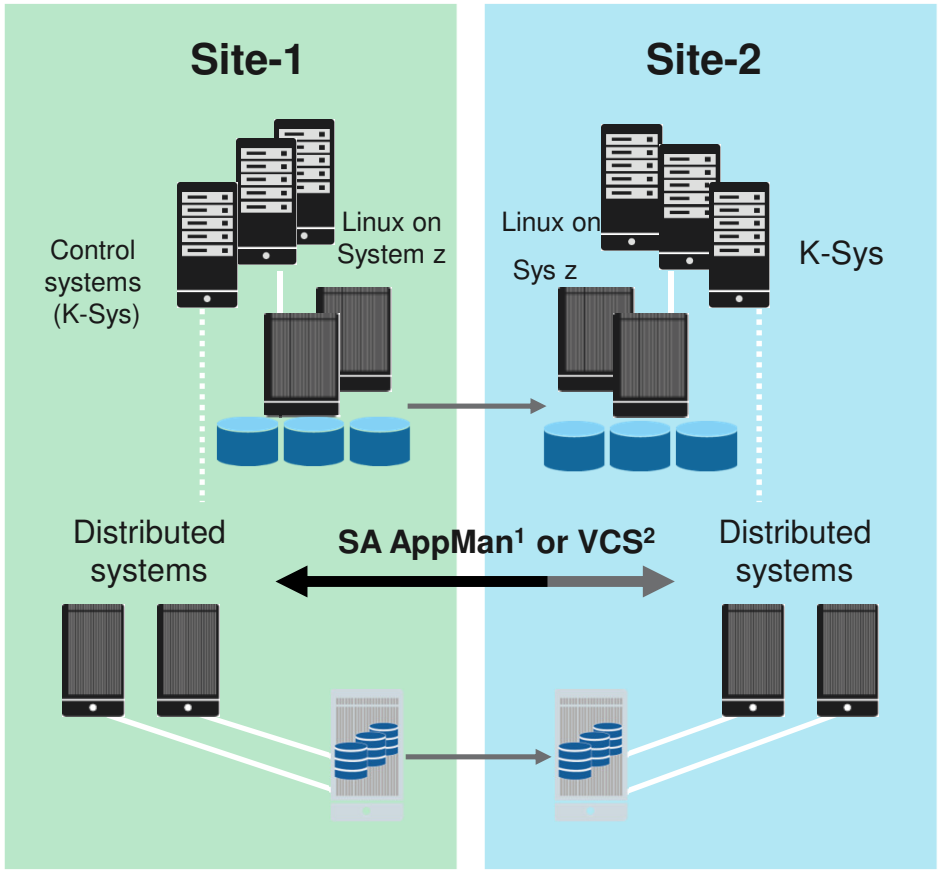
GDPS can also handle distributed or open systems.

Distributed Cluster Manager (DCM):

- Provides near-continuous availability in both the sites
- Extends IBM Geographically Dispersed Parallel Sysplex (GDPS) to help manage front-end distributed clusters
  (IBM AIX, HP-UX, Linux, Solaris, VMWare and Microsoft Windows)
- Support for SA AppMan and VCS with Global Cluster Option (GCO)
- Extends monitoring and management to open systems
- Extends data consistency to open systems
- Provides automation scripting for server management

Our Multiplatform Resiliency for IBM System z (xDR):

- Extends GDPS/PPRC "IBM z/OS support" to IBM zVM and associated-guests along with Linux
- Coordinated IBM HyperSwap – z/OS, z/VM with its guests and native Linux
- Graceful shutdown and startup of Linux clusters or nodes
- Coordinated takeover – recovery from a Linux cluster failure

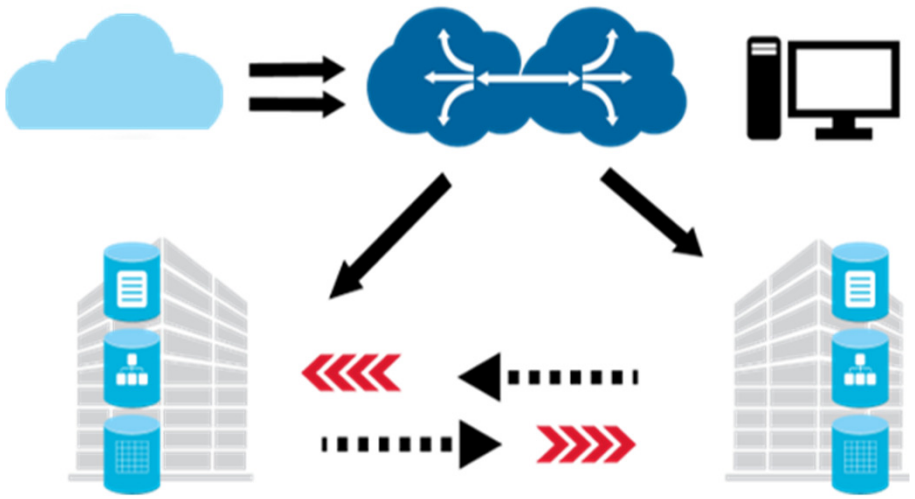


[1]IBM Tivoli System Automation Application Manager (SA AppMan), [2]Veritas Cluster System (VCS)

IBM GDPS active-active concept is to provide near-continuous data and systems availability across sites separated by virtually unlimited distances.

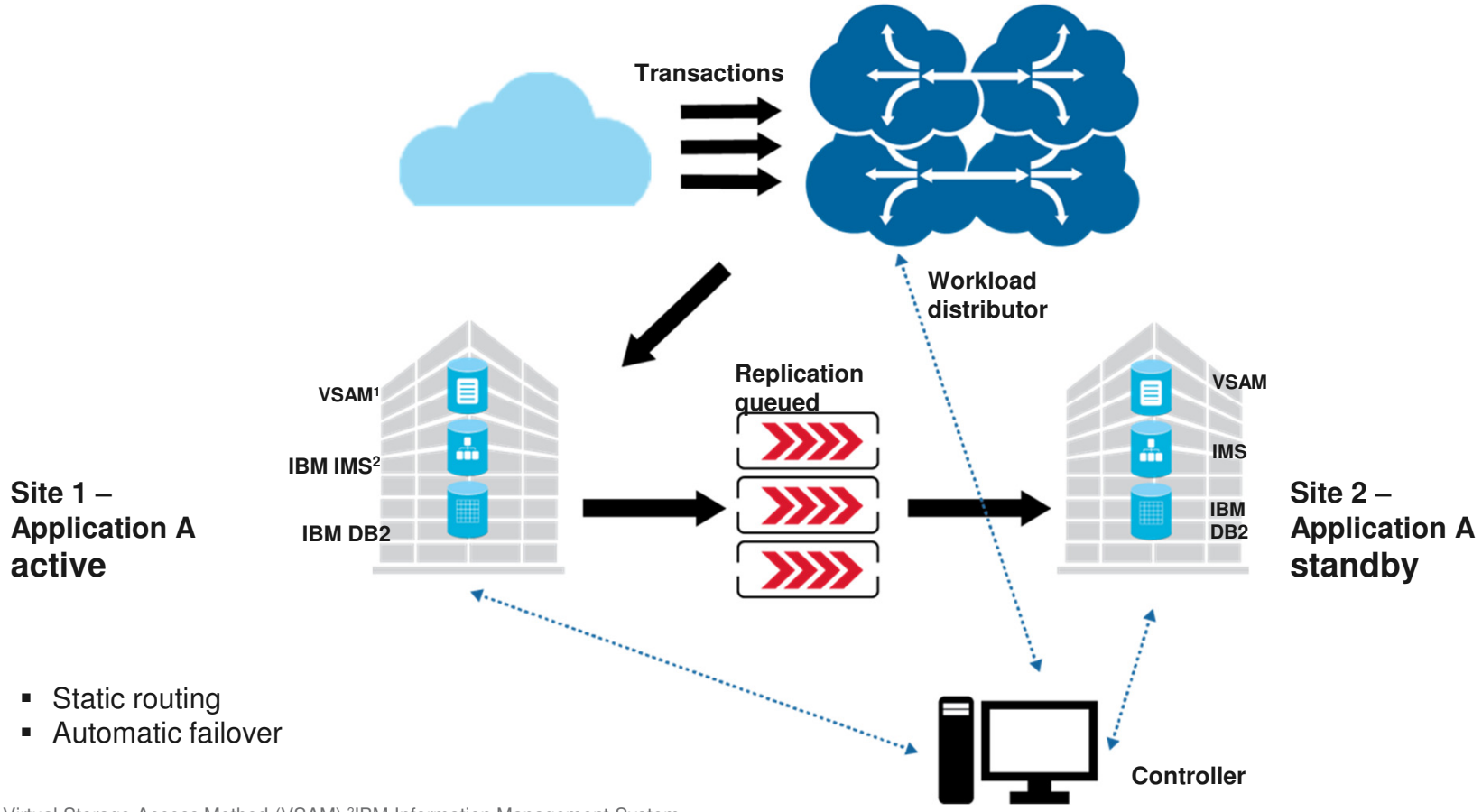
Solution features and capabilities and intended benefits:

- Manages availability at a workload level
- Provides a central point of monitoring and control
- Manages replication between sites
- Provides the ability to perform a controlled workload site switch
- Helps reduce recovery time and recovery point objectives – measured in seconds
- Provides near-continuous availability and helps simplify disaster recovery with an automated, centralized solution
- Facilitates better regulatory compliance management with a more effective business continuity plan
- Simplifies system resource management



We can provide the IBM GDPS active-standby configuration that is part of our roadmap to full active-active function (continued).

IBM GDPS active-standby configuration



- Static routing
- Automatic failover

[1] Virtual Storage Access Method (VSAM) [2]IBM Information Management System

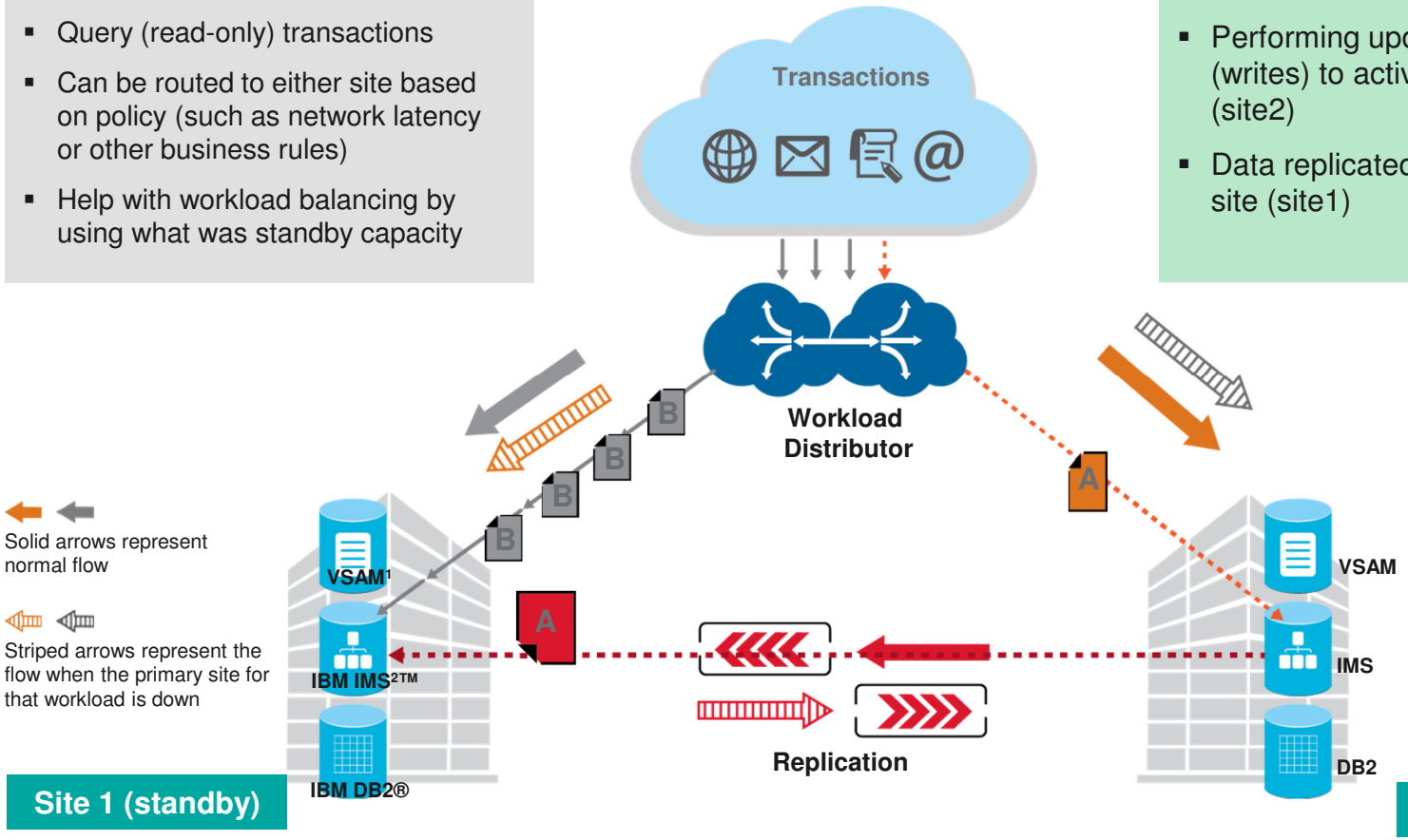
We can provide the IBM GDPS active-query configuration that is part of our roadmap to full active-active function (continued).

Application B (grey active-query)

- Query (read-only) transactions
- Can be routed to either site based on policy (such as network latency or other business rules)
- Help with workload balancing by using what was standby capacity

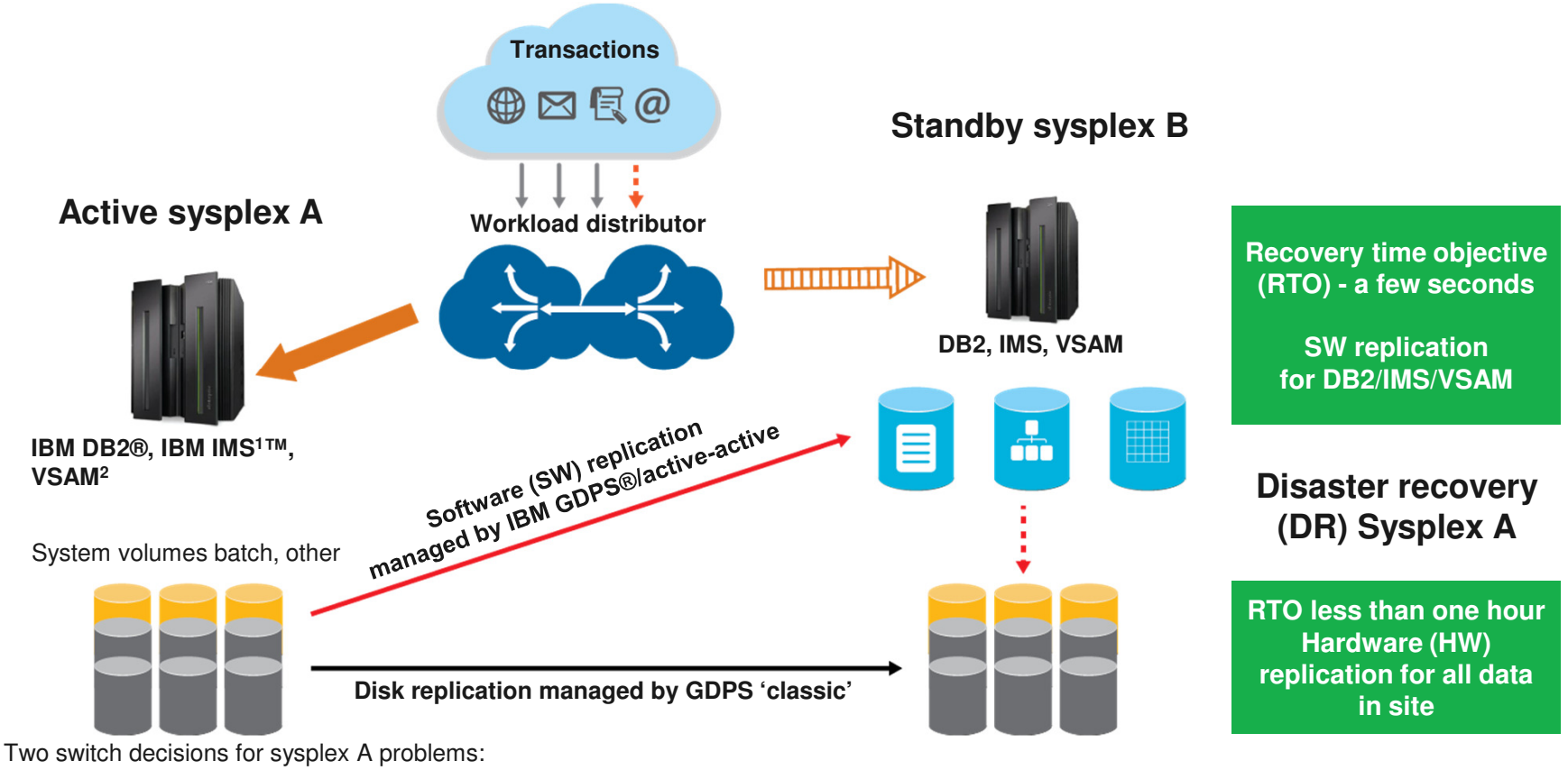
Application A (gold active-standby)

- Performing updates (writes) to active site (site2)
- Data replicated to standby site (site1)



[1] Virtual Storage Access Method (VSAM) [2]IBM Information Management System

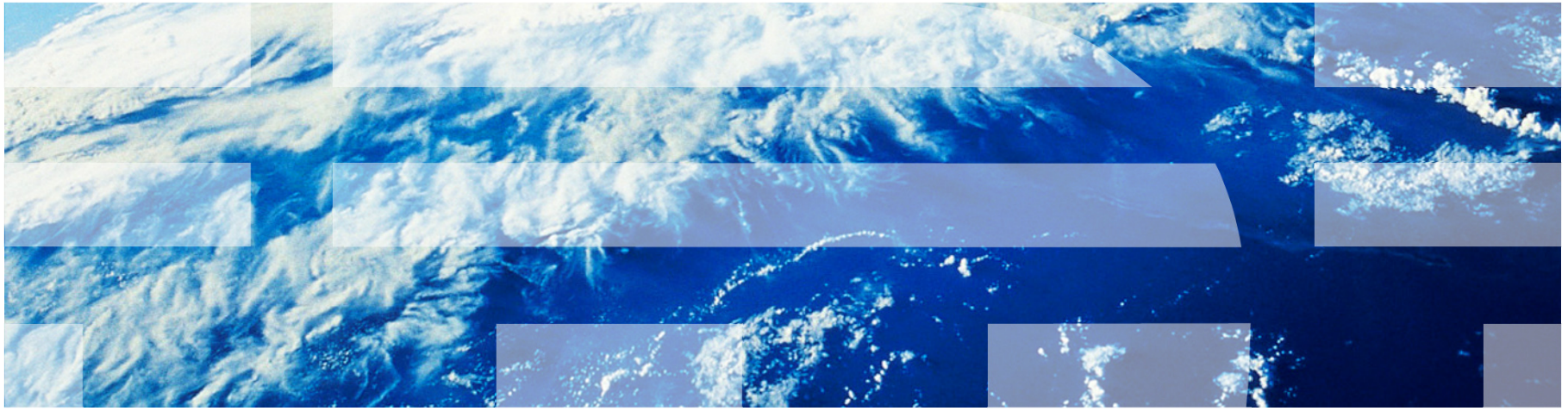
An IBM GDPS active-active workload can coexist with a traditional GDPS workload within the same sysplex.



Workload switch – switch to SW copy (B); once problem is fixed, simply restart SW replication
Site switch – switch to SW copy (B) and restart disaster recovery (DR) sysplex A from the disk copy

[1]IBM Information Management System, [2]Virtual Storage Access Method (VSAM)

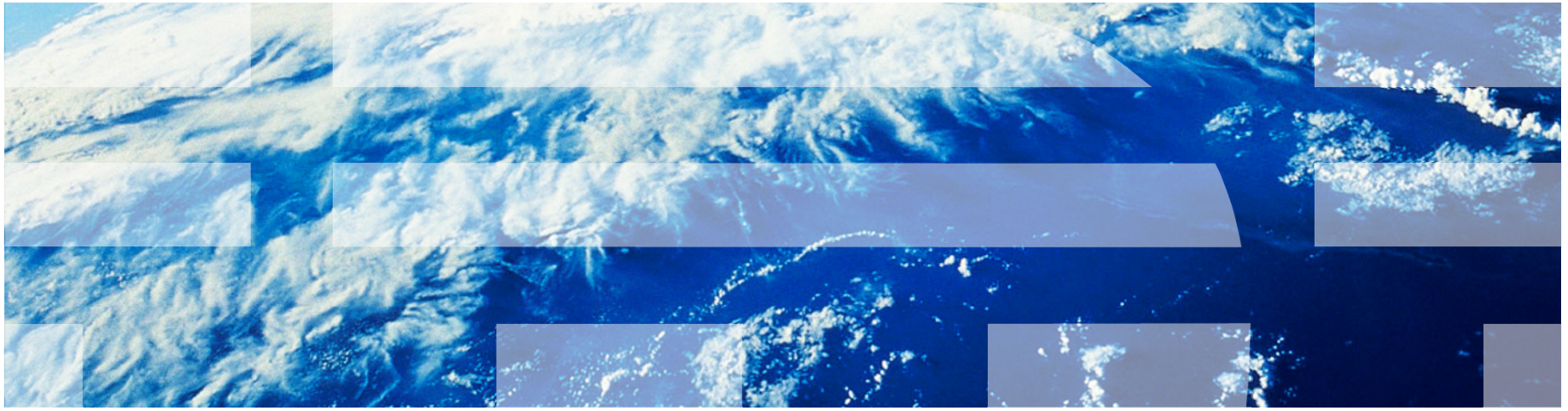
GDPS 3.14



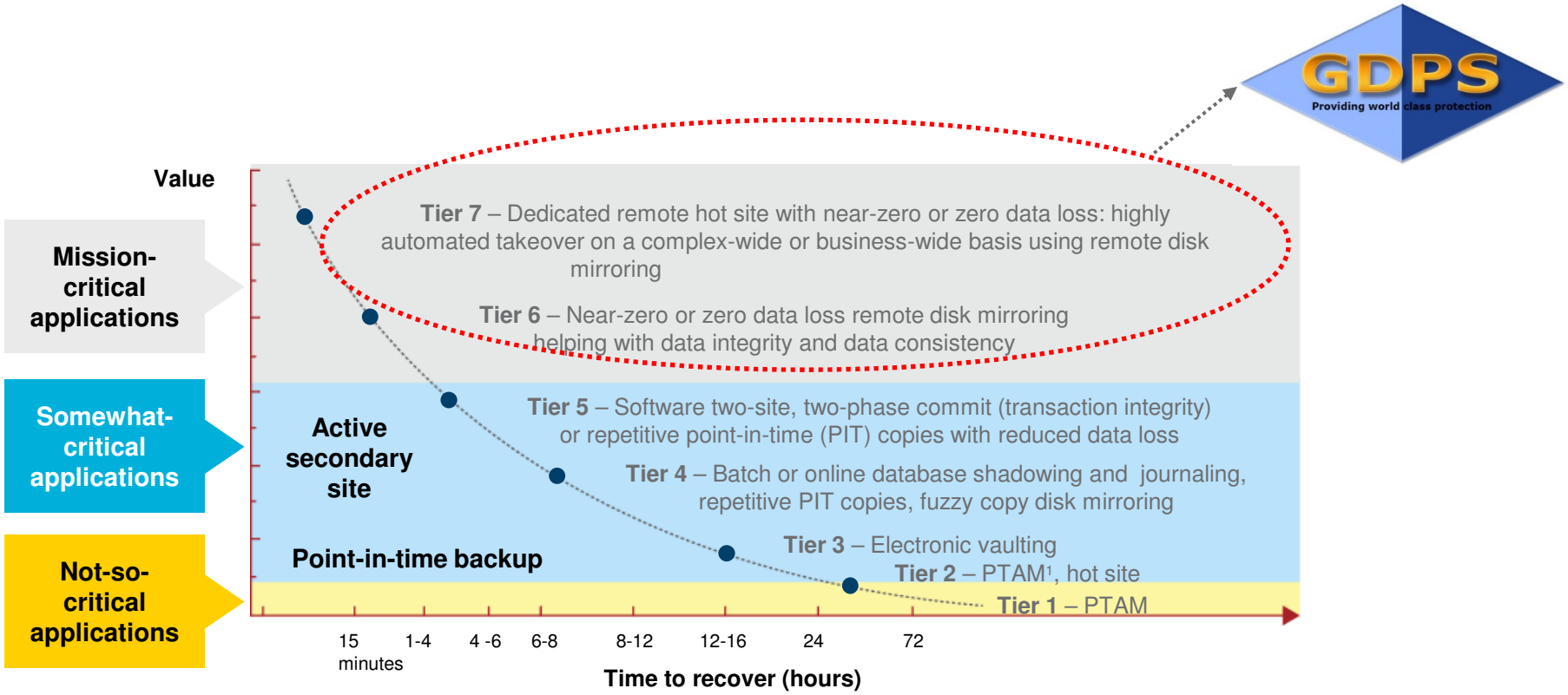
GDPS 3.14 became generally available on March 31, 2017 and it contains a substantial amount of new function.

- **GDPS/MTMM**
  - Heat Map Transfer panels enhanced
  - xDR VM Dump Switch handling
  - CDS management enhancements
  - Cooperation support in GDPS/A-A
  - RAS enhancements
  - SDF changes
  - System Automation 4.1 Support
- **GDPS/PPRC**
  - Heat Map Transfer panels enhanced
  - xDR VM Dump Switch handling
  - KVM support (Foreign system)
  - CDS management enhancements
  - GDPS GUI support for use in MzGM
  - RAS enhancements
  - SDF changes
  - System Automation 4.1 Support
- **GDPS/HM**
  - Heat Map Transfer panels enhanced
  - GDPS GUI support for use in MzGM
  - RAS enhancements
  - SDF changes
- **GDPS/XRC**
  - Heat Map Transfer panels enhanced
  - RAS enhancements
  - SDF changes
  - System Automation 4.1 Support
- **GDPS/GM**
  - Heat Map Transfer panels enhanced
  - RAS enhancements
- **GDPS/MGM 3-site /4-site**
  - GDPS/MGM MT support (3-site)
  - More explicit migration process defined
  - A number of procedure changes
- **GDPS/MzGM 3-site/4-site**
  - GUI support in PPRC environment
- **GDPS/Active-Active**
  - Zero data loss config
  - 2 Sysplexes per site support
  - IMS support in ROUTING SWITCH
  - ROUTING SWITCH FORCE option
  - SYSPLEX LOAD changes

Summary



Within the seven tiers of disaster recovery, we classify IBM GDPS in the topmost tier.



One of the best data recovery practices involves blending tiers of solutions in order to optimize application coverage at a reduced cost. One size, technology or methodology may not fit all applications.

[1]Pickup truck access method (PTAM) Note: More detail on this graph can be found at: http://www.redbooks.ibm.com/abstracts/tips0057.html?Open

What value can the IBM GDPS solution offer your organization?

Experience

Customer acceptance

- Over 870 IBM Geographically Dispersed Parallel Sysplex (GDPS) licenses installed in 49 countries worldwide
- Tested technology to support automated and repeatable results
- Complete implementation by experienced consultants

Commitment

Open industry standards

- IBM GDPS supports industry-accepted, open replication architectures (PPRC[1], XRC[2], Global Mirror and Fibre Channel)
- Architectures licensed by all enterprise storage vendors
- GDPS qualification program (IBM and Hitachi)

Investment protection

- Designed to be easily upgradeable
- Common code base for each product

Value

Product maturity

- Generally available since 1998
- Suite of products
- Enterprise-to-enterprise capability
- Many years of IBM System z production experience
- CA and DR best of breed
- Continually enhanced

Customer focus

- GDPS Design Council
- Synergy with IBM development labs
- Incorporates several IBM patents
- New release planned every year

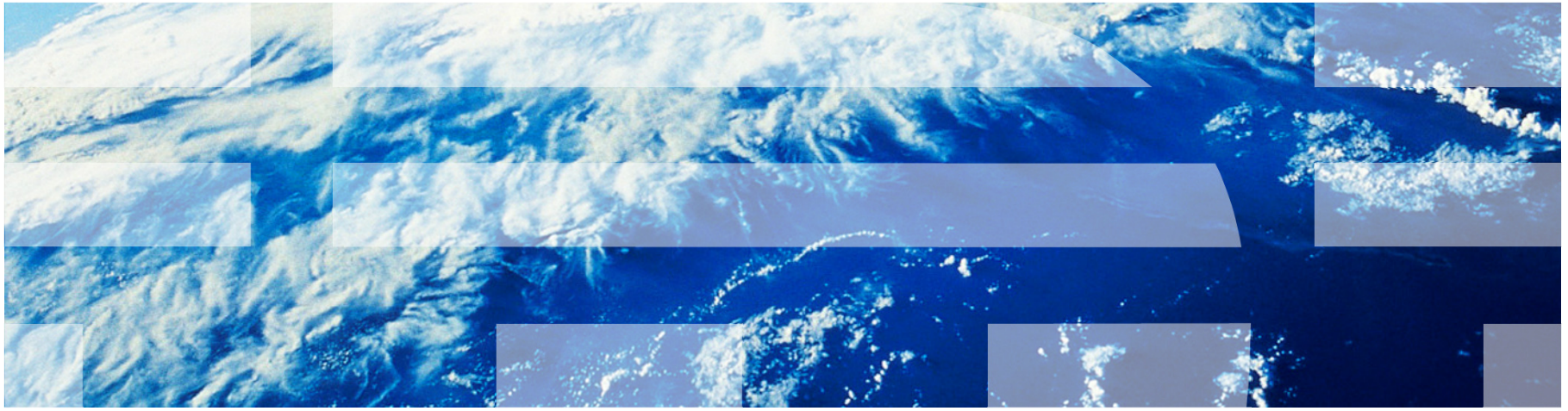
Vision

IBM support

- Fully supported via standard IBM support structure
- Fixes through normal IBM System z channels

[1]Peer to Peer Remote Copy (PPRC), [2]Extended Remote Copy (XRC)

Additional Charts



Additional Information

- **Web sites:**
  GDPS **www.ibm.com/systems/z/gdps**
  Parallel Sysplex **www.ibm.com/systems/z/pso**
  Bus Resiliency z **www.ibm.com/systems/z/resiliency**
  Bus Resiliency **www.ibm.com/systems/business_resiliency**
- **System z** **www.ibm.com/systems/z/hardware**
  Storage **www.ibm.com/systems/storage**
  Redbooks®GDPS Family: An Introduction to Concepts and Capabilities
  www.redbooks.ibm.com/abstracts/sg246374.html?Open
- **GDPS Web Site White Papers and Presentations**
  - **GDPS: The Ultimate e-business Availability Solution**
  - **IBM Implementation Services for GDPS/Global Mirror**
  - **GDPS Business Continuity Solutions**
  - **Consistency Groups in a Nutshell**
  - **DS8000™ Data Replication**
  - **GDPS Solutions**
- **e-mail:** **gdps@us.ibm.com**