Z/OS Academy:
DS8000 Copy Services Overview

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Agenda

- Data resiliency, types of disasters, mitigation strategies, Business Continuity
  - RPO, RTO, and consistency
- Copy services overview
  - Point-in-Time Copy
  - Synchronous Copy and Asynchronous Copy
- Management Software overview

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Why Data Resilience is important

Disasters Happen

A Disaster is any incident or event that interrupts access from decision-makers and applications to business data for whatever constitutes an unacceptable period of time

A Disaster is usually distinguished from a mere inconvenience (temporary crisis) by its duration

The nature of the business process impacted determine its tolerance for downtime, which is relative and contextual

Failures & Disasters

Cyber Attacks

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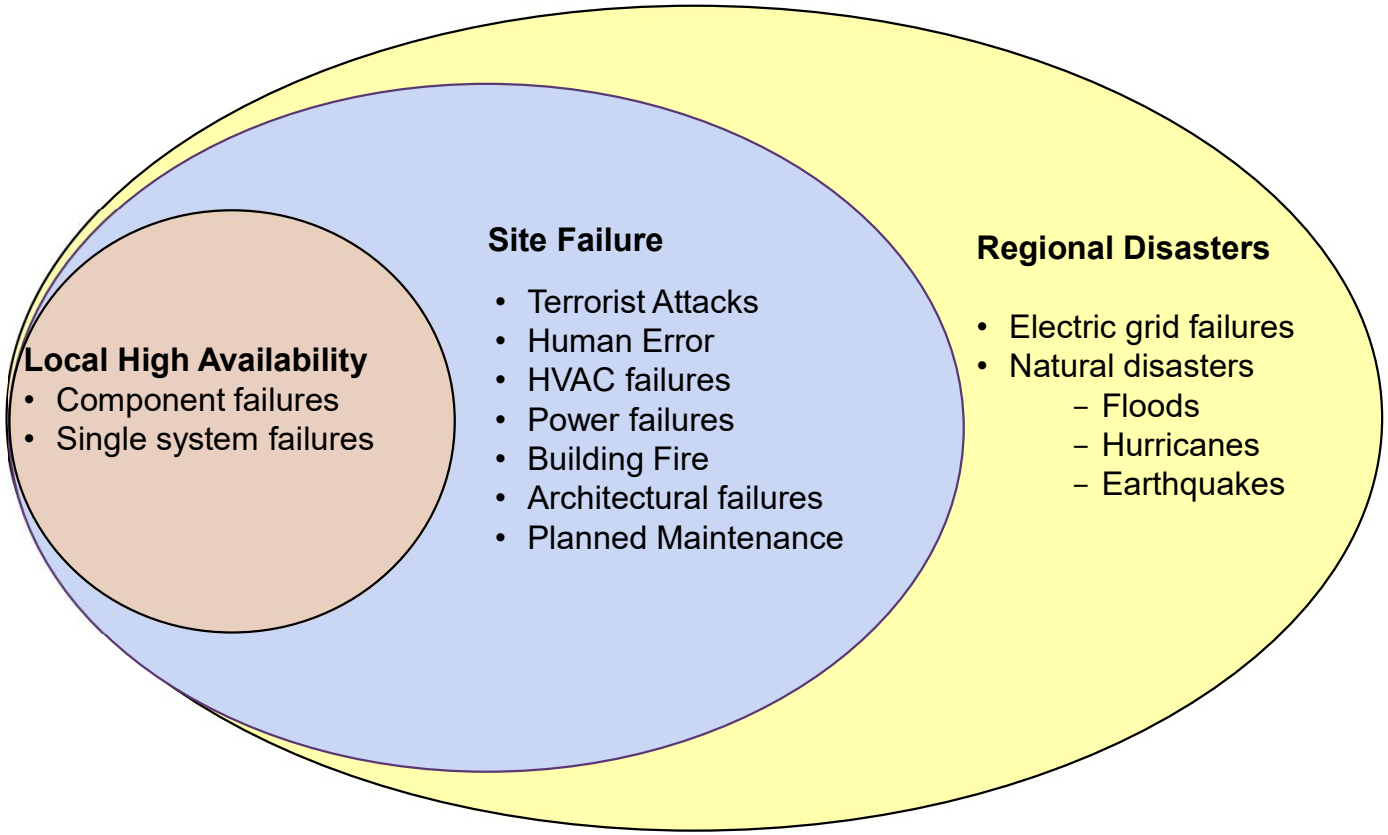
Types of disasters



Nowadays - **Logical Corruptions** thru malicious attacks must be considered too.

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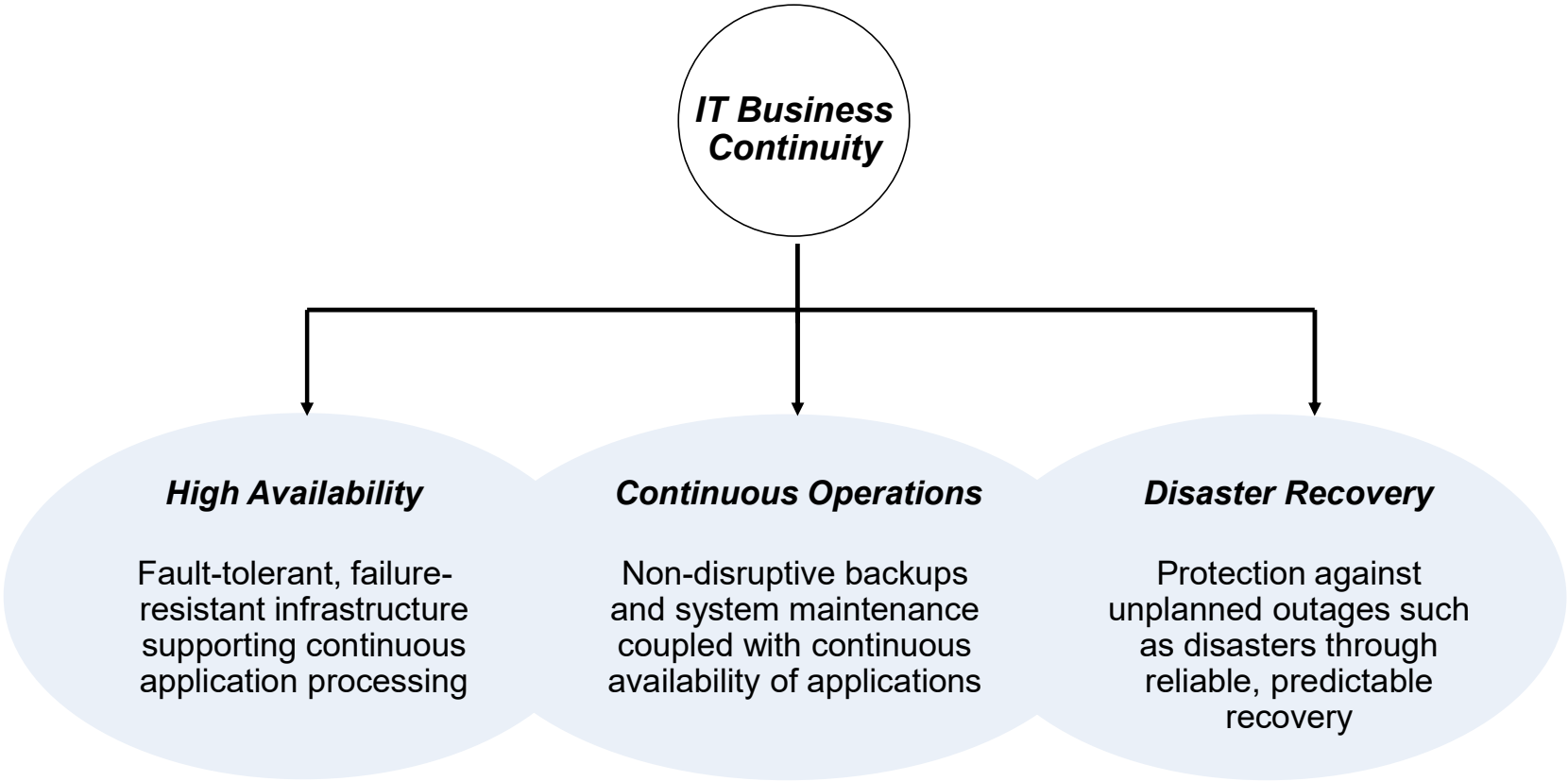
Terminology



Protection of critical Business data

Recovery is predictable and reliable

Operations continue after a disaster

Costs are predictable and manageable

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Business Continuity Objectives

Determine your Objectives for Business Continuity (by application)

Recovery Point Objective (RPO)

- How far behind the target volumes can be
- 'Currency' of data on target volumes
- How much 'data loss' can be tolerated?
- How much data can you afford to recreate?
- Often there is a tradeoff between RPO and
  - Application impact
  - Replication distance/bandwidth

Recovery Time Objective (RTO)

- How long it takes to bring up systems and applications
- How long can you afford to be without your systems?

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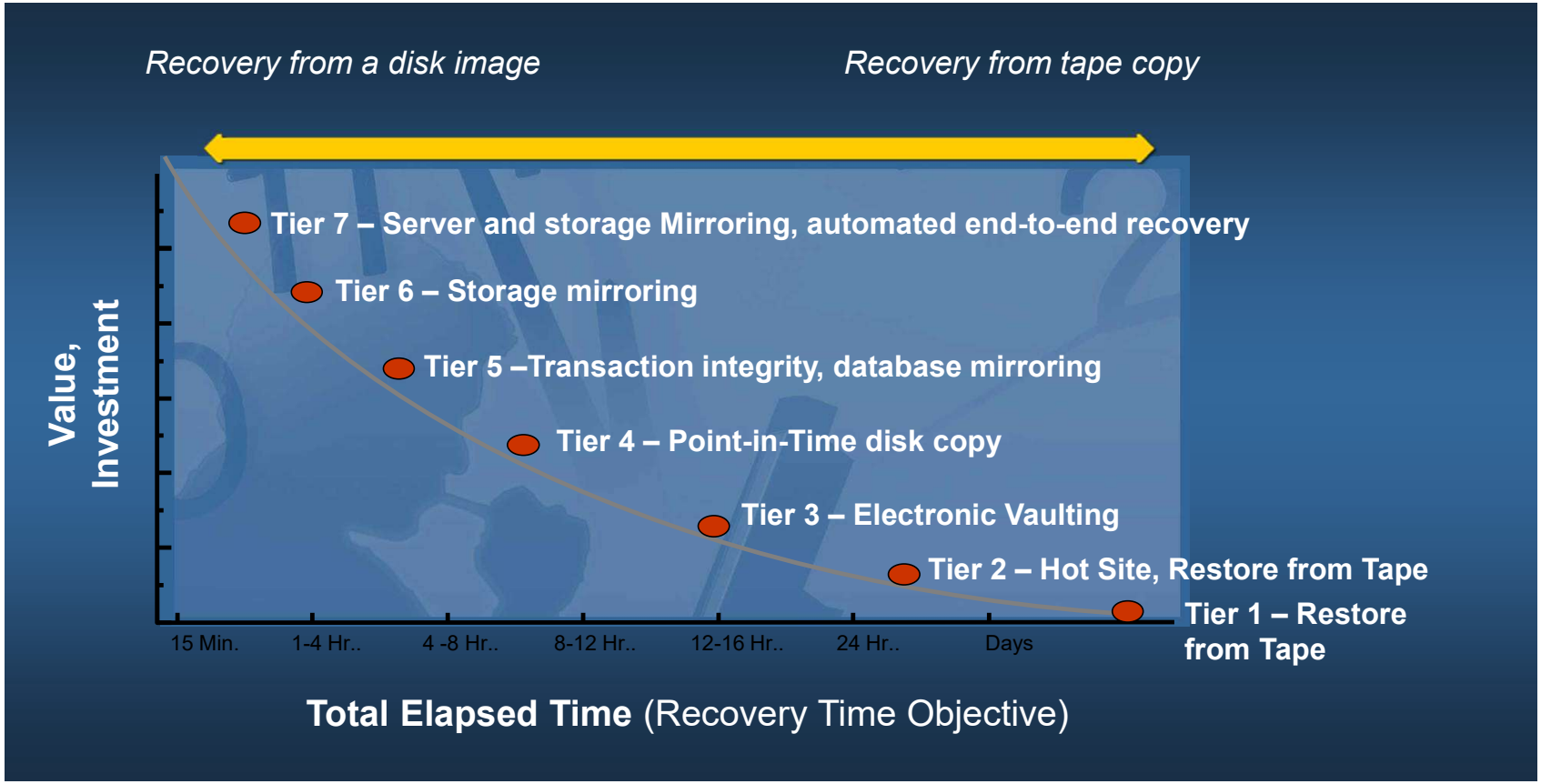
7 Tiers of IT Business Continuity and Technology



Match business process criticality with cost of recovery

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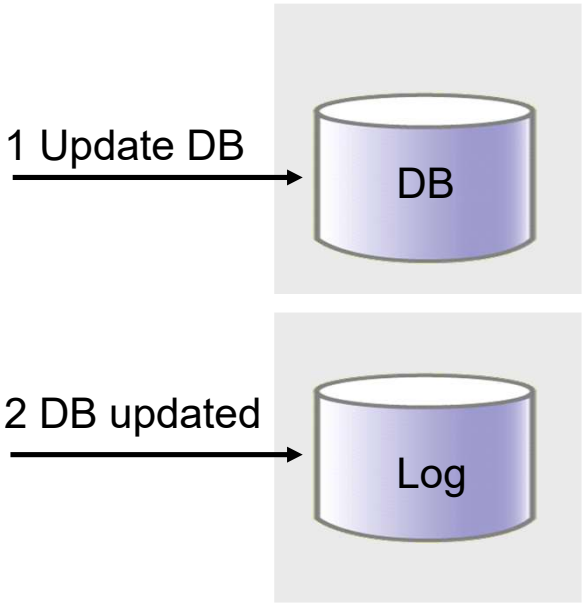
Data Consistency – Without Replication – Normal Operation



Consistency is managed by the application.

Database is updated, and then log is updated.

Database volumes and log volumes may be on the same or different storage subsystems.

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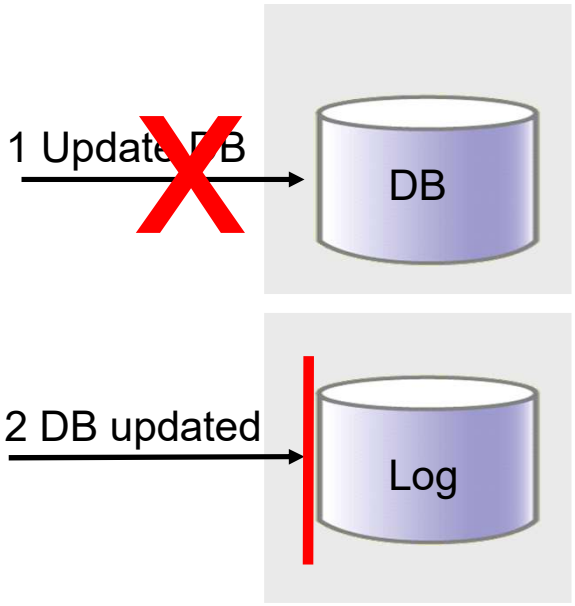
Data Consistency – Without Replication – Failure Situation



If there is a problem with updating the database (1), the application will prevent the write to the log (2).

Database volumes and log volumes may be on the same or different storage subsystems.

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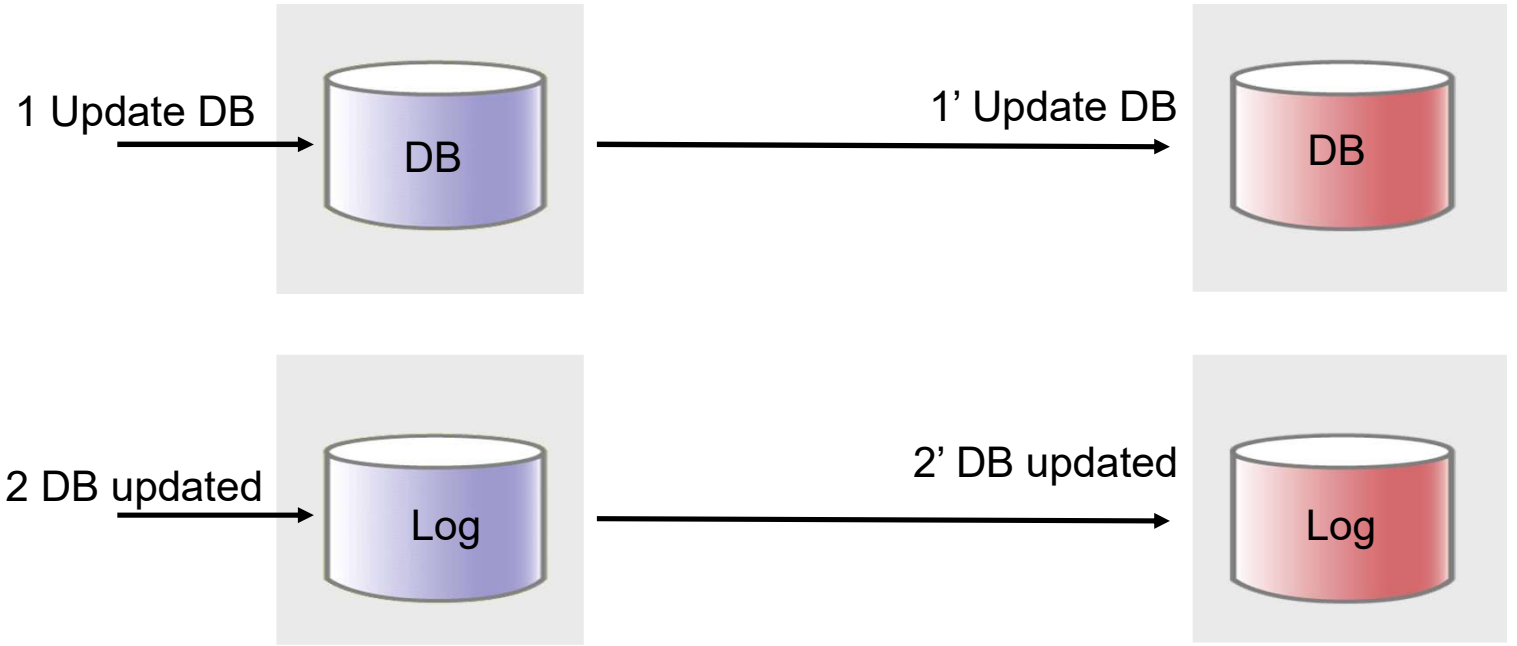
Remote Mirroring Consistency – Normal Operation



Replication solution must ensure that dependent write order is preserved on the target volumes.
DB updated must not be replicated unless Update DB has been replicated.
Database volumes & log volumes may be on the same or different storage subsystems.

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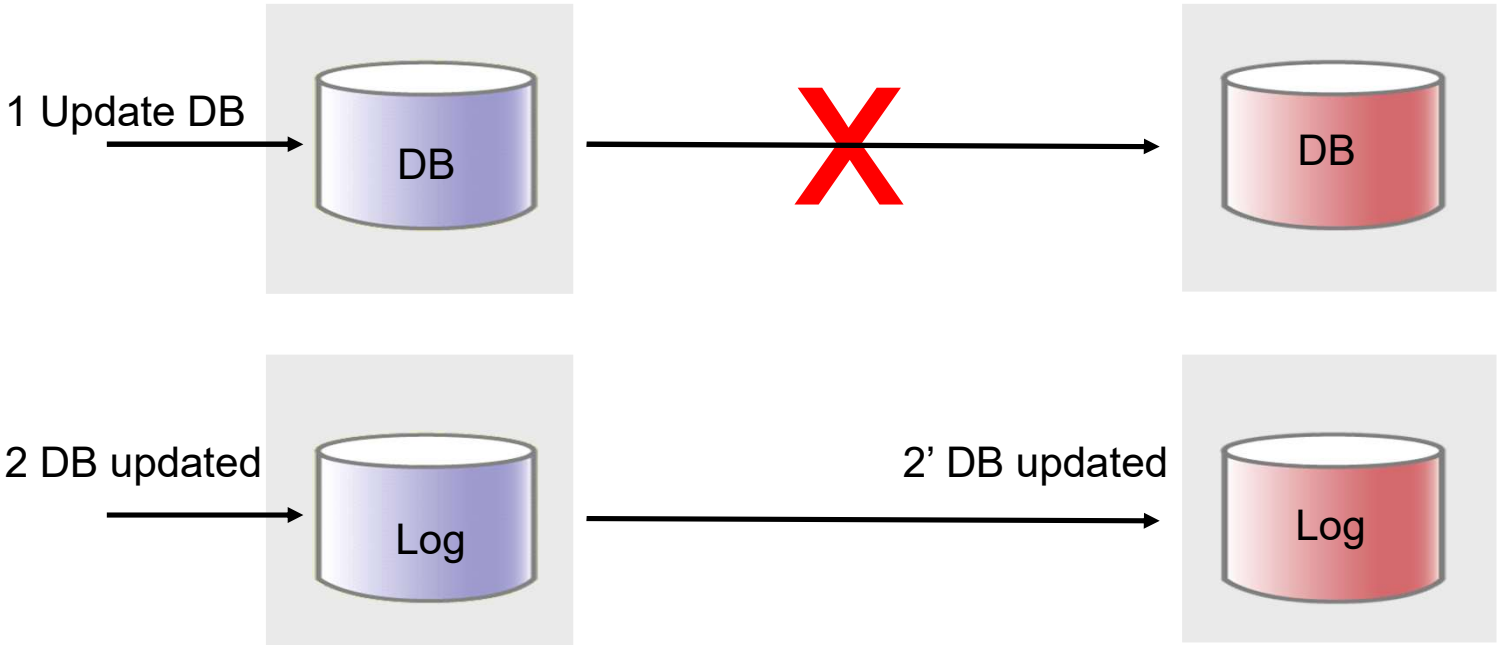
Remote Mirroring Partial Failure or Rolling Disaster



If replication of SOME volumes with dependent data fails or is stopped and replication of dependent writes is not stopped, data at remote may not be consistent.

If replication fails or is stopped for any volumes, remote mirroring replication solution must stop replication of all volumes with dependent data.

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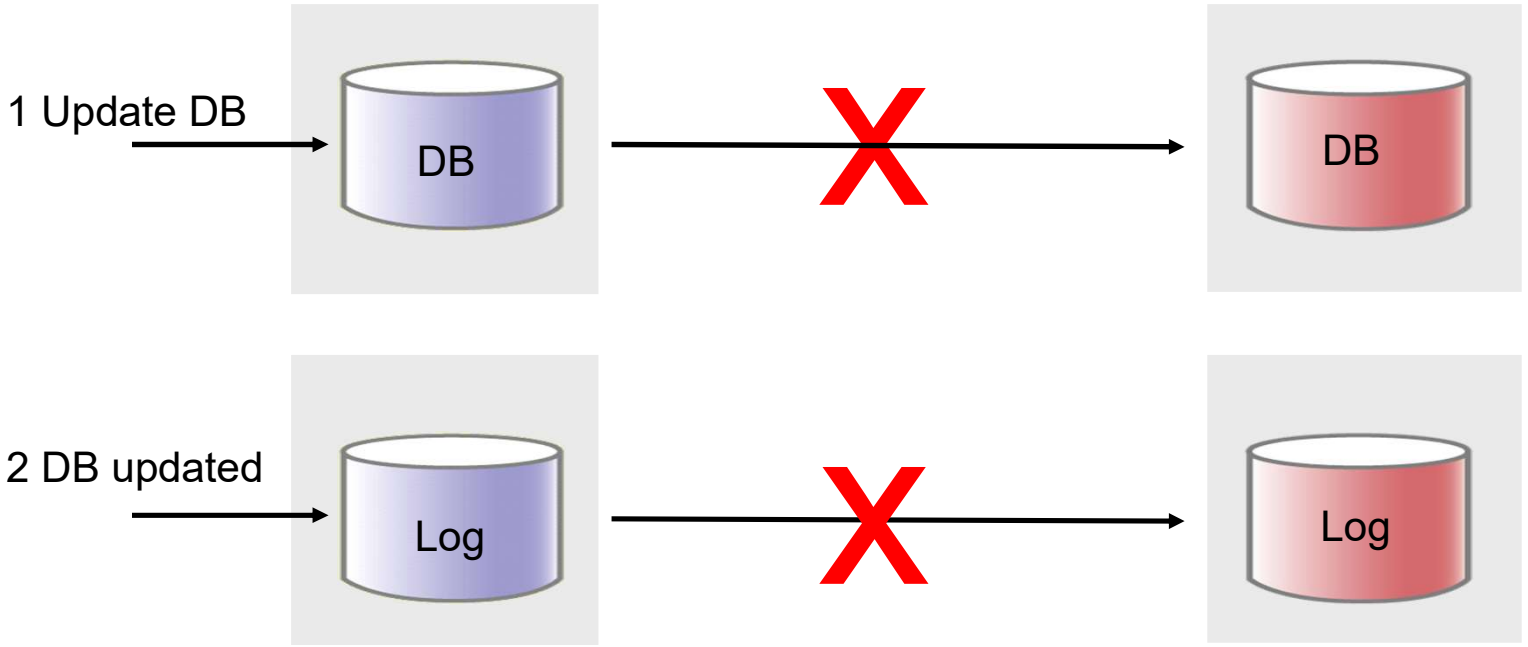
Remote Mirroring Consistency – Failure Situation



If replication of ALL volumes with dependent data fails or is stopped, no updates are replicated to remote so data at target is consistent.

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DS8000 Copy Services Overview

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DS8000 Copy Services solutions for your Business Resiliency requirements

FlashCopy

Safeguarded Copy

Point-in-time copy

Within the same Storage System

Metro Mirror

Synchronous mirroring

Primary Site A

Metro distance Site B

Global Mirror

Asynchronous mirroring

Primary Site A

Out of Region Site B

Metro/Global Mirror

Three- and four-site cascaded and multi-target synchronous and asynchronous mirroring

Primary Site A

Metro Site B

Out of Region Site C

DS8000 Copy Services fully integrated with GDPS and CSM to provide simplified CA and DR operations

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Point-in-Time Copy:

FlashCopy
Safeguarded Copy

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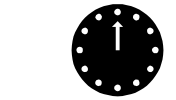
What is FlashCopy?

- Single system Point-in-Time copy (instant copy / T0 copy)
  - Source and target volumes immediately available for processing with full read/write access

- A hardware solution invoked by software
  - z/OS: DFSMSdss, TSO, ICKDSF, API, DS CLI
  - z/VM, z/VSE: ICKDSF, host commands, DS CLI
  - CSM
  - GDPS



Point in Time (PiT) Copy

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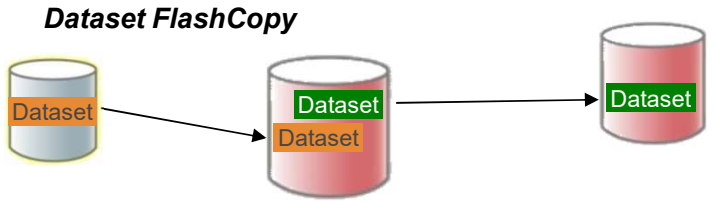
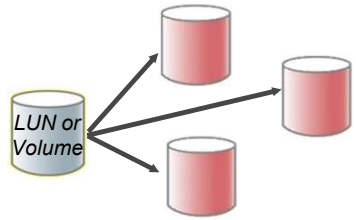
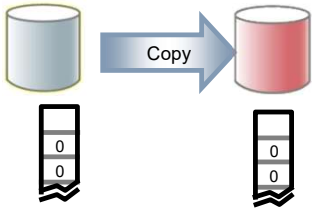
DS8000 FlashCopy overview

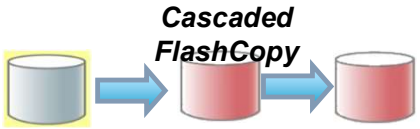
- Volume or dataset level
- Up to 64000 FlashCopy relations
- Multiple relationship FlashCopy (up to 12 targets)
- Incremental FlashCopy
- With or without background copy
- FlashCopy consistency groups
- Cascaded FlashCopy
- Common options
  - Persistent
  - Enable change recording
  - Allow target online
  - Allow target on existing PPRC primary
- Advanced options
  - Inhibit writes to source / Inhibit writes to target
  - Restore source to pre-FlashCopy state (Reverse)





Incremental FlashCopy Change Recording
(Tracks change since last FlashCopy)





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What else do you need to know about FlashCopy?

- DS8000 FlashCopy (FC) is a **Point-in-time copy** function that is using **Copy-on-Write** technology
- Can be space efficient using extent space efficient (ESE) volumes, incremental and cascaded
- **Cascaded FlashCopy** simplifies lots of use cases
- FC has a minimal temporary application impact only during consistency creation
- FlashCopy is supported with remote replication
  - Limitations in 3-site or 4-site replication topologies
  - **FC onto Global Mirror** is supported with Rel. 8.5.4 and higher
- Powerful function for various use cases, like Backup, Cloning, LCP and so on.
- If a Copy Service (FlashCopy) license is enabled, some commands use FC as a default (like z/OS DFSMSdss DEFRAG)
- **Consider FlashCopy background workload in a storage system sizing**
- **Max. volume** size with Copy Service is 4 **TB (FB)** / **1 TB (CKD)**

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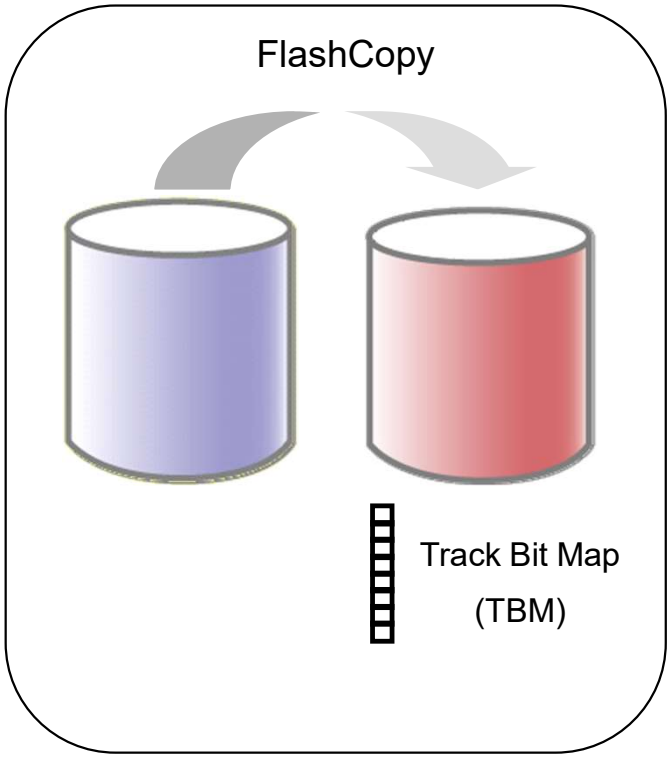
FlashCopy Initialization (‘Establish’)



- Request copy from source to target
  - FlashCopy relationship created between the volumes
  - Target is available for processing once the relationship is created
- A relationship between source and target volumes is set up, including a Track Bit Map (TBM) which will be used to show which tracks for the Point-in-Time image have been physically copied from source to target
- When the FlashCopy relationship has been ‘established’ (e.g. thousands of volumes in under a second), *the target is immediately accessible for read and write.*
- Physical copying of tracks from source to target occurs as needed (‘copy on write’) or sequentially as a background task.
- *Target volume is offline/not mounted during establish*.
  - System z DFSMSdss is an exception

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Use cases for FlashCopy

- Reduced Backup window
  - No application impact
  - Target immediately available to backup server, release after dump is complete
- Data Backup
  - Reduced restore/recovery time
  - Incremental option makes future backups efficient
  - Multi-target allows checkpointing/versioning
    - Regular DB restore point
    - Pre-batch restore point
    - Nightly market results
- DR backup
  - Maintain consistent copy during resynchronization
  - Create consistent copy before replication
- Protection from corruption (logical errors)
  - Operational errors
  - Application, middleware, ransomware, operating system, hardware errors
- Immediate use of production data without impact to production servers
- Extra copies for business processes:
  - Parallel processing (e.g. seismic data)
  - Analysis: data warehousing, data mining, business intelligence
  - Reporting
  - Clones/instances
    - For internal use
    - For business partners and vendors
    - Mount to several different servers
- Extra copy for IT processes:
  - Versioning (Retaining multiple checkpoints)
  - Test / Development
  - Support
  - Airgap

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Challenges with using FlashCopy for Logical Corruption Protection

- **Addressing requirements** of multiple FlashCopy target devices
  - Each FlashCopy target consumes a volume on the DS8000 restricting the number of copies that can be created
  - FlashCopy target devices could also consume **UCBs**
  - **Limit of 12** copies also an issue although other considerations probably mean this limit is not reached in practice
  - **Maximum of 65,280** logical volumes within DS8000 (255 LSSs each containing a maximum of 256 devices)
- **Space Requirements** using Thin Provisioned devices
  - The **21-cylinder** unit used for Extent Space Efficient devices is optimized for host and FlashCopy performance and is not as efficient as a smaller (e.g., track level) allocation unit especially for sparse updates
- **Performance impact** of maintaining large number of FlashCopy relationships
  - Updates to the production volume are copied to all FlashCopy target devices increasing the impact as more FlashCopies are created
- **Securing** the FlashCopy target volumes
  - FlashCopy volumes are normal production volumes and can be mapped to a host so extra efforts need to be made to secure these

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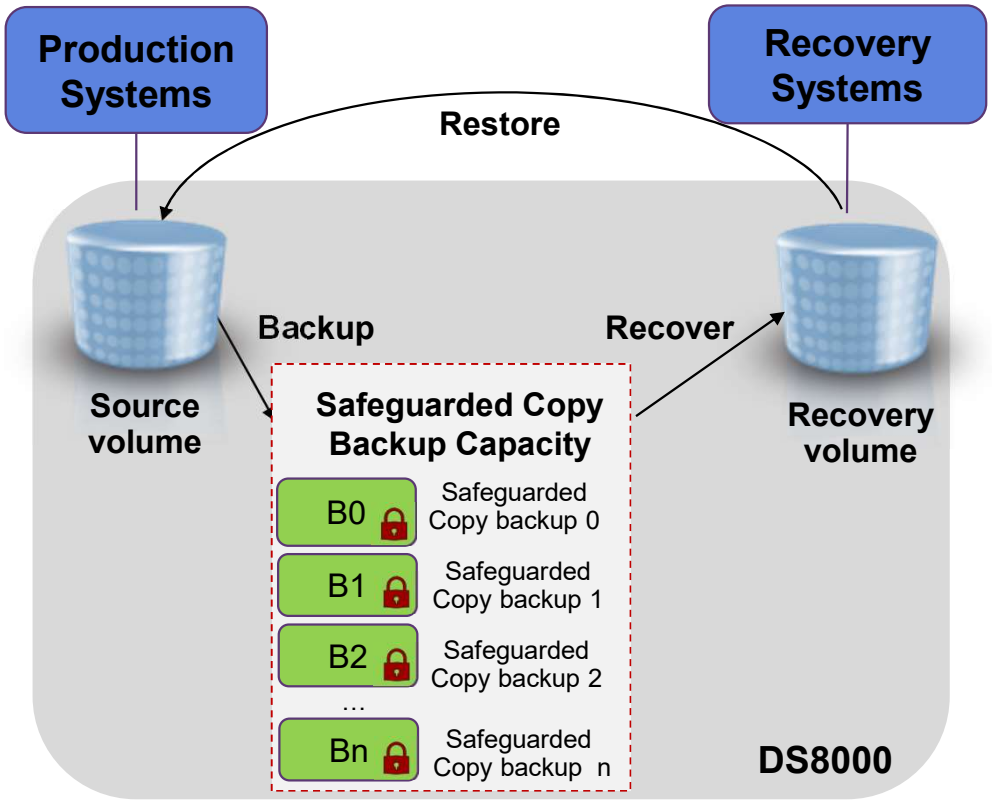
Logical Corruption Protection with DS8000 Safeguarded Copy



- Safeguarded Copy provides functionality to create up to 500 protected and consistent backups for a source volume
- Backups are stored in a storage space that is called Safeguarded Copy Backup Capacity which is hidden and not accessible by any server
- The data can only be accessed after a Safeguarded Copy Backup is recovered to a separate recovery volume.
- Recovery volumes can be used with a recovery system to perform data validation, forensic analysis or to restore production data. It is also possible to restart the production systems directly on the Recovery Volume.
- Safeguarded Copy is operating system independent and can be used with fixed block or CKD volumes
- It requires external management software (CSM or GDPS)

It used to recover from logical corruption events, like:

Ransomware Attacks
Intentional deletion
Selective Manipulation

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Replication:

Metro Mirror
Global Copy / Global Mirror

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DS8000 remote-mirroring options

Metro Mirror (MM) – Synchronous Mirroring

- Synchronous mirroring with consistency at remote site
  - RPO of 0

Global Copy (part of MM and GM) – Asynchronous Mirroring

- Asynchronous mirroring without consistency at remote site
  - Consistency manually created by user
    - RPO determined by how often user is willing to create consistent data at the remote

Global Mirror (GM) – Asynchronous Mirroring

- Asynchronous mirroring with consistency at the remote site
  - RPO between 2–4 seconds

Metro/Global Mirror – Synchronous / Asynchronous Mirroring

- Three-site mirroring solution using Metro Mirror between site 1 and site 2 and Global Mirror between site 2 and site 3
  - Consistency maintained at sites 2 and 3
    - RPO at site 2 near 0
    - RPO at site 3 near 0 if site 1 is lost
    - RPO at site 3 between 2–4 seconds if site 2 is lost

z/OS Global Mirror (zGM, aka. XRC)

- Asynchronous mirroring with consistency at the remote site
  - RPO between 2–4 seconds
- Timestamp based
- Managed by System Data Mover (SDM)
  - Data moved by System Data Mover (SDM) address space(s) running on z/OS
  - Supports heterogeneous storage systems
- Supports z/OS, z/VM and Linux on Z data
- DS8900F being last generation for this

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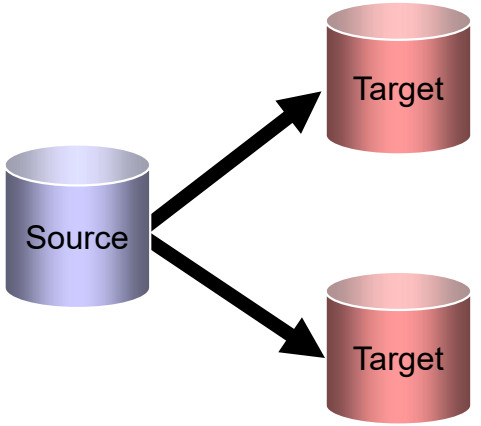
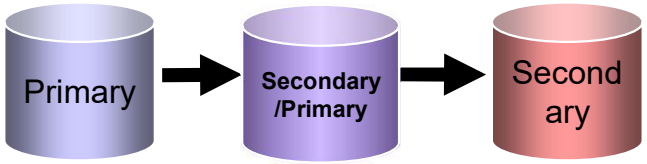
DS8000 Replication Concepts

- **Multi-target**
  - One source with multiple targets
    - A target can only have 1 source
  - FlashCopy
  - Metro Mirror + Global Mirror



- **Cascading**
  - An intermediate volume acts as primary and secondary
  - Primary → secondary / primary → secondary
  - Remote mirroring + remote mirroring
  - Remote mirroring + FlashCopy
  - FlashCopy + Remote mirroring



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Metro Mirror

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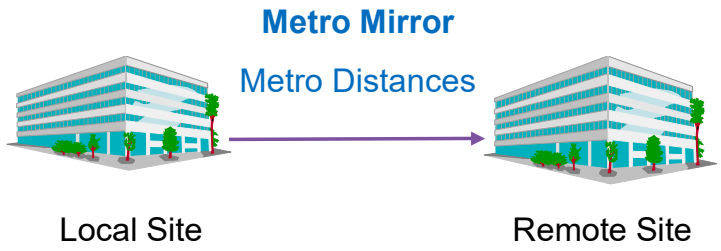
Everything you need to know about IBM DS8000 Metro Mirror

- **Metro Mirror (MM) is a storage hardware based synchronous mirroring solution with data consistency**
  - **Designed for zero data loss**
- Established at volume level
- Enables HyperSwap **z/OS, AIX and IBM i**



- **Multi-Target PPRC** (DS8870 or newer) allows two synchronous copies from the primary storage system.
- **300 km distance between storage system is supported.**
- **Application response time impact by copy delay of write I/Os.**
- Use Copy Services Management software to establish data consistency across storage systems / LSSs
  - IBM Copy Services Manager / GDPS / IBM PowerHA SystemMirror for AIX / IBM i
- **Max. volume size** with Copy Service is **4 TB** (FB) / **1 TB** (CKD)

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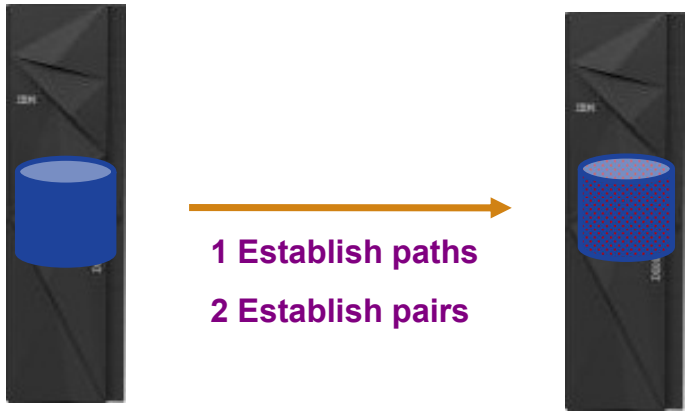
Metro Mirror configuration

1. Establish PPRC physical and logical paths
2. Establish Metro Mirror relationships



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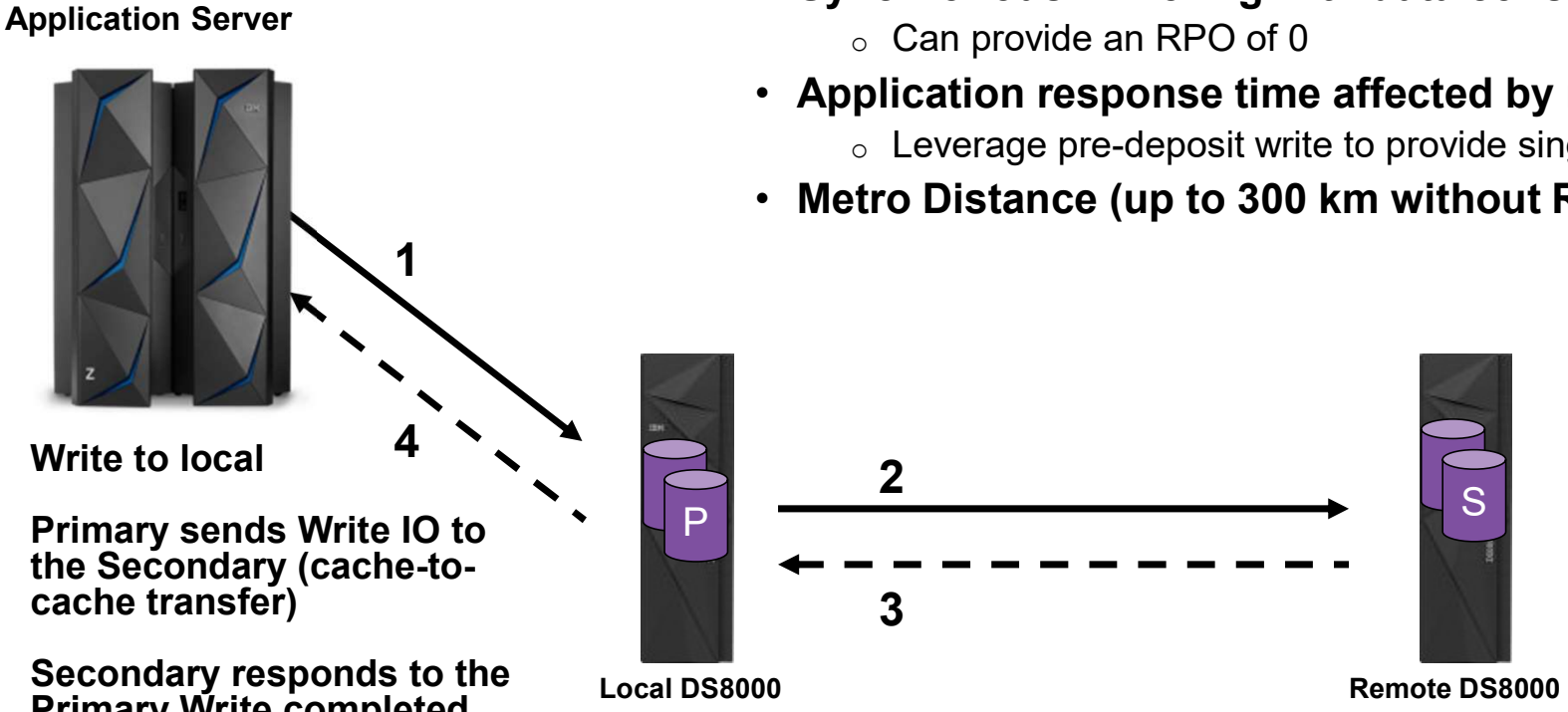
DS8000 Metro Mirror normal operation

Metro Mirror

- **Synchronous mirroring with data consistency**
  - Can provide an RPO of 0
- **Application response time affected by remote-mirroring distance**
  - Leverage pre-deposit write to provide single round trip communication
- **Metro Distance (up to 300 km without RPQ)**



1. **Write to local**
2. **Primary sends Write IO to the Secondary (cache-to-cache transfer)**
3. **Secondary responds to the Primary Write completed**
4. **Primary acknowledges Write complete to application**

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Global Copy

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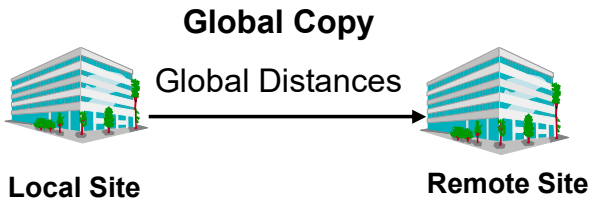
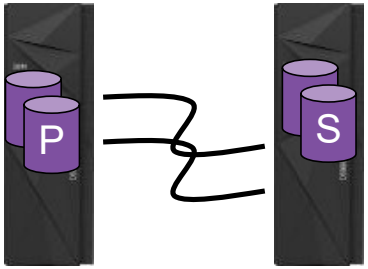
Everything you need to know about IBM DS8000 Global Copy

- **Global Copy (GC) is a storage hardware based asynchronous mirroring solution which doesn't inherently provide data consistency**
- Metro Mirror / Global Mirror Copy Service license bundle also includes the Global Copy function
- Established at volume level
- GC is used as a transfer mechanism in Global Mirror and it is used in the "first copy phase" of Metro Mirror
- Global Copy is very often used in storage-based data-migration scenarios
  - Cascaded Global Copy is supported



- **Distance between storage systems is unlimited.**

- **Application independent with minimal performance impact to write I/Os**
  - **For best replication performance** (Metro Mirror, Global Copy or Global Mirror), assign even and odd LSS/LCU to different ports



- **Max. volume size** with Copy Service is **4 TB** (FB) / **1 TB** (CKD)

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Global Copy configuration

1. **Establish PPRC physical and logical paths**
2. **Establish Global Copy relationships**

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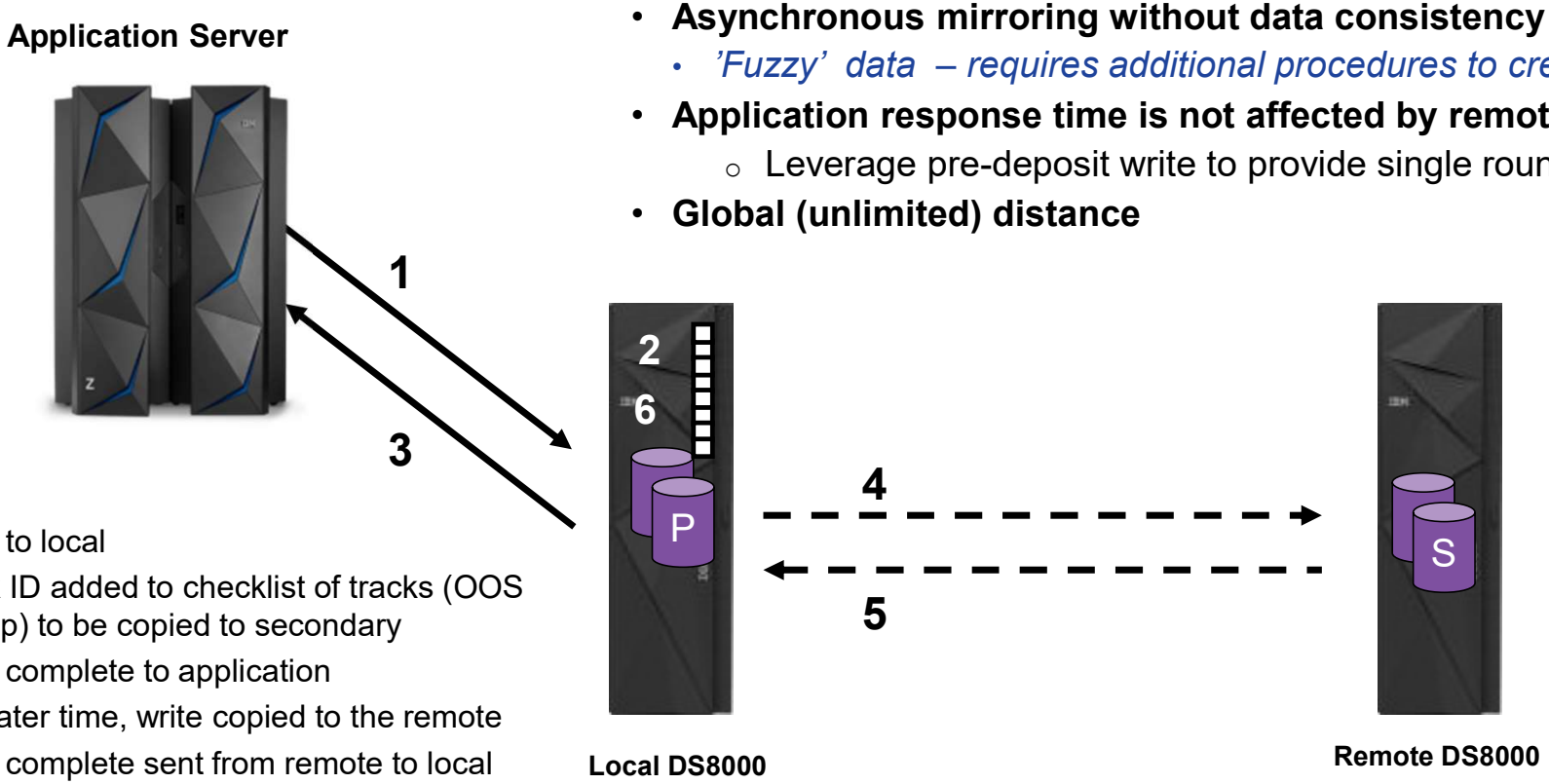
DS8000 Global Copy normal operation



- **Asynchronous mirroring without data consistency**
  - *'Fuzzy' data – requires additional procedures to create consistency*
- **Application response time is not affected by remote mirroring distance**
  - Leverage pre-deposit write to provide single round-trip communication
- **Global (unlimited) distance**

1. Write to local
2. Track ID added to checklist of tracks (OOS bitmap) to be copied to secondary
3. Write complete to application
4. At a later time, write copied to the remote
5. Write complete sent from remote to local
6. Track ID removed from checklist ('Out-of-sync' or OOS bitmap)

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Global Copy – creating consistency

There are 3 approaches to creating consistency with Global Copy:

1. **Stop updates at source (quiesce application)**
   - Wait for all data to be replicated to the target
   - Suspend, or use FlashCopy to create an additional consistent copy

2. **Transition to synchronous mode and suspend as soon as data is consistent (*aka* 'duplex') at remote**
   - Optionally use FlashCopy to create an additional consistent copy and then resume mirroring

3. **Create a consistent FlashCopy at the *local* site and then replicate it with Global Copy**

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Global Mirror

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Everything you need to know about IBM DS8000 Global Mirror

- **Global Mirror (GM)** is a storage hardware based **asynchronous mirroring solution with data consistency**
  - Recovery Point Objective is 2–4 seconds
  - Works across multiple storage systems (up to 33 GM primaries)
- ***Global Mirror** is a **combination of FlashCopy, Global Copy** and **automated consistency creation***
- **Global Mirror can be combined with Metro Mirror and Global Copy to build 3- or 4-Site solution**
  - Can be done in a Multi-Target PPRC, or cascaded configuration
- **Global (unlimited) distance** between storage systems is supported
- **Minimal application impact**
  - For best replication performance assign even and odd LSS/LCU to different ports
- System z and open systems data in a single consistency group
- Use of Copy Services Management software for managing the relationship is best practice
  - IBM Copy Services Manager / GDPS
- **Max. volume size** with Copy Service is **4 TB** (FB) / **1 TB** (CKD)

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Global Mirror initialization

1. **Establish PPRC Paths**
2. **Establish Global Copy relationships**
3. **Complete Global Copy initial copy (‘first pass’)**
4. **Establish FlashCopy**
5. **Define local volumes to Global Mirror Session (consistency group)**
6. **Begin Global Mirror consistency formation**
   - User-specified or autonomic interval

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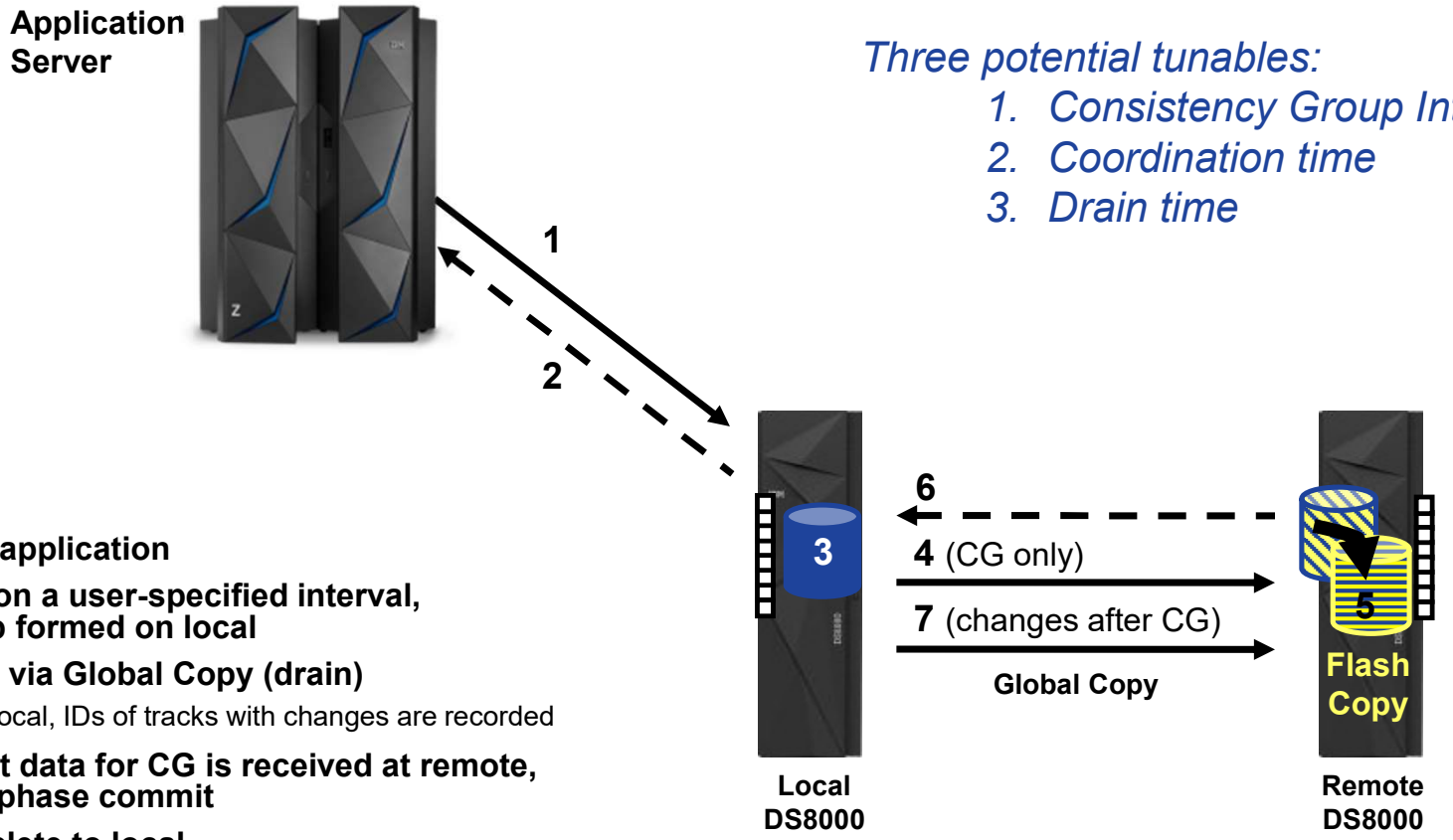
DS8000 Global Mirror normal operation



Three potential tunables:

1. *Consistency Group Interval (CGI)*
2. *Coordination time*
3. *Drain time*

1. **Write to local**
2. **Write complete to application**
3. **Autonomically or on a user-specified interval, consistency group formed on local**
4. **CG sent to remote via Global Copy (drain)**
   - If writes come in to local, IDs of tracks with changes are recorded
5. **After all consistent data for CG is received at remote, FlashCopy with 2-phase commit**
6. **Consistency complete to local**
7. **Tracks with changes (after CG) are copied to remote via Global Copy, and FlashCopy Copy-on-Write preserves consistent image**

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Metro Global Mirror

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Metro/Global Mirror Overview

- **3-site, volume-based hardware replication**
  - 4-volume design (Global Mirror FlashCopy target may be Space Efficient)
- **Combination of Synchronous (Metro Mirror) + Asynchronous (Global Mirror)**
  - Continuous + near-continuous replication
  - Cascaded or multi-target
- **Metro Distance + Global Distance**
- **RPO as low as 0 at intermediate or remote for local failure**
- **RPO as low as 2–4 seconds at remote for failure of both local and intermediate sites**
- **Application response time impacted only by distance between local and intermediate**
  - Intermediate site may be co-located at local site
- **Fast resynchronization of sites after failures and recoveries**
- **Single consistency group may include open systems, IBM Z and IBM i volumes**

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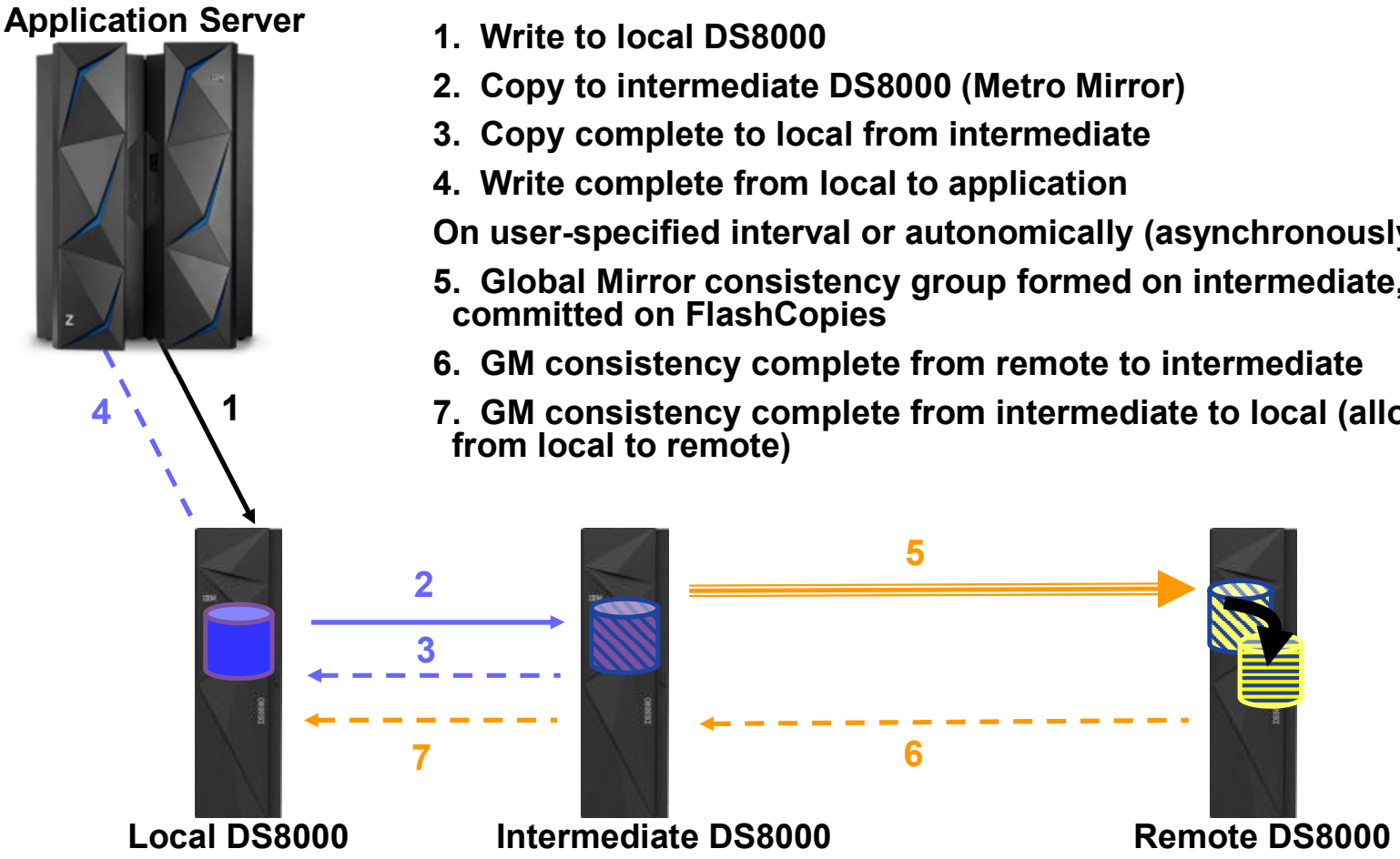
Metro/Global Mirror Normal Operation



1. Write to local DS8000
2. Copy to intermediate DS8000 (Metro Mirror)
3. Copy complete to local from intermediate
4. Write complete from local to application

On user-specified interval or autonomically (asynchronously)

5. Global Mirror consistency group formed on intermediate, sent to remote, and committed on FlashCopies
6. GM consistency complete from remote to intermediate
7. GM consistency complete from intermediate to local (allows for incremental resynch from local to remote)

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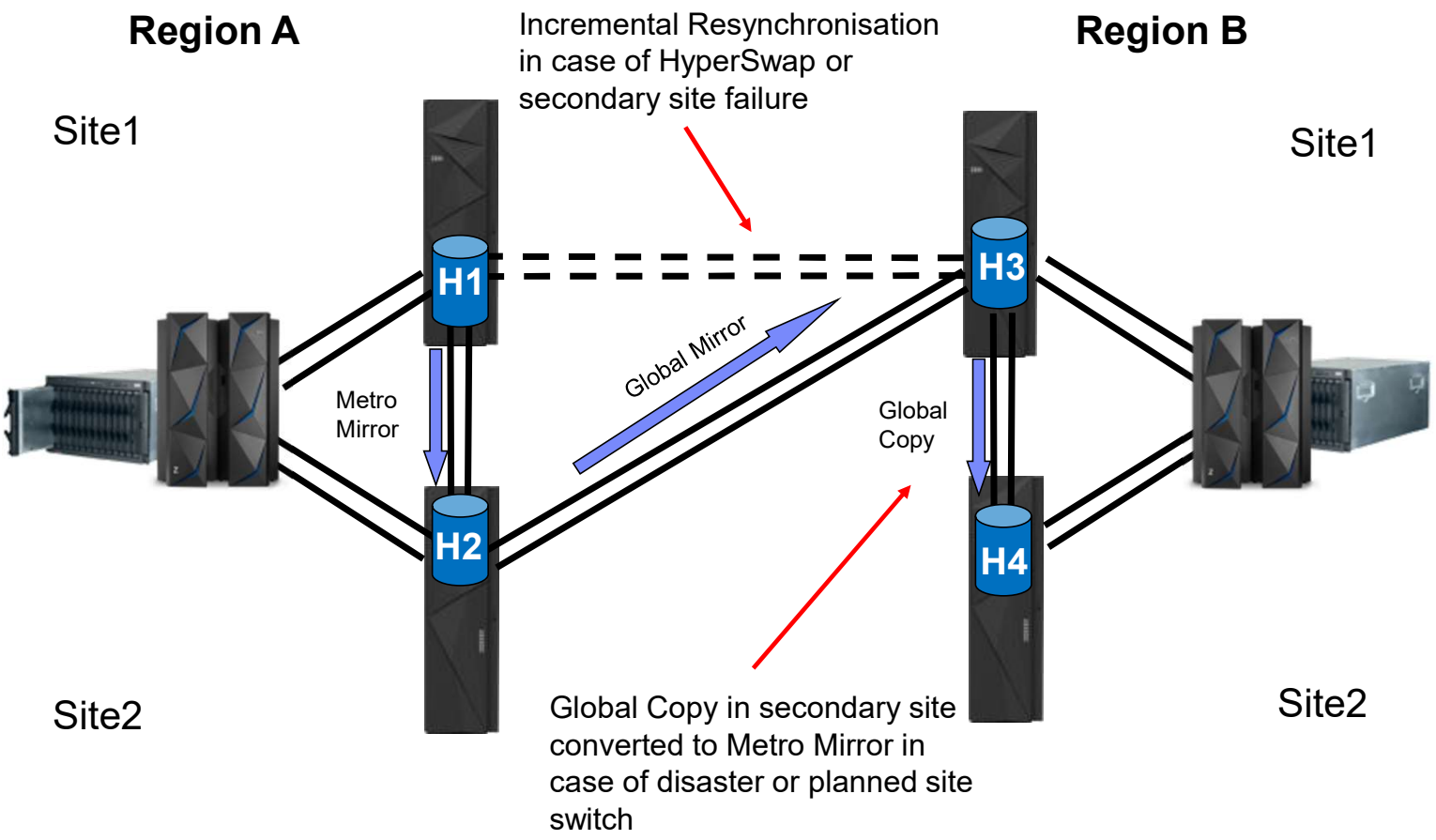
4-site topology with Metro/Global Mirror (cascaded)



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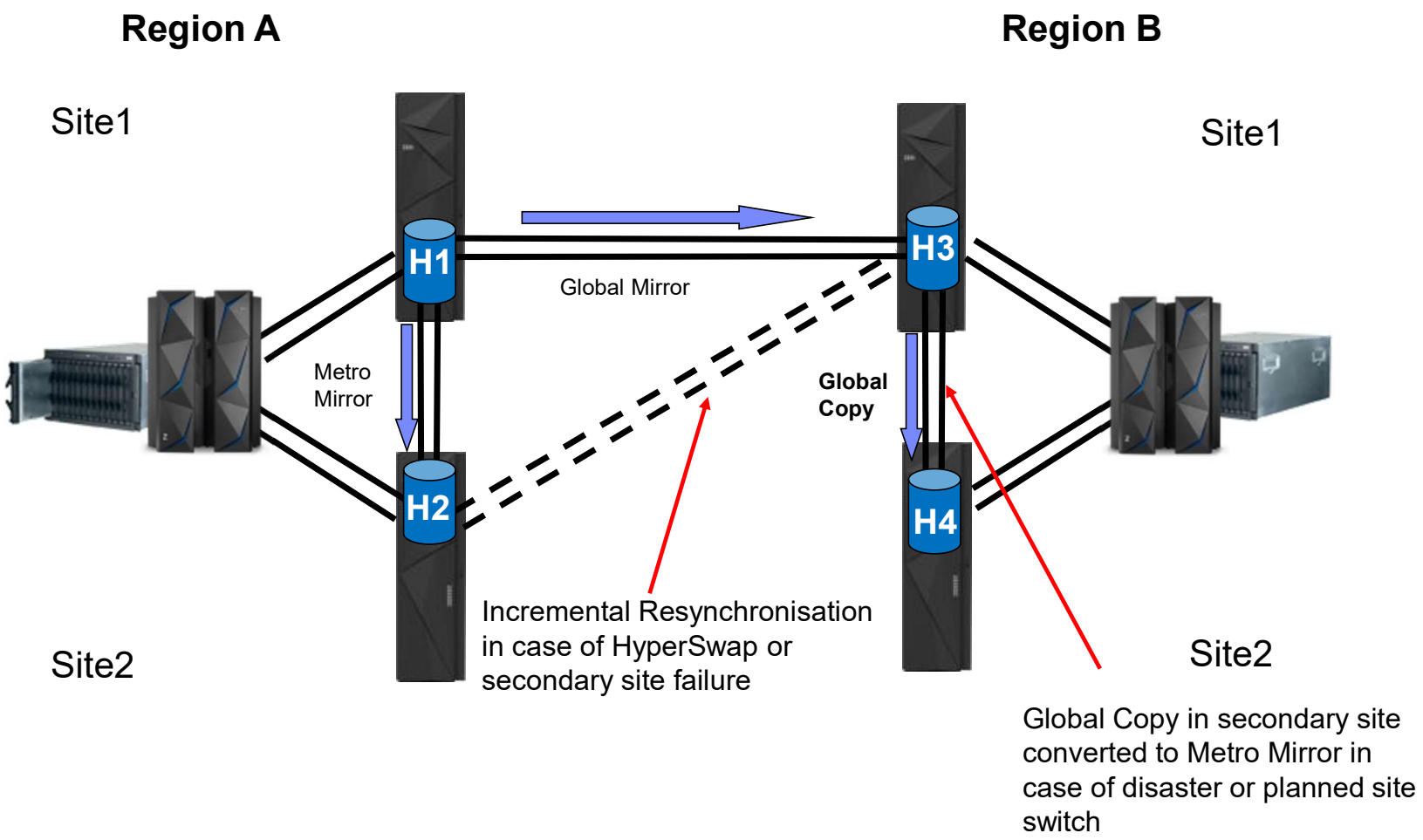
4-site topology with Multi-Target Metro Mirror – Global Mirror



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Copy Services Management Software

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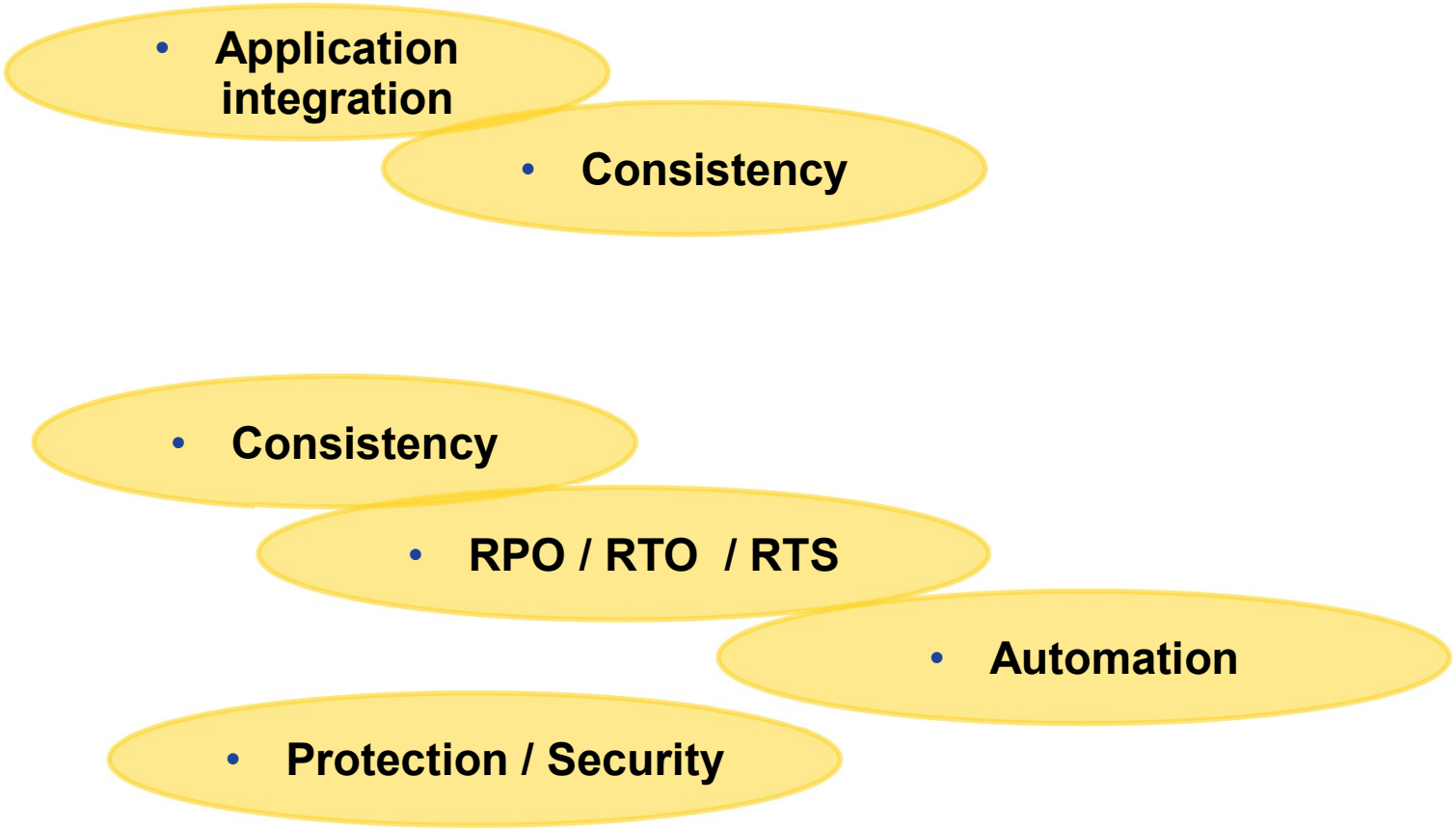
Different types of Copy Services need different ways of management

- FlashCopy
  - Point in time copy
  - Online backup
  - Fast server-less copy
- Remote mirroring
  - Disaster recovery
  - Continues Availability
- Safeguarded Copy
  - Cyber resiliency



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Different Interfaces

- DS8000 DSCLI and DSGUI
- zOS native interfaces
  - TSO
  - ISKDSF
  - DFSMS
  - ANTRQST and ANTTREXX
- HyperSwap
- Copy Services Manager (CSM)
- CSM z/OS FlashCopy Manager
- GDPS

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DS8000 Command Line Interface (DSCLI)

- Supports all Copy Services types and options, except dataset level FlashCopy
- No cross LCU PPRC consistency
- No inherent automation

- Example: set up and start Global Mirror
  1) Set up connectivity (mkpprcpath)
  2) Start Global Copy (mkpprc)
  3) Setup FlashCopy to Journal (mkflash / mkremoteflash)
  4) Create and populate Global Mirror session (mksession)
  5) Start session (mkgmir)

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IBM Z native interfaces

- **z/OS**
  - **TSO commands**
  - **ICKDSF**
  - **DFSMSdss copy commands with fast replication**
  - **ANTRQST and ANTTREXX application programming interfaces (APIs)**
- z/VM:
  - ICKDSF
  - Native CP FLASHCopy command.
- z/VSE
  - ICKDSF
  - Native IXFP SNAP used to start FlashCopy
- z/TPF
  - ICKDSF
  - Native ZXCPY command to start FlashCopy, Global Copy, or Metro Mirror

- Not all interfaces support all options

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Example: FlashCopy interfaces

Function \ Interface	DS front ends		zOS front ends			
	DS GUI	DS CLI	DFSMSdss	TSO	ANTRQST	ICKDSF
Multiple relationship FlashCopy	✓	✓	✓	✓	✓	✓
Consistency Group FlashCopy	✗	✓	✓ (3)	✓	✓	✗
Target on existing Metro Mirror or Global Copy primary	✓	✓	✓	✓	✓	✓
Incremental FlashCopy	✓	✓	✓ (3)	✓	✓	✓
Remote FlashCopy	✗	✓	✗	✓	✓	✓
Persistent Flashcopy	✓	✓	✓ (2) (3)	✓ (2)	✓ (2)	✗
Dataset FlashCopy	✗	✗	✗	✓ (1)	✓ (1)	✗
Reverse restore, fast reverse restore	✓	✓	✗	✓	✓	✓
FlashCopy to space efficient target	✓	✓	✓	✓	✓	✓

(1) Extents can be specified, but the VTOC and the catalogs are not updated
(2) Persistent relationships are available via Incremental support
(3) With z/OS V1R6 or later, and APARs OA11002, OA12707, OA12748, and OA14105

- **Copy Services Manager is strategic GUI**
- **Higher level interfaces:**
  - **DB2 tools**
  - **IMS utilities**
  - **FlashCopy Manager**
  - **GDPS**

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DFSMSdss FlashCopy integration

- DSS COPY commands
  - Full volume or dataset level
  - DUMPCOND available to provide volume clone to be used for backup purposes
    - Avoid duplicate VOLSER
    - Dump Conditioning Used for DB2 copy pool (CDP) support
- DSS DEFRAG
- Fast Replication is the default for DFSMS copy functions
  - Can be overridden by command or exits
  - Some commands may result in a mix of FlashCopy and traditional I/O
  - Also invoked by DFSMShsm, DB2, or IMS
  - SMS managed or non-SMS managed

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Application Programming Interfaces (APIs)

- ANTRQST
  - Executable Assembler Macro
  - Calls to DSFSM System Data Mover (SDM)
- ANTTREXX
  - REXX binding for ANTRQST
  - Examples in SYS1.DGTCLIB
    - ANTFREXX - Invokes FlashCopy® commands
    - ANTPREXX - Invokes PPRC commands
    - ANTRREXX - Invokes Global Mirror commands
    - ANTXREXX - Invokes XRC commands
    - ANTIMAIM - Shows building a custom command

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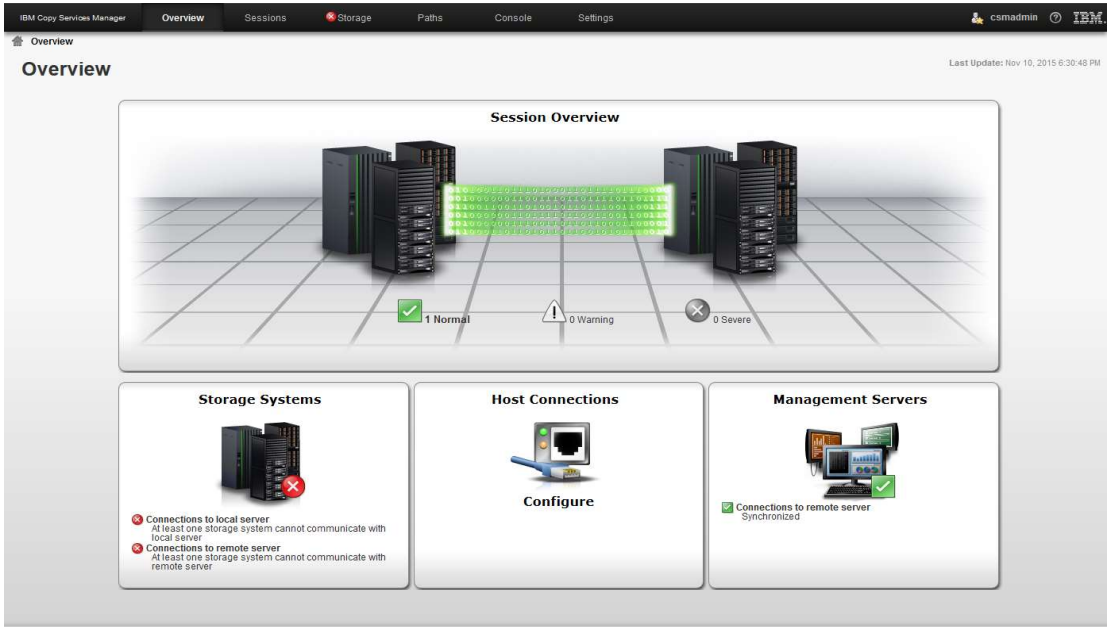
IBM Copy Services Manager

- **Session based Copy Service Management**
  - Manages Data Consistency across a set of volumes with logical dependencies
  - Supports multiple devices
  - Unlimited session, 10000s of volumes
- **Coordinates Copy Service Functionalities**
  - Flash Copy
  - Metro Mirror
  - Global Mirror
  - Metro Global Mirror
  - Multi Target PPRC (MM and GC/GM)
- **Supports IBM storage systems**
  - DS8000
  - FlashSystem / SAN Volume Controller
- **Ease of Use**
  - Single common point of control
  - Web browser-based GUI and CLI
  - Persistent Store Data Base
  - Source / Target volume matching
  - SNMP Alerts
  - Wizard based configuration
  - Scheduled tasks for automation
  - Dual control for security

- **Business Continuity**
  - Site Awareness
  - High Availability Configuration – active and standby management server
  - No Single point of Failure
  - Disaster Recovery Testing
  - Disaster Recovery Management
  - Supports z/OS HyperSwap for CKD devices
  - Supports A9000/A9000R HyperSwap



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What is CSM z/OS FlashCopy Manager?

- **CSM z/OS FlashCopy Manager (CSMFCM)** is a separate z/OS **ISPF application** that simplifies use of FlashCopy capabilities with IBM DS8000

- It is an **independent part** of the **IBM Copy Services Manager for z/OS** 6.1.3 or higher
- It provides the ability to **discover and build FlashCopy configurations** from the z/OS environment with mix-and-match capabilities using z/OS concepts.
- **Batch jobs created by z/OS FlashCopy Manager** can be submitted manually or incorporated into sophisticated job streams.
- It utilizes the **Freeze/Unfreeze option** of the FlashCopy operation on DS8000
- It provides **full volume FlashCopy** with CKD volumes, *no dataset level* FlashCopy is supported

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HyperSwap

HyperSwap provides high availability by substituting Metro Mirror secondaries for Metro Mirror primary devices *transparently*

- Can swap large number of devices fast and non-disruptively
- Changes status in secondary disk subsystem
- Transparent to applications

Swap

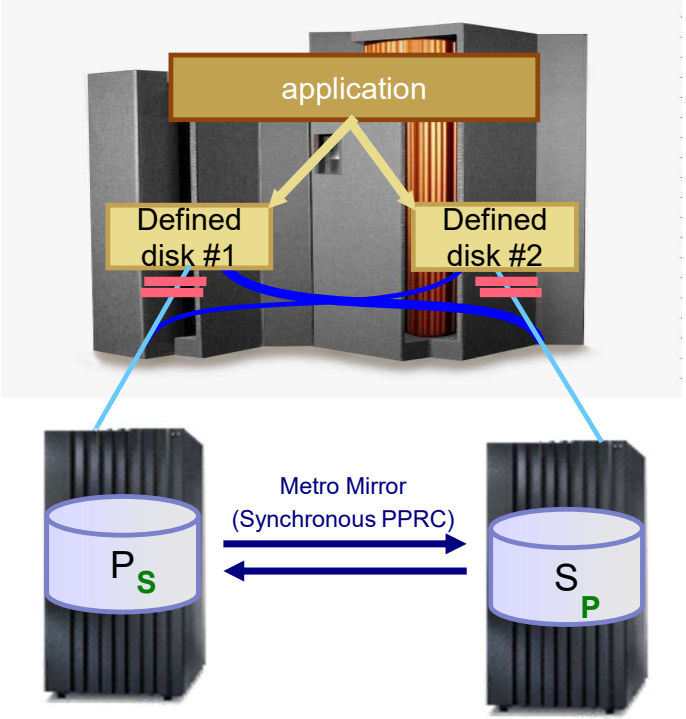
- Mirror is suspended and Changed Recording bitmap is created
- Suspend – Maintain CR bitmap
- Resynch – Maintain PPRC mirror

Planned HyperSwap

- Possibly for maintenance actions

Unplanned HyperSwap

- Swaps of complete disk configuration for various problems that cause an interruption to the communication between the server and the primary disk subsystem



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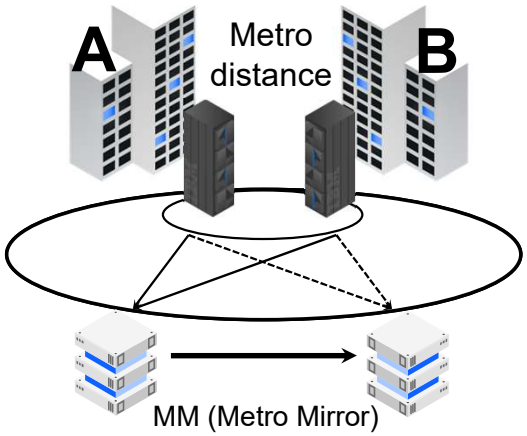
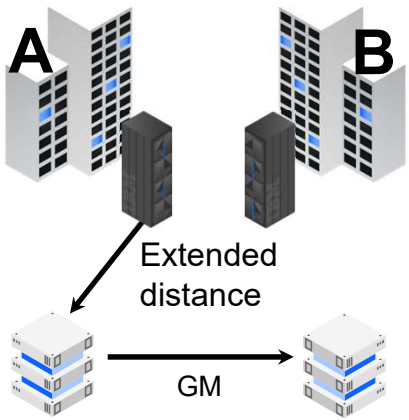
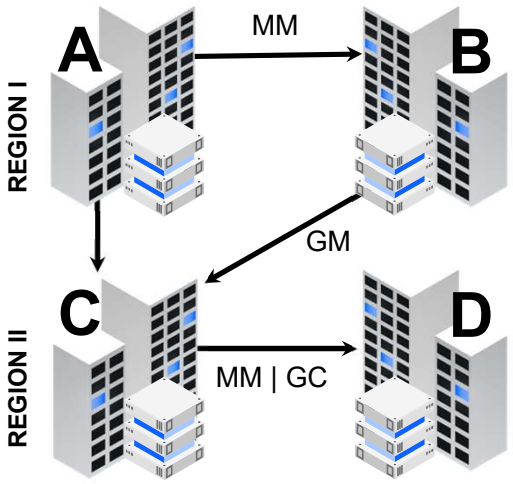
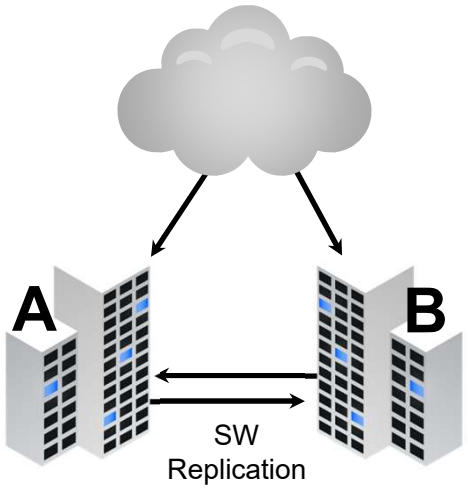
GDPS: Balanced solutions designed to address different requirements

GDPS Metro	GDPS Global	GDPS Metro Global	GDPS Continuous Availability
Near-continuous availability and recovery at metro distances	**Disaster recovery at extended distance**	**Near-continuous availability regionally & recovery for 3-4 sites**	**Near-continuous availability, recovery & workload balancing**
Systems remain active Multisite workloads can withstand site and storage failures	Rapid systems DR with "seconds" of data loss	Metro near-continuous availability and out of region disaster recover	Continuous availability at unlimited distances









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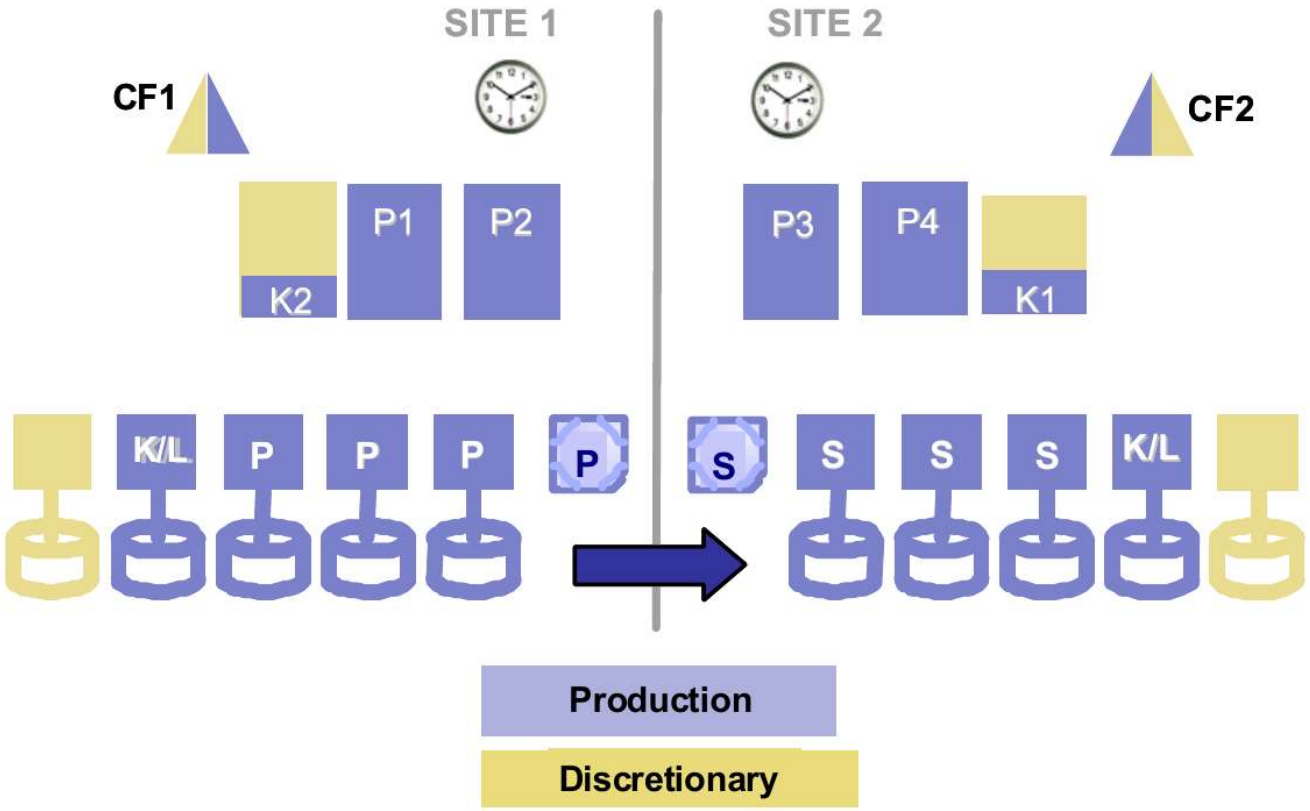
General GDPS capabilities

- Replication management
  - Consistency
  - Recovery for test and DR
  - Incremental resync
- Tape management
- HyperSwap configuration
- System / Sysplex management
  - LPAR deactivation / activation
  - CDS and CF
  - IO and IPL configuration
  - Backup capacity on demand
  - Sysplex timer
- Scripting
- Exception processing



Redbooks®GDPS Family: An Introduction to Concepts and Capabilities
www.redbooks.ibm.com/abstracts/sg246374.html?Open

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Sources of information

- DS8000 Copy Services
  - http://www.redbooks.ibm.com/abstracts/sg248367.html?Open
- DFSMS Advanced Copy Services: TSO commands, ANTRQST, ANTTREXX
  - https://www.ibm.com/docs/en/zos/2.5.0?topic=dfsms-zos-advanced-copy-services
- DFSMSdss Storage Administration: DFSMSdss FlashCopy integration
  - https://www.ibm.com/docs/en/zos/2.5.0?topic=dfsms-zos-dfsmsdss-storage-administration
- Device Support Facilities User's Guide and Reference
  - https://www.ibm.com/docs/en/zos/2.5.0?topic=ickdsf-device-support-facilities-users-guide-reference
- IBM Copy Services Manager
  - https://www.redbooks.ibm.com/abstracts/sg248375.html
- IBM GDPS: An Introduction to Concepts and Capabilities
  - https://www.redbooks.ibm.com/abstracts/sg246374.html

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Session summary: DS8000 Copy Services overview

- Data resiliency , types of disasters, mitigation strategies, Business Continuity
  - RPO, RTO, and consistency
- Copy services overview
  - Point-in-Time Copy
  - Synchronous Copy and Asynchronous Copy
- Management Software overview

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