

# IMS Disaster Recovery Overview

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## Disaster Recovery VS. Local Recovery

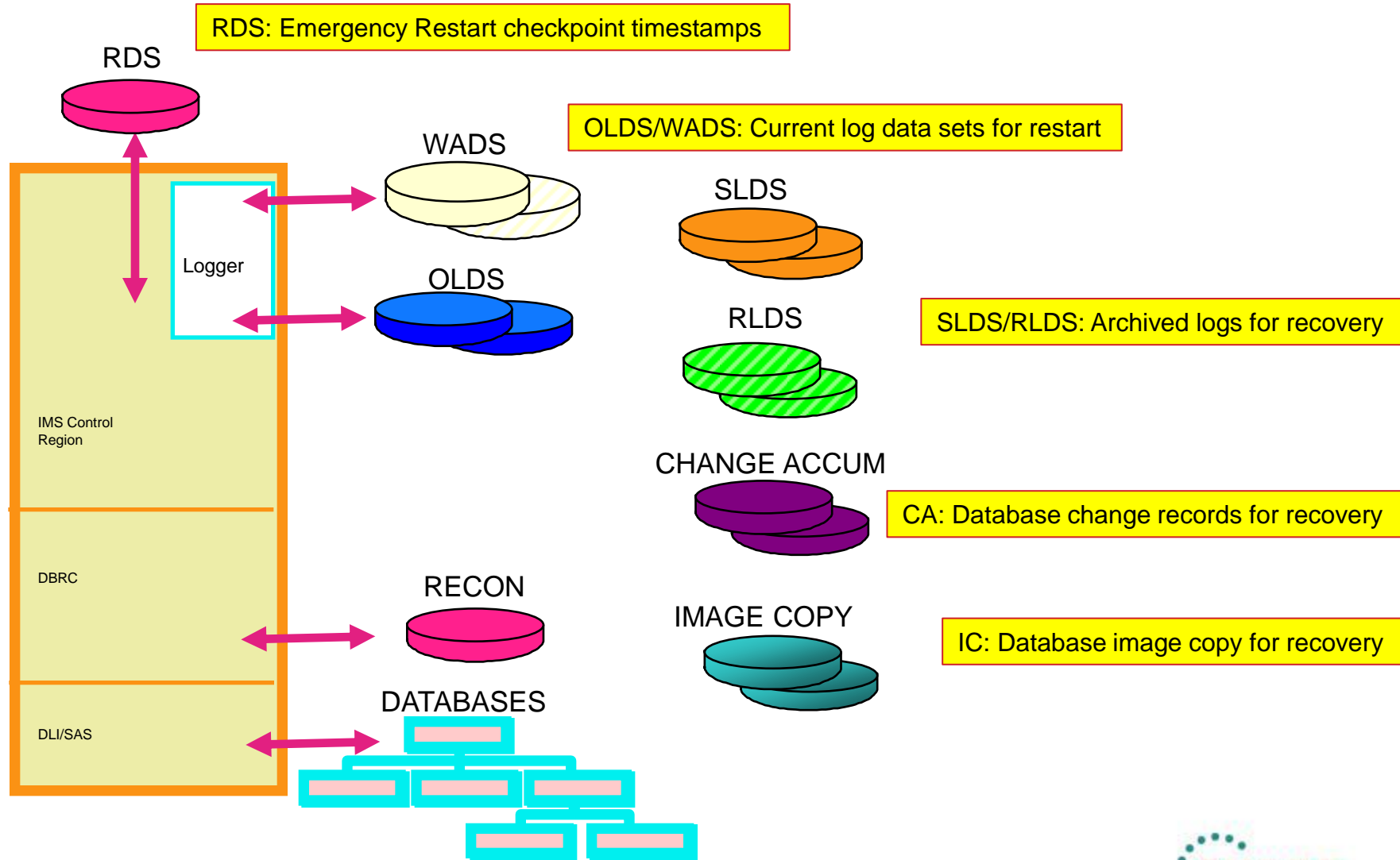
- Disaster Recovery
  - All production data is mirrored to remote site
  - After disaster failover, mirroring systems are disabled
  - DBMS systems are restarted using mirrored data
  - Major operation to switch to remote site
  - Used for major site failures or other “real” disasters



# Disaster Recovery VS. Local Recovery

- Local Recovery
  - User application failures or operational errors
    - Recovery is for one or more groups of databases
    - Application errors, operational errors, local hardware problems
  - DBMS systems need local recovery resources
    - Image copies, change accums, RECONs, etc.
  - Recovery resources are mirrored to remote site
    - Needed for local recovery following a failover
    - Remote site is new production system for a period of time

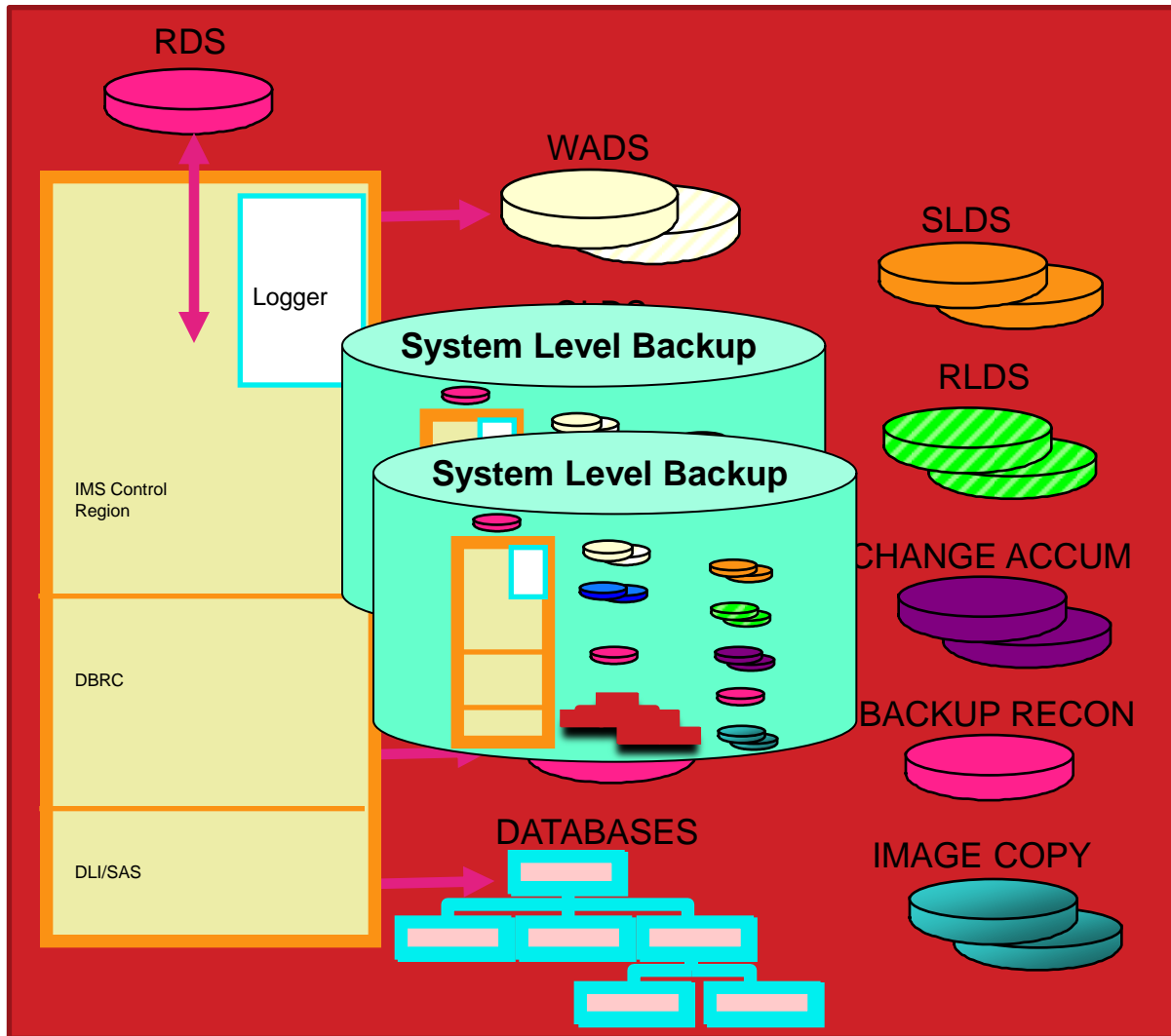
# IMS Recovery Resources



# IMS Recovery Resources



SLB: System Level Backup





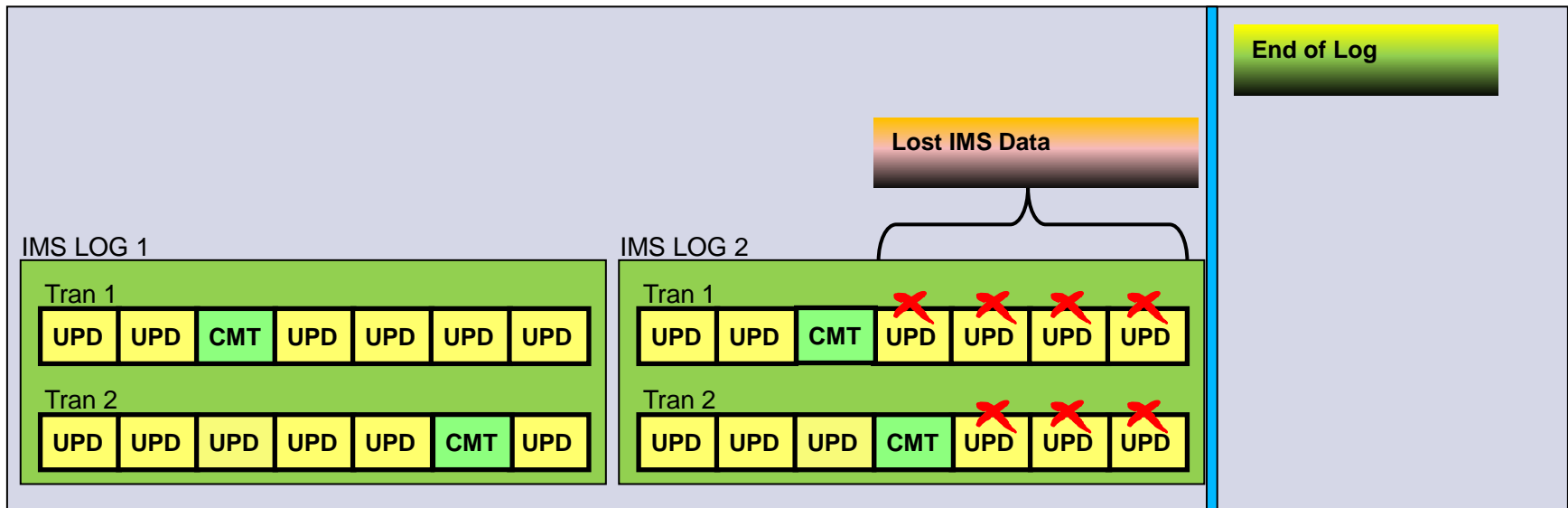
# IMS Recovery Methodologies

- Full Database Recovery
  - Image Copy + Logs + Change Accum
  - Uncommitted updates are backed out
- Timestamp Recovery
  - Image Copy + Logs + Change Accum
  - Or.... Image Copy only
  - Recovery to a Recovery Point
- Point-In-Time Recovery
  - Image Copy + Logs + Change Accum + Recon
  - Recovery is to any timestamp
  - Uncommitted updates are not applied

# Full Database Recovery



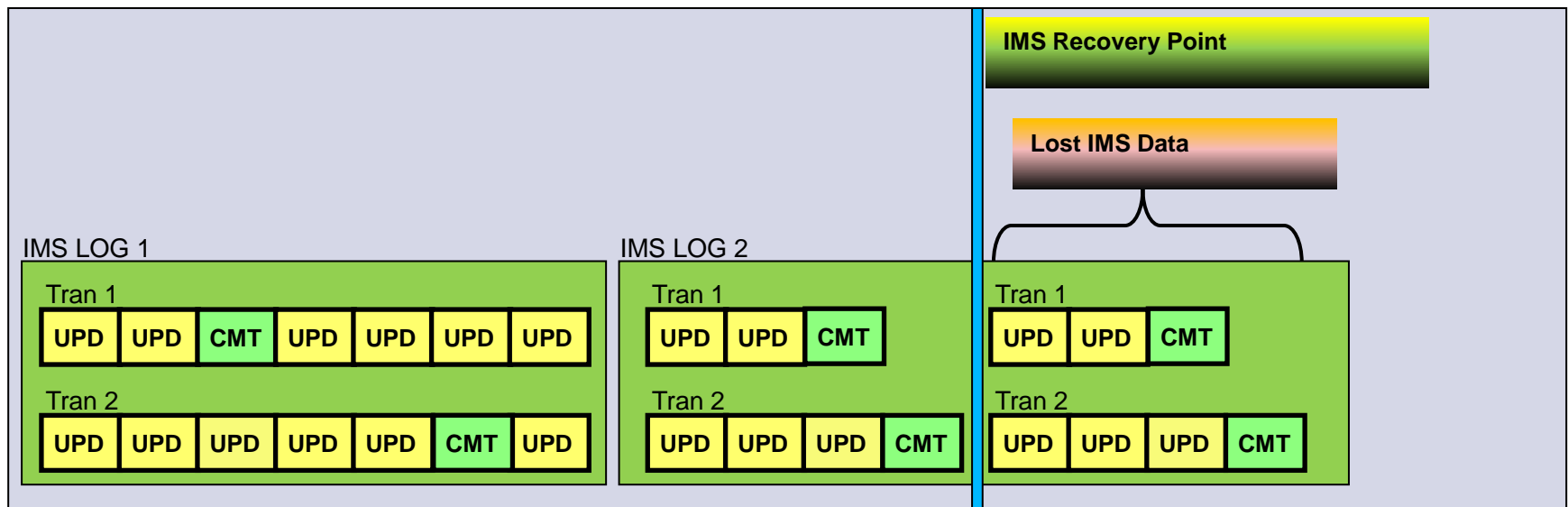
- Recover to the end of the log data set (to current)
  - Uncommitted updates are backed out



# Timestamp Recovery



- Recover to a Recovery Point
  - ▶ No uncommitted updates exist at Recovery Point
  - ▶ Recovery Point creation:
    - UPDATE DB STOP(ACCESS) or /DBR
    - UPDATE DB STOP(UPDATES) or /DBD
    - UPDATE DB START(QUIESCE)

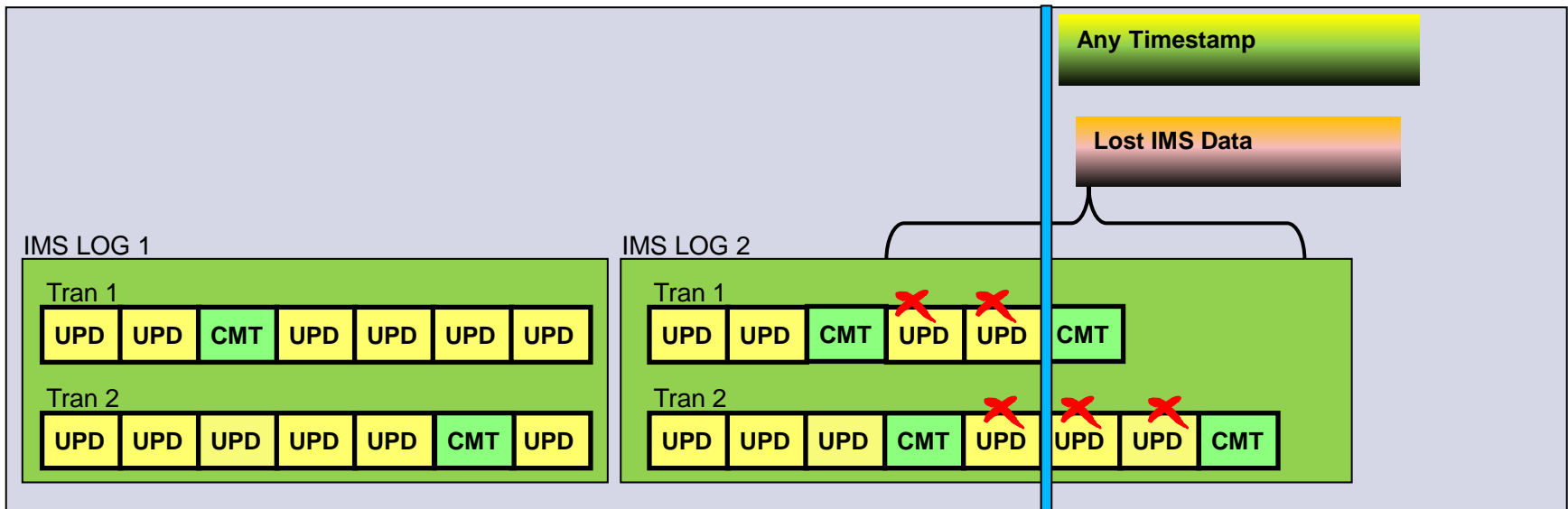




# Point-In-Time Recovery



- Recover to any timestamp
  - ▶ No uncommitted updates are applied





# IMS Database Recovery Solutions

- IMS Database Recovery utility (DFSURDB0)
  - Recovers a single DBDS per execution
  - DBRC GENJCL.RECOV support
- IMS Database Recovery Facility (DRF) tool
  - Part of the IMS Recovery Solution Pack
  - Recovers multiple DBDS or Areas in single step
  - Recovery methodologies supported
    - Full Database Recovery (to current)
    - Time Stamp Recovery to a Recovery Point
    - Point-In-Time Recovery to any timestamp
- IMS Recovery Expert tool
  - Uses System Level Backups for both Local and Disaster Recovery

# IBM Disaster Recovery Solutions



- IMS *Recovery* Solutions
  - IMS databases are recovered using image copies and/or logs
    - IMS Full Database recovery or IMS Timestamp recovery
- IMS *Restart* Solutions
  - IMS system and databases are mirrored to remote site
    - IMS Recovery Expert Disaster Restart
    - Coordinated IMS and DB2 Disaster Restart
    - GDPS and Storage Mirroring
- IMS *Restart & Recovery* Solution
  - IMS system and databases are mirrored to remote site
  - Additional transmitted data allows for forward recovery



# IMS Disaster *Recovery* Solutions

- Many IMS solutions
  - IMS data is transmitted to recover databases to some point in time
    - Image copies, Change Accums, Recons, Logs
    - IMS environment data sets exist at remote site
    - Databases are restored using recovery utilities
      - Recovery to a consistent point (ex. Recovery Point)
      - Or, recovery requires backout of uncommitted updates
    - IMS is restarted with some amount of data loss
- IMS Tools Products enhance DR solutions:
  - IMS Recovery Solution Pack (DRF, HPIC, DRF/XF, IIB)
  - IMS HPPC



# IMS Disaster *Restart* Solutions

- IMS Recovery Expert System Level Backup
  - Creates a System Level Backup (SLB) of IMS environment
    - Snapshot is restored at remote site
  - IMS is emergency restarted with dynamic backout
- Coordinated IMS and DB2 Disaster Restart
  - IMS Recovery Expert and DB2 Recovery Expert
    - Creates a System Level Backup (SLB) of IMS and DB2 environment
  - IMS and DB2 are restarted with dynamic backout and Undo/Redo
- GDPS and Storage Mirroring
  - Data is transferred synchronously or asynchronously to Remote site
  - IMS is emergency restarted with dynamic backout

# Coordinated IMS/DB2 *Recovery & Restart*



- IMS Recovery Expert and DB2 Recovery Expert
  - Creates a System Level Backup (SLB) of IMS and DB2 environment
  - Additional Logs, Change Accums and Recons are transmitted
    - Point-In-Time Recovery
      - *Brings databases forward using SLB and logs*
    - Reduction in RPO
  - IMS and DB2 are restarted

# RTO vs. RPO



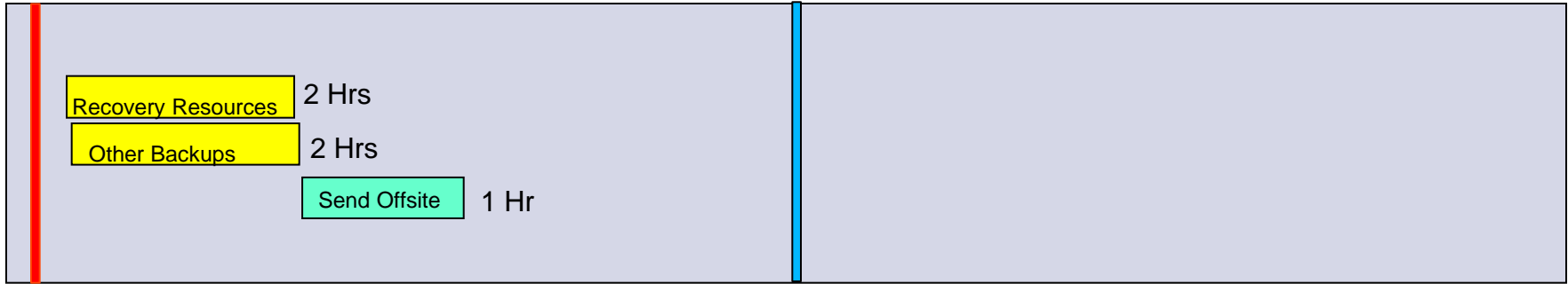
- Recovery Time Objective (RTO)
  - Time allowed to recover the applications
  - All critical operations are up and running again
  - Considerations include:
    - Recovery of databases
    - Restarting the network
- Recovery Point Objective (RPO)
  - Amount of data lost in the disaster
  - Last point-in-time when all data was consistent
  - Considerations include:
    - Frequency of creating recovery points
    - Frequency of transfer of data to remote site

# Defining RPO (Created Once/Day)



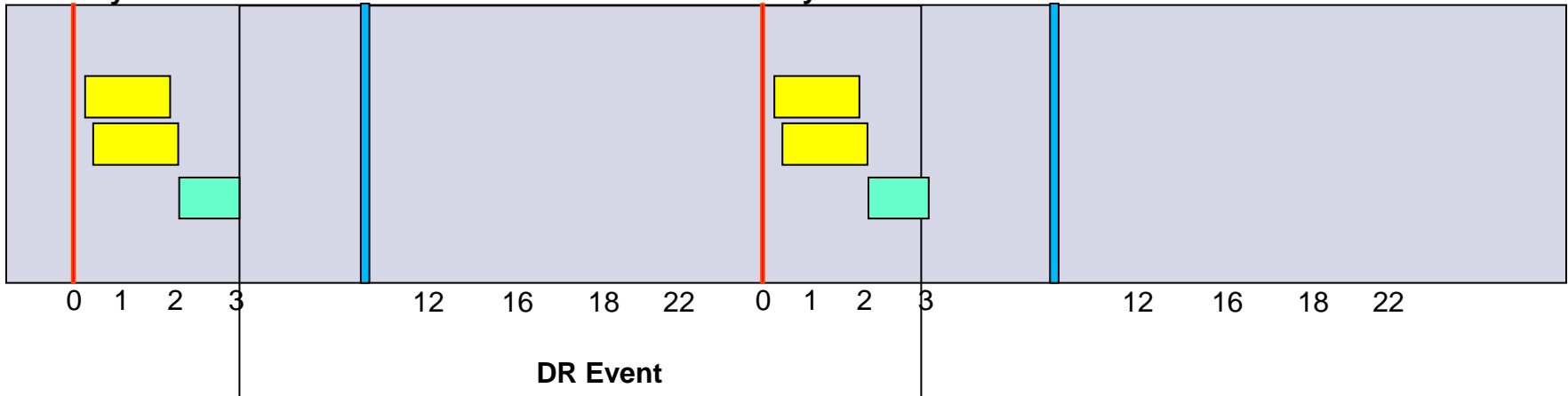
Midnight

Noon



Day 1

Day 2



Best Case

Worst Case

| DR Event | RPO Best Case             | RPO Worst Case             |
|----------|---------------------------|----------------------------|
| DR Event | Day 1 = Resources + 3 Hrs | Day 2 = Resources + 27 Hrs |



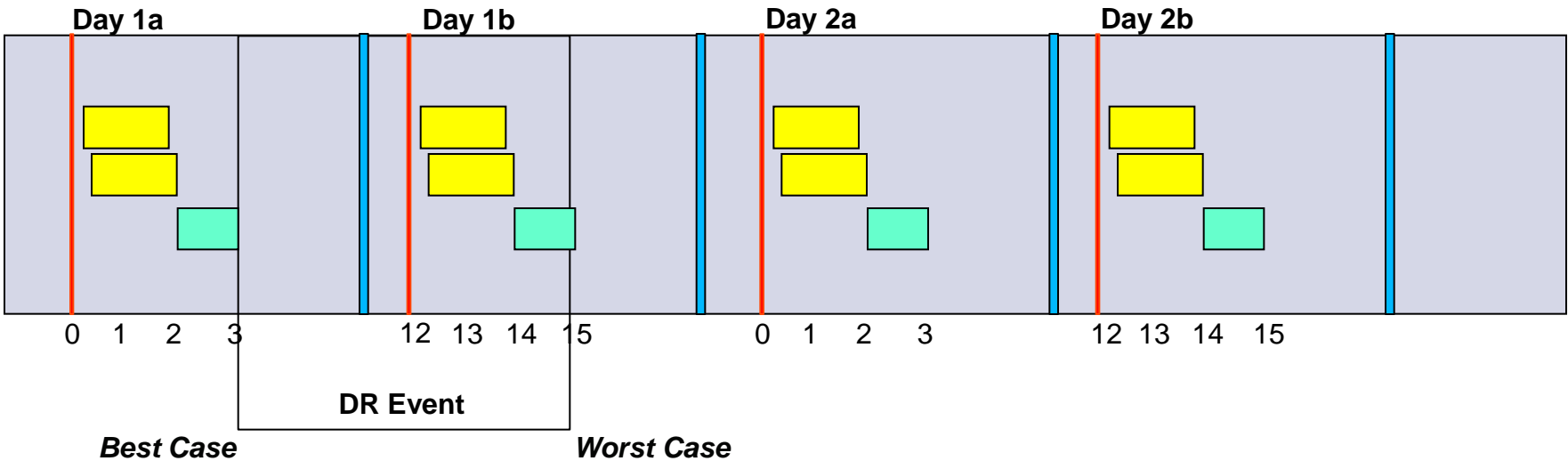
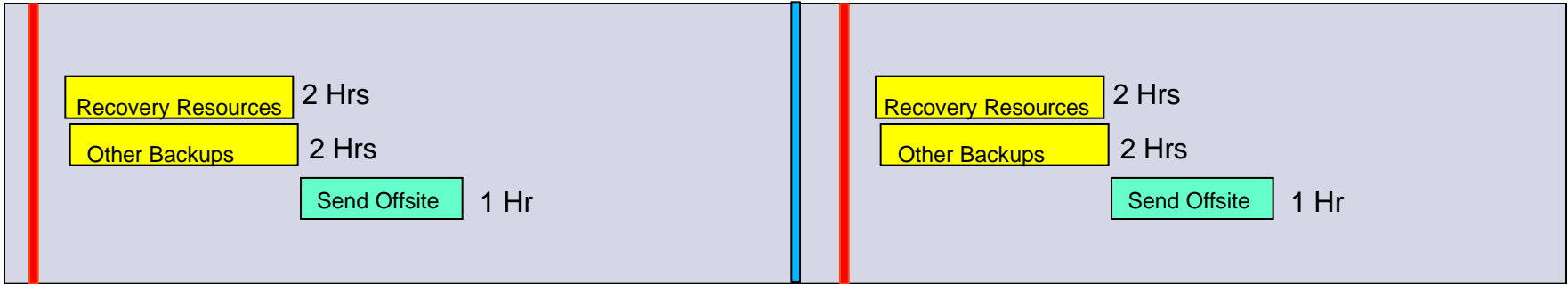


# Defining RPO (Created Twice/Day)



Midnight

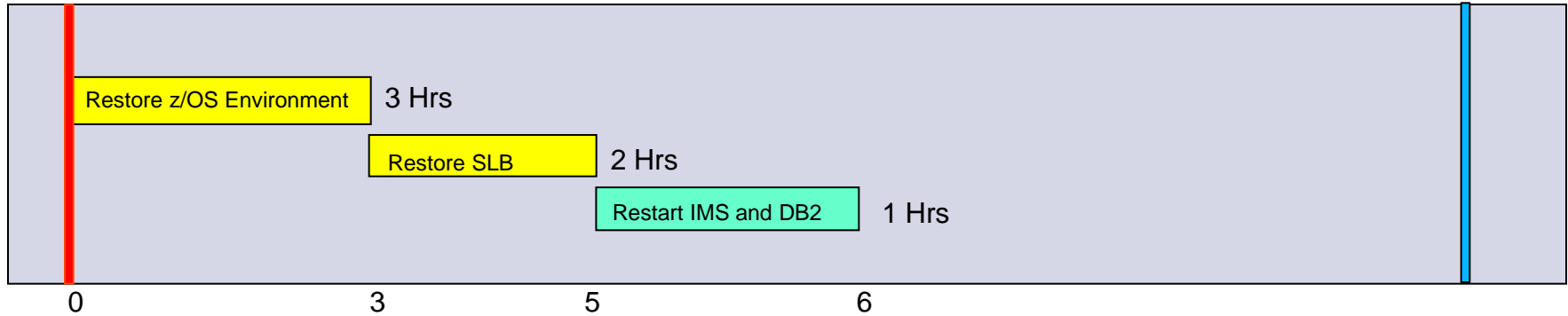
Noon



| DR Event | RPO Best Case              | RPO Worst Case              |
|----------|----------------------------|-----------------------------|
| DR Event | Day 1a = Resources + 3 Hrs | Day 1b = Resources + 15 Hrs |



# Defining RTO



| Recovery at Remote Site | RTO Time |
|-------------------------|----------|
| DR Event                | 6 Hours  |



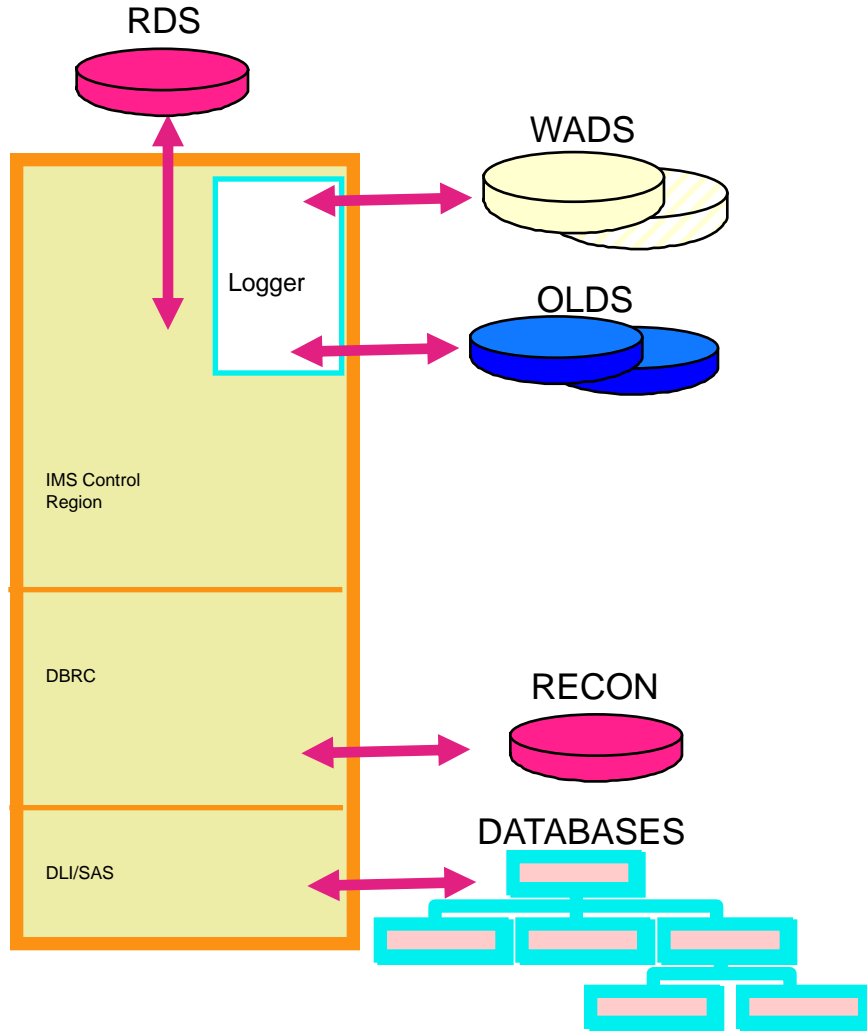
# IMS Disaster *Recovery* Solutions

- ✓ IMS Full Database Recovery
- ✓ IMS Timestamp Recovery

# IMS Disaster Recovery Solutions



## Production Site



## Remote Site

Transmitted

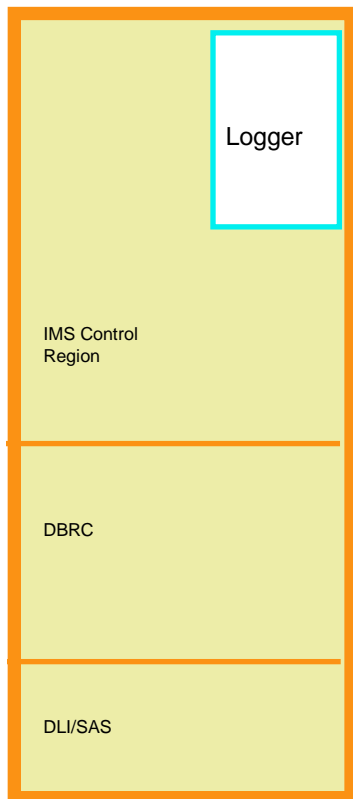


# IMS Disaster *Recovery* Solutions

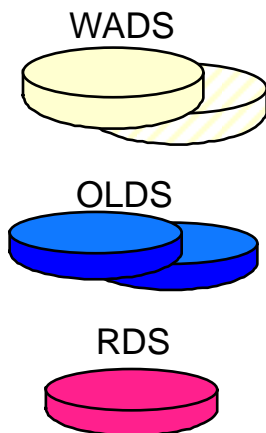
## Remote Site



### Restart IMS



### Allocate New



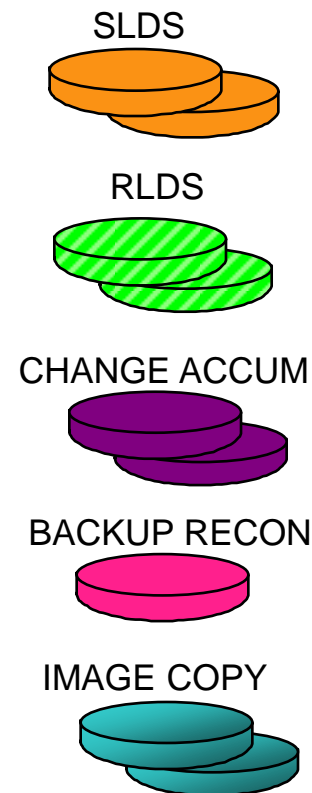
### Clean Recon



### Recover DB



### Transmitted





# IMS Disaster **Recovery** Solutions

- Remote Site Backup Recon Cleanup
  - Backup Recon reflects all activity in production Recon
    - Must be manually cleaned for use at remote site
  - Cleanup Steps
    - Step 1: Close and archive open OLDS data set
    - Step 2: Abnormally terminate and/or delete active subsystems
    - Step 3: Flag primary image copy as invalid
    - Step 4: Change Accumulation data sets
    - Step 5: Flag DEDB AREAs for recovery



# IMS Disaster **Recovery** Solutions

- Recover Databases and Restart IMS
  - Backup Recon is ready for remote site
  - GENJCL.RECOV creates recovery JCL
    - If databases are registered to DBRC
  - Full Database Recovery
    - Recovery includes uncommitted updates
      - Emergency restart with dynamic backout
      - Batch backout and Cold start
  - Timestamp Recovery
    - Image copies only or with log data sets
      - No uncommitted updates
      - Cold start IMS



# IMS Disaster *Restart* Solutions

- ✓ **IMS Recovery Expert System Level Backup**
- ✓ **Coordinated Disaster Restart for IMS and DB2**
- ✓ **GDPS and Storage Mirroring**



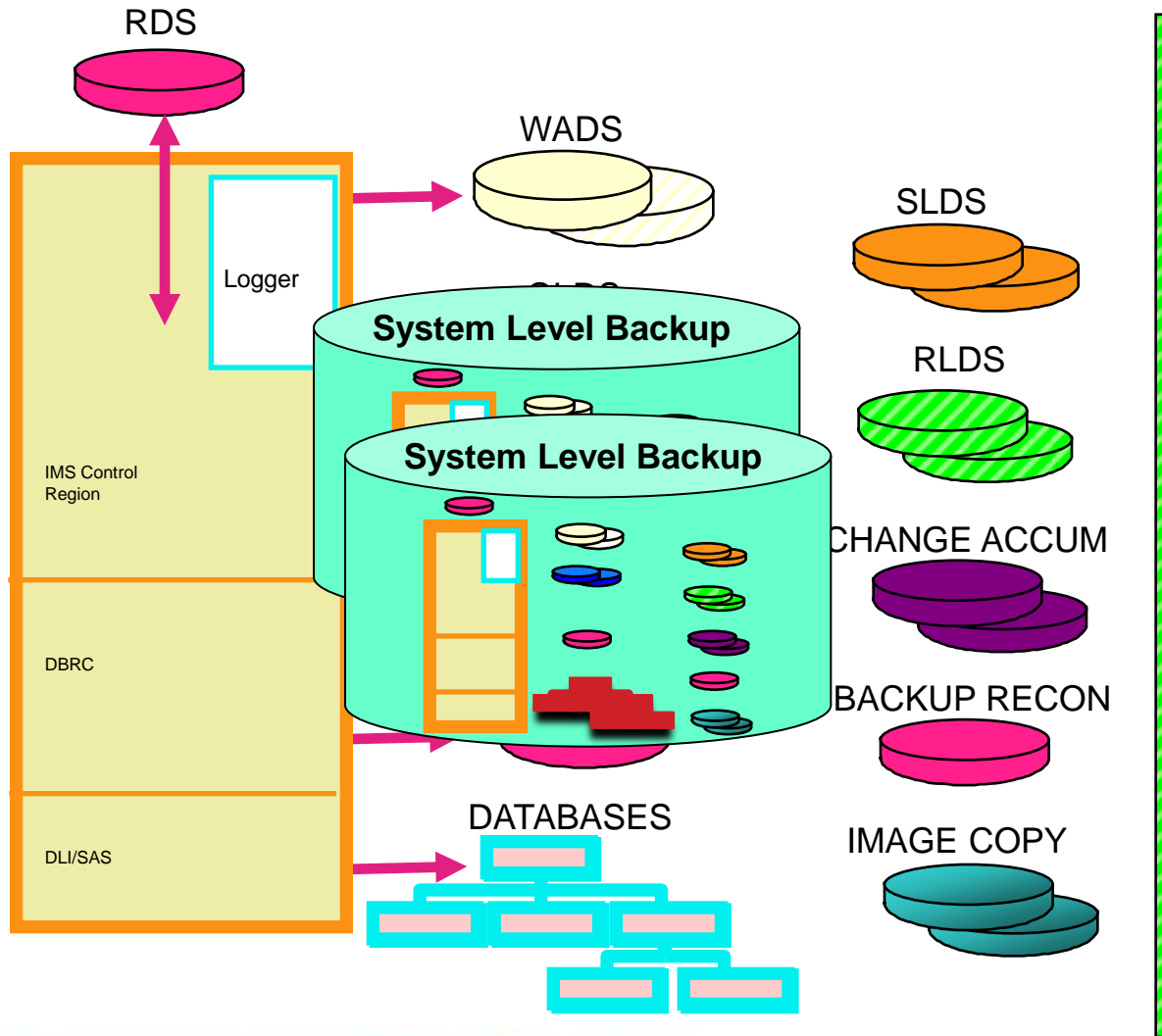
# IMS Recovery Expert: Disaster Restart



Remote Site

Transmitted

Production Site



# IMS Recovery Expert: Disaster *Restart*

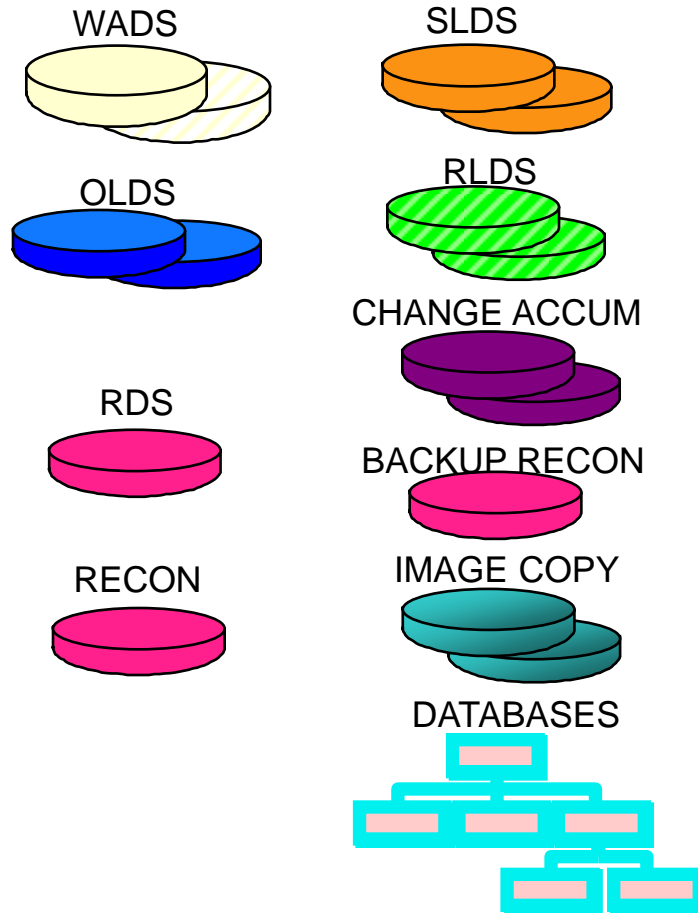


## Remote Site

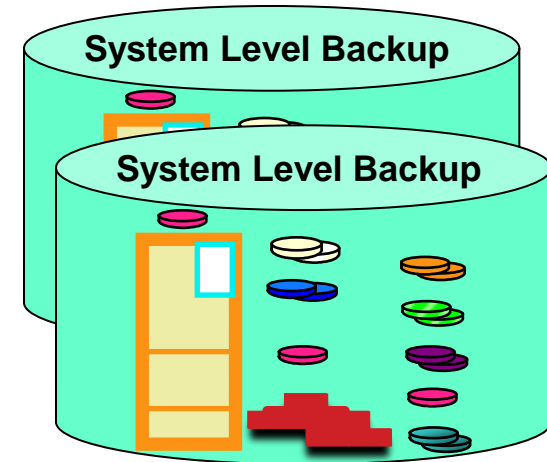
### /ERE IMS



### Restore SLB



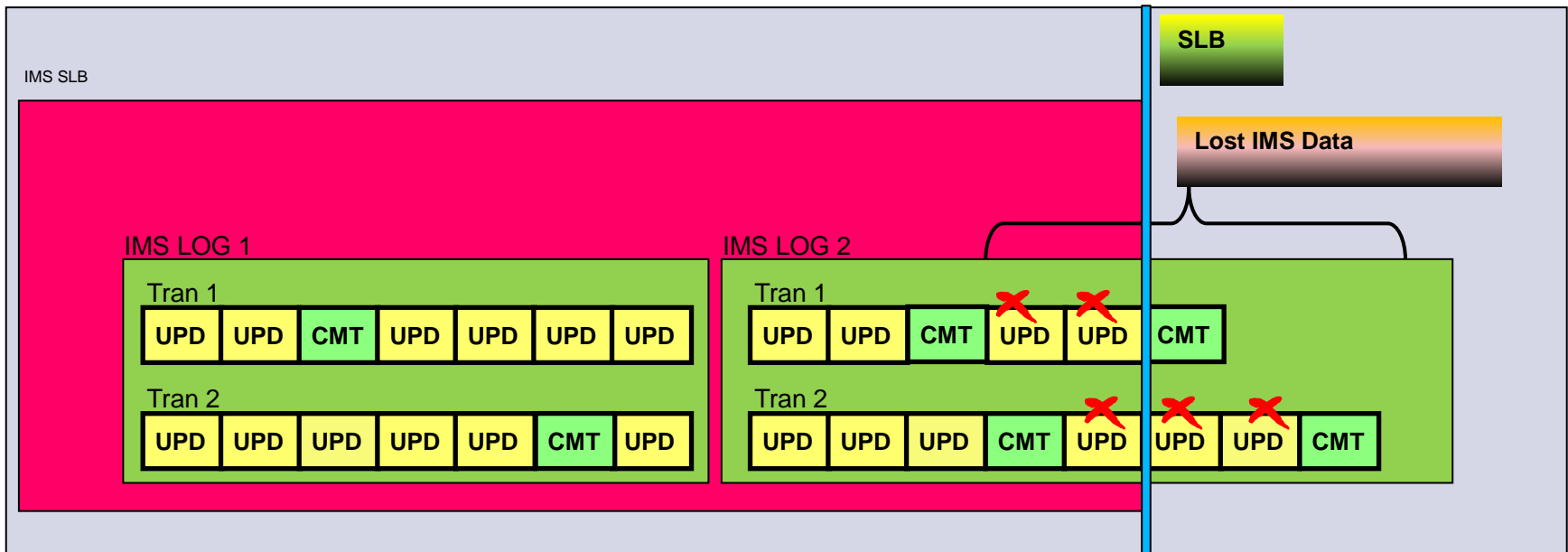
### Transmitted



# Restart from System Level Backup (SLB)



- Restore the System Level Backup (SLB)
  - ▶ Dynamically backout uncommitted updates during /ERE





# IMS Disaster *Restart* Solutions

- ✓ **IMS Recovery Expert (5655-S98) System Level Backup**
- ✓ **Coordinated Disaster Restart for IMS and DB2**
- ✓ **GDPS and Storage Mirroring**

# Coordinated IMS and DB2 *Restart*

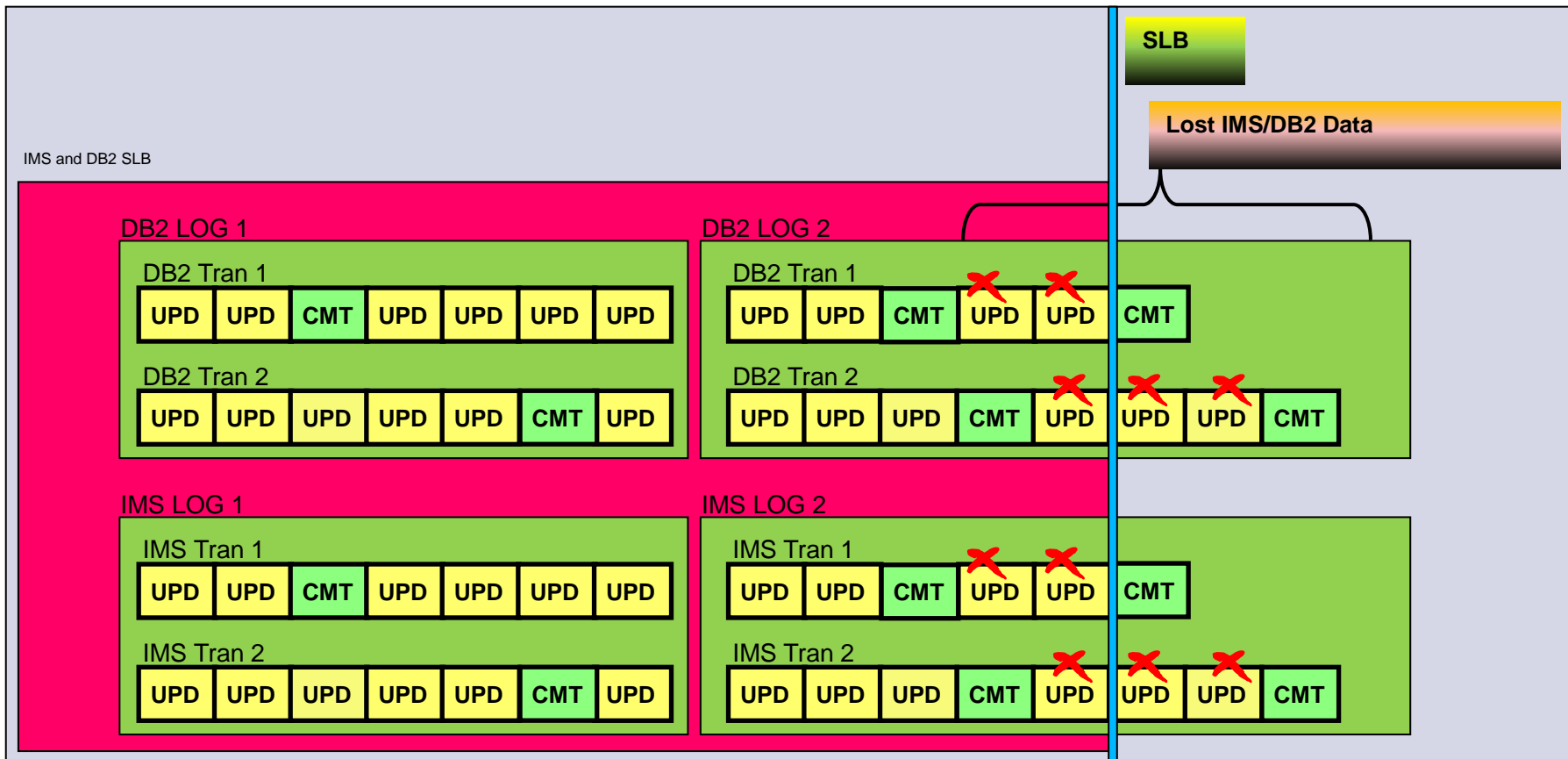


- Combined SLB created from IMS and DB2 volumes
  - Separate analysis is performed on IMS and DB2
    - Volumes combined under one Recovery Expert product
  - At Primary site, one SLB is created
    - One Flashcopy for all IMS and DB2 volumes
  - At Remote site
    - Single SLB is restored
    - IMS and DB2 are restarted individually
      - IMS Dynamic Backout and DB2 Undo/Redo processing occur

# Restart from Combined System Level Backup (SLB)



- Restore the System Level Backup (SLB)
  - ▶ Dynamically backout IMS and DB2 uncommitted updates



# Coordinated IMS/DB2 *Recovery & Restart*

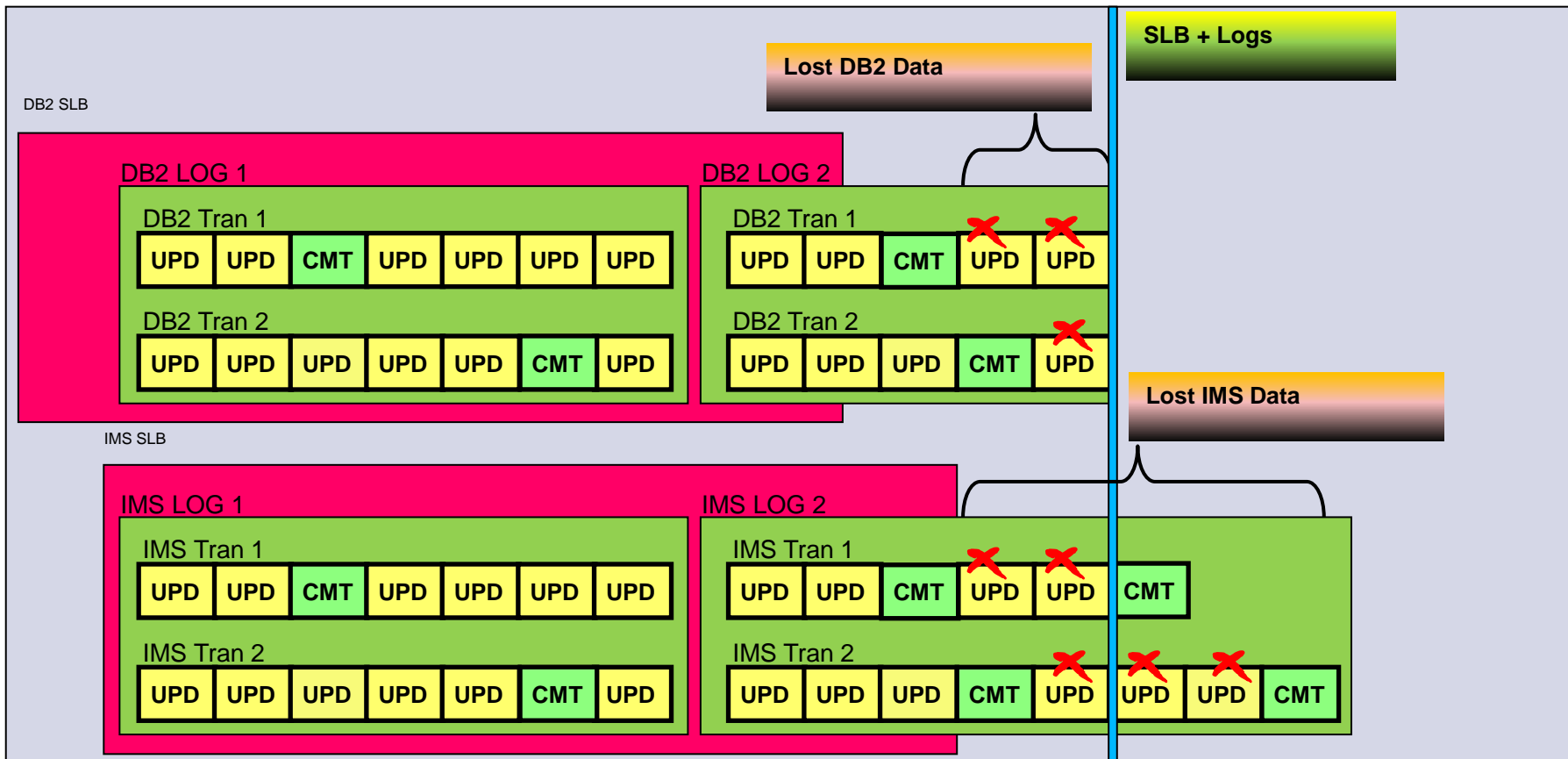


- Separate SLBs created for IMS and DB2 volumes
  - Separate analysis is performed on IMS and DB2
  - At Primary site:
    - Separate SLB is created for IMS and for DB2
    - Archived logs are transmitted to remote site
  - At Remote site:
    - IMS and DB2 SLBs are restored
    - Point In Time Recovery using timestamp in IMS and DB2
    - Start IMS and DB2

# Coordinated IMS/DB2 *Recovery & Restart*



- Restore the System Level Backup (SLB)
  - ▶ Find coordinated timestamp between IMS and DB2
  - ▶ Dynamically backout IMS and DB2 uncommitted updates







# IMS Disaster *Restart* Solutions

- ✓ IMS Recovery Expert (5655-S98) System Level Backup
- ✓ Coordinated Disaster Restart for IMS and DB2
- ✓ **GDPS and Storage Mirroring**

# IMS Disaster *Restart* Solutions

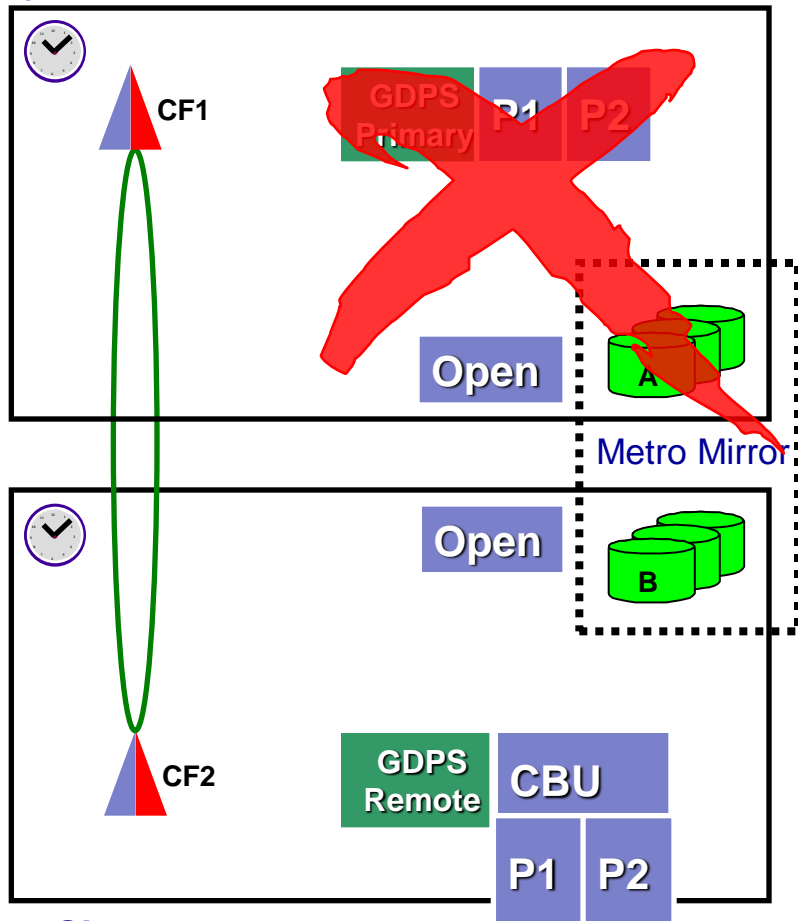


- IBM managed storage mirroring environments
  - IBM Metro Mirror (formerly PPRC)
  - IBM Hyperswap Manager
  - IBM Global Mirror
  - IBM z/OS Global Mirror (formerly XRC)
- Geographically Dispersed Parallel Sysplex (GDPS)
  - Optional for storage mirroring
  - Provides automation for mirroring procedures

# GDPS/PPRC... IBM Metro Mirror



## Primary Site



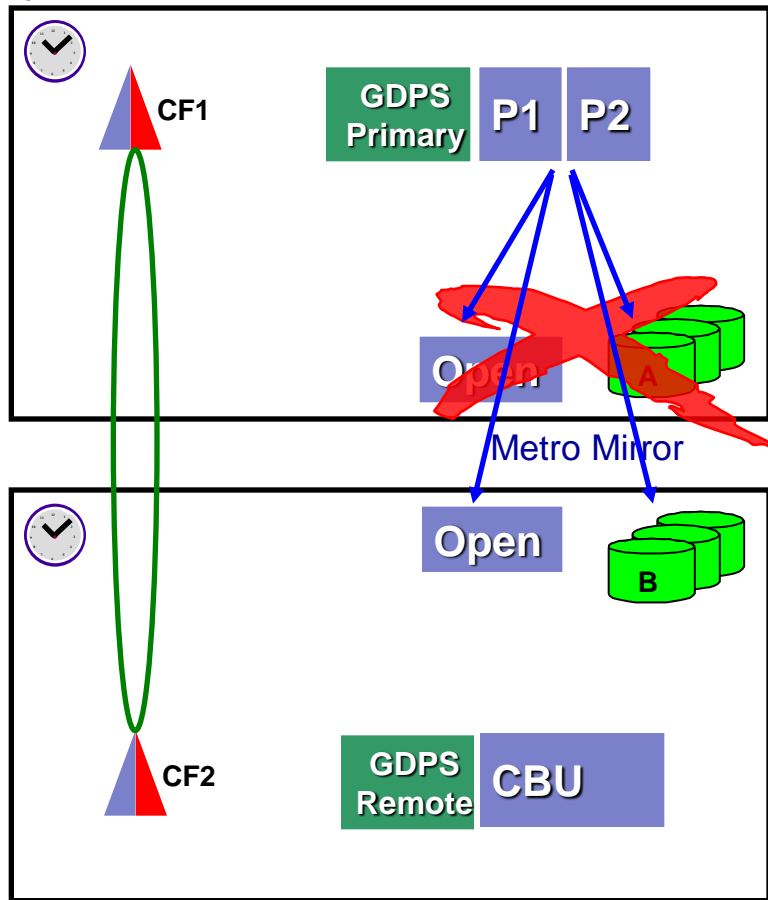
## Remote Site

- Synchronous data transmission
- RPO = 0
- RTO = Restart of systems
- GDPS uses Freeze policy
- Distance is limited (about 20KM)
- After failover
  1. Stop GDPS/PPRC
  2. Start CBU
  3. IPL Systems
  4. Restart DBMS systems

# GDPS/PPRC... HyperSwap Manager



## Primary Site



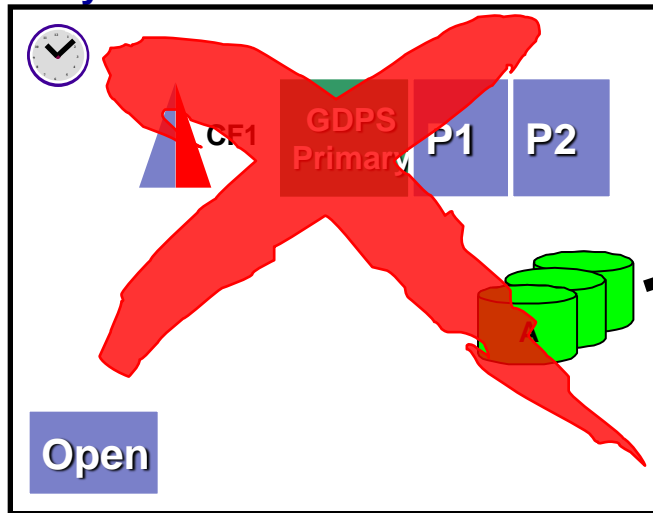
## Remote Site

- GDPS managed MM disks
- Data is System z and Open data
  - HyperSwap for system z
  - Open data is “frozen”
- Primary disk failures (Unplanned)
  - I/O errors
  - Boxed devices
  - Control unit failures
- User initiated switch (Planned)
  - HyperSwap to switch disks

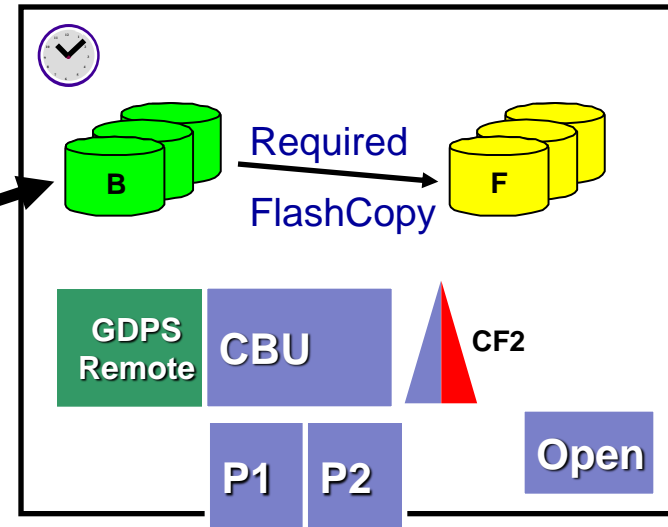
# GDPS/Global Mirror



## Primary Site



## Remote Site



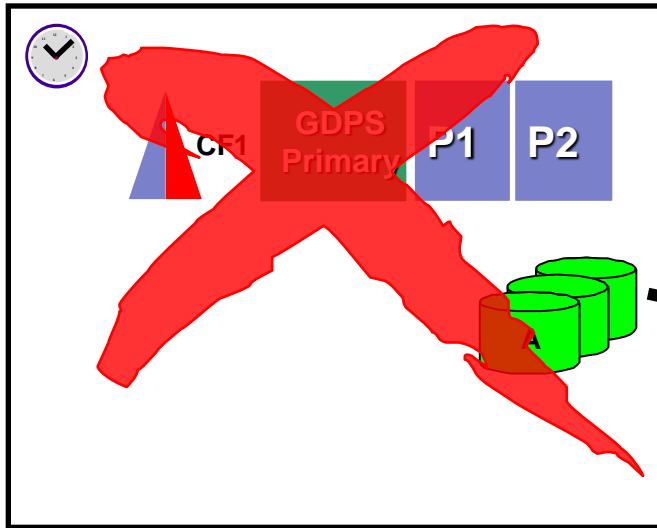
- Asynchronous data transmission
- RPO = 3-5 seconds (bandwidth)
- RTO = Restart of systems
- System z and Open data
- Distance is unlimited

- After failover
  - Stop GDPS/GM
  - Start CBU
  - IPL Systems
  - Restart DBMS systems

# GDPS/XRC... z/OS Global Mirror

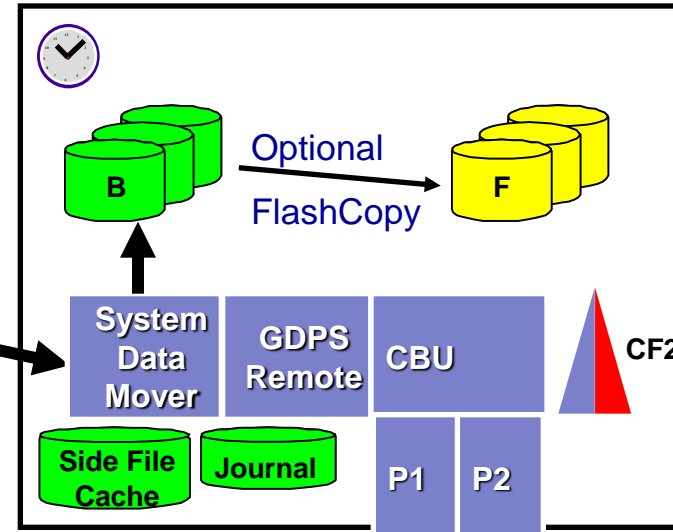


## Primary Site



## Remote Site

z/OS  
Global Mirror



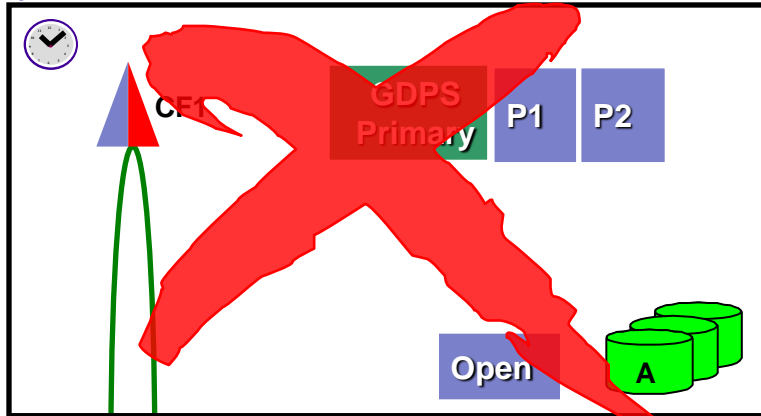
- Asynchronous data transmission
- RPO = 3-5 seconds (bandwidth)
- RTO = Restart of systems
- System z only
- Distance is unlimited

- After failover
  - Stop GDPS/XRC, SDM
  - Start CBU
  - IPL Systems
  - Restart DBMS systems

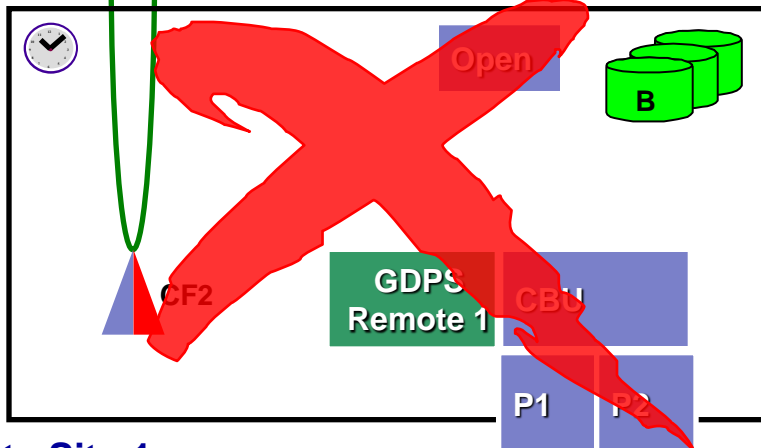
# GDPS/Metro-Global Mirror (Cascaded)



Primary Site 1

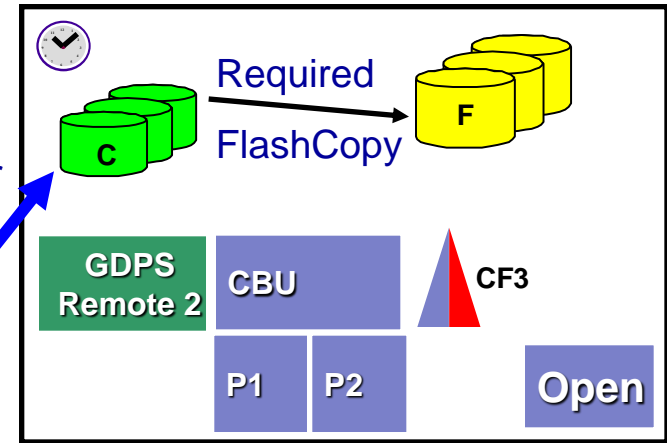


Metro Mirror



Remote Site 1

Remote Site 2

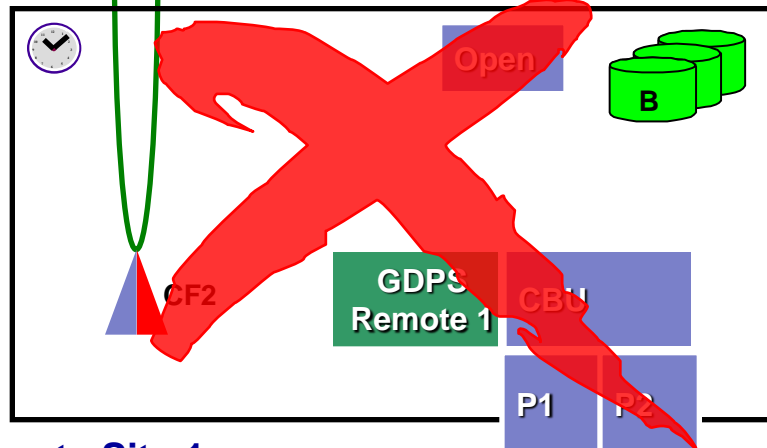
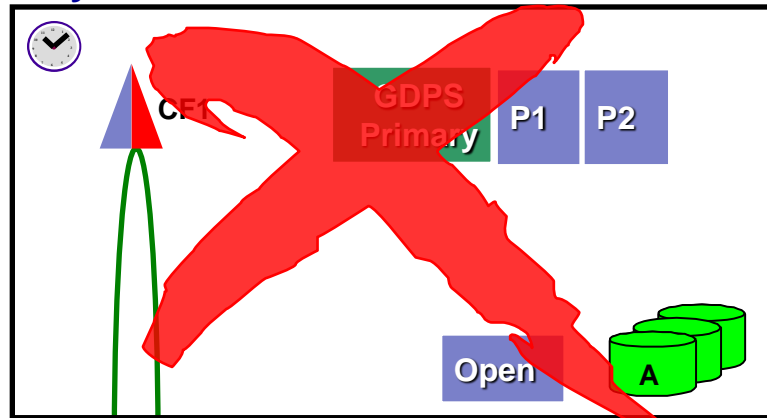


- Three-site solution
  - GDPS/PPRC = Site 1 and 2
    - RPO = 0
    - RTO = Restart of systems
    - Distance is limited
  - GDPS/GM = Site 2 and 3
    - RPO = 3-5 seconds
    - RTO = Restart of systems
    - Distance is unlimited

# GDPS/Metro-z/OS GM (Multi-Target)

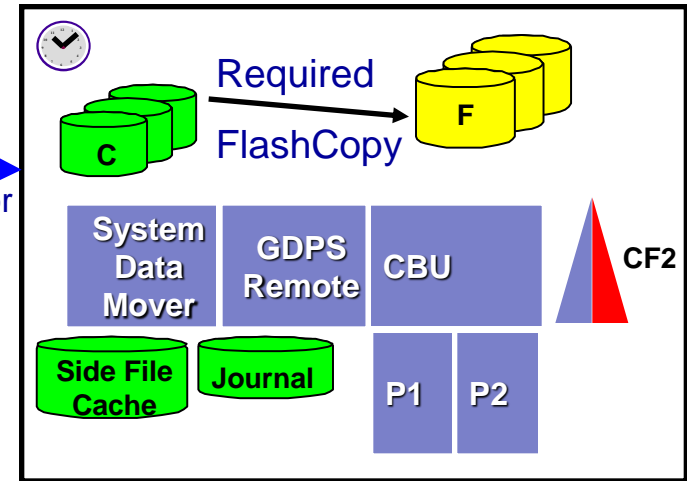


Primary Site 1



Remote Site 1

Remote Site 2



z/OS Global Mirror

- Three-site solution
  - GDPS/PPRC = Site 1 and Site 2
    - RPO = 0
    - RTO = Restart of systems
    - Distance is limited
  - GDPS/XRC = Site 1 and Site 3
    - RPO = 3-5 seconds
    - RTO = Restart of systems
    - Distance is unlimited



# IMS and DB2 DR Tutorials



- IBM developerWorks
  - [www.ibm.com/developerworks](http://www.ibm.com/developerworks)
    - External IBM website with articles, tutorials and demonstrations
- IMS Disaster Recovery Tutorials
  - Four parts:
    - Part 1: Overview of all solutions
    - Part 2: IMS Base and IMS Tool solutions
    - Part 3: IMS Recovery Expert Disaster and Local Recovery
    - Part 4: Coordinated IMS and DB2 Disaster Recovery
  - Downloadable demonstration file
    - Demos are installed on hard disk and viewed with internet browser

# IMS and DB2 DR Tutorials



- DeveloperWorks URL for Tutorials
  - [http://www.ibm.com/developerworks/views/data/libraryview.jsp?search\\_by=IMS+disaster+recovery+solutions](http://www.ibm.com/developerworks/views/data/libraryview.jsp?search_by=IMS+disaster+recovery+solutions)
  - **Search on “Exploring IMS Disaster Recovery” in DeveloperWorks**

| Title  | Type     | Date        |
|--|----------|-------------|
| <a href="#">Exploring IMS disaster recovery solutions, Part 1: Overview</a><br>Every customer needs a Disaster Recovery (DR) plan. The strategies used differ from one customer to another and they differ in time to recovery and loss of data. For IMS, there are five types of disaster recovery solutions: restart, recovery, recovery and restart, coordinated IMS and DB2 restart, and coordinated IMS and DB2 disaster recovery and restart. While the Storage Mirroring recovery solutions are classified as restart solutions, we will focus only on the non-Storage Mirroring <b>IMS disaster recovery solutions</b> in this series. | Articles | 29 Mar 2012 |
| <a href="#">Exploring IMS disaster recovery solutions, Part 2: IMS Base and IMS Tools recovery solutions</a><br>Every customer needs a Disaster Recovery (DR) plan. The strategies used differ from one customer to another and they differ in time to recovery and loss of data. For IMS, there are five types of DR solutions: restart, recovery, recovery and restart, coordinated IMS and DB2 restart, and coordinated IMS and DB2 disaster recovery and restart. Here in Part 2, we explore the recovery solutions that use only the IMS base functions and some of the functions in the IMS Tools.                                       | Tutorial | 12 Apr 2012 |
| <a href="#">Exploring IMS disaster recovery solutions, Part 4: Coordinated IMS and DB2 solutions</a><br>Every customer needs a disaster recovery (DR) plan. The strategy will differ from one customer to the next. For IMS, there are two types of DR solutions: 1) IMS specific, and 2) Storage Mirroring. In this tutorial, we explore the IMS specific DR solutions. There are solutions that use only the IMS base product and solutions that use the IBM IMS Tools products. For each DR solution, there will be a discussion of the key concepts related to that solution.  | Tutorial | 03 May 2012 |
| <a href="#">Exploring IMS disaster recovery solutions, Part 3: IMS Recovery Expert solutions</a><br>Every customer needs a Disaster Recovery (DR) plan. The strategies used differ from one customer to another and they differ in time to recovery and loss of data. For IMS, there are five types of DR solutions: restart, recovery, recovery and restart, coordinated IMS and DB2 restart, and coordinated IMS and DB2 disaster recovery and restart. Here in Part 3, we explore both the recovery and recovery and restart solutions provided by the IMS Recovery Expert product.   | Tutorial | 19 Apr 2012 |

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