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Delivering High Availability and Disaster Recovery Using GDPS

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IBM Corporation

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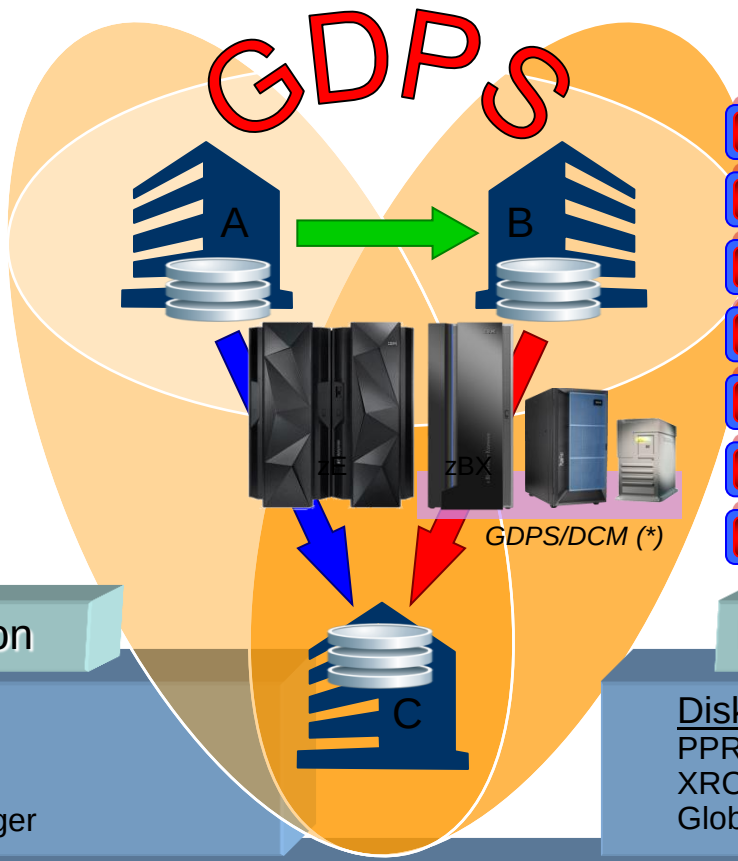
Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon many factors, including considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve results similar to those stated here.

Enterprise-level Availability & Disaster Recovery Management

15 years and still going strong

Manage & Automate

- **Central Point of Control**
  - System z and Distributed Servers
  - Remote Copy infrastructure
- **Real-time Monitoring & Alert Mgt.**
- **Automated Recovery**
  - Planned & Unplanned Outages
- **Site Management**
  - Single or Multiple Sites
- **Automated Provisioning**
  - System z CBU



Solutions

GDPS/PPRC HM	PPRC HyperSwap Manager
GDPS/PPRC	PPRC (Metro Mirror)
GDPS/XRC	XRC (z/OS Global Mirror)
GDPS/GM	Global Mirror
GDPS/MzGM	z/OS Metro Global Mirror
GDPS/MGM	Metro Global Mirror
GDPS/A-A	Active-Active

System Automation

SA for z/OS
NetView for z/OS
SA Multi-Platform
SA Application Manager

Replication

Disk
PPRC
XRC
Global Mirror

Software
InfoSphere for DB2
InfoSphere for IMS

Technology

First GDPS installation 1998, now more than 665 in 42 countries

(*) Distributed Cluster Manager

Implementing and Managing an Automated Availability and Recovery Solution Across Your Entire Enterprise can be Challenging.

You need to take into account:

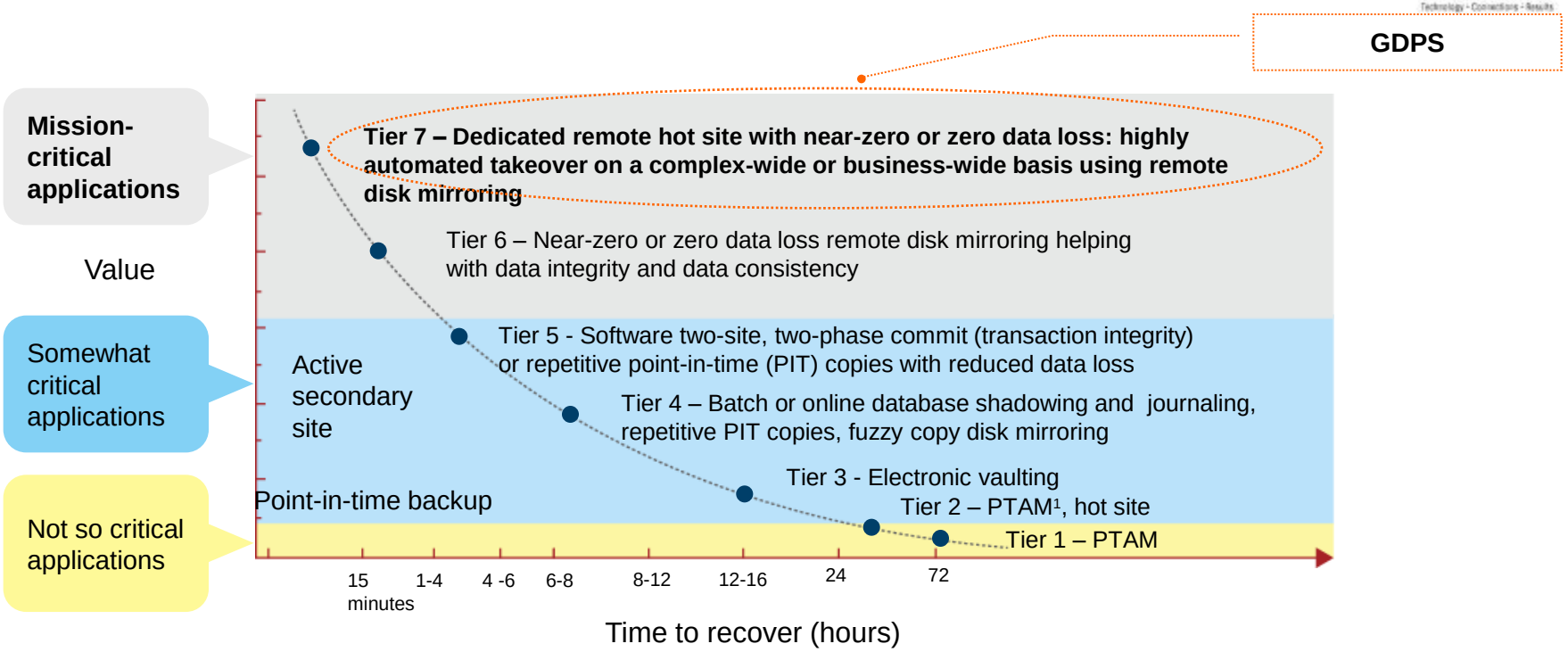
- **Complex, multivendor, multiplatform infrastructure**
- **Geographically dispersed infrastructure**
- **Build versus buy**
- **An IT environment where data protection is critical**
- **The tools required to monitor and send messages about events that happen within the IT infrastructure**
- **Labor-intensive tasks that are prone to error**
- **The need for key IT staff at the disaster recovery site**
- **Recovery procedures that must be continuously updated**

GDPS can support Reduced Risk, and Recovery Time and Point Objectives, while helping you Manage Complexity.

The IBM GDPS® solution is designed to provide:

- **Resiliency**
  - Deliver an end-to-end application and data availability solution within a single site or across multiple sites
- **Automation**
  - Automate recovery procedures for planned and unplanned outages to provide near-continuous availability and disaster recovery
- **Management**
  - Monitor systems, disk and tape subsystems that support open and IBM copy technology architectures, including IBM, Hitachi Data Systems and EMC
  - Simplify Sysplex and server management tasks
  - Provide an easier-to-use interface from a central point of control

IBM GDPS® Features Seven Tiers of Disaster Recovery



The best data recovery practice is to blend tiers of solutions in order to optimize application coverage at the lowest possible 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://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/tips0340.html?Open

GDPS is a Suite of Solutions Designed to meet the Unique Business Continuity Needs of your Business.

IBM GDPS®

- GDPS/PPRC HyperSwap® Manager
  Near-continuous availability of data within a data center
- GDPS/PPRC
  Near-continuous availability or disaster recovery within a metropolitan region
- GDPS/GM
  GDPS/XRC
  Disaster recovery across extended distances
- GDPS/MGM
  GDPS/MzGM
  Near-continuous availability regionally and disaster recovery across extended distance

GDPS / Classic

- GDPS/A-S
  Near-continuous availability across virtually unlimited distances
- GDPS/A-Q
  SOD with Near-continuous availability across virtually unlimited distances and Query capability
- GDPS/A-?
  Future considerations

GDPS / Active / Active

There are many GDPS Service Products under the GDPS Solution Umbrella Designed to help meet various Business Requirements for Availability and Disaster Recovery.

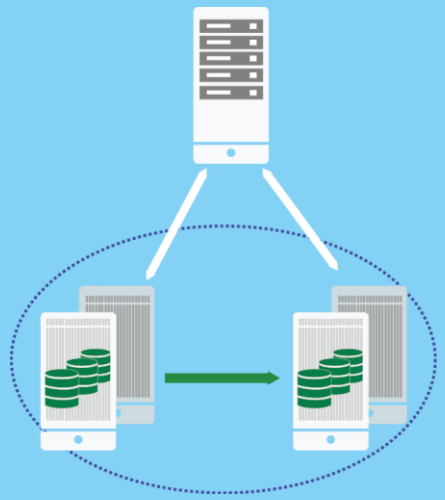
GDPS/PPRC HM

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

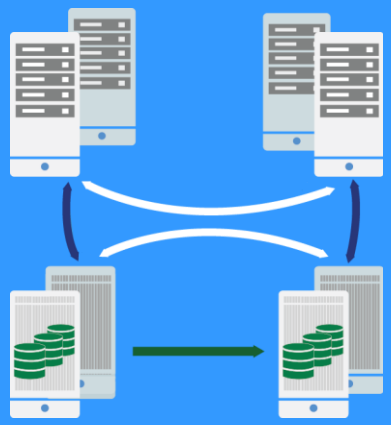
GDPS/PPRC

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/GM and GDPS/XRC

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

RPO – recovery point objective
RTO – recovery time objective

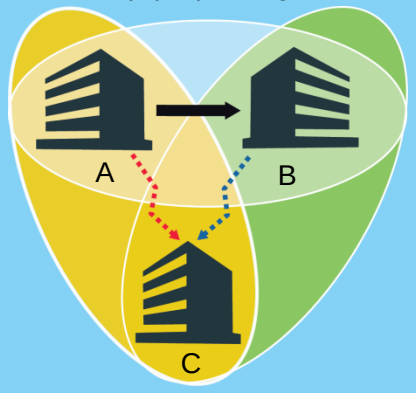
Synch replication
Asynch replication

There are many GDPS Service Products under the GDPS Solution Umbrella Designed to help meet various Business Requirements for Availability and Disaster Recovery.

IBM GDPS®/MGM and GDPS/MzGM

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

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

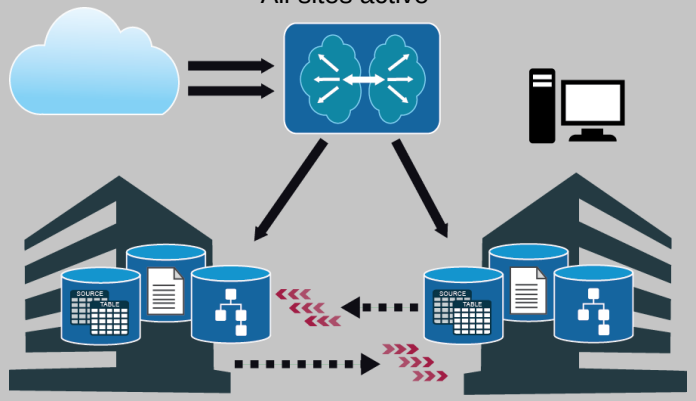


DR RPO equals 0 and RTO less than 1 hour or CA RPO equals 0 and RTO minutes
and RPO seconds and RTO less than 1 hour

GDPS/Active-Active

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

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



RPO seconds and RTO seconds

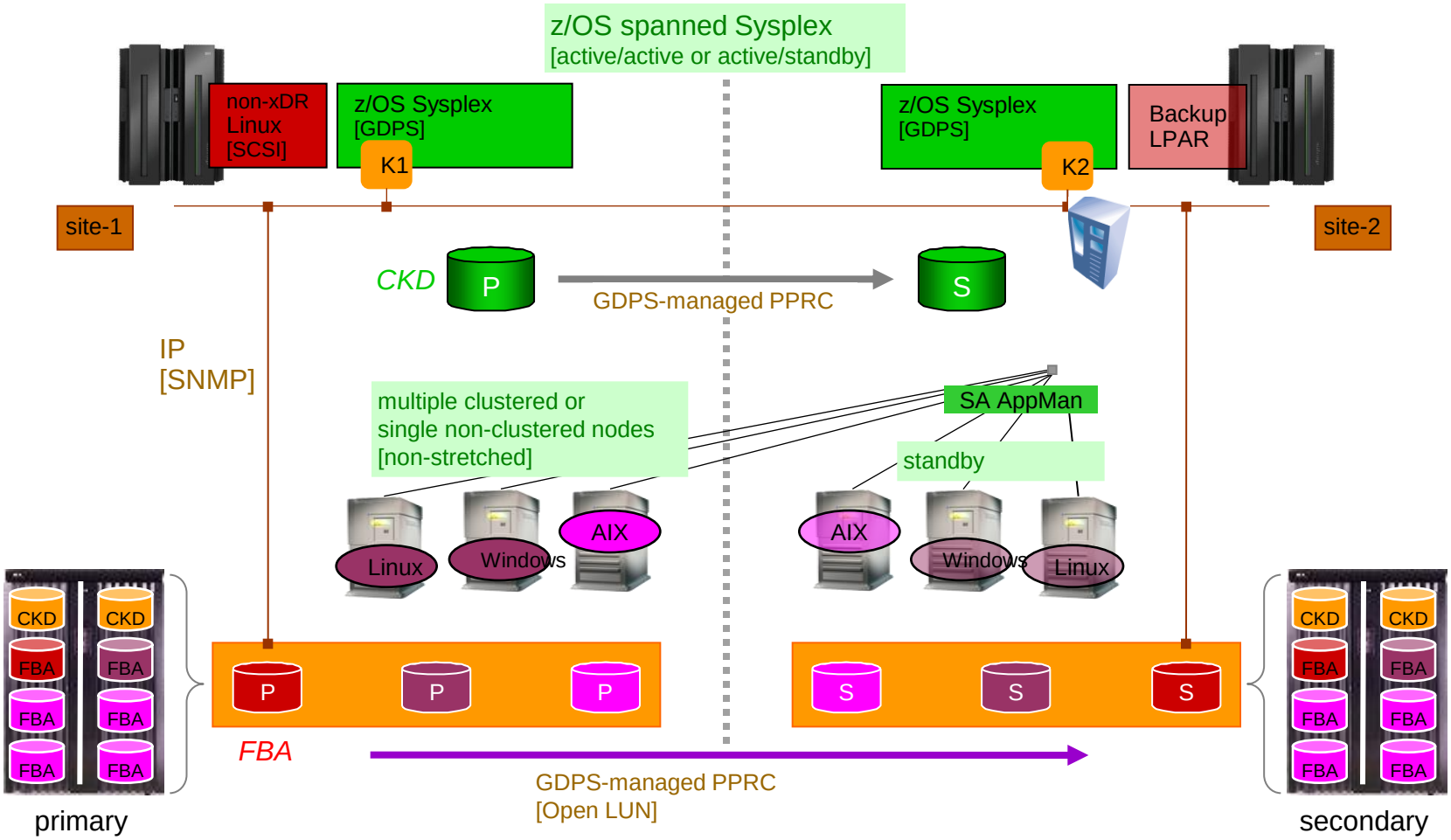
RPO – recovery point objective
RTO – recovery time objective

Synch replication
Asynch replication

GDPS Extensions Evolution

- *GDPS initially focused on z/OS and sysplex. Subsequently, it has been extended to manage distributed server disk to support of enterprise storage, zVM & associated guests and zLinux in support of server consolidation, and distributed servers to provide end-to-end application CA/DR*
- **Open LUN management / GA 2/04**
  - **Provides ability for GDPS to manage system z data (ECKD disk) and distributed server data (FB disk)**
    - **GDPS/PPRC – CA / DR within a metropolitan region (synch disk replication)**
    - **GDPS/GM – DR at extended distance (asynch disk replication)**
  - **Only available on IBM DS8K disk**
- **Multiplatform Resiliency for System z (xDR) / GA 3/07**
  - **Extends GDPS/PPRC "z/OS support" to zVM & associated guests & zLinux**
  - **Available on all enterprise disk**
- **Distributed Cluster Manager (DCM) / GA 3/08**
  - **Extends GDPS to manage front end distributed clusters (AIX, HP-UX, Linux, Solaris, VMWare, & Windows)**
  - **Support for SA AppMan and VCS with Global Cluster Option (GCO)**

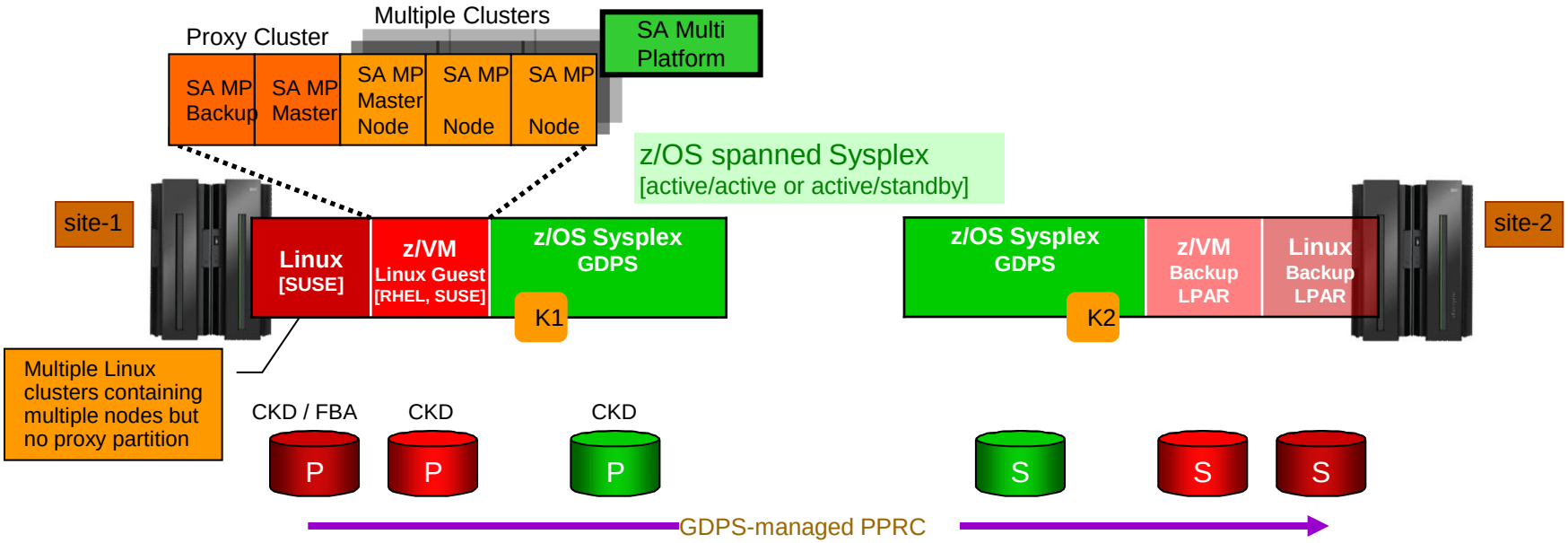
GDPS/PPRC Configuration with Open LUNs



Enterprise-wide DR with Data Consistency

Open LUN LSSs are defined to run with a very long ELB value

GDPS/PPRC xDR: Linux Guest & Native Linux on System z – Continuous Data Availability



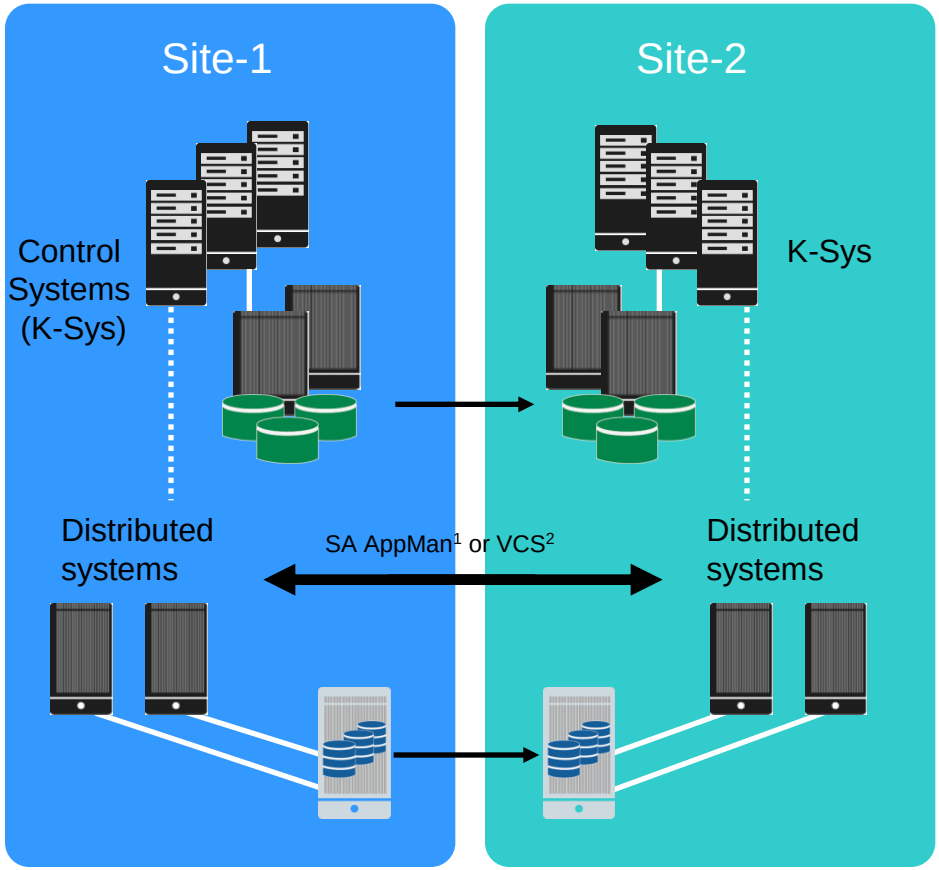
- **Coordinated HyperSwap – z/OS, z/VM with its guests, and native Linux**
- **Graceful shutdown and startup (re-IPL in place) of Linux clusters or nodes**
- **Coordinated takeover – recovery from a Linux node or cluster failure**
- **Multiple Linux clusters are supported, as are multiple z/VM systems & Linux LPARs**
- **All members of a cluster must run under same z/VM system or in same Linux**

Coordinated recovery for planned and unplanned events

Solutions for Distributed or Open Systems.

Distributed Cluster Manager (DCM) interface is an enterprise-level continuous availability and disaster recovery solution that can:

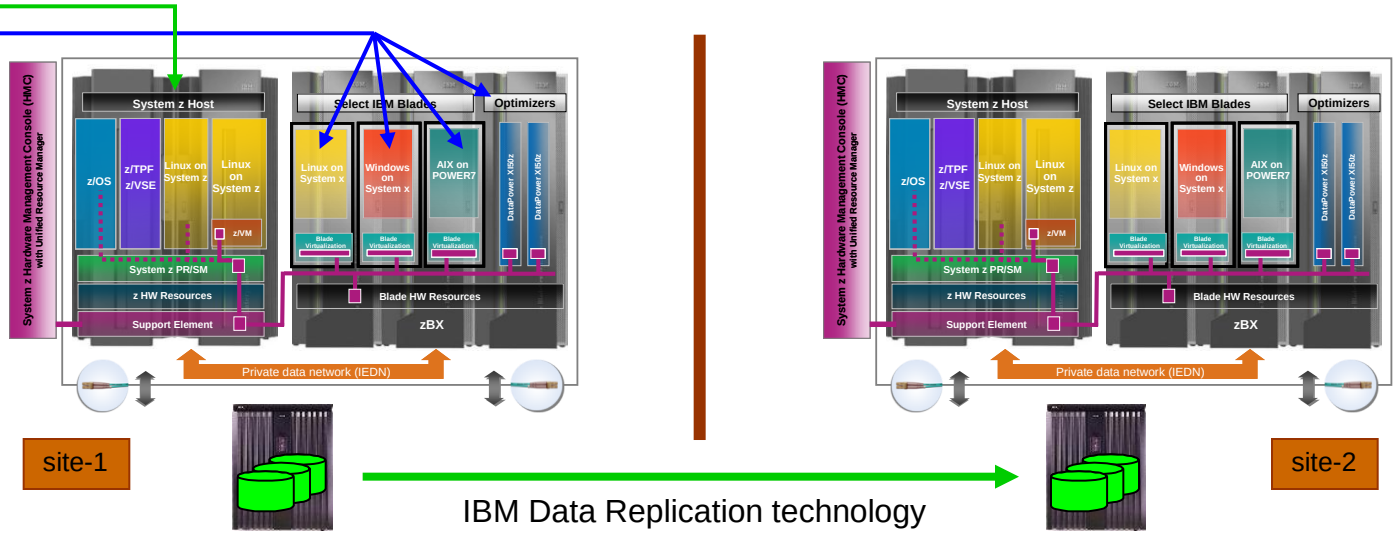
- **Provide a more integrated, industry-unique, automated, end-to-end recovery solution that can help optimize operations to meet enterprise-level recovery time objectives and recovery point objectives**
- **Coordinate automation tasks during planned and unplanned actions**
  - **End-to-end coordinated automation across IBM System z® and distributed servers using clustering solutions (for example IBM AIX®, Oracle Solaris, HP UX, Linux)**
    - **Shutdown of workload and start-up on backup site**
  - **Single point of control for site switching**
- **Allows notification about application or cluster outages that:**
  - **Could be beginning of a rolling disaster detected first on non-System z server**
  - **Can lead to IBM GDPS® takeover prompt**



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

GDPS Capabilities using EC12, zEnterprise Business Continuity

GDPS/PPRC, GDPS/XRC, GDPS/GM



- **Management of Metro Mirror or Global Mirror remote copy configurations (Open LUN) –** ***Data consistency across System z (z/OS, z/VM, & zLinux) and distributed systems running in zBX***
- **Infrastructure management solution for z/OS and Linux applications on System z (xDR) –** ***Data consistency, HyperSwap, Infrastructure planned/unplanned site switches across System z and distributed systems running in zBX***
- **Application management and coordination of planned and unplanned outages (DCM) –** ***Application planned/unplanned site switches across System z and distributed systems running in zBX***

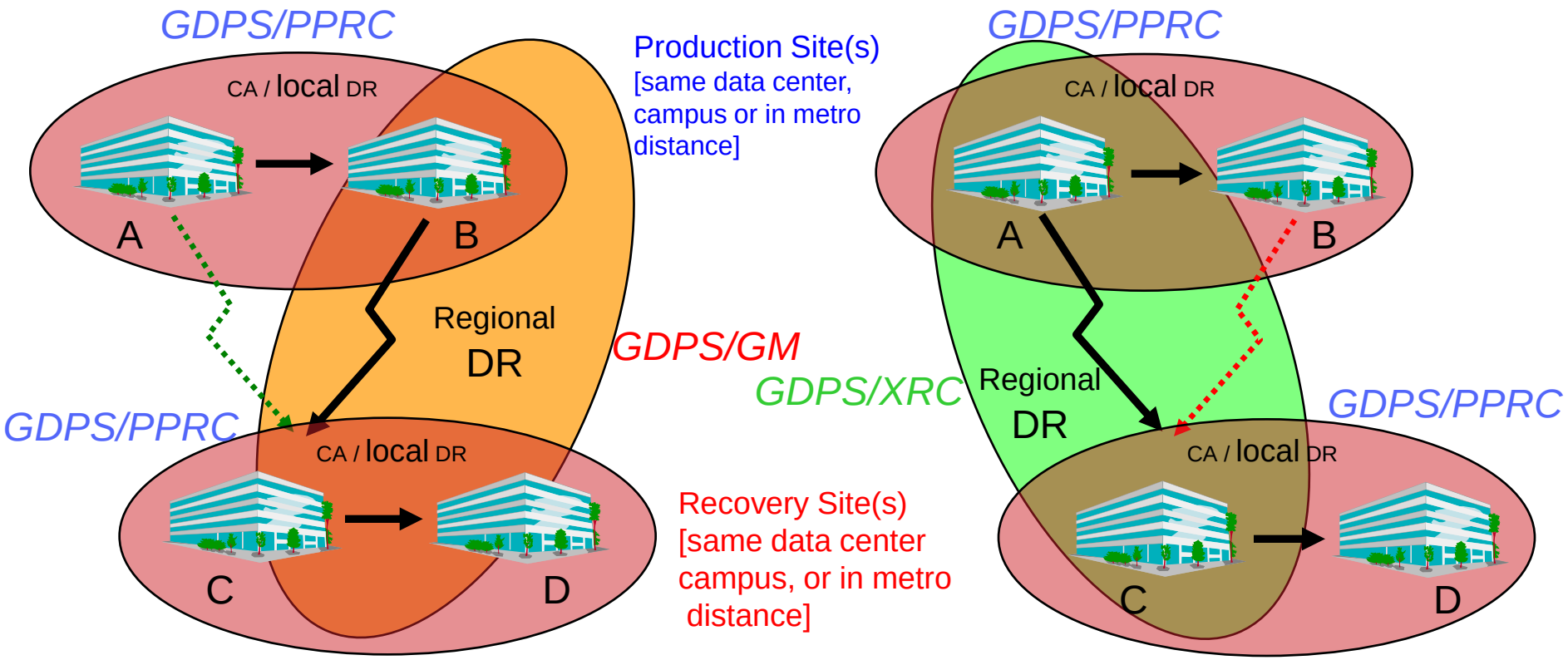
Preview Themes for GDPS 3.x.x
– extending a rich portfolio of capability

- **Configuration Management**
  - **4-site configuration support**
  - **Site/Region Switch/Return Home scenarios increased to include all 2 and 3-site MzGM configuration options**
  - **Remote script execution capability**
- **Technology Exploitation & Synergy**
  - **VM SSI Live Guest Relocation from within GDPS Planned Actions for xDR guests**
  - **TS7700 Support extensions**
  - **Consistent FlashCopy exploitation for GDPS/PPRC**
- **RAS Enhancements**
  - **MzGM 3-site automatic incremental resynchronization reducing DR exposure**
  - **GDPS Health check extensions giving awareness of bad configuration options**
  - **XRC Performance Monitor integration simplifies management**

GDPS Four-site Configurations

GDPS Metro Global Mirror
Cascading: A → B → C → D

GDPS Metro zOS Global Mirror
Multi-target: A → B, A →C, C → D



A GDPS 4-site solution combines both GDPS/PPRC or GDPS/PPRC HM, one of GDPS/XRC or GDPS/GM , and GDPS/PPRC or GDPS/PPRC HM

GDPS/XRC & GDPS/MzGM Region Toggle / Go Home

- GDPS 3.9 provided new facilities in support of GDPS/XRC 2-site configuration Region Toggle and Go Home
  - Support originally restricted to 2+2 configurations (configurations with FlashCopy in both regions)
- GDPS 3.xx adds support for additional GDPS/XRC 2-site configurations:
  - D/R configuration with FlashCopy in recovery region only (1+2)
  - D/R configuration with no FlashCopy in application or recovery region (1+1)
- GDPS 3.xx also adds support for GDPS/MzGM configurations

Remote Script Execution Capability

- Ability to initiate a script from one GDPS environment in a different GDPS environment
- Execution is synchronous (initiating script waits for remote script completion)
- Script in the remote target must already exist
  Enables single point of control for multi-site configurations
  - Only available from within a script, not panels

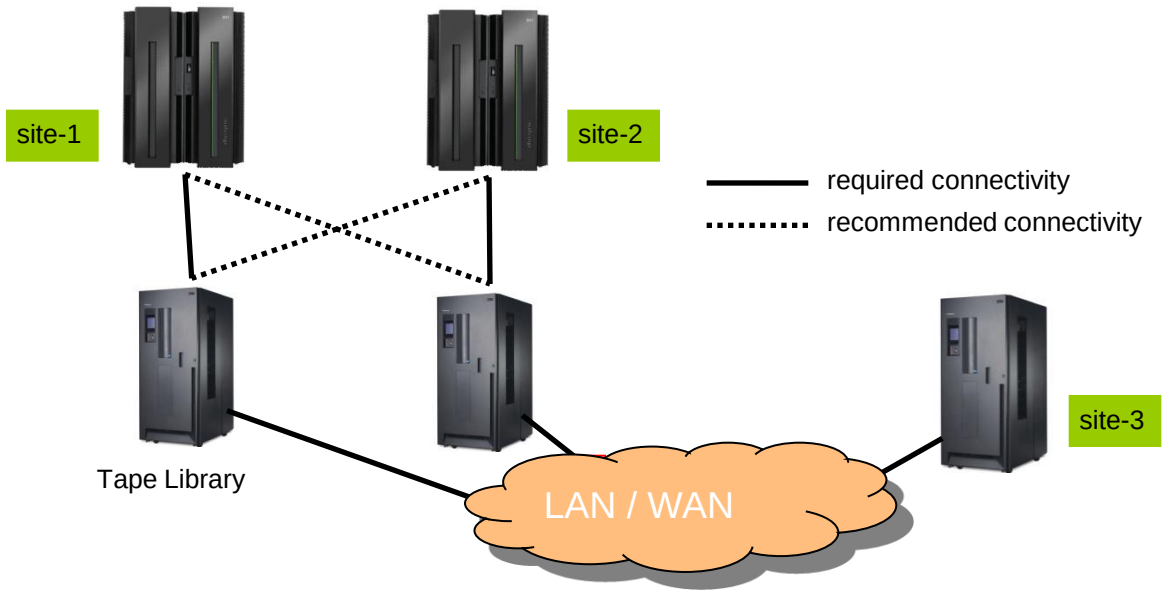
xDR z/VM Single System Image Clustering support & exploitation

- z/VM Single System Image (SSI) Clusters introduced with z/VM 6.2
- GDPS xDR supports clustered z/VM SSI systems – 3.9 SPE
  - GDPS recognizes that a VM system is member of SSI Cluster
  - When systems reset via GDPS, GDPS ensures the system is marked down and taken out of the cluster PDR (similar to z/OS partitioning from sysplex CDS)
  - Automatic reply to VM IPL time prompt concerning systems not taken out cleanly

- GDPS xDR exploits SSI Live Guest Relocation
  - Ability to relocate guests non-disruptively from one z/VM image in the SSI to another
  - Supported via panels or scripts
  - Together with HyperSwap, facilitates non disruptive planned site switch of z/VM workloads

GDPS/PPRC TS7700 support extension

- **GDPS support for 'In doubt' tape reporting**
  - **Create report of inconsistencies between libraries in the TS7700 cluster**
    - **Inconsistencies can indicate that tape does not exist or is back level in a particular location and recovery may require special action (such as re-running a batch job)**
  - **Display report on panel and in NetView log**



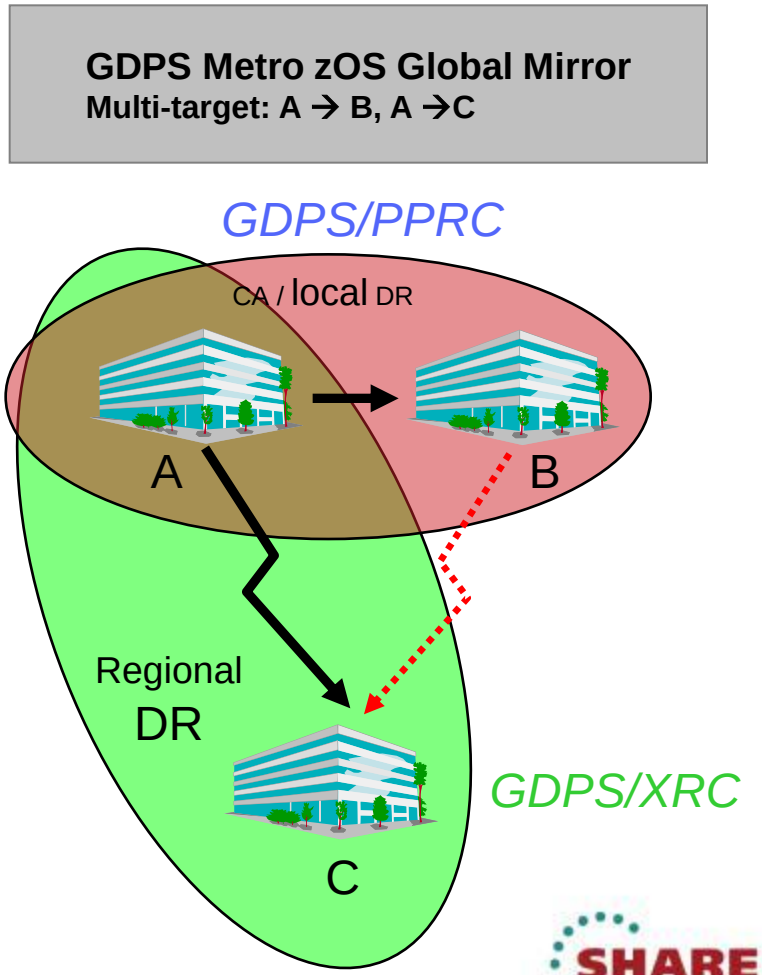
GDPS/PPRC + GDPS/PPRC HM Consistent FlashCopy

- Brings dependent-write consistency to Metro Mirror FlashCopy
  - PPRC primary or secondary as source
    - GDPS/PPRC HM supports secondary only
- Exploits FlashCopy Freeze capability of the DS8K storage
  - Customizable parameter to limit Freeze time
  - Redundant monitors to avoid hangs in case of K-sys failure
- Removes the need to suspend/resync to get a consistent secondary FlashCopy
- Removes the need to stop systems for a primary FlashCopy
- Reduces HyperSwap disabled time to just a few seconds
- Facilitates expanded and more frequent use of FlashCopy

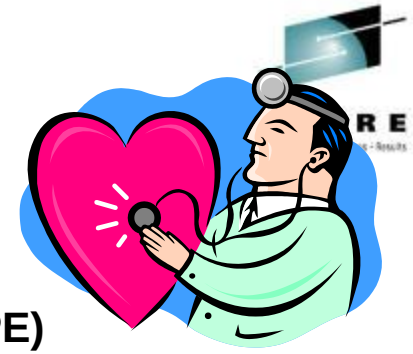
MzGM Automatic Incremental Resynchronization (GDPS 3.9 SPE)

- After planned/unplanned HyperSwap A to B or B to A
- XRC must be resynchronized to C from new swapped-to PPRC primary (Incremental Resynchronization –IR)
- IR previously manually initiated
- With SPE, IR can be automatically initiated by GDPS immediately after the HyperSwap

- Minimize operator intervention
- Minimize elapsed time between the completion of a HyperSwap event and the subsequent resynchronization of XRC .



New GDPS Health Checks



- GDPS/PPRC + GDPS/PPRC HM Ksys disk site check (GDPS 3.9 SPE)
  - Check that each Ksys is using volumes on local disk subsystems in site where that Ksys is running .
- GDPS/XRC Links SPOF check
  - Check for SPOF from each SDM to Production and recovery site Disk subsystems for each XRC session active – for example device has all online paths go through one switch
- GDPS/PPRC + GDPS/PPRC HM Mirrored volume and GDPS configuration check
  - Check that PPRCed devices used by production systems are defined to GDPS
- GDPS/PPRC + GDPS/PPRC HM CICS staging datasets on mirrored device check
  - Check that CICS Logstreams are unconditionally duplexed to disk
- GDPS/XRC System GRS structure and RNL definition
  - Check that RNL definitions required for XRC RECOVER CONTROLLING are present
- GDPS/XRC SuppressTimeStamp setting check (new setting in z/OS 1.13)
  - Check that setting is NO on production systems, YES on SDMs
- GDPS/PPRC + GDPS/PPRC HM GRS GRS Contention Notification System check
  - Raise exception if Ksys is GRS CNS
- Existing NetView REXX environments check enhanced to allow an override parameter
- Existing Critical Paging check enhanced to allow parameter to disable check on Ksystems

GDPS/PPRC + GDPS/PPRC HM disk size configuration check

- PPRC (native) allows replication from smaller to larger size disk
  - HyperSwap from smaller to larger disk can be useful for a disk migration scenario
- Attempt to reverse such a PPRC configuration will fail
- Config processing will check for size mismatch for each pair in the GDPS configuration
  - Mismatch also checked at other points such as HyperSwap enablement
- Config process can be optionally failed if there is a mismatch
- Disk switches that would fail are disallowed
  - HyperSwap with RESYNC option
  - DASD SWITCH DELPAIR
- Avoids disk switch failures that can occur in case installation was not aware of the mismatch

GDPS/XRC Integrated XRC Performance Monitoring

- GDPS/XRC Performance Monitoring Tool was available 20 June 2012
  - Even with ST messages…
- Next step is to begin enhancing GDPS control code to incorporate monitoring
  - Key objectives are to reduce complexity and XRC administration cost
- Multi-part project spanning several releases. First installment will be 3.xx
  - GDPS/XRC becomes aware of SDM monitor data
  - Provides function to replace XPM Exception Monitor
  - New alerts, logging, and improved automated suspension

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GDPS/A-Q
SOD with Near-continuous availability across virtually unlimited distances and Query capability

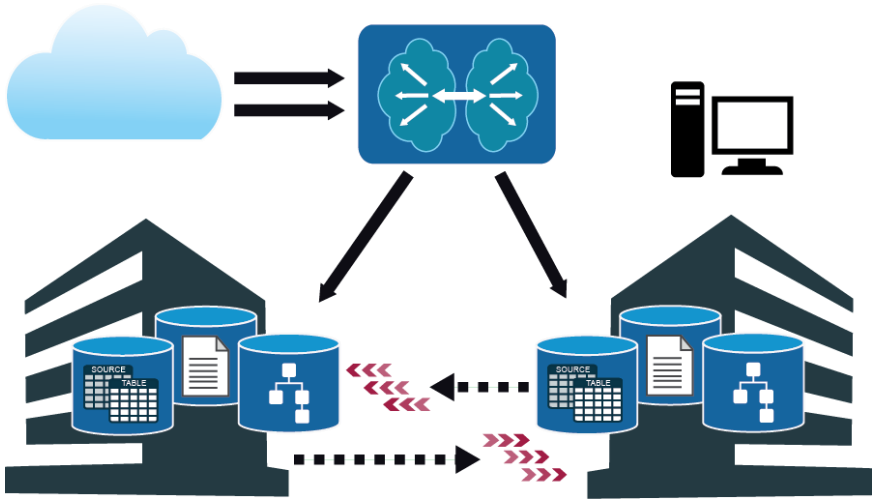
GDPS/A-?
Future considerations

GDPS / Active / Active

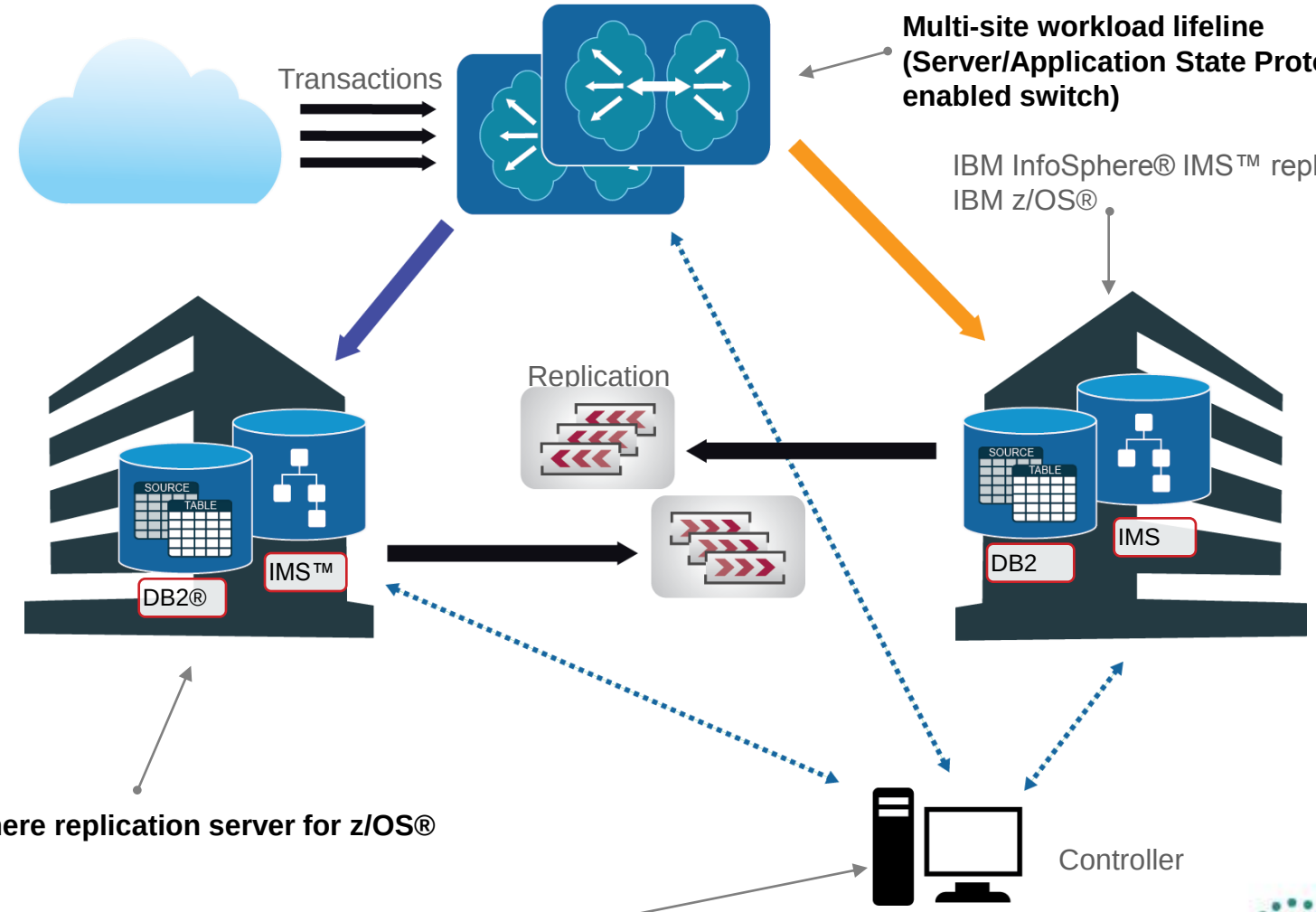
GDPS® Active/Active Continuous Availability helps provide Near-continuous Data and Systems Availability across sites separated by virtually unlimited distances

Solution features, 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.



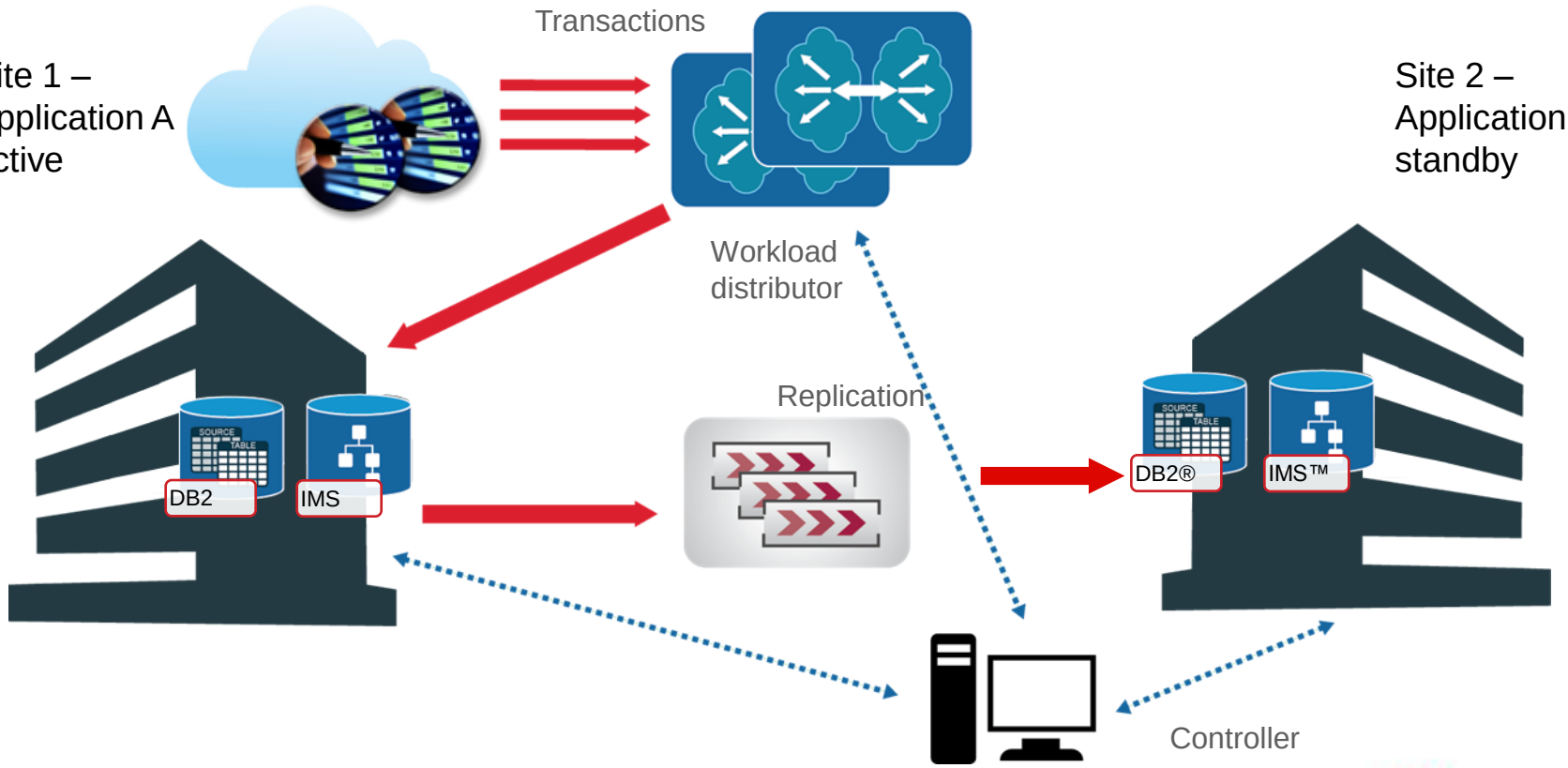
A Graphical Overview of the IBM GDPS® Active/Active Solution Concept



We currently provide the GDPS® Active-Standby Configuration, our future roadmap includes a Statement of Direction (SOD) for continued enhancements

GDPS Active-Standby Configuration

- Static routing
- Automatic failover



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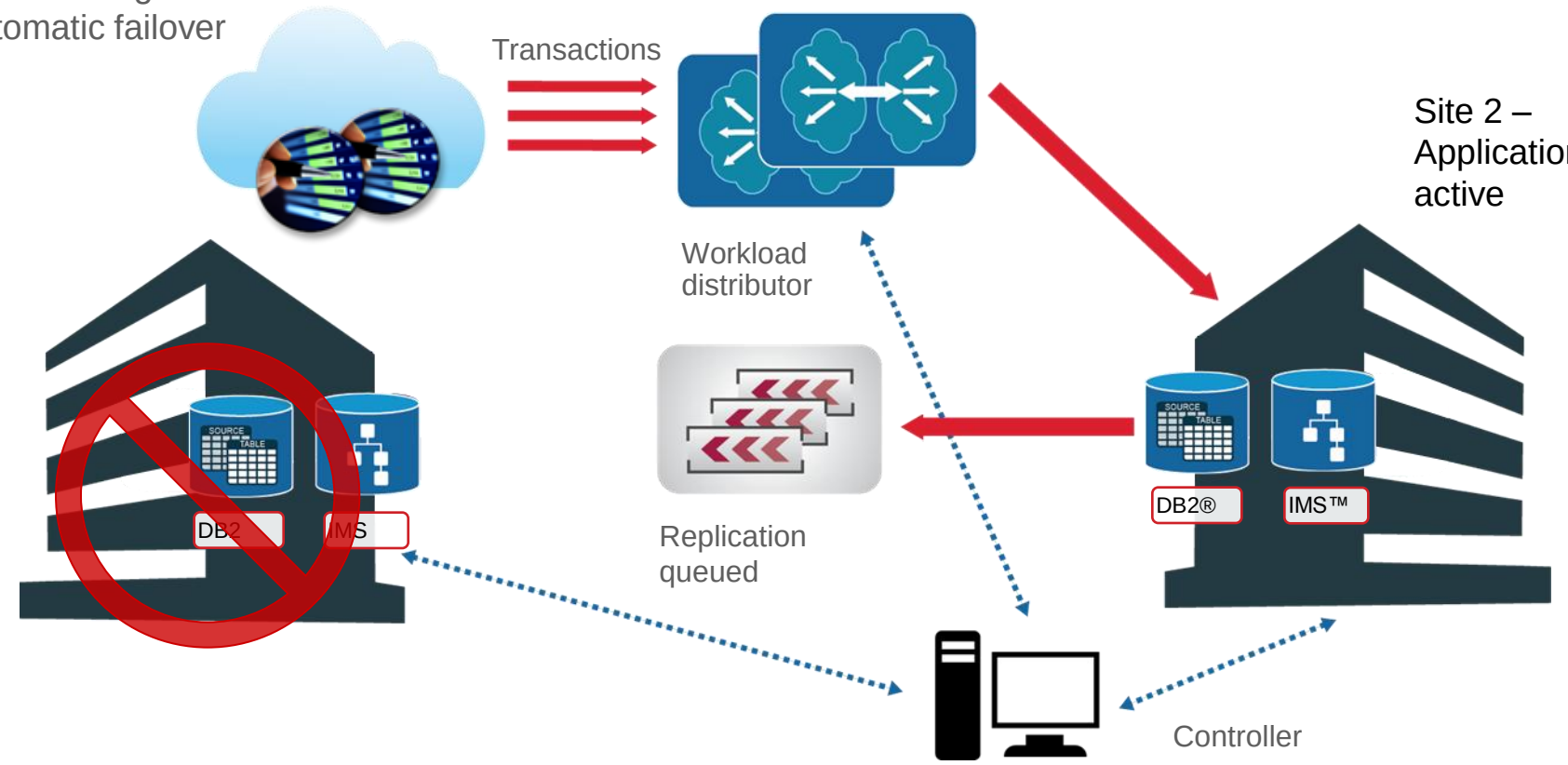
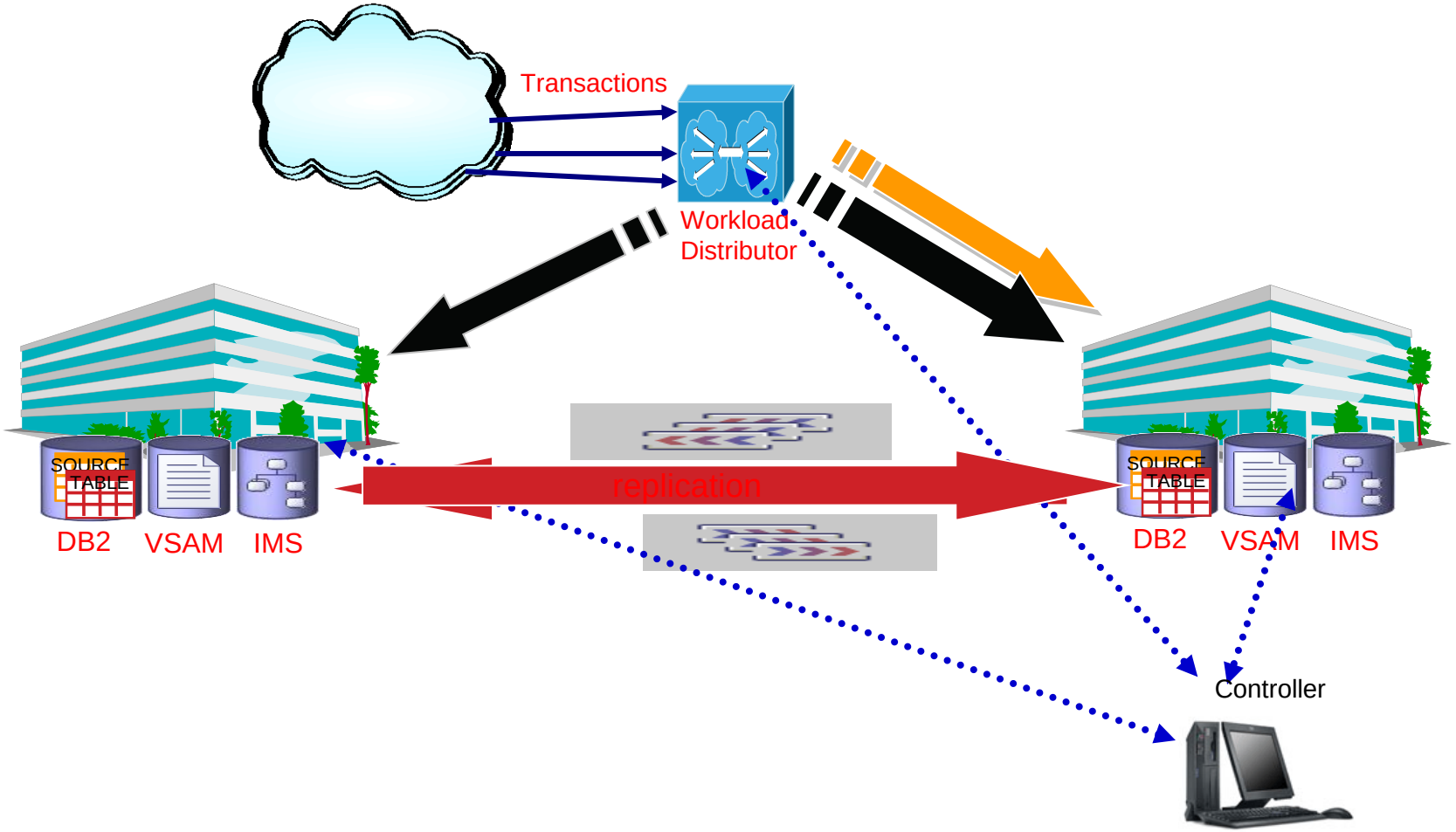
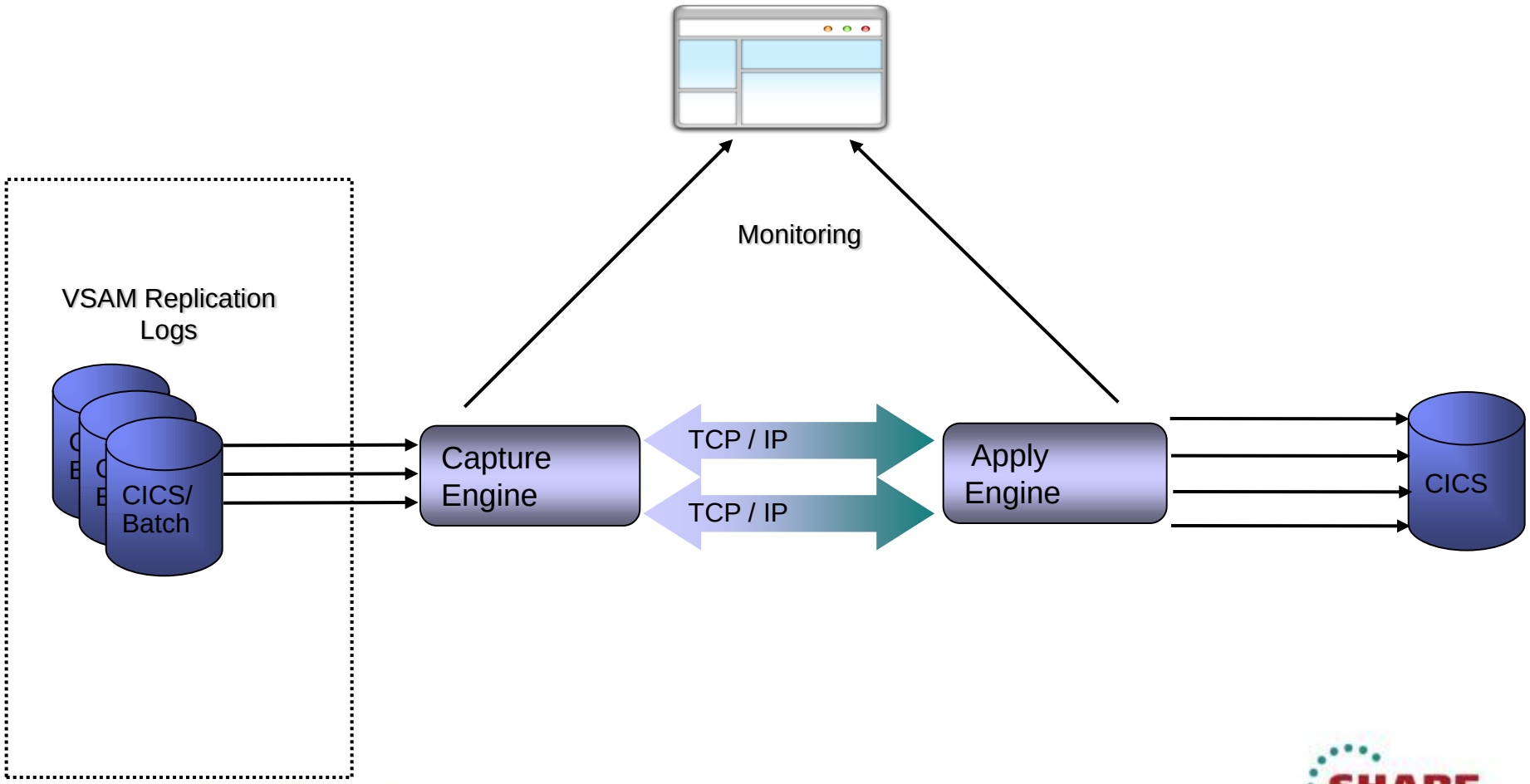


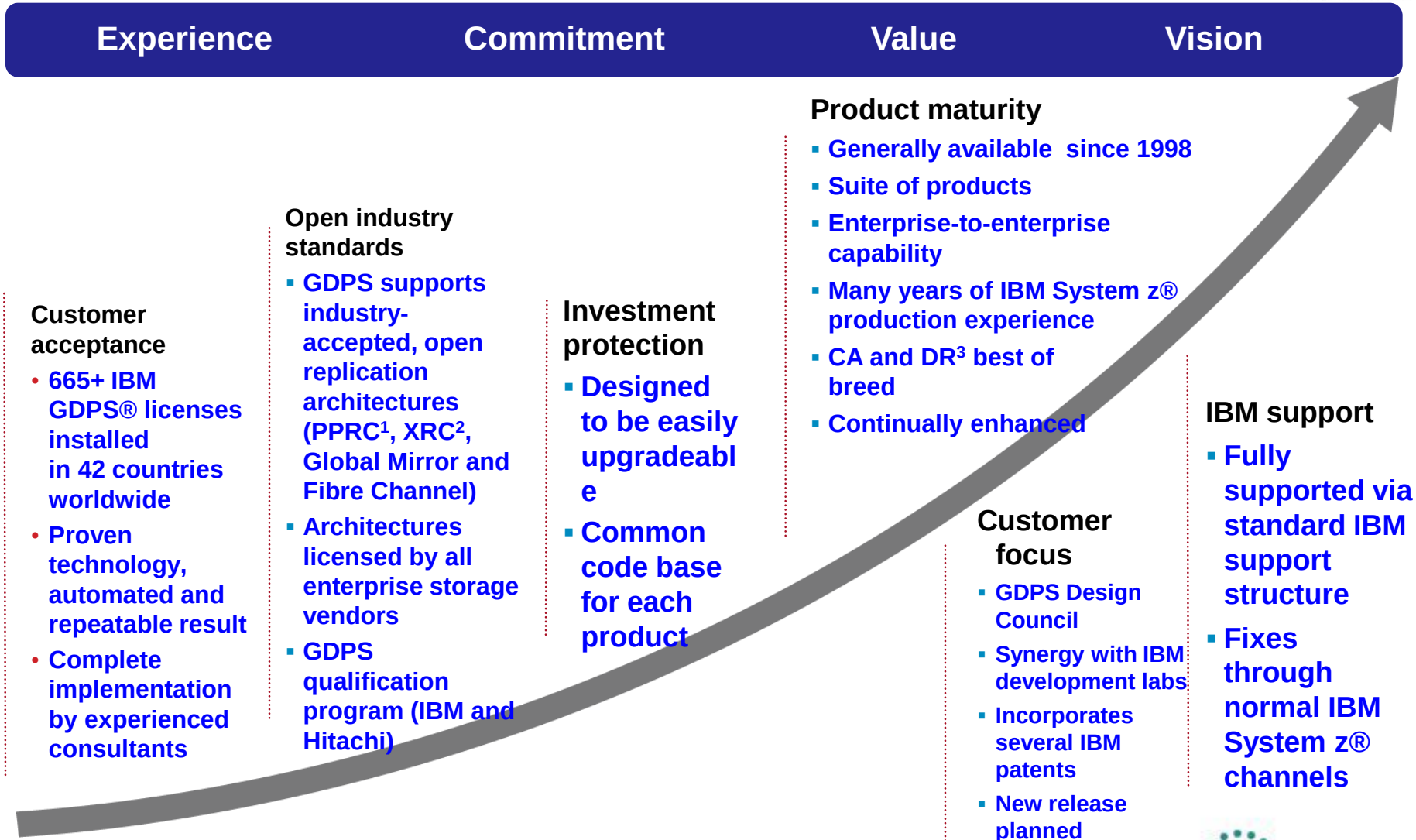
GDPS Active/Query Configuration (SOD)



InfoSphere VSAM Replication for z/OS (SOD)



What Value can the IBM GDPS Solution offer Your Organization?



[1]Peer to Peer Remote Copy (PPRC), [2]Extended Remote Copy (XRC), [3]Continuous availability and disaster recovery (CA and DR)

For More Information on GDPS®

- **GDPS External pages**
  - http://www-935.ibm.com/services/us/index.wss/offering/its/a1000189/
  - http://www-03.ibm.com/systems/z/advantages/gdps/
  - **GDPS Introduction and Overview Redbook**
    - http://www.redbooks.ibm.com/abstracts/sg246374.html
  - **GDPS Executive White Paper**
    - http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=SA&subtype=WH&htmlfid=ZSW01920USEN
  - **GDPS Active-Active White Paper**
    - ftp://public.dhe.ibm.com/common/ssi/ecm/en/zsw03194usen/ZSW03194USEN.PDF
- **eMail**
  - **gdps@us.ibm.com**

Note: put in screen show mode to activate hyperlinks

Dank u
Dutch

Merci
French

Спасибо
Russian

Gracias
Spanish

شكراً
Arabic

감사합니다
Korean

Tack så mycket
Swedish

धन्यवाद
Hindi

תודה רבה
Hebrew

Obrigado
Brazilian Portuguese

谢谢
Chinese

Dankon
Esperanto

Thank You !

ありがとうございます
Japanese

Trugarez
Breton

Tak
Danish

Danke
German

Grazie
Italian

நன்றி
Tamil

děkuji
Czech

ขอบคุณ
Thai

go raibh maith agat
Gaelic

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