



IBM

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Business Continuity on zSeries and System z9

THE WORLD DEPENDS ON IMS
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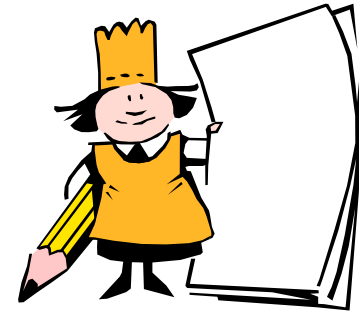
May 8, 2007 IMS Teleconference: IMS Disaster Recovery with GDPS

David Petersen
IBM Distinguished Engineer
petersen@us.ibm.com



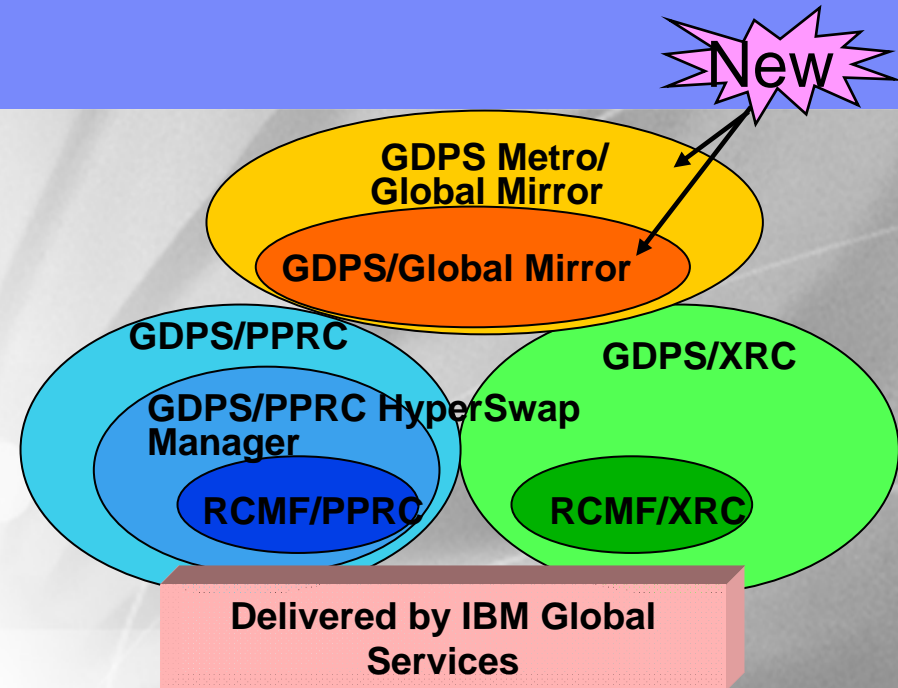


Agenda



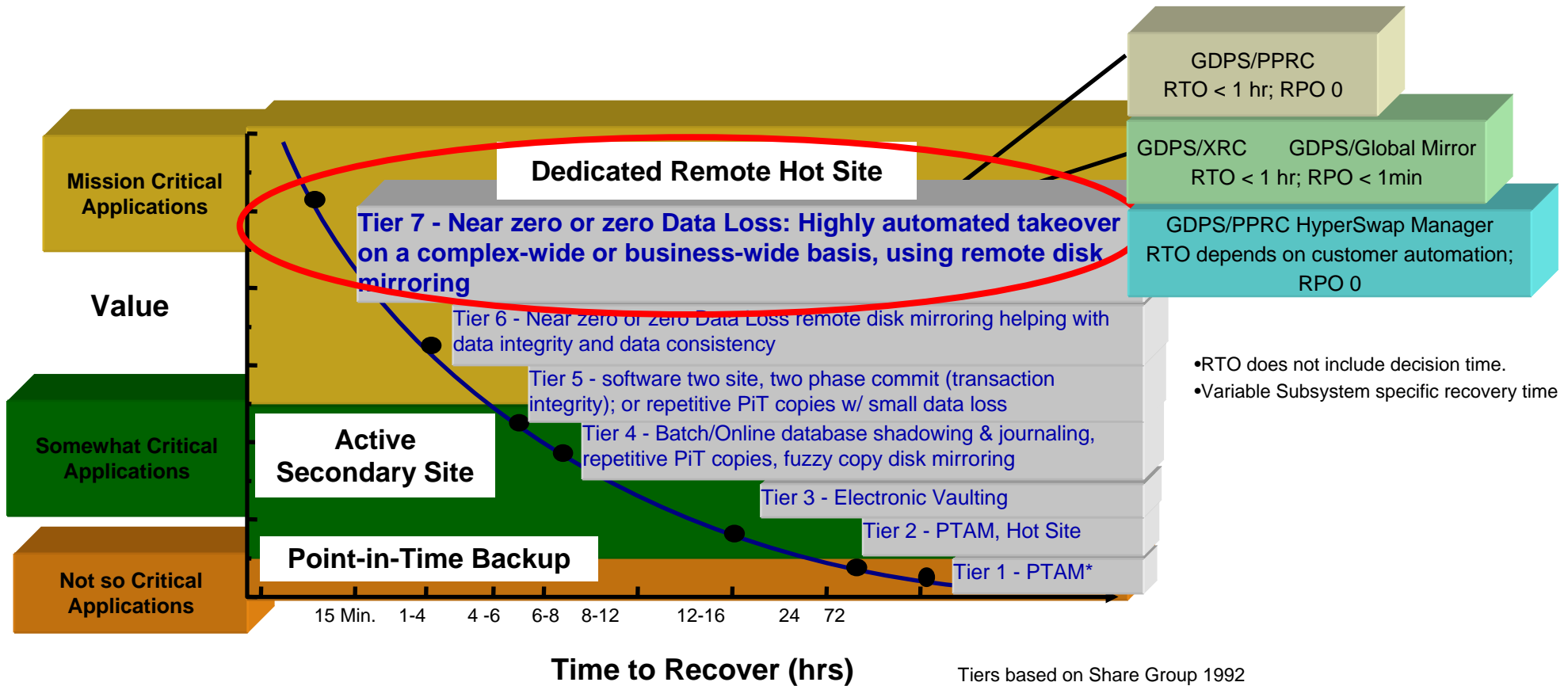
- **GDPS Overview**
- **Continuous Availability (CA) of Data within a Single Site**
- **Metropolitan Distance CA/Disaster Recovery (D/R) Solution (2 sites)**
- **Unlimited Distance D/R Solution (2 sites)**
- **CA/DR Solution (3 sites)**
- **CSC / SAS GDPS/PPRC User Experience**
- **iT-AUSTRIA GDPS/PPRC User Experience**
- **COMMERZBANK GDPS/PPRC &XRC User Experience**
- **Summary**

GDPS Overview





Tiers of Disaster Recovery: Level Setting GDPS



Best D/R practice is blend tiers of solutions in order to maximize application coverage at lowest possible cost . One size, one technology, or one methodology does not fit all applications



What are customers doing today ?

Continuous Availability of Data within a Data Center

Continuous Availability / Disaster Recovery within a Metropolitan Region

Disaster Recovery at Extended Distance

Continuous Availability Regionally and Disaster Recovery Extended Distance

**Single Data Center
Applications remain active**

**Two Data Centers
Systems remain active**

**Two Data Centers
Rapid Systems Disaster Recovery with "seconds" of Data Loss**

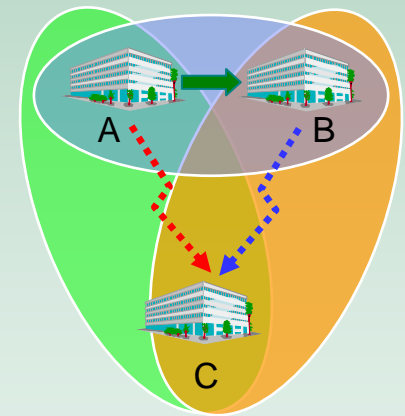
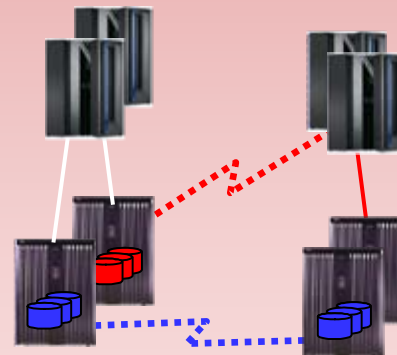
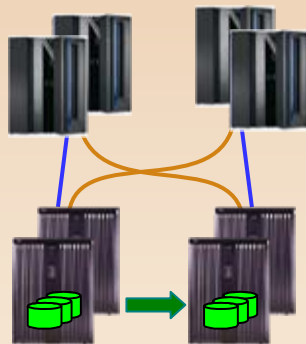
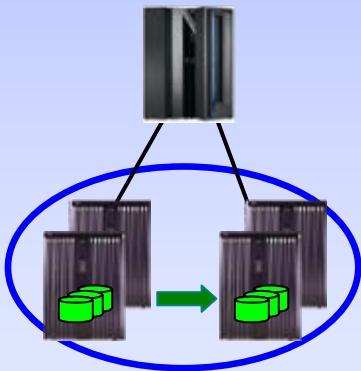
**Three Data Centers
High availability for site disasters**

Continuous access to data in the event of a storage subsystem outage

Multi-site workloads can withstand site and/or storage failures

Disaster recovery for out of region interruptions

Disaster recovery for regional disasters



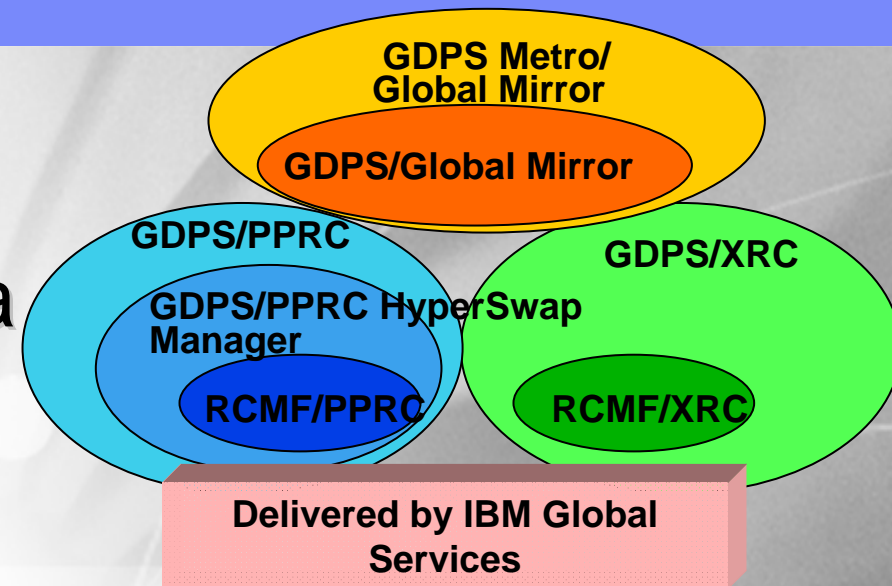
GDPS/HyperSwap Mgr

**GDPS/HyperSwap Mgr
GDPS/PPRC**

**GDPS/GM
GDPS/XRC**

**GDPS/MGM
GDPS/MzGM**

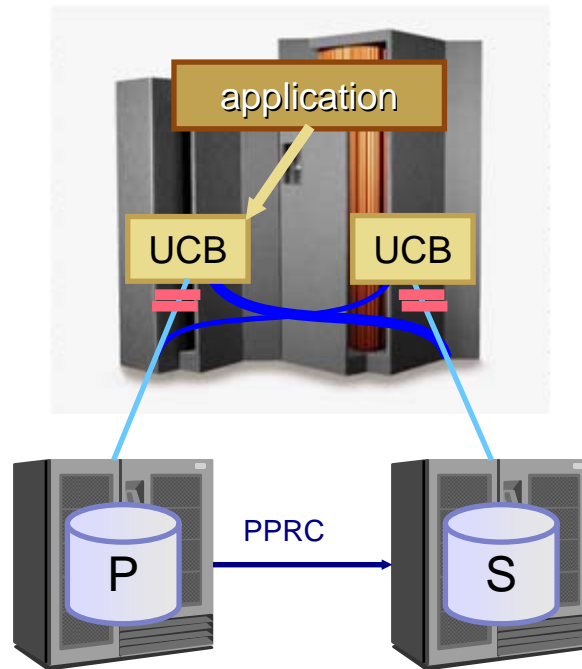
Continuous Availability of data within a single site



- ✓ **HyperSwap technology**
- ✓ **Unplanned and Planned disk reconfiguration w/ HyperSwap**



GDPS/PPRC HyperSwap – the Technology



- Substitutes PPRC secondary for primary device
 - No operator interaction - GDPS-managed
 - Can swap large number of devices - fast
 - Includes volumes with Sysres, page DS, catalogs
 - Non-disruptive - applications keep running

Brings different technologies together to provide a comprehensive application and data availability solution



GDPS/PPRC HyperSwap Manager Functional Overview

- **Single point of control to manage the remote copy configuration**

- zSeries and open data
 - Cannot HyperSwap Open Data; Open data will be “frozen” to maintain data consistency

- **Unplanned HyperSwap**

- Masks primary disk subsystem failures by transparently switching to use secondary disks

- **Planned HyperSwap**

- Provides ability to perform disk maintenance without requiring applications to be quiesced

- **Enables data consistency in the event of failures or disaster**

- **FlashCopy support**

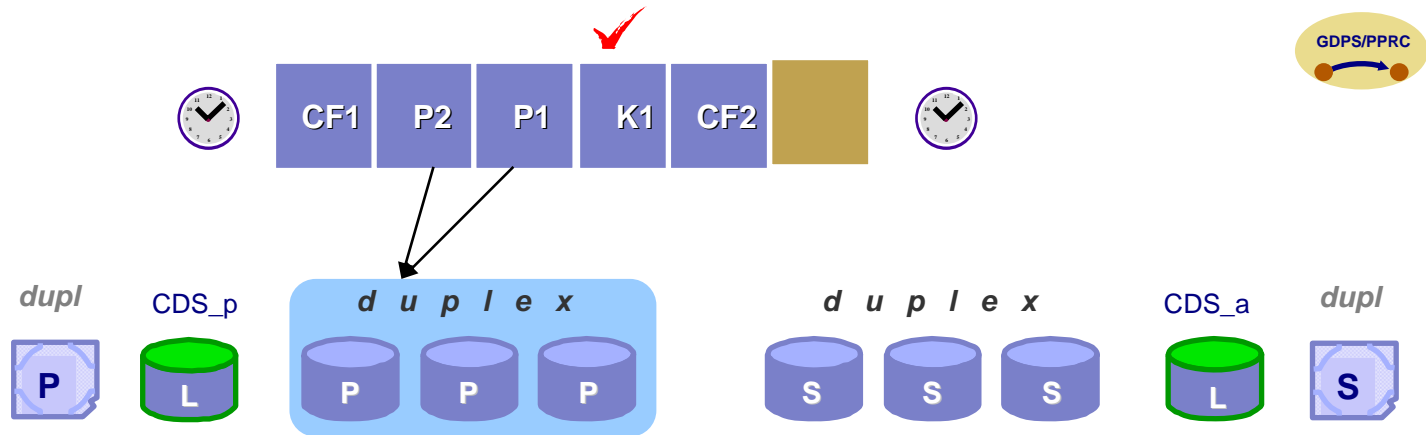
- Auto initiated by GDPS prior to resynchronization
- User initiated

- **User interface through panels**

- Status and planned actions
- Facilitates Primary/Secondary disk swaps for Planned Disk/Site Maintenance

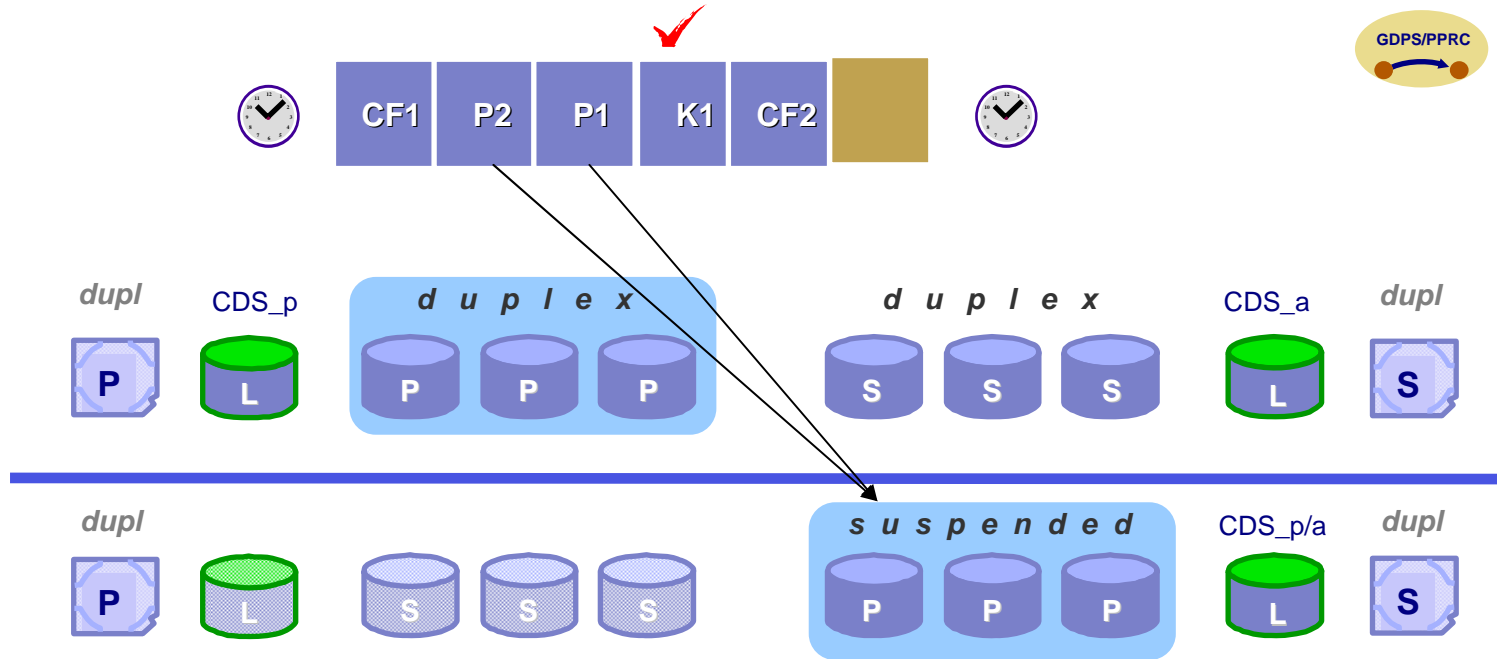


Planned Disk Reconfiguration with HyperSwap





Planned Disk Reconfiguration with HyperSwap



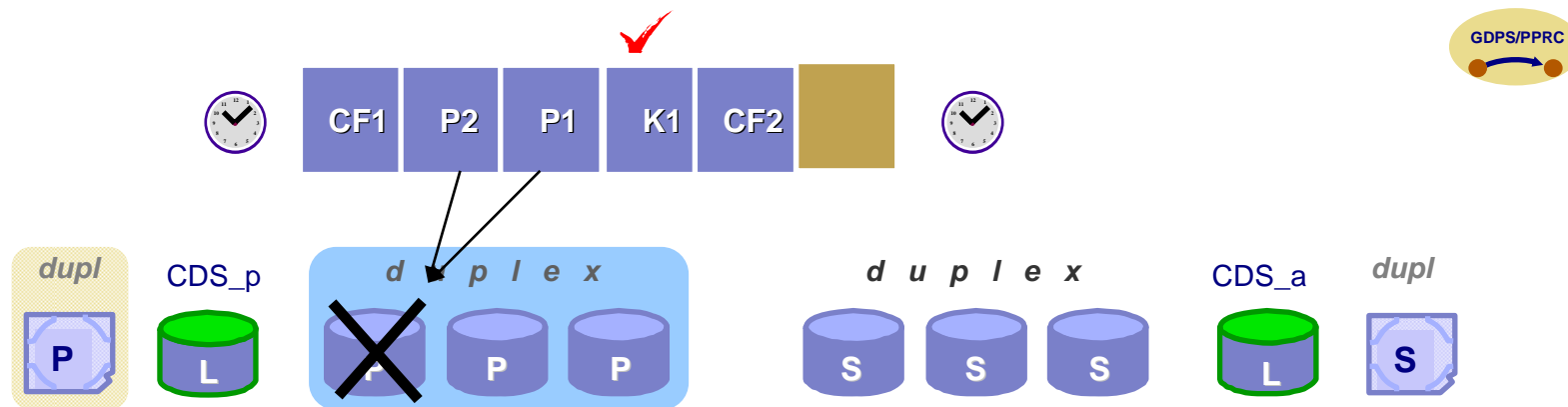
With HyperSwap and FO/FB

→ **15 Seconds! (6545 vol pairs, 19.6 TB, 46 LSS's)!**
PPRC Failover, swap the primary & secondary PPRC UCBs, systems continue

P1, P2 remain active throughout the procedure



Unplanned Disk Reconfiguration with HyperSwap

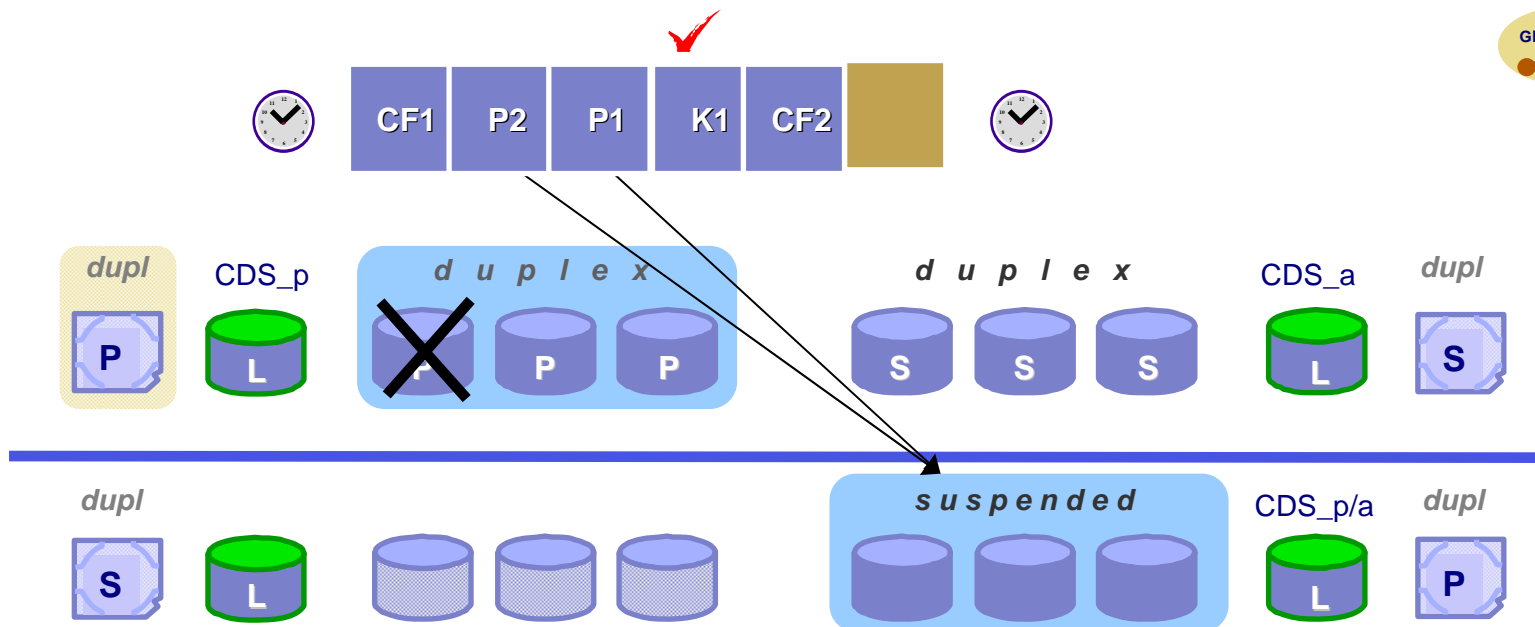




Unplanned Disk Reconfiguration with HyperSwap



HyperSwap



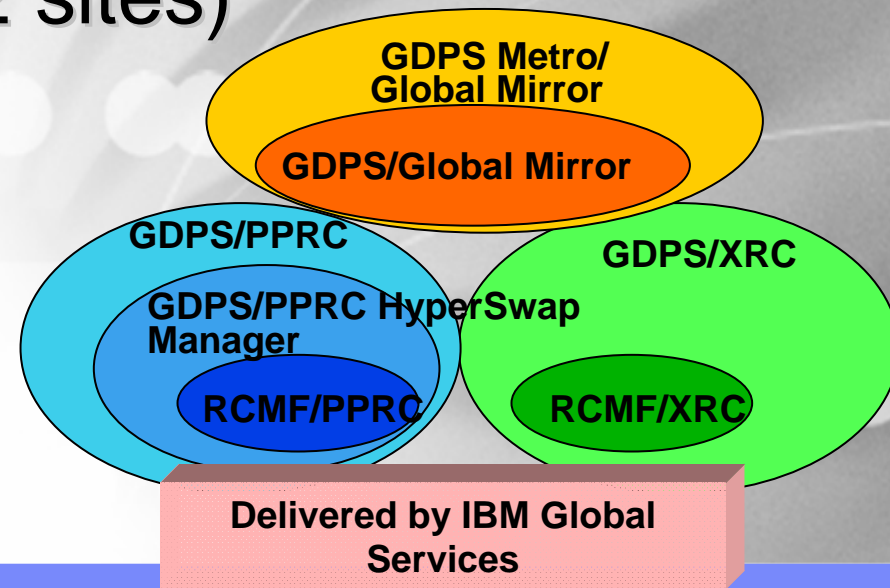
With HyperSwap and FO/FB

13 Seconds! (6545 volume pairs, 19.6 TB, 46 LSSs)
Only changed data needs to be copied to restore to original configuration
 PPRC Failover, swap the primary & secondary PPRC UCBs, systems continue

P1, P2, remain active throughout the procedure

Metropolitan Distance Continuous Availability / Disaster Recovery Solution (2 sites)

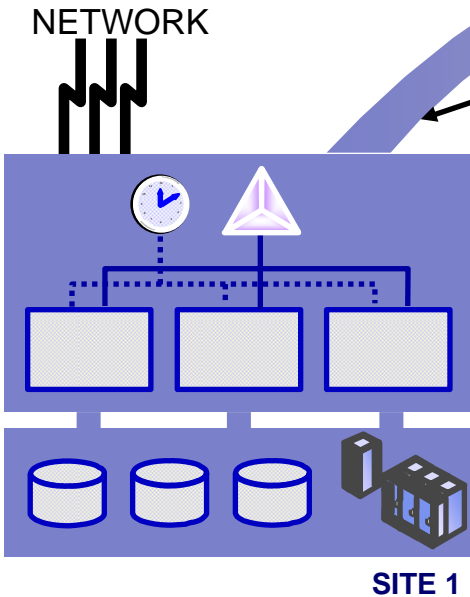
- ✓ **GDPS/PPRC**
- ✓ **Configurations**
- ✓ **Multi-Platform Resiliency**



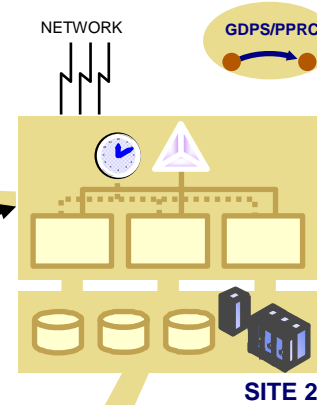
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What is GDPS/PPRC? (Metro Mirror)



100 km

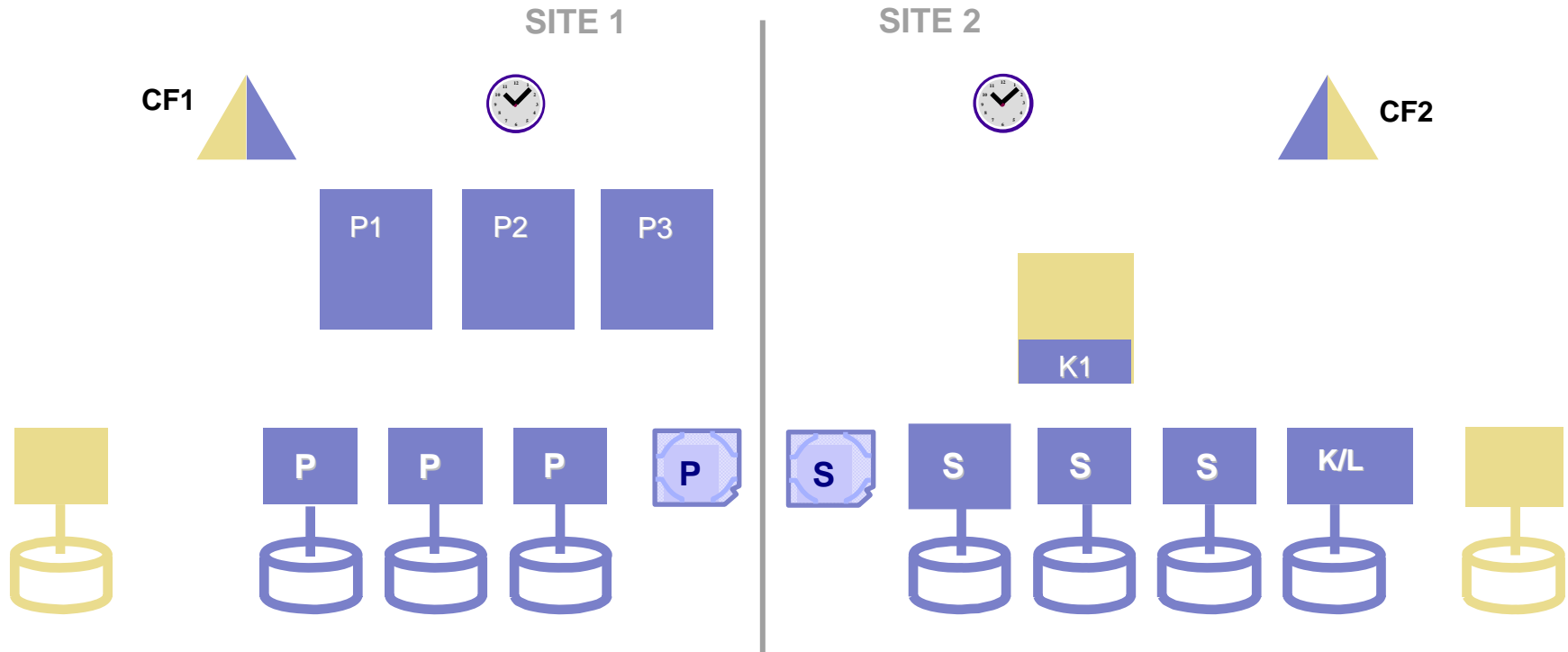


Planned and Unplanned exception conditions

- **Multi-site base or Parallel Sysplex environment**
- **Remote data mirroring using PPRC**
- **Manages unplanned reconfigurations**
 - z/OS, CF, disk, tape, site
 - Designed to maintain data consistency and integrity across all volumes
 - Supports fast, automated site failover
 - No or limited data loss - (customer business policies)
- **Single point of control for**
 - Standard actions
 - Stop, Remove, IPL system(s)
 - Parallel Sysplex Configuration management
 - Couple data set (CDS), Coupling Facility (CF) management
 - User defined script (e.g. Planned Site Switch)
 - PPRC Configuration management



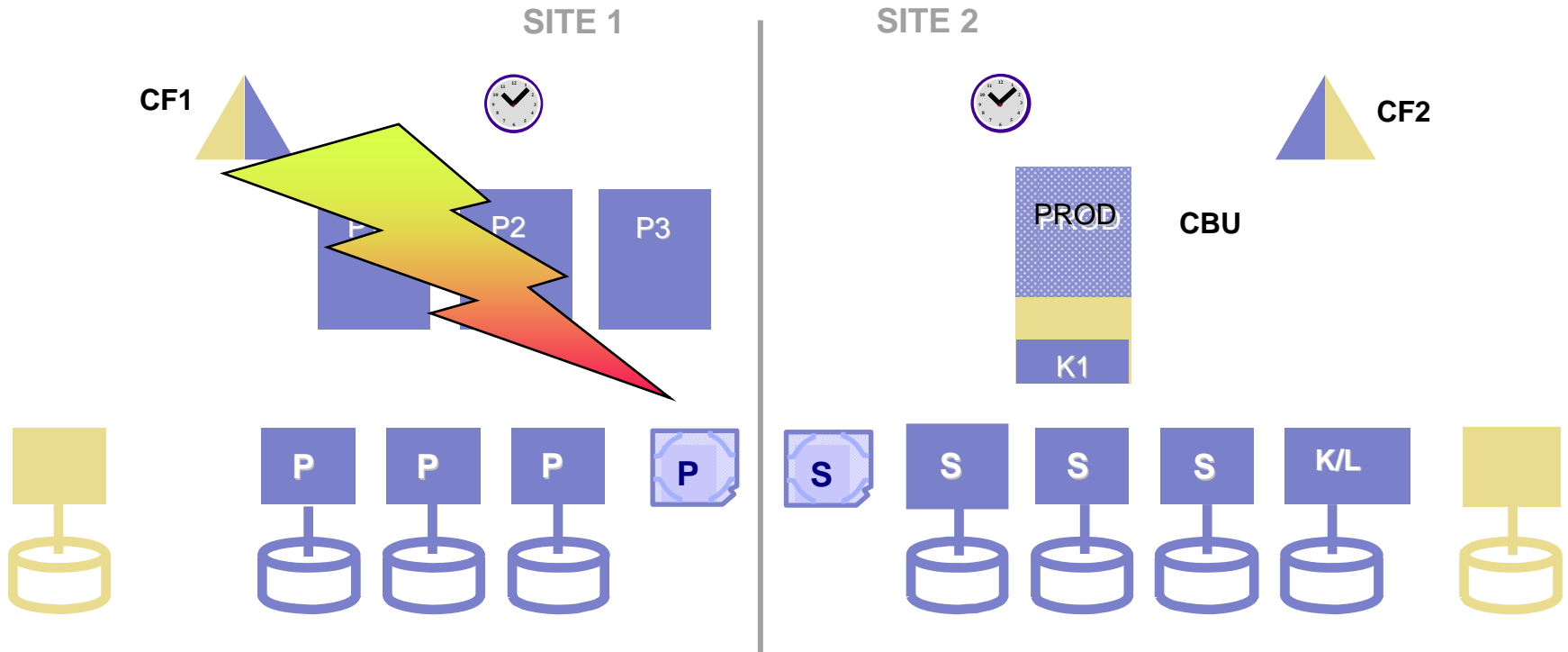
Single Site Workload - Cross-site Sysplex Near Continuous Availability Configuration



**Site recovery by restarting failed system images in Site 2
 Designed to support continuous access to data from site 1
 Unplanned and planned disk reconfiguration with HyperSwap**



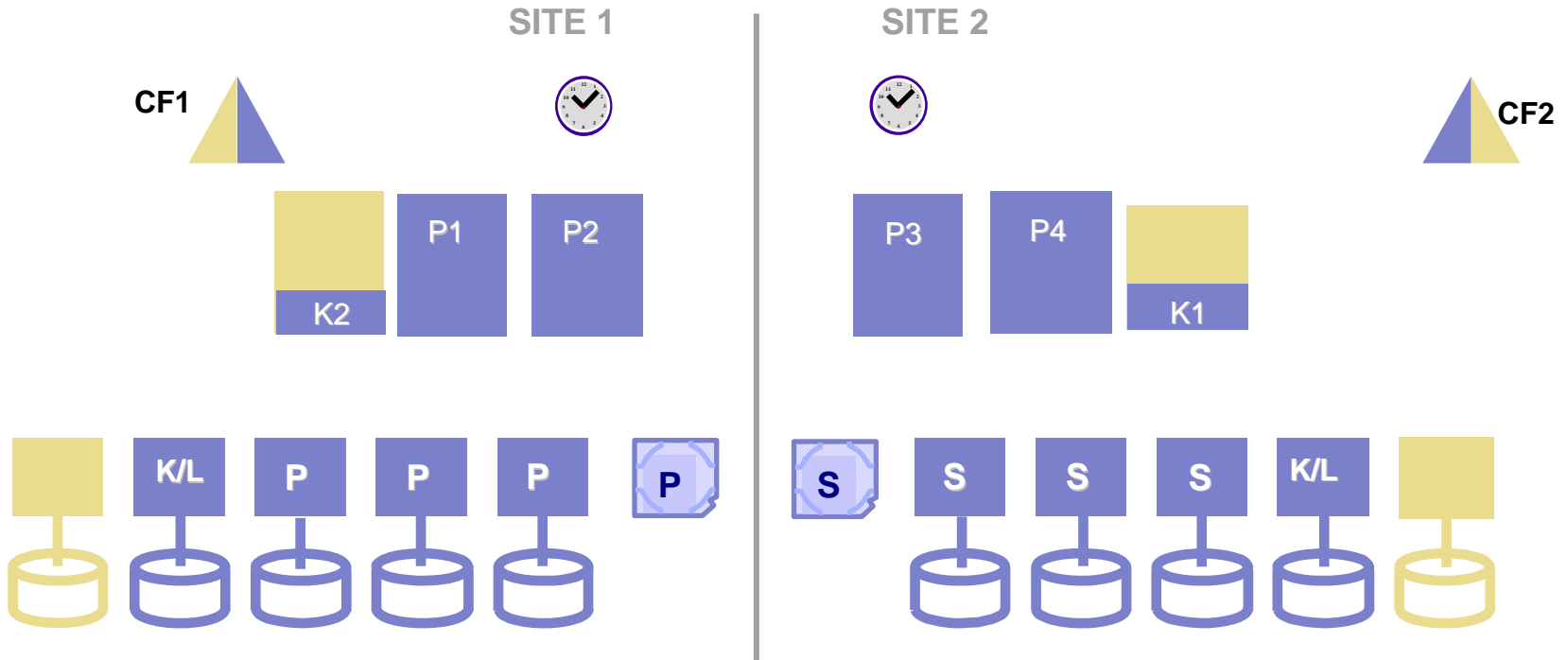
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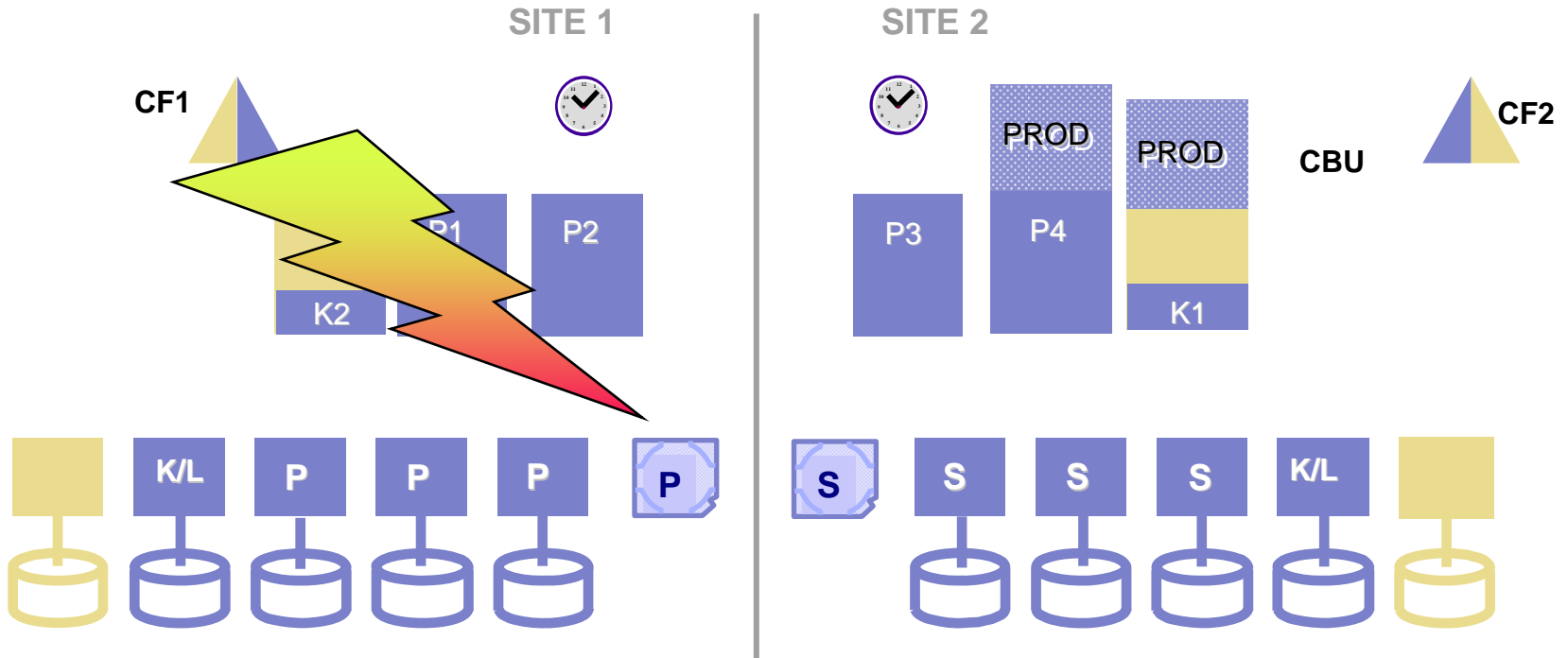
Multiple Site Workload - Cross-site Sysplex Continuous Availability Configuration



**Supports Planned and Unplanned Site and Disk reconfiguration via HyperSwap
 Operating systems remain active, applications need to be recycled
 Designed to provide continuous access to data from either site**



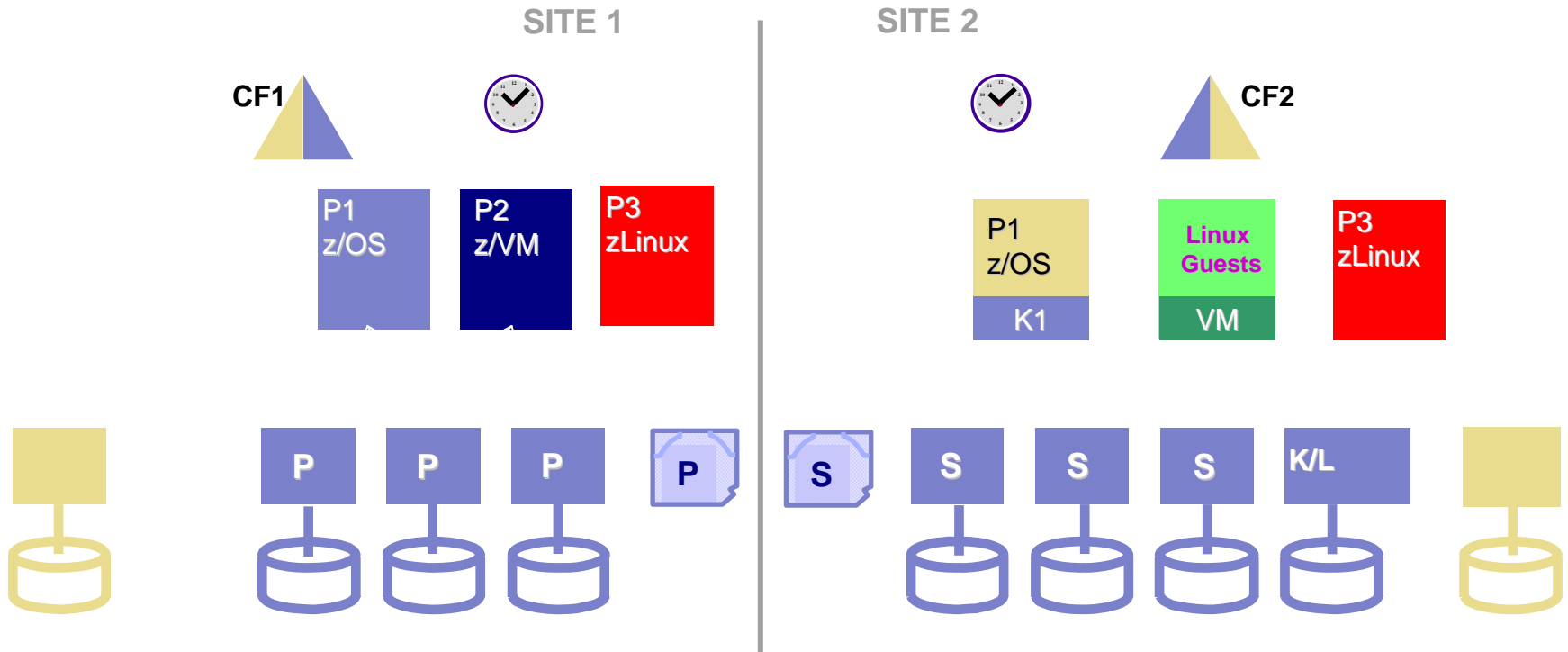
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GDPS/PPRC Multi Platform Resiliency for zSeries

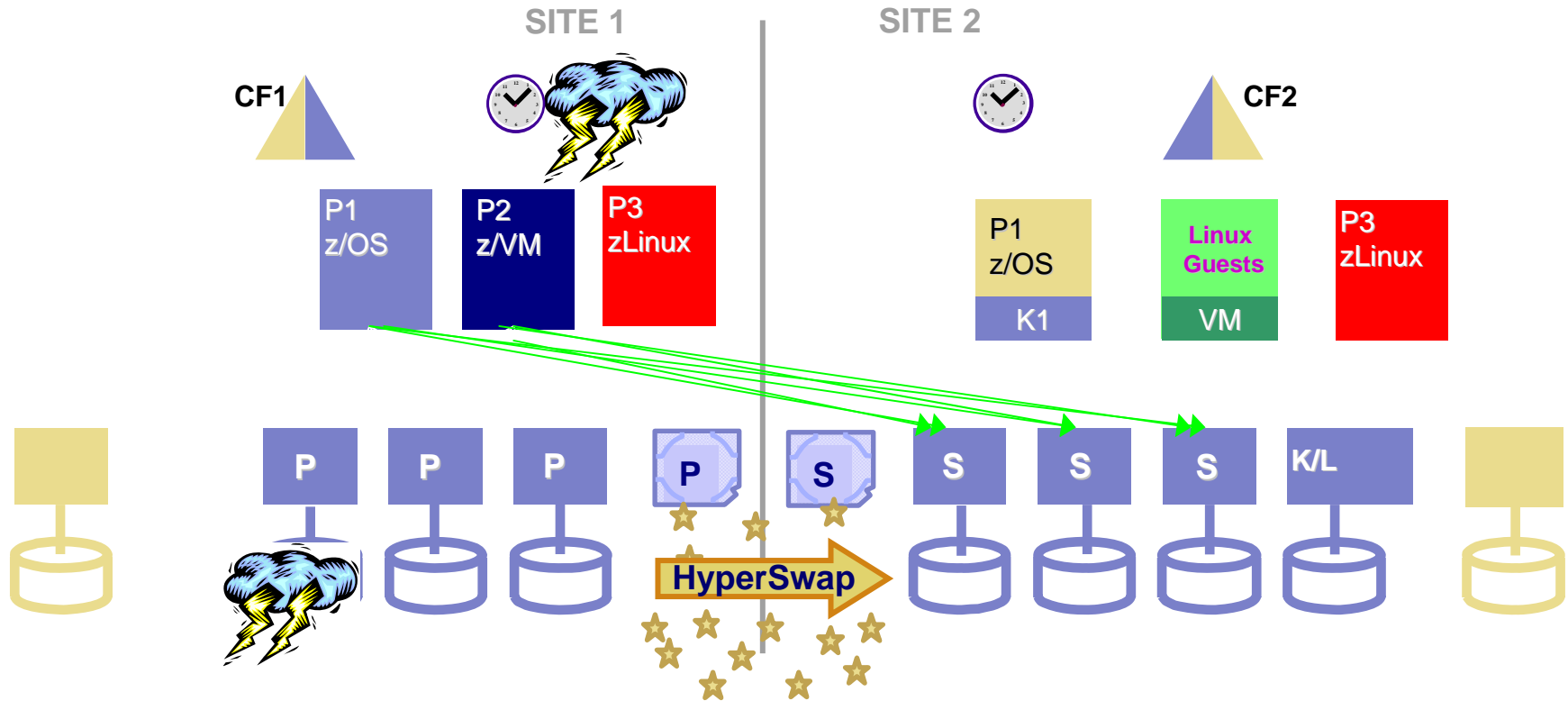


- ✓ **Coordinated near-continuous availability and DR solution for z/OS and Linux guests running under z/VM**
 - **Valuable for customers with distributed applications**
 - SAP application server running on Linux for zSeries
 - SAP DB sever running on z/OS
- ✓ **Planned and Unplanned Reconfigurations**





GDPS/PPRC Multi Platform Resiliency for zSeries

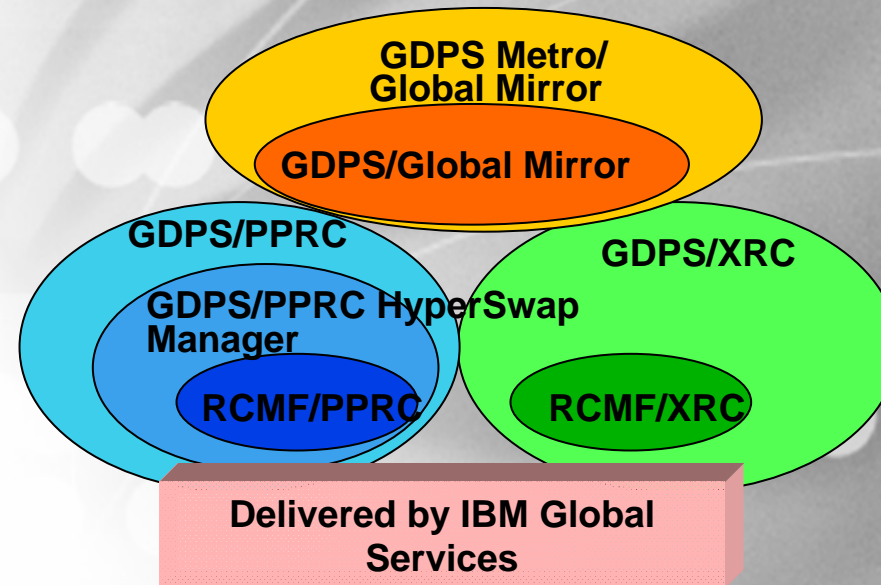


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- ✓ **Planned and Unplanned Reconfigurations**



Unlimited Distance Disaster Recovery (2 sites)

- ✓ **GDPS/XRC**
- ✓ **GDPS/Global Mirror**





What is GDPS/XRC? (z/OS Global Mirror)



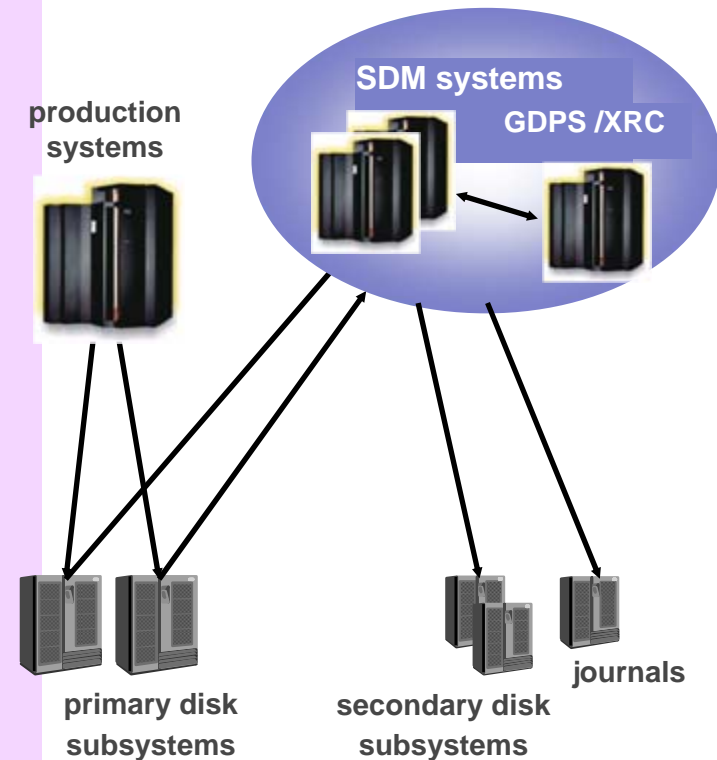
- **Productivity tool that integrates management of XRC and FlashCopy**

- Full-screen interface
- Invoke scripted procedures from panels or through exit

- **GDPS/XRC runs in the SDM location and interacts with SDM(s)**

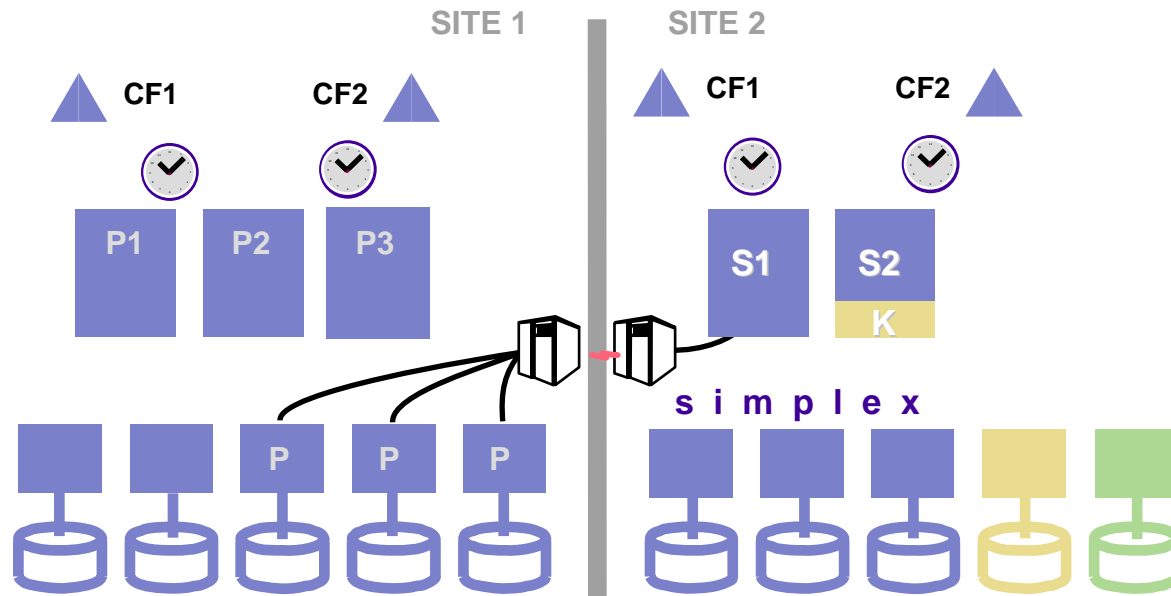
- Manages availability of SDM Sysplex
- Performs fully automated site failover

- **Single point of control for multiple / coupled Data Movers**





GDPS/XRC - Primary Site Failure

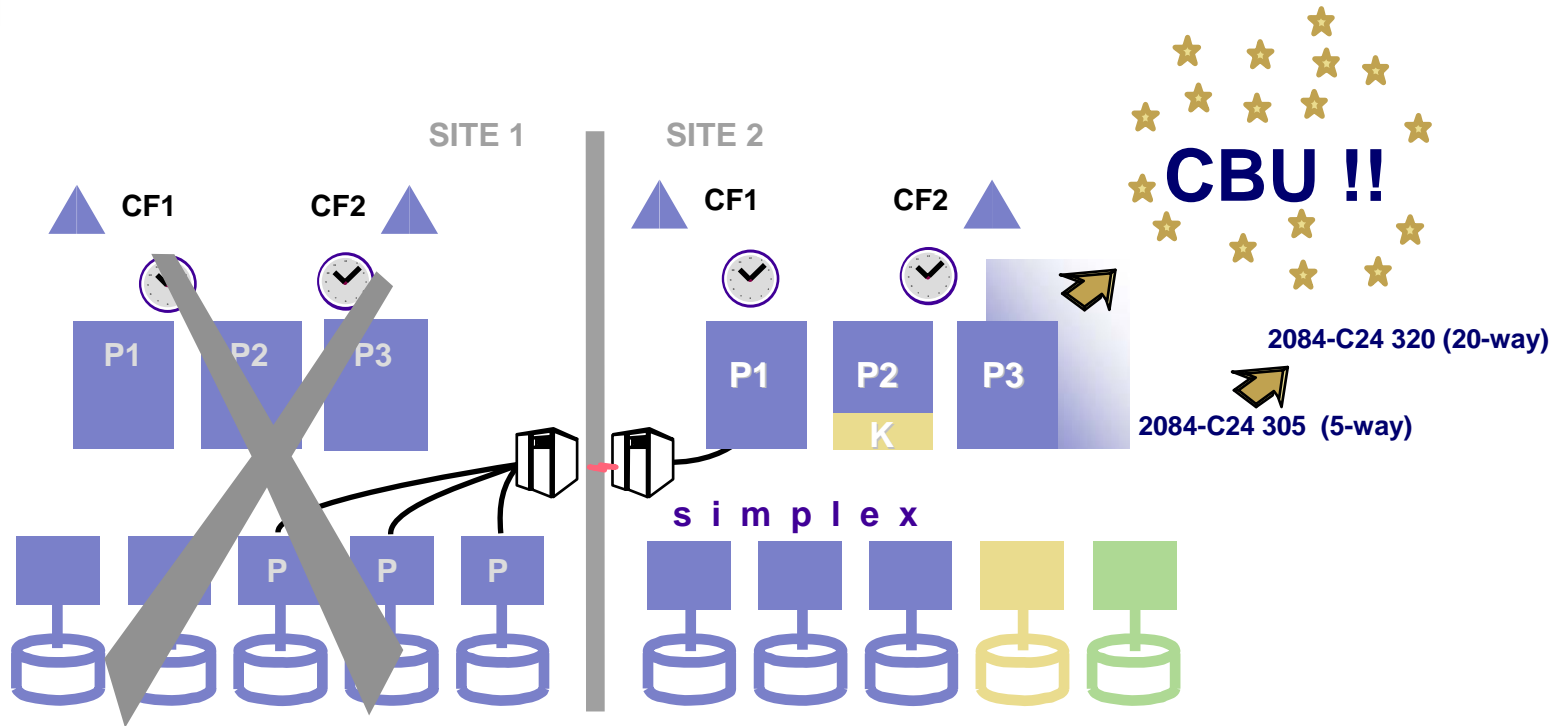


- Production system can be
 - No, Base, or Parallel Sysplex environment
 - SUSE Linux Enterprise Server (SLES) 8
- System Data Mover(s) must run in Base or Parallel Sysplex

Automates recovery of production environment
Automates invocation of CBU



GDPS/XRC - Primary Site Failure

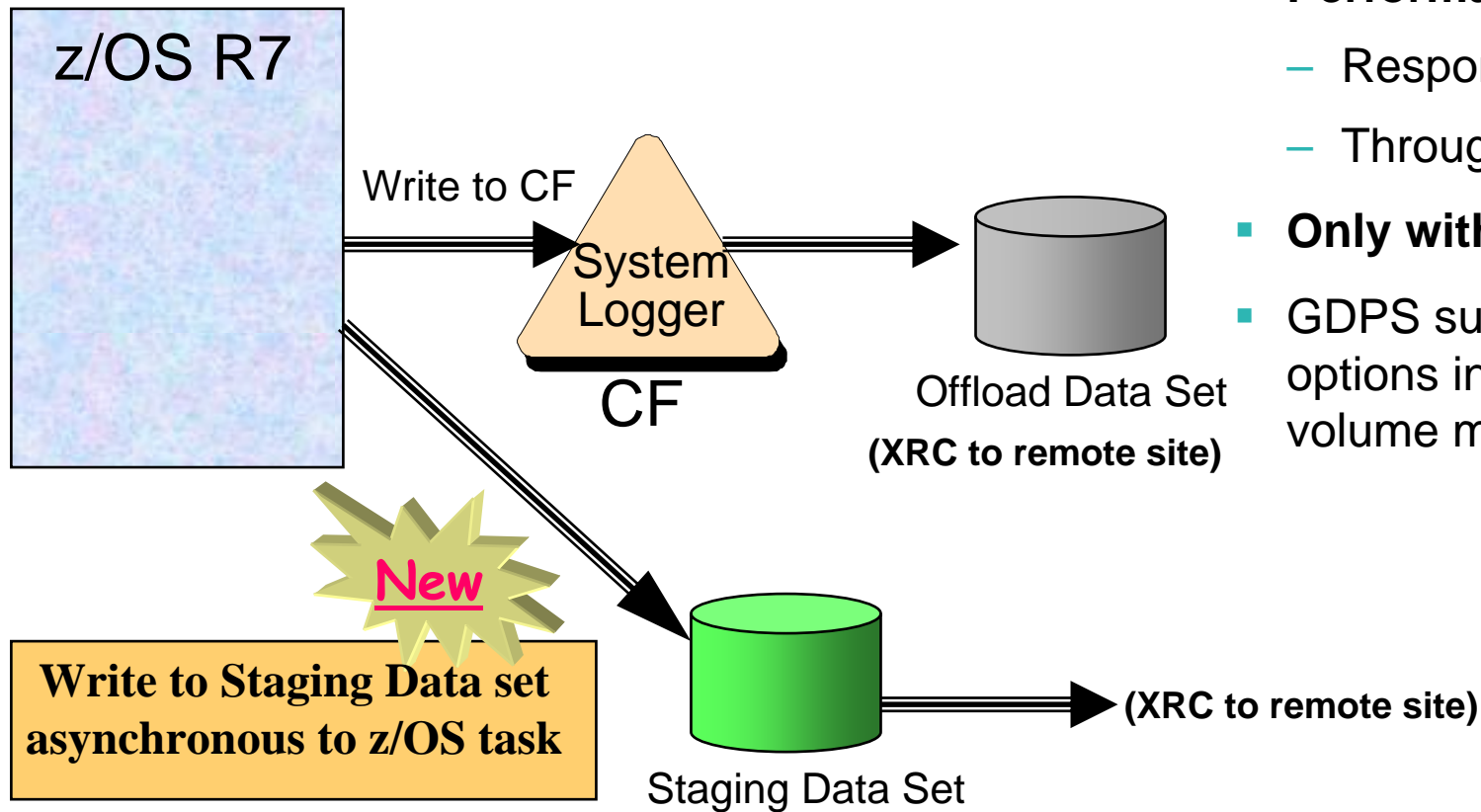


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 - No, Base, or Parallel Sysplex environment
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Automates recovery of production environment
Automates invocation of CBU



GDPS Support for "XRC+" z/OS R7



- **Performance Improvements**
 - Response Time
 - Throughput
- **Only with XRC**
- GDPS support will include the options in their setup for volume management.

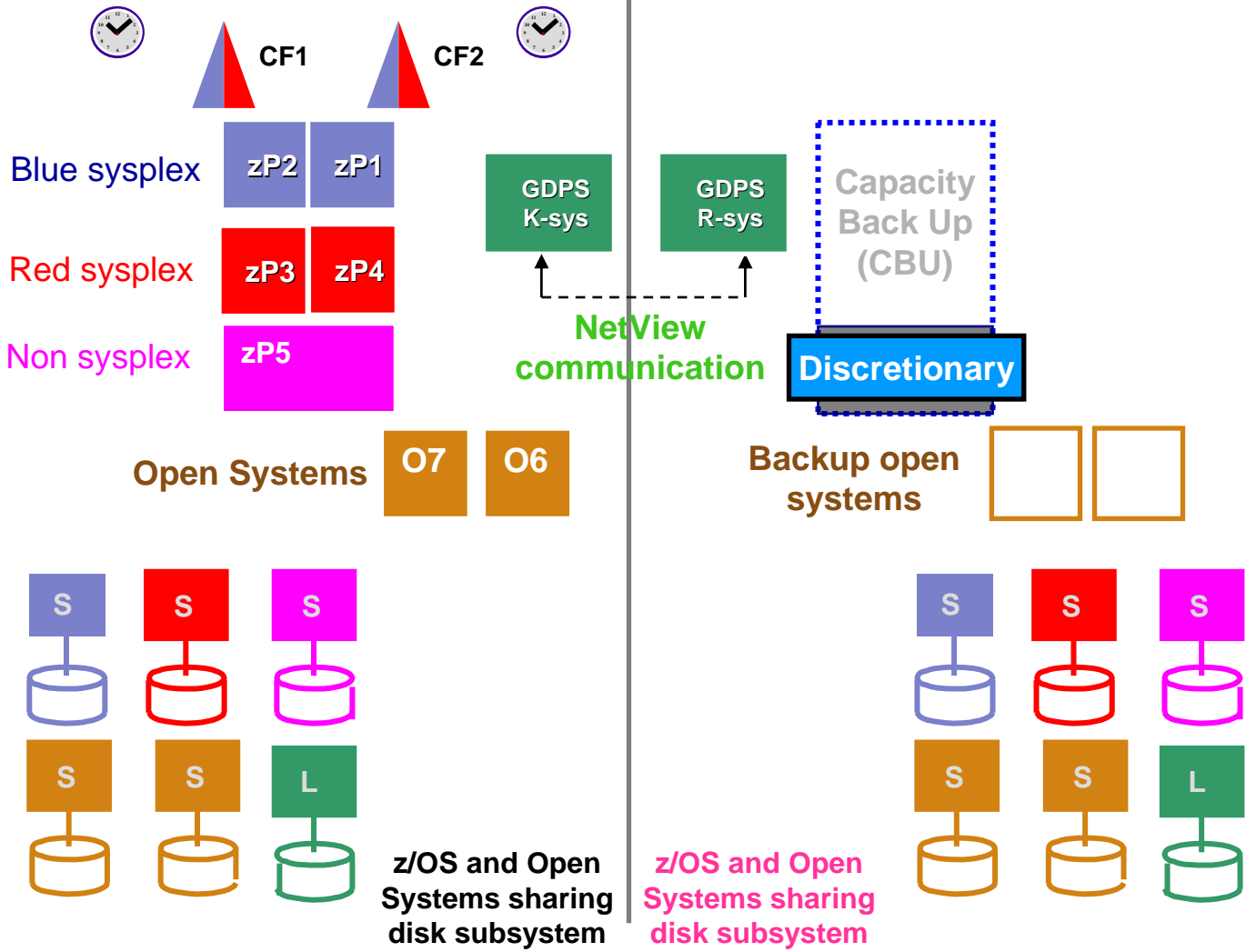
***Improved throughput
for high volume logging applications***



GDPS/Global Mirror

Application Site

Recovery Site



- **Application site can have single z/OS Systems, Open Systems, Systems in a Sysplex**
- **All data (z/OS and Open Systems) can be mirrored using Global Mirror**
- **K-sys activities**
 - **Manages multiple Global Mirror sessions**
 - **Sends device info, scripts, alerts to R-sys**
- **R-sys activities:**
 - **Secondary disk recovery, CBU activation, activate backup LPARs, IPLs systems.**

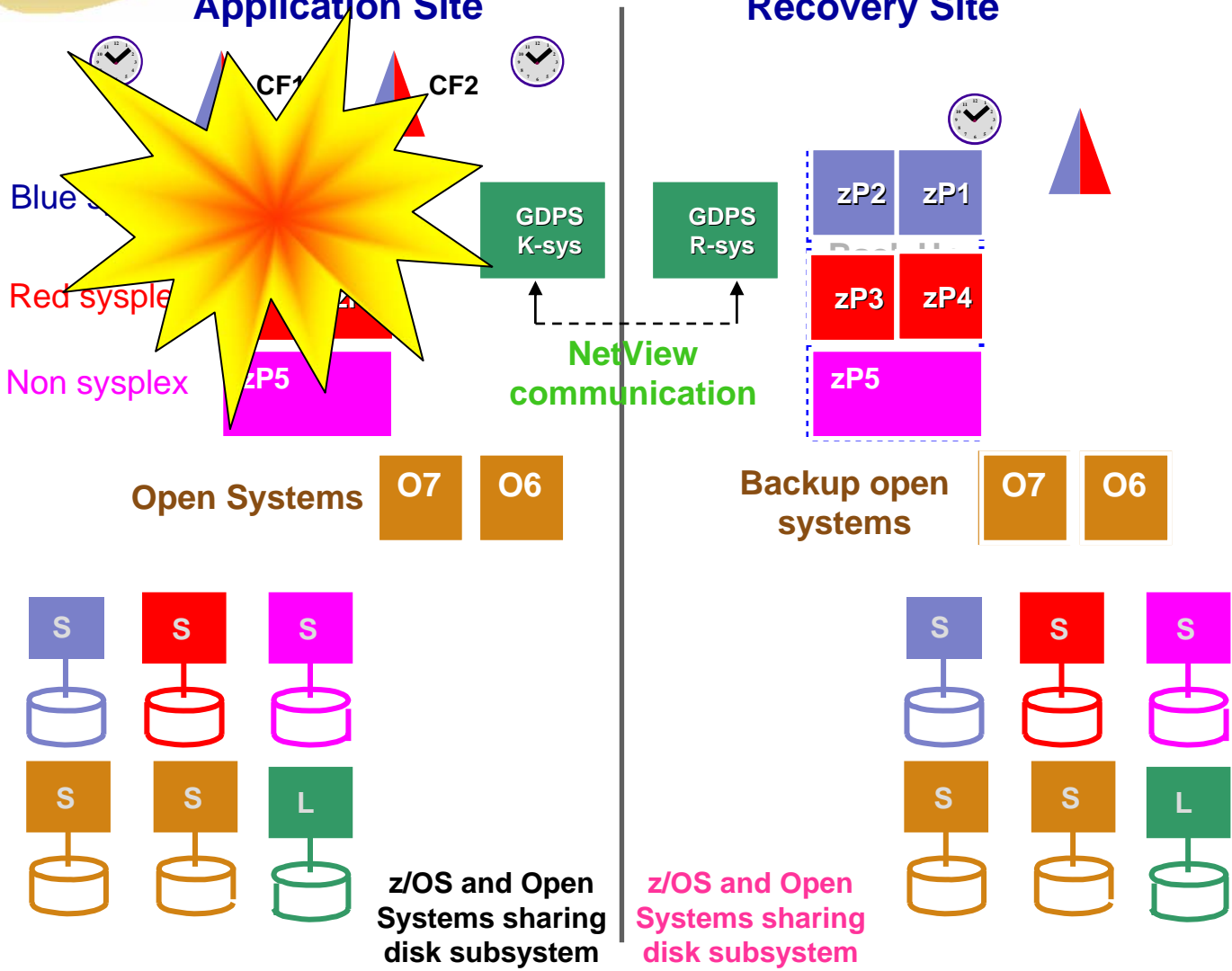
GDPS/Global Mirror – Site 1 Failure



Application Site

Recovery Site

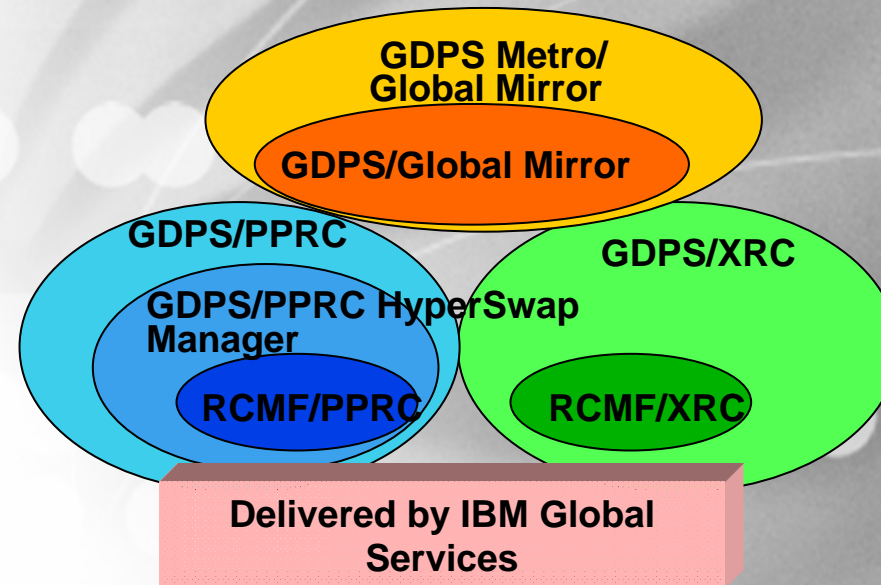
- RTO < 1 hour
- RPO < 1 minute
- (depends on bandwidth)



← Global Mirror over Unlimited Distance →

Continuous Availability and Disaster Recovery Solutions (3 site)

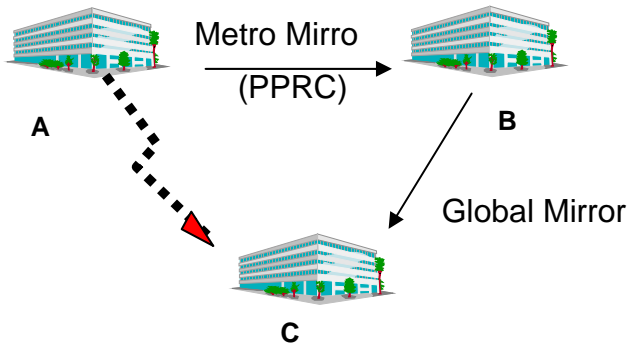
- ✓ CA/DR within metro distance
- ✓ DR at unlimited distances





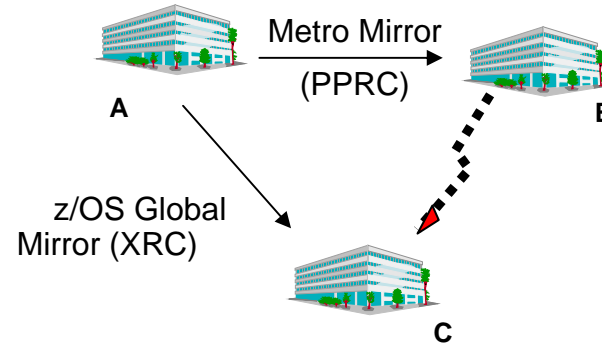
Cascading vs Multi-target Configurations

GDPS / Metro/Global Mirror (Cascading: A->B->C) :



- IBM Metro / Global Mirror
 - Synchronous Metro Mirror A to B
 - Asynchronous Global Mirror B to C
 - PiT copies created by the master disk subsystem
- Comments
 - No data loss
 - System z & open
 - Scalable bandwidth (trade-off RPO)
 - A to C network connectivity required for IR
 - If A fails, A restarted in B and DR maintained
 - If B fails, reconfig needed to restore DR

GDPS / Metro / z/OS Global Mirror (Multi-target: A->B, A->C)



- IBM Metro / z/OS Global Mirror
 - Synchronous Metro Mirror A to B
 - Asynchronous z/OS Global Mirror A to C
 - PiT copies created by the z/OS System Data Movers (SDM)
- Comments
 - No data loss
 - System z only
 - Peak bandwidth (no RPO impact)
 - B to C network connectivity required for IR
 - Mitigates system logger overhead (XRC+)
 - Maturity
 - If A fails, A restarted in B and reconfig needed to restore DR
 - If B fails, no reconfig needed to restore DR



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EXPERIENCE. RESULTS.

CSC / SAS GDPS/PPRC User Experience

IMS XRF Continuous Availability

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About SAS



EXPERIENCE. RESULTS.

1. SAS Group

- **Scandinavian (Norway, Sweden and Denmark) Airline Services**
- **Member of Star Alliance**
- **Domestic and International Routes**

2. Scandinavian IT group sold to CSC in 2004

- **Independent company: CSC Airline Solutions**
- **Application development and IT Operation**

3. IT Environment

- **Long time online applications**
- **Long time z/OS based IT**
- **IMS/DC, IMS/DB, IMS/XRF since early days**
- **DB2 with Data Sharing added later**
- **Application and systems build for Continuous Availability**



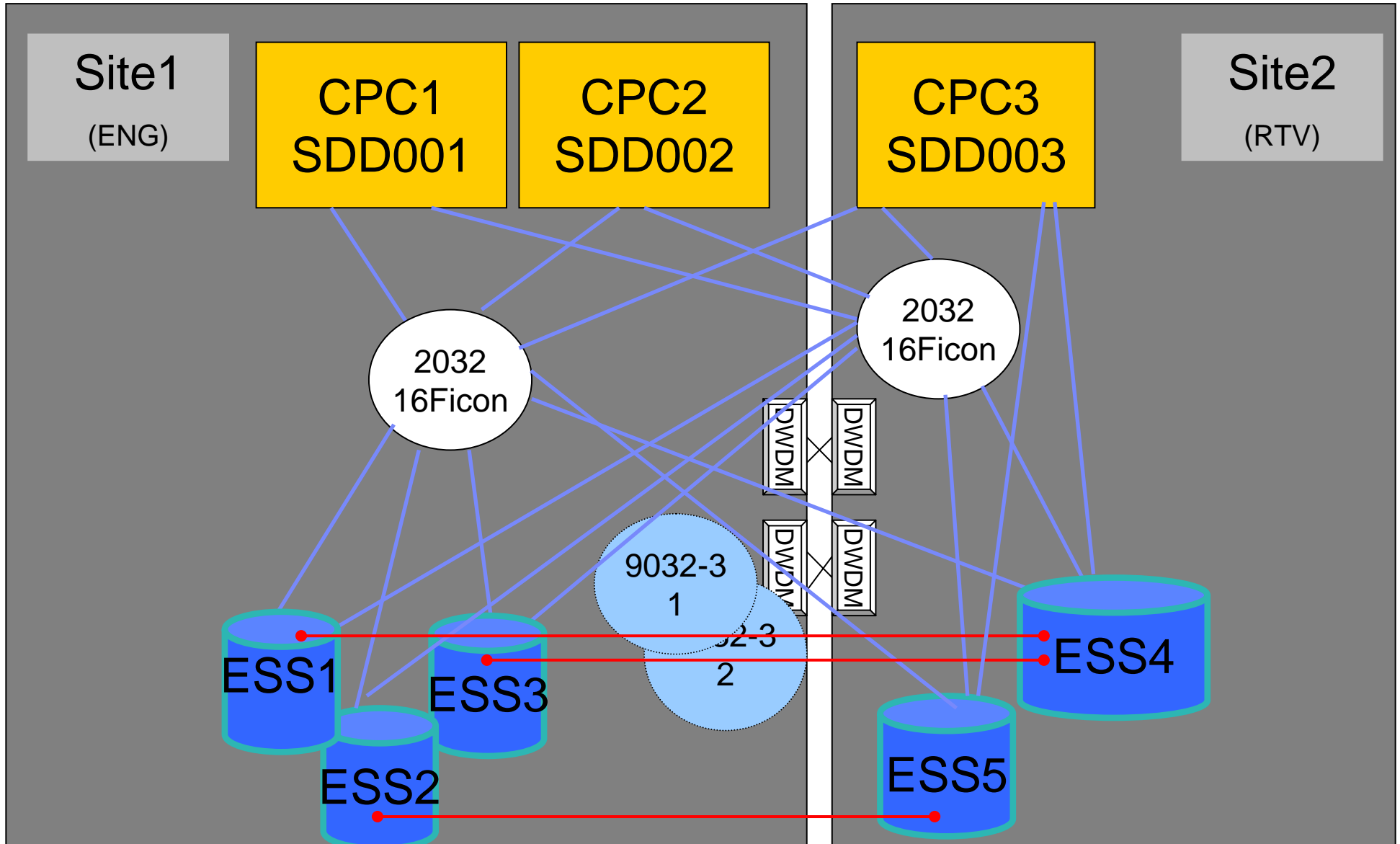
GDPS/PPRC Environment



1. **GDPS project 2005-2006**
 - **Site1:** SAS former buildings
 - **Site2:** CSC center
 - **Distance:** 15 KM
 - **Connectivity:** DWDM
 - **Multisite Workload**
 - **Main application active on one z/OS image**
 - **IMS/XRF switching to backup z/OS image**
2. **SWAP,GO policy activated 2H 2006**
 - **SWAP,STOP under consideration to achieve RPO=0**
3. **IT Equipment**
 - **IBM CPCs**
 - **IBM ESS**
 - **IBM CF's**
 - **IBM VTS**
4. **GDPS Plexes**
 - **Production environment**
 - **Test environment used for intensive testing**

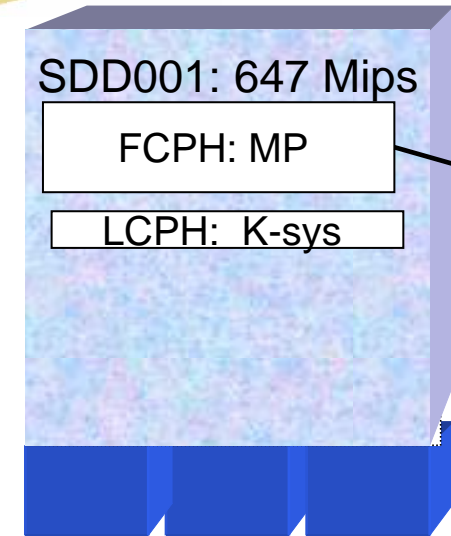


SAS Production GDPS Enviroment

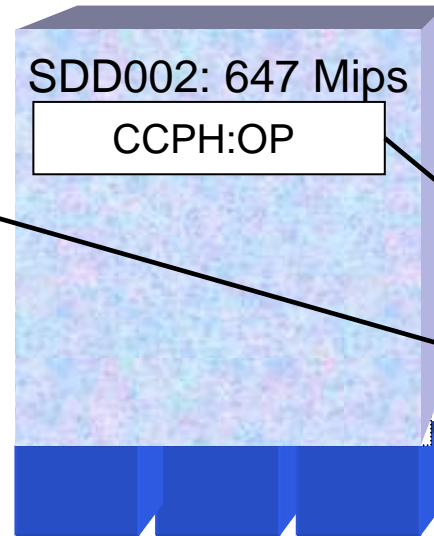




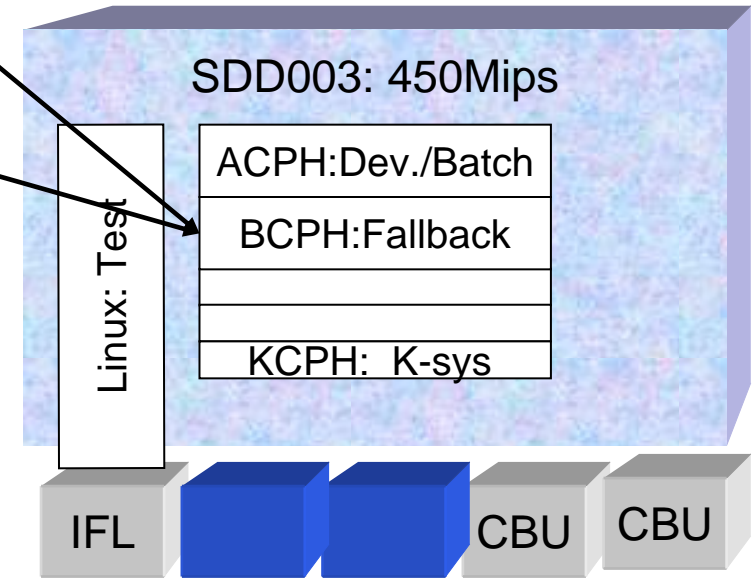
System environment overview: z/900 Server Configuration



2064/103-capped=
647-166mips=
481mips



2064/103-capped=
647-316mips=
331mips



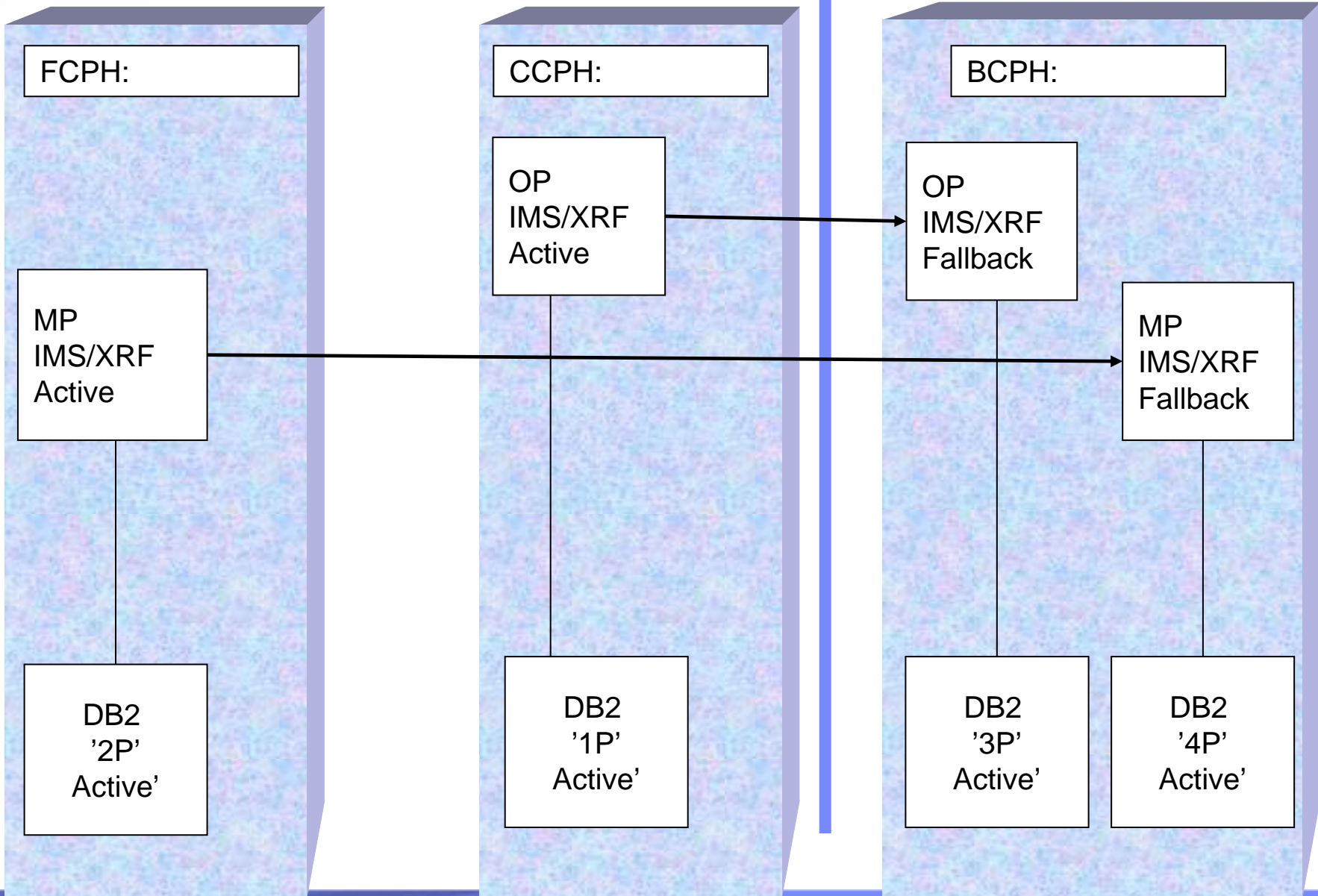
2064/102-capped+IFL+CBU(2) =
450 -62=
388Mips (up to 835mips w.CBU active)

Site1: Engvej

Site2: Retortvej



IMS and DB2 environment overview:





GDPS/PPRC Environment



- 1. Two individual IMS/XRF pairs (MP and OP Applications)**
 - Used for planned and unplanned switch
 - Very short application outage
 - No IMS DB sharing
 - No IMS Shared Queues
- 2. One 4 way DB2 sharing group**
 - '2P' and '1P' active when MP and/or OP active in site1
 - '3P' and '4P' active when MP and/or OP active in site2
 - Passive data sharing
 - DB2 available immediately after XRF switch
- 3. IMS/XRF and GDPS HyperSwap coexistence**
 - Allows IMS Reserves during XR switch
 - Prevents GDPS planned or unplanned HyperSwap to take place during XRF switch
- 4. Other z/OS images in the sysplex runs less important workload**



GDPS/PPRC Value



- 1. Adds Disaster Recovery to the existing Continuous Availability solution**
- 2. Ensures data consistency on PPRC Secondary devices**
 - DB2 and IMS data is 'restartable'
- 3. Hyperswap**
 - Integrated with XRF implementation
 - Data availability
 - Planned and unplanned events for DASD
 - DB2 available immediately after XRF switch
- 4. System automation**
 - Stop, start of z/OS images
 - CBU activation
- 5. Integrated solution.**
 - Fits into DR plans, including regular testing



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iT-AUSTRIA GDPS/PPRC User Experience

IMS Continuous Availability

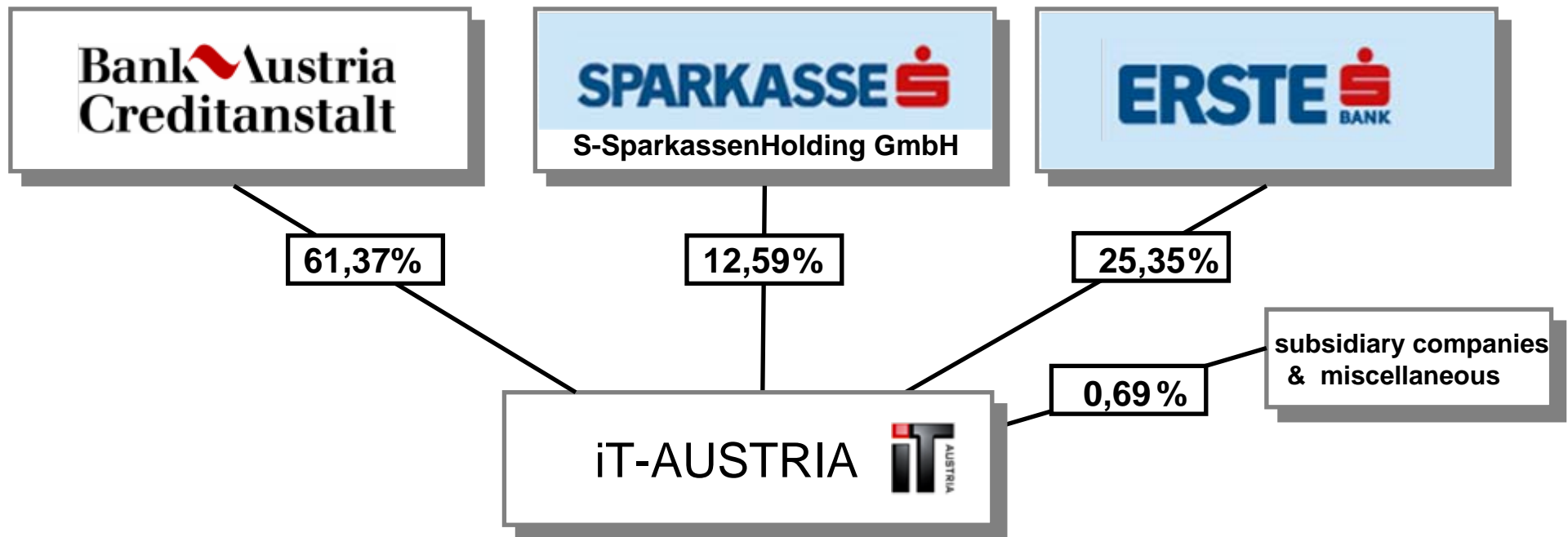
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About iT-AUSTRIA

Largest EDP-service provider for the financial sector in Austria

Who are the shareholders?





Some data



mainframe

- **number of server:** 3 IBM
- **disk capacity z/OS:** 237 terabyte
- **computing power z/OS (IBM):** 27,800 MIPS



midrange

- **UNIX:** 740 systems 77 terabyte disk capacity
- **OS/400:** 36 systems 101 terabyte disk capacity
- **NT-server:** 1.450 systems 147 terabyte disk capacity



telecommunication

- **network connections**
Banken/Sparkassen – network®ional-service : 779 in Austria
City - service: 755
international sites: 110 in 32
countries
- **network access points / local:** 47,500
- **internal connections:** 26,600
- **telephone exchange:** 381



Business Requirements

- No loss of committed data (RPO = 0)
- No more than five minutes disruption in the event of catastrophic systems or data center failure (RTO < 5 min)
- Supporting site maintenance without application outage





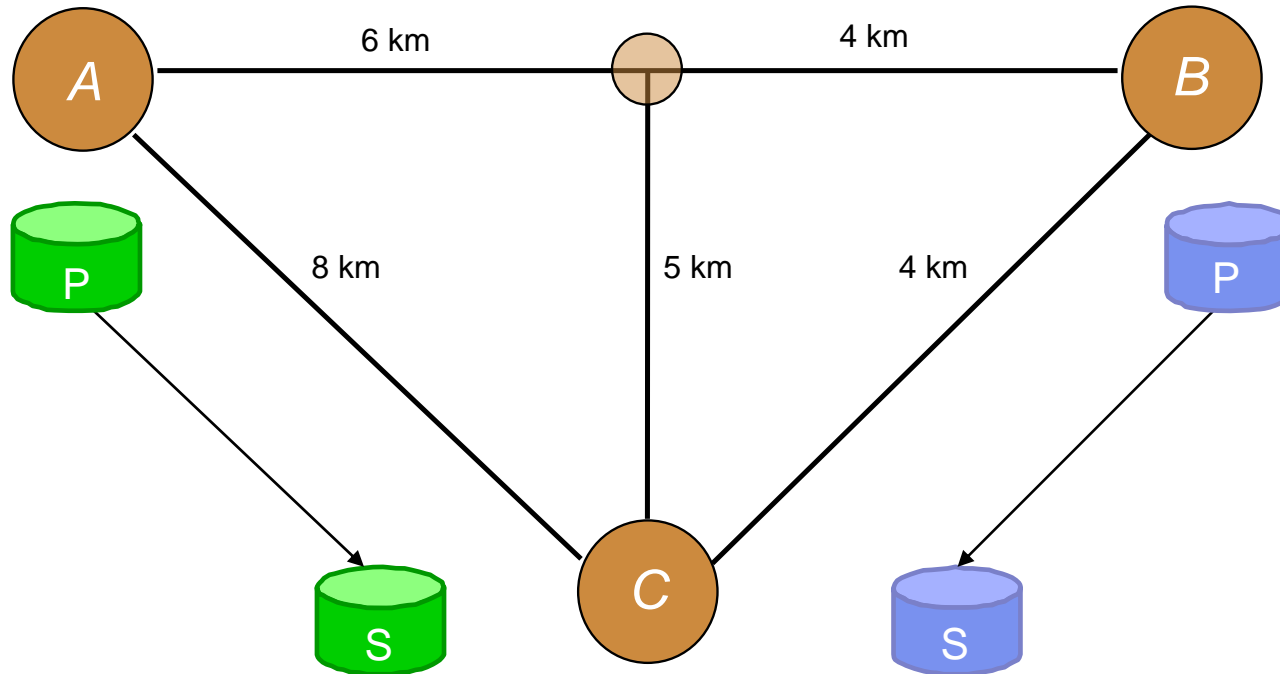
GDPS Architecture (3-Site CA Model)

Spardat & Erste Bank GDPS
(5-way PS, CICS/Natural, Adabas, DB2)

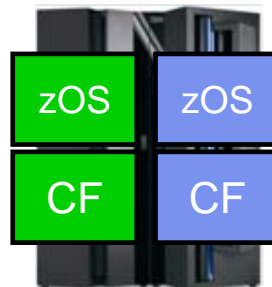
Bank Austria Creditanstalt GDPS
(10-way PS, CICS/DB2, IMS/DB, VSAM/RLS)



Primary Site



Primary Site



Secondary Site

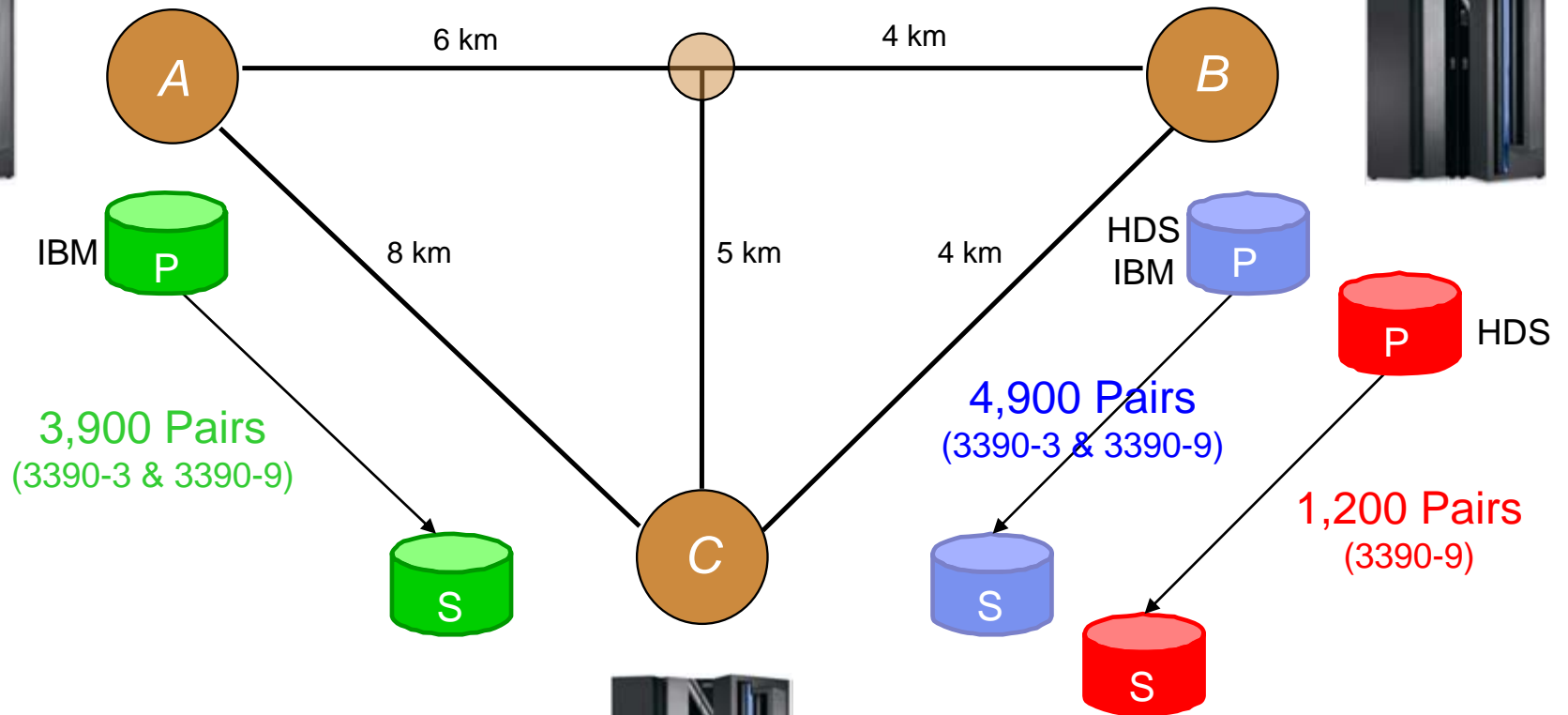
Secondary Site



GDPS - Disk Mirroring (PPRC)

Spardat & Erste Bank GDPS
(5-way PS, CICS/Natural, Adabas, DB2)

Bank Austria Creditanstalt GDPS
(10-way PS, CICS/DB2, IMS/DB, VSAM/RLS)



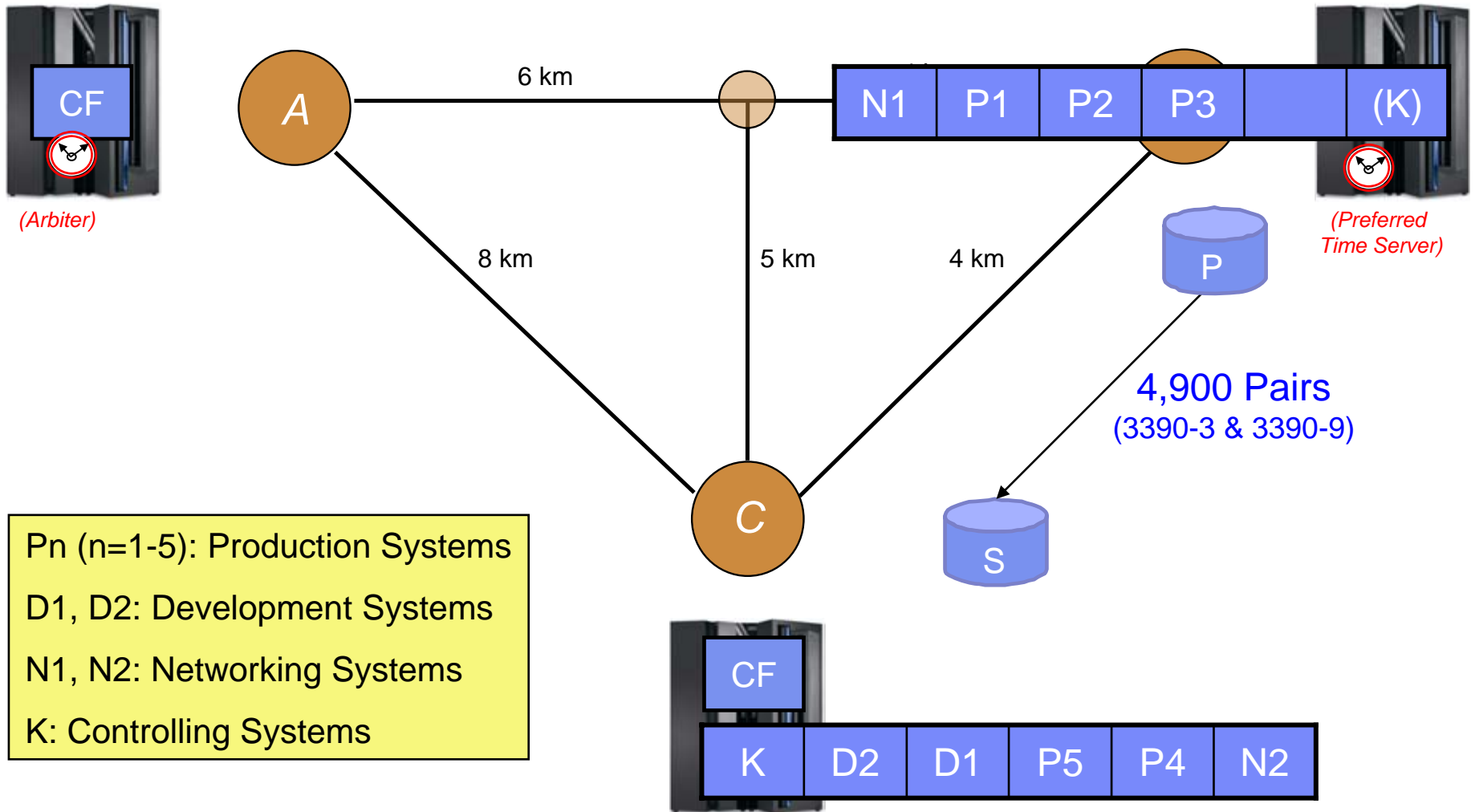
**Bank Austria Creditanstalt
Spardat & EB GDPS**
(3-way PS, TSM)





GDPS - LPARs & Sysplex Timer

*Bank Austria Creditanstalt GDPS
(10-way PS, CICS/DB2, IMS/DB, VSAM/RLS)*

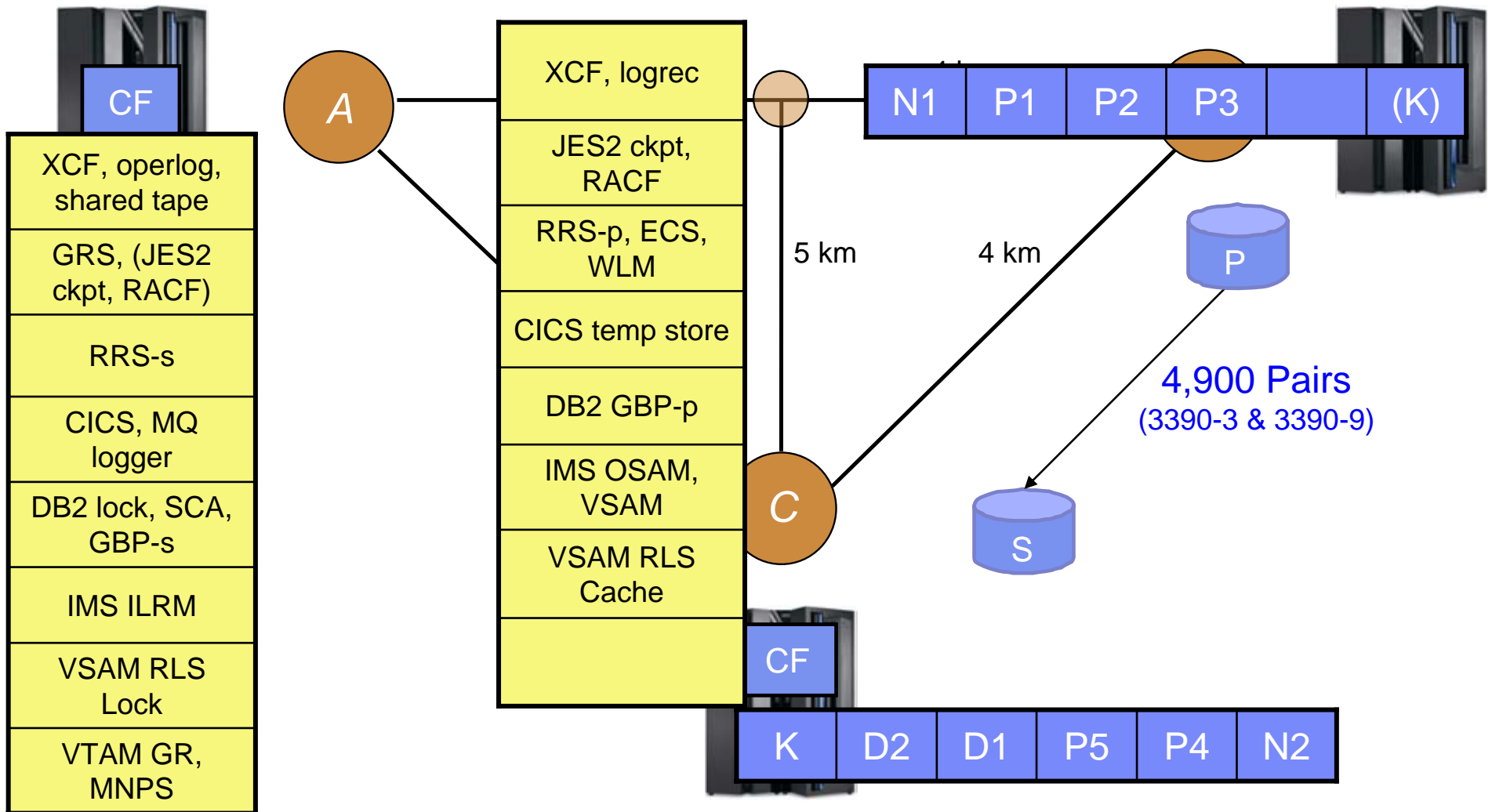


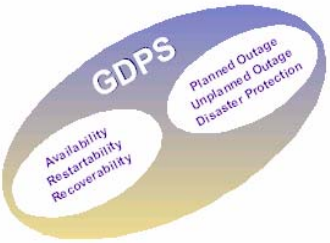
Pn (n=1-5): Production Systems
 D1, D2: Development Systems
 N1, N2: Networking Systems
 K: Controlling Systems



GDPS - CF Structure Placement

*Bank Austria Creditanstalt GDPS
(10-way PS, CICS/DB2, IMS/DB, VSAM/RLS)*

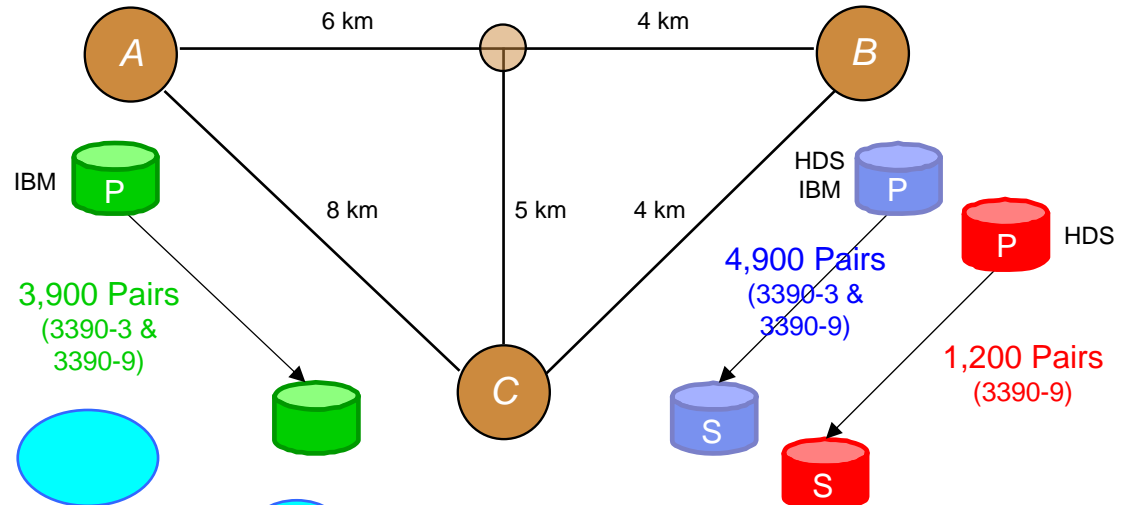




GDPS/PPRC Experience

*Spardat & Erste Bank GDPS
(5-way PS, CICS/Natural,
Adabas, DB2)*

*Bank Austria Creditanstalt GDPS
(10-way PS, CICS/DB2, IMS/DB,
VSAM/RLS)*



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No more than five minutes disruption in the event of catastrophic systems or data center failure (RTO < 5 min)

Supporting site maintenance without application outage

n-way GDPS (MSW)	Number PPRC Volumes	Planned HS RESYNCH UIT	Planned HS SUSPEND UIT	Unplanned HyperSwap UIT
3-way	1,200 pairs	63 sec	12 sec	3 sec
5-way	3,900 pairs	20 sec	12 sec	7 sec
10-way	4,900 pairs	109 sec	19 sec	8 sec

MSW = Multi-Site Workload

UIT = User Impact Time (seconds)

*Bank Austria Creditanstalt
Spardat & EB GDPS
(3-way PS, TSM)*





IBM

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COMMERZBANK GDPS/PPRC & XRC User Experience

IMS Continuous Availability & Disaster Recovery

ON DEMAND BUSINESS™



About Commerzbank

| ideas ahead | COMMERZBANK 

Commerzbank is Germany's second largest bank and one of the leading banks in Europe. Its consolidated balance sheet total stands at 608bn euros.

Roughly 36,000 employees
8,725 of them outside Germany
More than 8 million customers worldwide





Commerzbank IT

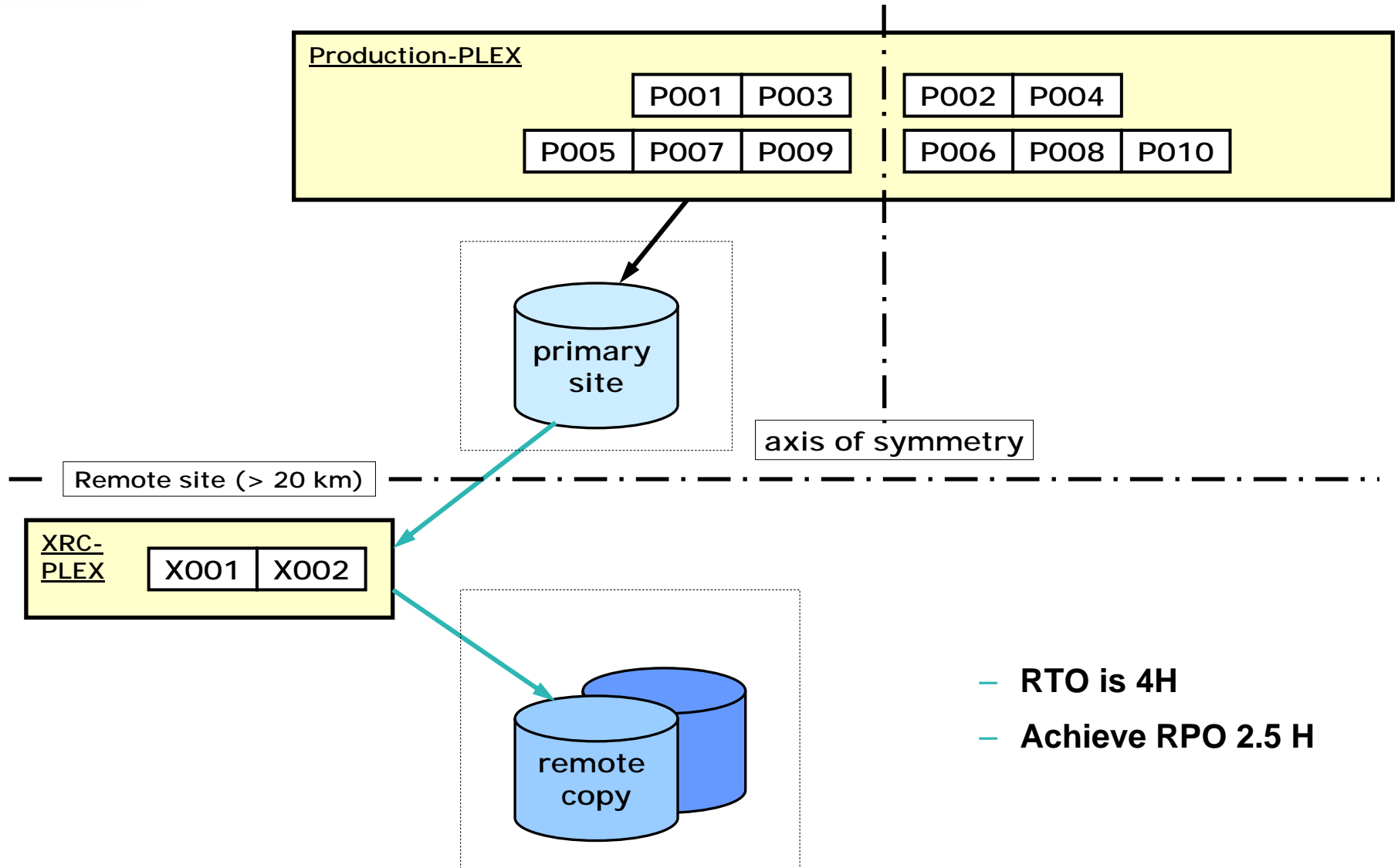
/ ideas ahead / COMMERZBANK 

- About 2,000 employees work in IT development, IT production and IT support
- There are two data centers in the Rhine-Main area for disaster recovery purposes
- In the mainframe environment
 - 143 TB DASD capacity
 - 890 TB TAPE capacity





Remote Disaster Recovery

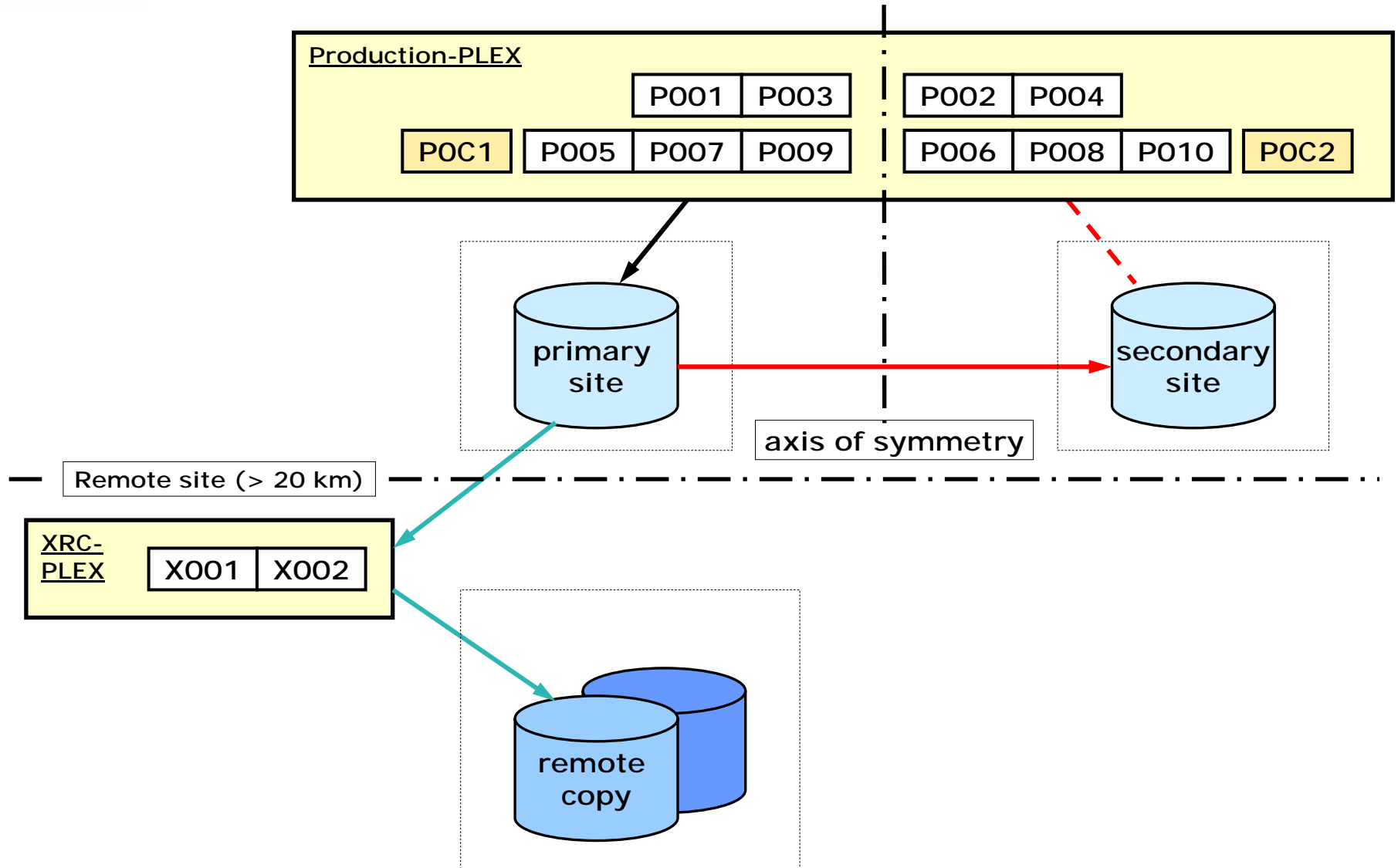


- RTO is 4H
- Achieve RPO 2.5 H



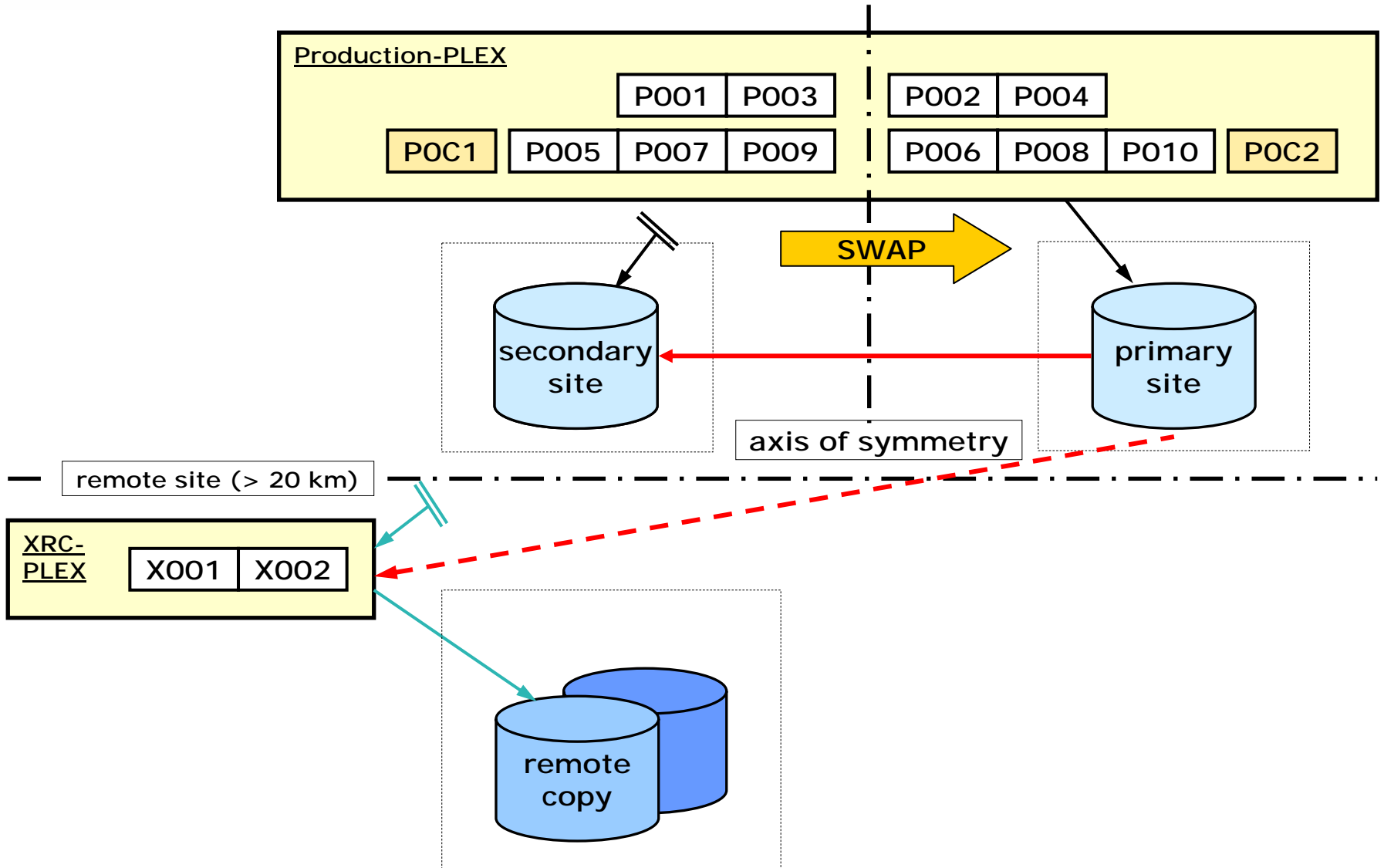
Remote Disaster Recovery and Local High Availability

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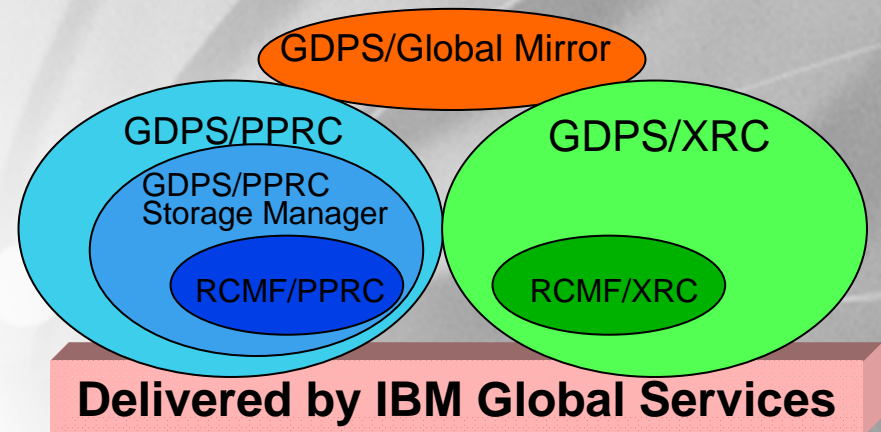




And what happens when the primary DASD subsystem fails?



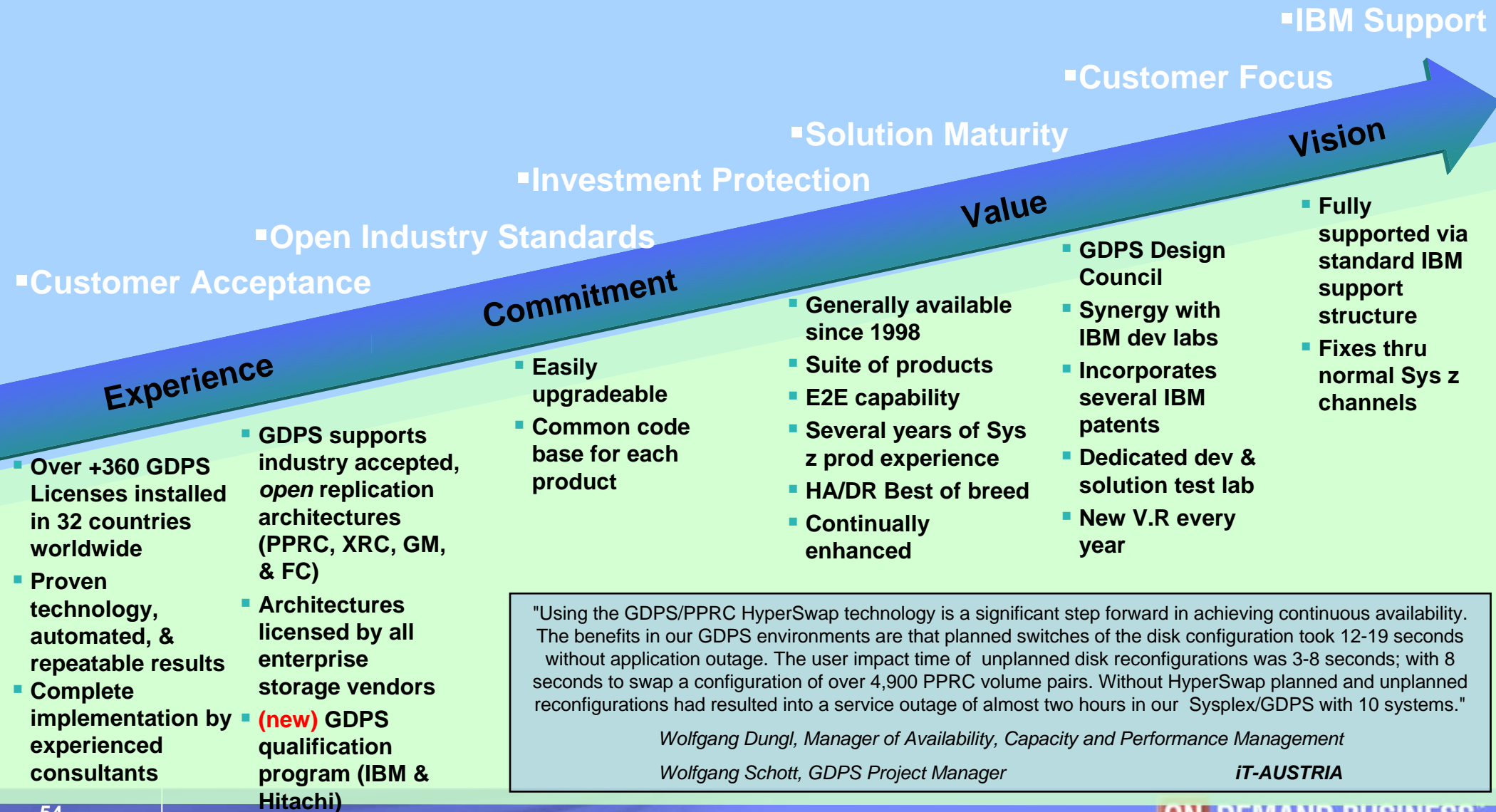
To Summarize



- ✓ **GDPS Value Proposition**
- ✓ **Additional Information**



GDPS Value Proposition





Summary

- **GDPS / IMS synergy**
- **Flexible configuration options to meet a wide-range of Business Continuity requirements**
 - Near-Continuous Availability of data within a single site – HyperSwap Manager
 - Solutions to handle distributed applications
 - **GDPS/PPRC Open LUN Management**
 - **GDPS/PPRC Multi Platform Resiliency for zSeries (xDR)**
- **In case of disaster**
 - Designed to enable data consistency and integrity
 - No data loss (GDPS/PPRC) or
 - Minimal data loss (GDPS/XRC, GDPS/GM)
 - Offers prompt, responsive disaster recovery through end-to-end automation
- **Uninterrupted data availability with HyperSwap**
- **Simplified routine management of systems, disk subsystems and data mirroring**
 - Single point of control
 - Covering z/OS, Linux and other Open Systems platforms
 - Automates software, hardware or site facilities maintenance procedures



Additional Information



- **Detailed GDPS Presentation and Information e-mail:**
 - gdps@us.ibm.com
- **White Papers:**
 - *Business Continuity Considerations and the IBM eServer zSeries*
 - *GDPS - The Ultimate e-business Availability Solution* – GF22-5114
- **Publications:**
 - **(new)** GDPS Family of Offerings Introduction to Concepts and Capabilities - SG24-6374
 - *TotalStorage Disaster Recovery Solutions Redbook* – SG24-6547
 - *z/OS Advanced Copy Services* – SC35-0428
 - *ESS Copy Services on zSeries Redpiece* - SG24-5680
 - *ESS Copy Services on Open Redpiece* – SG24-5757
- **GDPS Services Offerings**
 - GDPS Announcement
 - GDPS/XRC Announcement
- **www.ibm.com/servers/eserver/zseries/gdps**



Additional Information

- **Questions?**

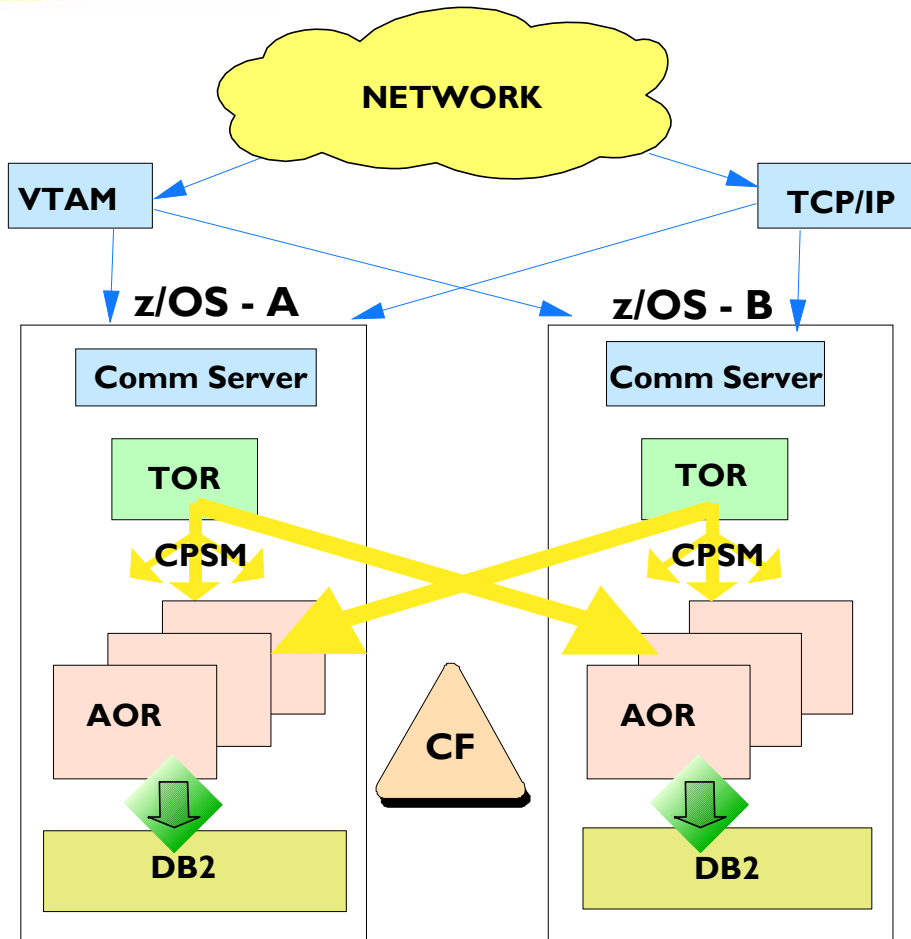


Appendix

- ✓ **Parallel Sysplex**
- ✓ **Need for Time Consistency**
- ✓ **GDPS/PPRC across 100 Km**
- ✓ **GDPS Product Family**



Start with z/OS Parallel Sysplex

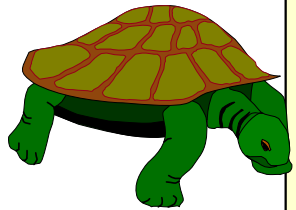


- Removes SPOF of
 - Server
 - LPAR
 - Subsystems
- Planned and Unplanned Outages
- Single System Image
- Dynamic Session Balancing
- Dynamic Transaction Routing

✓ **Continuous Availability**
 ✓ **Scalable Growth**
 ✓ **System Management**

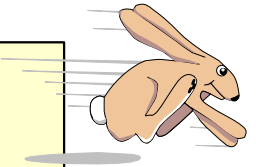


Need for Time Consistency



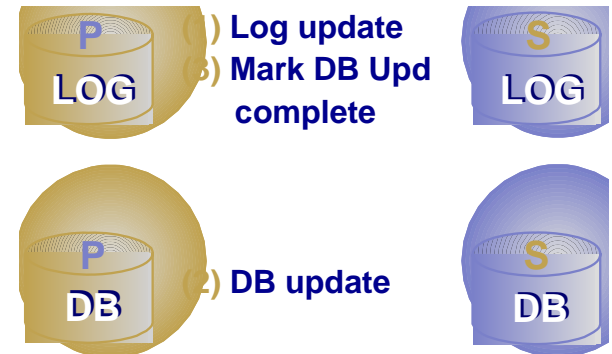
Recovery
Process measured in hours or days
 Restore last set of Image Copy tapes
 Apply log changes to bring database up to point of failure

Restart
Process measured in minutes
 To start a DB application following an outage without having to restore the database



Protection against mirroring failures

- Many examples where the start of one write is time dependent on the completion of a previous write
 - Database & log
 - Index & data components
 - Time sequence could be exposed
- GDPS automation ensures consistency
 - Across any number of primary subsystems
- Consistency enables Restart instead of Recovery
- *Even if second copy can be trusted, disk switch is disruptive for the entire workload*



- ✓ 1 is OK
- ✓ 1, 2 is OK
- ✓ 1, 2, 3 is OK
- ✓ 1, 3 is NOT OK



Server Time Protocol (STP) Overview

- Designed to provide capability for multiple System z9 and zSeries platforms to maintain time synchronization with each other
 - Does not require the 9037 Sysplex Timer if all servers STP capable
- Timing information transmitted over ISC-3 links (Peer mode), ICB-3 and ICB-4 links
- Supports a multi-site timing network of up to **100 km** (62 miles)
 - Allows a Parallel Sysplex cluster to span up to 100 km
- May reduce the cross-site connectivity required for a multi-site Parallel Sysplex clusters
- Can coexist with an External Time Reference (ETR) network (9037 based)
 - Mixed Timing Network
- Designed to allow use of dial-out time services to set the time to international time standard (UTC) as well as adjust to UTC
- Planned to be available as a feature on z9-109, z990 and z890
- Prerequisites
 - z9-109 HMC Code load
 - z/OS V1.7



GDPS Solutions - Synchronous

Continuous Availability of Data (Single Site)

Solution	Target Customer	Value
GDPS/PPRC HyperSwap Manager (Single site)	Parallel Sysplex	Continuous Availability of Data

Metropolitan Distance CA/DR (2 sites)

Solution	Target Customer	Value
RCMF/PPRC	Disk Mirroring	PPRC Management Ease of Use
GDPS/PPRC HyperSwap Manager	Entry Level Disaster Recovery (DR)	Planned & Unplanned reconfiguration RPO=0; RTO depends on customer automation
GDPS/PPRC Sysplex/PPRC across 2 sites Prod systems in same site or Prod systems in 2 sites)	DR for zSeries and Open Data Continuous zSeries Data availability	Planned & Unplanned reconfiguration RPO=0; RTO< 1 hr
GDPS/PPRC BRS configuration Sysplex in one site PPRC across 2 sites	DR for zSeries and Open Data	Planned & Unplanned reconfiguration RPO=0; RTO< 4 hrs



GDPS Solutions - Asynchronous

Unlimited Distance D/R (2 sites)

Solution	Target Customer	Value
RCMF/XRC	Disk Mirroring	XRC Management Ease of Use
GDPS/XRC	DR (zSeries Only)	Site failover RTO < 1 hr; RPO < 1 min
GDPS/Global Mirror	DR (zSeries & Open data)	Site failover RTO < 1hr ; RPO < 1 min

CA/DR 3 sites (Metro + Unlimited Distance)

Solution	Target Customer	Value
GDPS/PPRC & GDPS/XRC (z/OS data only)	Economically essential businesses; Ultimate Bus Continuity	Metro distance CA for zSeries data & unlimited distance DR
GDPS Metro/Global Cascading (z/OS & Open Data)	Economically essential businesses; Ultimate Bus Continuity	Metro distance CA & unlimited distance DR



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