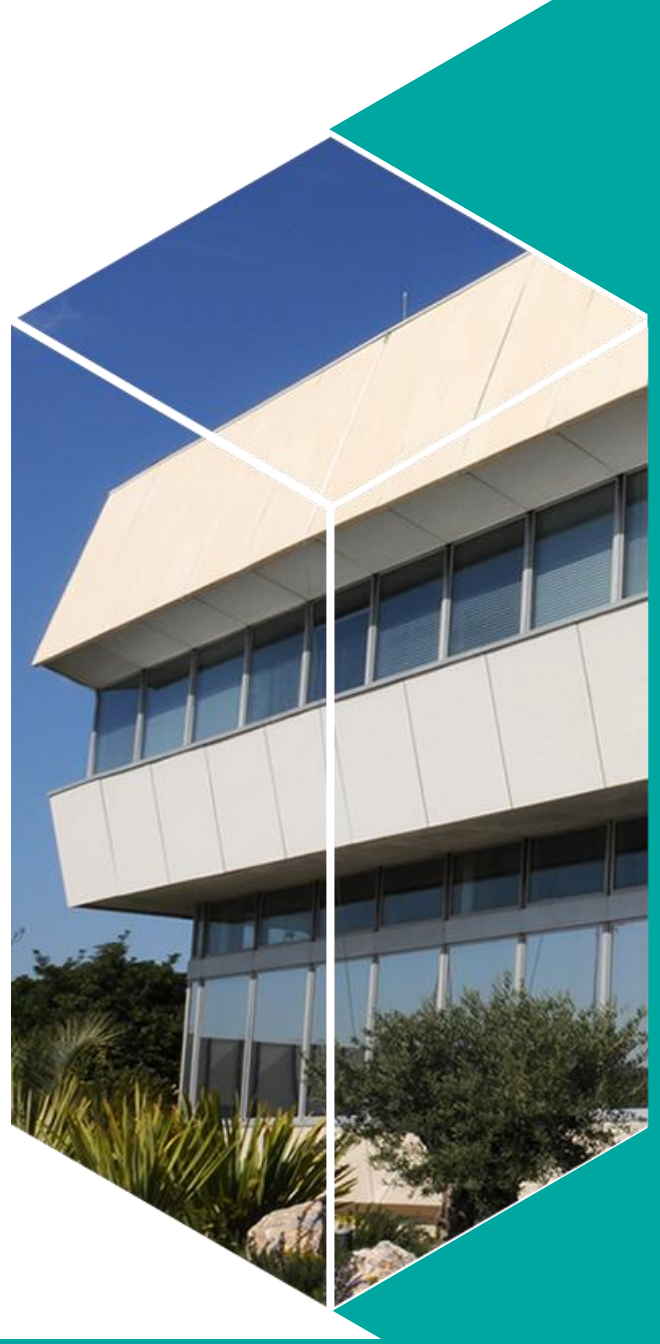
IBM **Client Center** Montpellier



PowerHA SystemMirror for i

HA/DR & Storage Replication

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Credit/Materials:
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Sabine Jordan – PowerHA Expert sabine_Jordan@de.ibm.com

Want a live demo? https://www-304.ibm.com/systems/clientcenterdemonstrations

Power Systems Latest HA/DR offerings & positioning

PowerHA
Clustering

GDR
Replicated VM Restart

SRR
VM Restart

Tape Backup
Minimal downtime with Flashcopy

Pain point	Desired Outcome	Solution Offering	Technology	Benefit	Considerations
Down time for software maintenance	mission critical HA solution requiring minimal admin	**PowerHA**	shared/replicated storage based clustering	all outages; planed and unplanned are covered	-cluster admin -multiple data -active standby OS's -vary-on time
DR compliance testing is labor intensive and disruptive	simple DR solution requiring no admin	**GDR**	replicated virtual machine restart	low cost simple to use automates DR operations	-full frame restart -replicated copies of VMs -reboot time
admin required to manage clustering	simple HA solution requiring no admin	**PowerVC / SRR**	virtual machine restart	low cost simple to use automatic restart	-full frame restart -single copy of VM -primarily CEC outage -reboot time
Tape backup operations and off site storage	low cost alternative to local tape drives	**IBM Cloud Storage Solutions for I** **NEW! DSI VTL**	cloud object data containers	low cost automated off-site archive and backups	-bandwidth requirements -total restore time

Session Objectives

- PowerHA for IBM i
- Highly automated solutions for high availability and disaster recovery
- HA/DR solutions based on IBM storage or on internal disk solution
- Ultra low cost modern HA/DR solutions for small customer shops
- Several ways to save money: CBU, CBU for PowerHA, Enterprise Pools
- Lab Services brings expertise and added value like smart assists
- Resources ..new redbooks, the wiki, join the PowerHA on i Linkedin group

Agenda

- Understand the concepts of **IASP** and shared storage clustering
- **Typical Storage Based HA/DR PowerHA configurations**
- **Flashcopy**
- New PowerHA **HyperSwap** clustering
- **Lun-level switching and SVC Split Cluster**
- PowerHA with **geomirroring** and internal disk
- PowerHA geomirror price example (amazingly low cost solution)
- PowerHA and **CBU** for i example
- **PowerHA Offering, Tools & Services Summary**
- **Additional Solutions: GDR / SRR**
- Discussion , Q&A

Agenda

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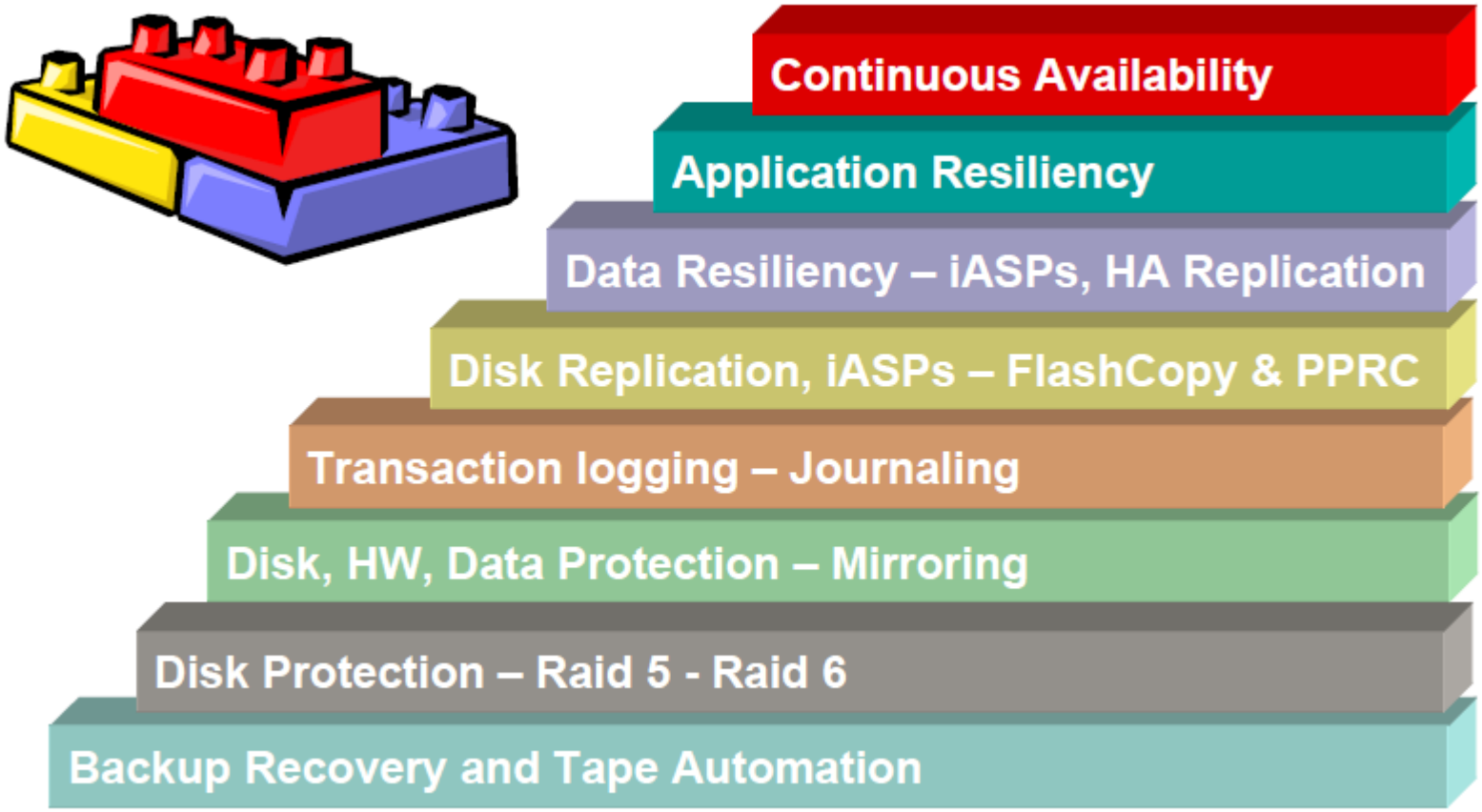
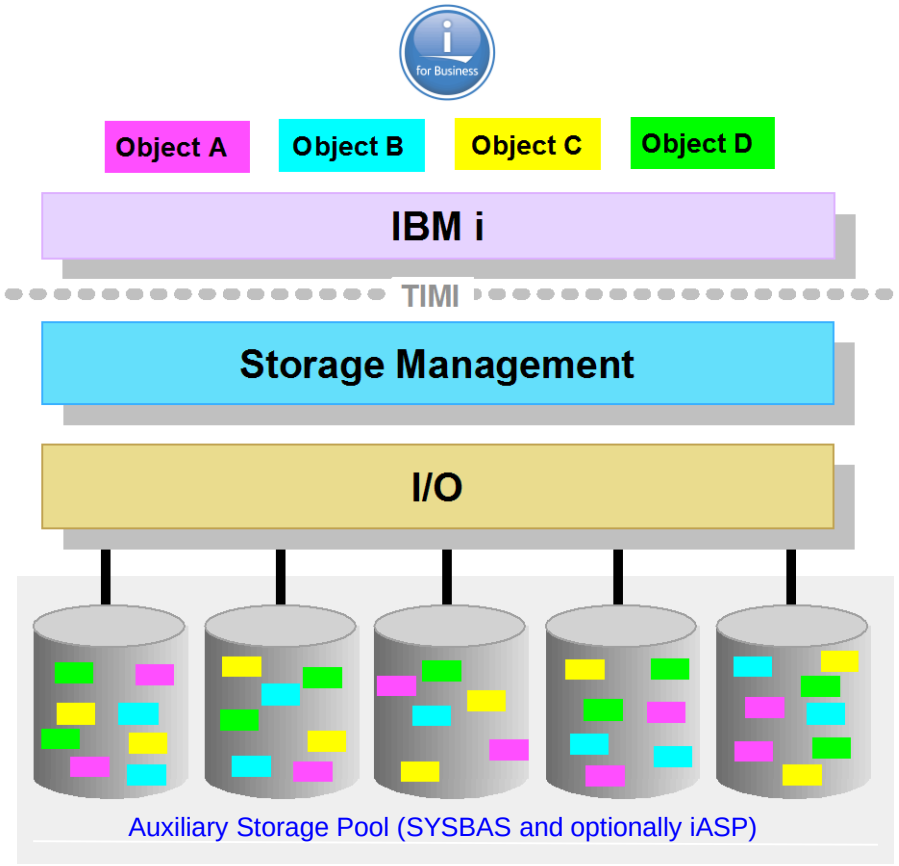
High Availability?

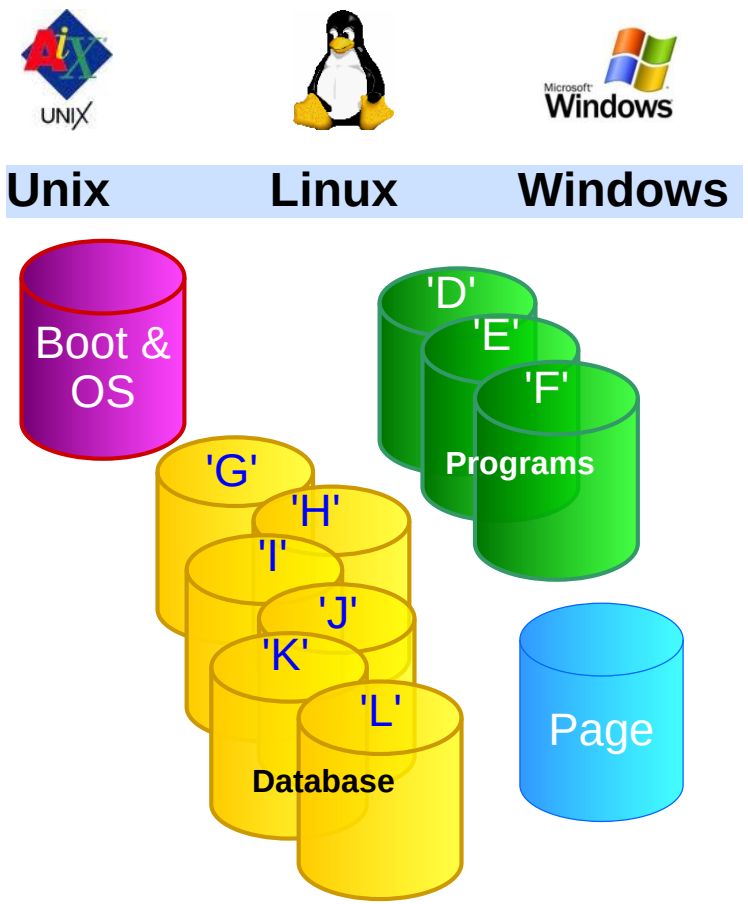


Storage Management Styles – IBM i Compared To …



Internal or External Storage

*TIMI – Technology Independent Machine Interface



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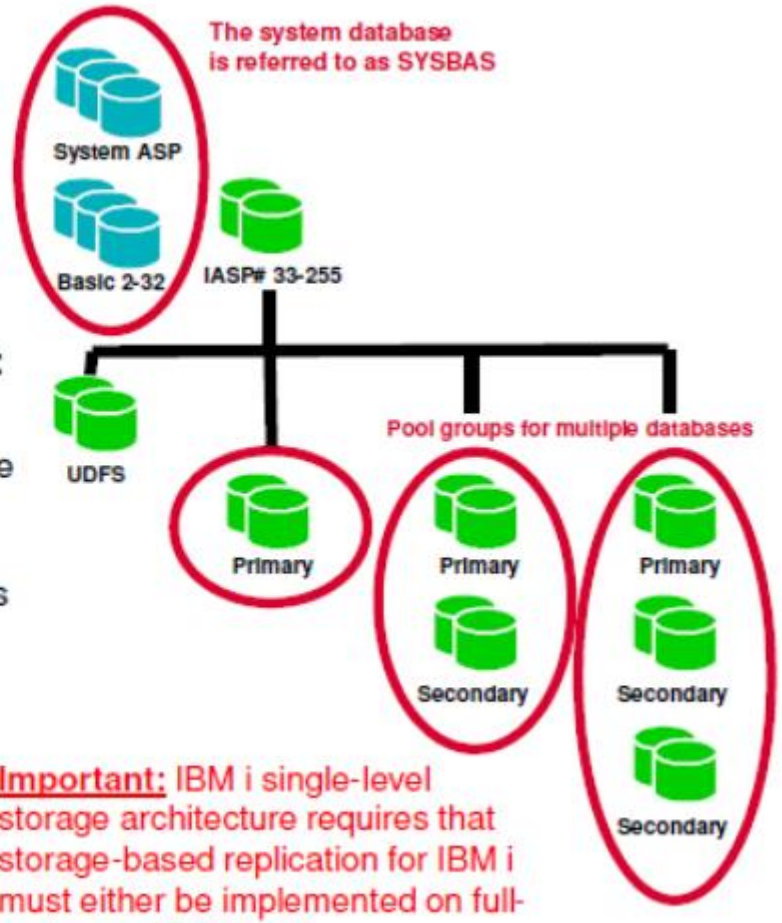
iASPs: What is it?

Auxiliary Storage Pools (ASPs):

- ASPs are created from one or more disk units to isolate data / workload to the same storage area
- System ASP (ASP 1) contains the load source disk unit and exists on every IBM i system
- Optionally basic user ASPs 2-32 or/and independent user ASPs (IASPs) 33-255 can be created

Independent Auxiliary Storage Pools (IASPs):

- a primary disk pool and zero or more secondary disk pools which are grouped together and share the same database
  - similar as System ASP and basic ASPs
  - e.g. primary IASP for libraries and database files and secondary IASP for journals and journal receivers
- IASPs can be varied on/off (as groups together)
- IASPs can be made switchable to be switched (as groups together) between IBM i cluster nodes
- IASPs do not overflow (unlike user ASPs which overflow into the system ASP)

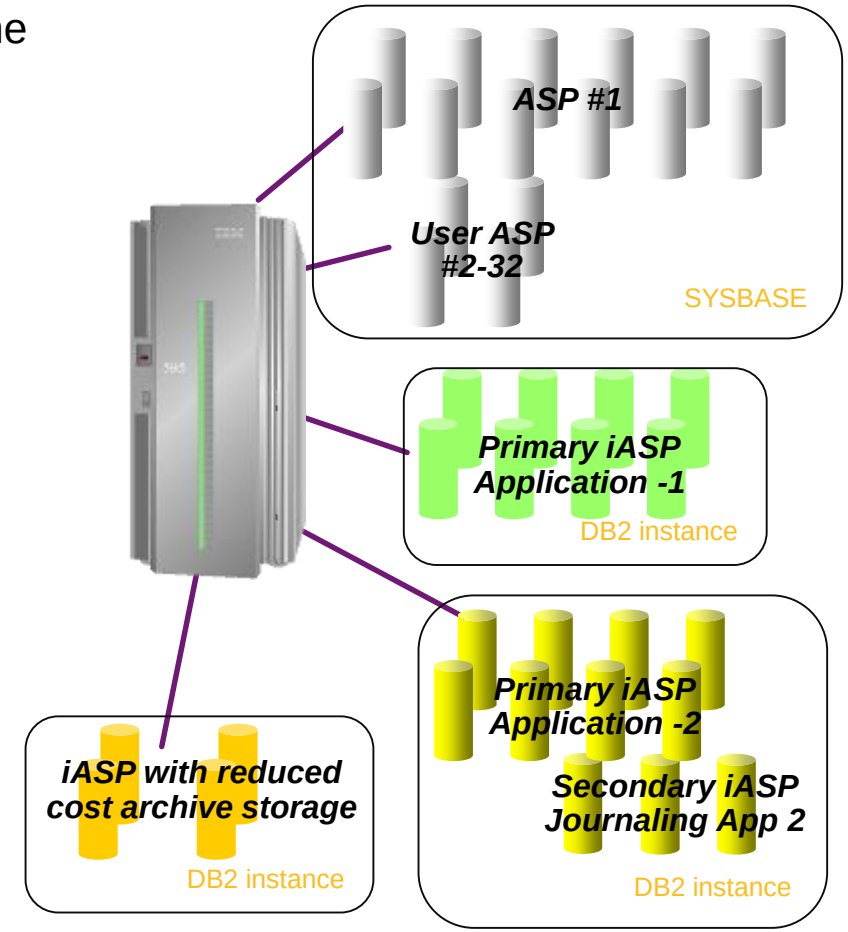


Important: IBM i single-level storage architecture requires that storage-based replication for IBM i must either be implemented on full-system or IASP level.

iASPs: Foundation for Long Term, Scalable HA/DR

- Independent ASP (iASP) offer:
  - Uptime
    - Shorter IPLs – leave non-critical iASP on-line
    - Reclaim Storage (RCLSTG) by iASP
  - Security
    - Data and path encryption by ASP
  - Archive
    - Storage performance and cost by ASP
  - Consolidation
    - Meet compliance needs for isolation
    - SaaS (Software as a Service)
    - Reduce software licensing fees (single OS)
    - Reduce number of OS upgrades

- Foundation for PowerHA
  - Switched iASP
  - External Storage LUN Level Switching
  - IBM i Power HA Geographic Mirror
  - Power HA external storage copy services



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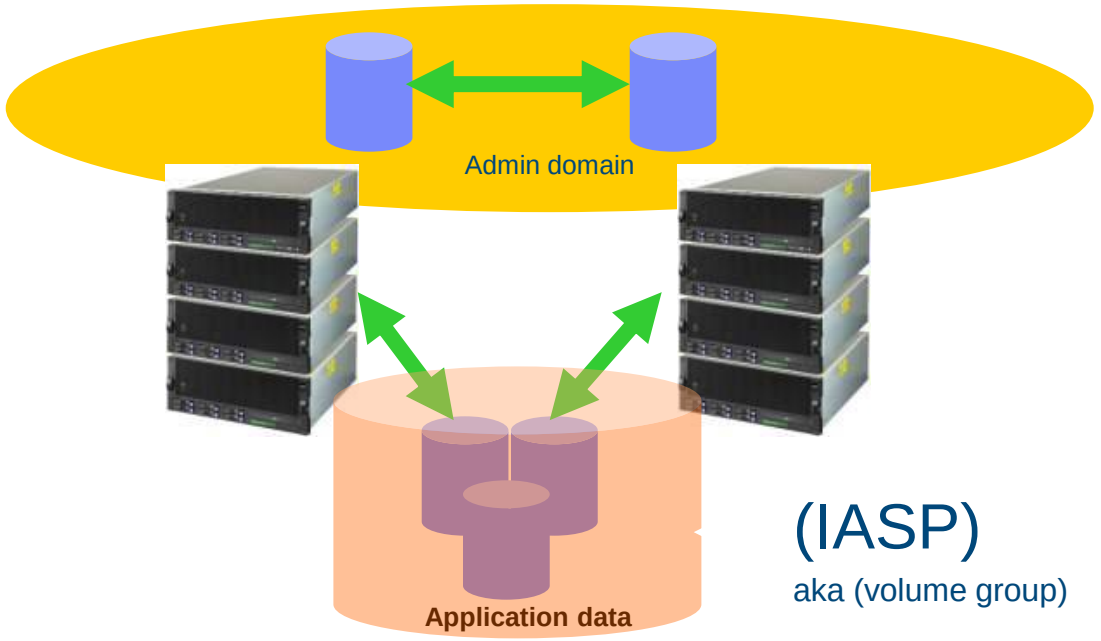
PowerHA on IBM i basic concepts



- **PowerHA SystemMirror creates and manages a shared storage cluster topology**
  - IASP volume group hosts the DB, IFS data
  - Admin Domain manages the sysbas data
  - Note that the foundational topology does not involve replication

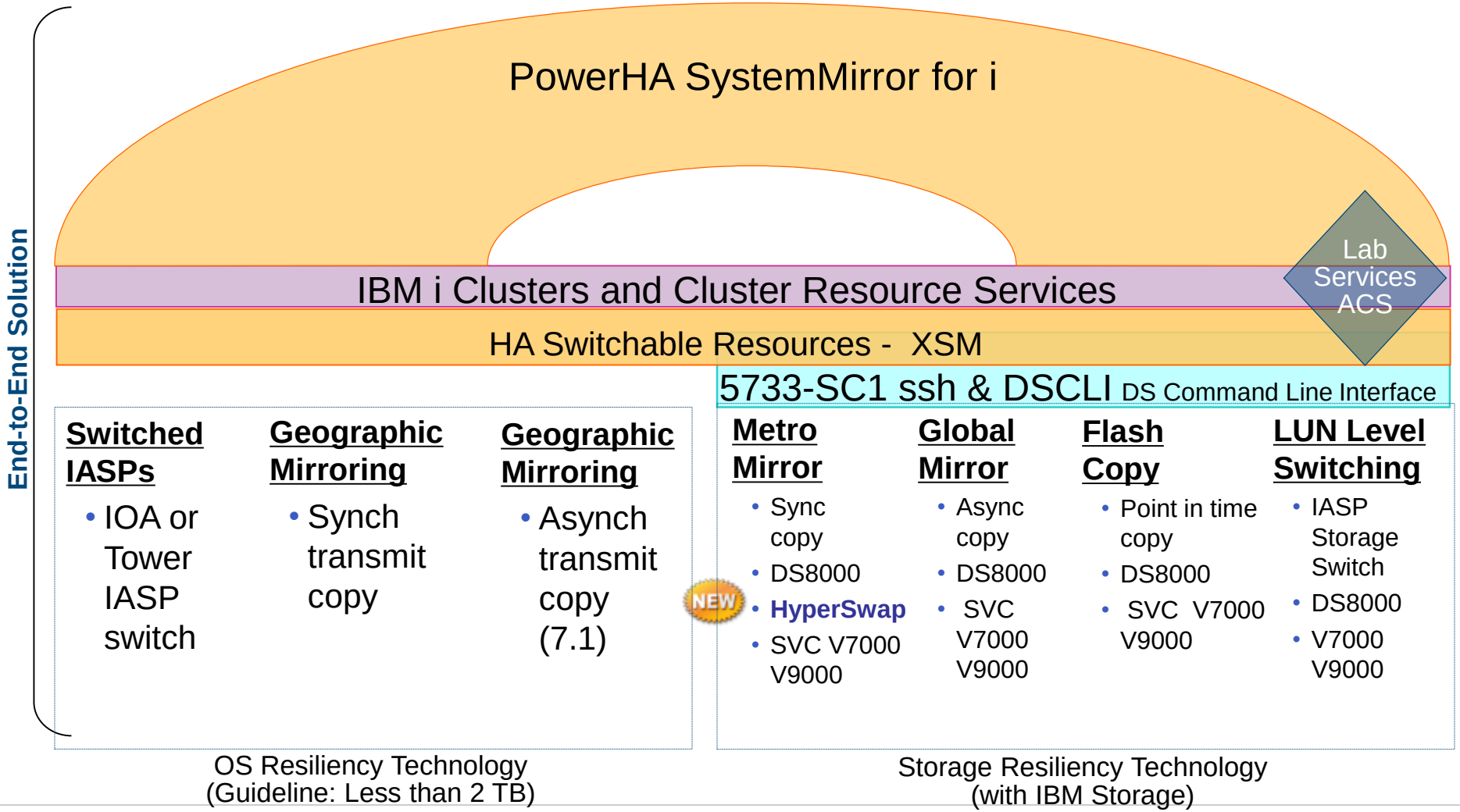
Objects that can be Monitored with Cluster Admin Domain

Allows "SYSBAS" object synchronization over Cluster Nodes

- Independent disk pools device descriptions (*ASPDEV)
- Classes (*CLS)
- System environment variables (*ENVVAR)
- Ethernet line descriptions (*ETHLIN)
- Job descriptions (*JOBD)
- Network attributes (*NETA)
- Network server configuration for connection security (*NWSCFG)
- Network server configuration for remote systems (*NWSCFG)
- Network server configurations for service processors (*NWSCFG)
- Network server descriptions for integrated network servers (*NWSD)
- Network server descriptions for iSCSI connections (*NWSD)
- Network server host adapter device descriptions (*NWSHDEV)
- Network server storage spaces (*NWSSTG)
- Optical device descriptions (*OPTDEV)
- Subsystem descriptions (*SBSD)
- System values (*SYSVAL)
- Tape device descriptions (*TAPDEV)
- TCP/IP attributes (*TCPA)
- Token-ring line descriptions (*TRNLIN)
- User profiles (*USRPRF)
- Autorisation lists (*AUTL)

PowerHA SystemMirror for i

An IBM delivered, end-to-end solution for HA, DR and on-line backups



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Client Need: Data Center

- Requirements
  - Near continuous application service
  - Recovery Time Objective (RTO) measured in minutes
  - Recovery Point Objective (RPO) is Zero (no data loss)
  - Eliminate affects of planned outages
  - Eliminate tape back-up window

- Solution Strategy:
  - PowerHA SystemMirror Standard Edition

Client Need Today: Multi-Site

- Requirements
  - HA/DR clustering for data center & multi-site operations
  - Automated role-swap operations
  - Readily demonstrate remote recoverability compliance

- Solution Strategy:
  - Unified clustering solution for data center & multi-site resiliency
  - PowerHA SystemMirror **Enterprise Edition**

Data Center

Remote Site

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PowerHA SystemMirror for i

- **IBM PowerHA SystemMirror was restructured with IBM i 7.2 and is offered now in three editions:**
  - New *Express Edition* (5770-HAS *BASE & option 3) for full-system DS8000 HyperSwap
  - *Standard Edition* (5770-HAS *BASE & option 2) for local datacenter replication
  - *Enterprise Edition* (5770-HAS *BASE & option 1) supporting also multi-site replication

PowerHA SystemMirror for i	Express Edition	Standard Edition	Enterprise Edition
Centralized cluster management		✓	✓
Cluster resource management		✓	✓
Centralized cluster configuration		✓	✓
Automated cluster validation		✓	✓
Cluster admin domain		✓	✓
Cluster device domain		✓	✓
Integrated heartbeat		✓	✓
Application monitoring		✓	✓
IBM i event / error management		✓	✓
Automated planned switch over		✓	✓
Managed unplanned fail over		✓	✓
Centralized Flash Copy		✓	✓
LUN level switching		✓	✓
GeoMirror sync delivery		✓	✓
GeoMirror async delivery			✓
Multi-Site HA/DR management			✓
SVC / Storwize / DS8000 Metro Mirror			✓
SVC / Storwize / DS8000 Global Mirror			✓
Full-System DS8000 HyperSwap	✓	✓	✓

PowerHA SystemMirror for i

- Hardware based IBM solution, developed and supported by the IBM i team
- Integrated as an intrinsic part of the IBM i firmware (SLIC) and operating system
- No overhead, the underlying replication technology is storage based
- No lag on the target system in the cluster
- Eliminates complex processes associated with 3rd party replication software
- Over 2000 customers WW with support from the major ISV partners
- Integrated with IBM storage & flashcopy effectively eliminates the backup window
- Economical per core pricing + the CBU = significant savings
- Geographic mirroring for small clients with internal disk is very inexpensive
- Unique advanced capabilities like metro-global-mirroring (MGM) and HyperSwap

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IBM PowerHA SystemMirror for i

- First released in 2008 *(IBM i 6.1 release)*
- Hardware based replication solutions (disk level)
- Supports both:
  - IBM i replication – *any storage*
  - External storage replication – *DS8000, SVC, Storwize models*

- **Integrated** – *Can manage IBM i and external storage HA from one IBM i GUI or command line*
- **Reliable** – *Using IBM replication technologies*
- **Efficient** – *Deeply integrated with lower levels of the OS*
- **Automated** – *Minimal IT management required*
- **Versatile** – *Solutions for any storage, any distance*

Who are our PowerHA for IBM i customers ?

PowerHA for IBM I is installed in accounts ranging from small to very large enterprises. Virtually all of them (over 95%) moved off of logical replication solutions.

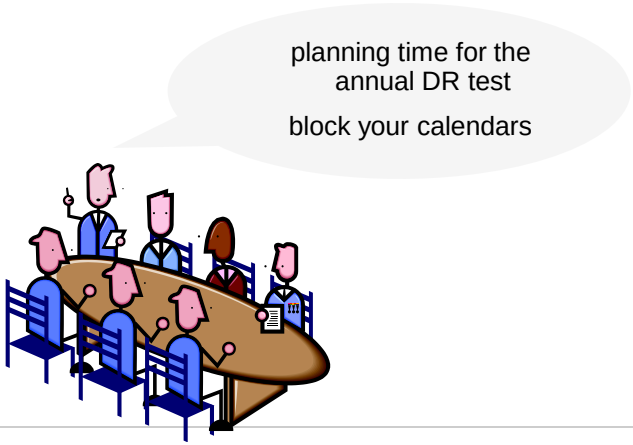
- Over 1000 are clients with fewer than four processor cores.
  - These customers typically are using PowerHA with geomirroring and internal disk
  - About 20% of these are using ihosting i with geomirroring for a full system replication solution. Although the IBM I hosting IBM i with geomirroring is classified as a disaster recovery solution, some clients prefer it because its relatively easy to set up and doesn't require a cluster configuration where the database is separated out into an IASP.
  - The customers using PowerHA with geomirroring are represented in every industry; municipalities, retail, distribution, banking, manufacturing

- The other half of the PowerHA on IBM i customers are using IBM storage servers.
  - The DS8K implementations are LUG class customers who nearly always have at least two sites involved in the cluster and increasingly, three sites.
  - The rest of the customers are using Storwize servers ranging from the V3700 on up to the SVC or the V9000. The V7000 has been the most popular in recent years.
  - The motivation behind storage servers ranges from scalability, robustness, flash copy and the capability to support various combinations for HA and DR in a PowerHA cluster.

IBM i HA/DR Customer Profile

TRADITIONAL

- Internal Disk
- Logical replication
- CBU with multiple cores licensed for replication workload
- Role-swap = seldom if ever
- Backup window = ranges up to a few hours
- TCO = staffing, SWMA, upgrade charges,
- Staffing = dedicated specialist
- Outage management = complex
- Support = vendor



PowerHA

- IBM Storage or (Internal Disk with geomirroring)
- Switchable LUNs, Metro or Global Mirroring
- CBU with only 1 core licensed
- Role-swap = daily, weekly, monthly, quarterly
- Backup window = minutes
- TCO = minimal staffing, SWMA
- Staffing = minutes/week
- Outage management = simple
- Support = IBM

Agenda

- Understand the concepts of IASP and shared storage clustering
- **Typical Storage Based HA/DR PowerHA configurations**
- Flashcopy
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- Additional Solutions: GDR / SRR
- Discussion , Q&A

Typical HA/DR Configuration: Full System Replication

- Full system replication is a means to provide a real-time full copy of your system/partition disks at another site.
- DR Solution (manual tasks, recovery procedure on target). Target Environments:

  - Customers unable (or un-willing) to implement Independent Auxiliary Storage Pools (IASPs) for any reason
    - Time constraints
    - Resource limitations
    - Budgetary constraints
    - Application-specific technical obstacles
  - Customers needing an interim solution while migrating to IASP
  - Customers requiring a Disaster Recovery (DR) solution for their entire system, not limited to IASP
  - Customers NOT needing simultaneous access to host attached to target volumes, while source (production) host is online and replication is active
    - Only ONE production copy IBM i host is accessible/online at any one time while replication is active
    - Replication CAN be stopped, and the target host CAN be IPL'ed but caution should be taken and manual changes will be required (these steps are outlined later)

- PowerHA not mandatory but recommended for automation & ease of management…in that case, PowerHA Enterprise is necessary for Controller LPARs. (PowerHA FSR)
- PowerHA Full System Copy Services Manager Replication for Storwize is a toolkit offering developed by IBM Lab Services Power Systems Delivery Practice.
- Can be used in conjunction with Full System Copy Service Manager (FSCM) for Flashcopy automation & **backup** with minimal impacts on production.
- **FSR is a DR Solution**, not HA (abnormal IPL,…)

Typical HA/DR Configuration: Full System Replication

❑ 3 methods to achieve Full System Replication:

- **IBM i Hosting i with Geographic Mirroring**
  - Full IBM i partition hosted within an Independent ASP (IASP)
  - PowerHA geographic mirroring replicates the IASP contents
  - Dependent on host IBM i availability, PowerHA clustering, LIC-level replication

NB: for IBM i hosted LPARs with
PowerHA configured on the Host LPAR

- **SAN Replication with DS8000 Family**
  - Metro mirror – synchronous remote mirror & copy (PPRC)
  - Global Copy – asynchronous remote mirror & copy (PPRC)
  - Global Mirror – global copy, consistency groups, and flashcopy

NB: Requires
- Licensing for Remote Copy Services on the Storage System.
- PowerHA for automation: automates partition shut-down, partition IPL, IPL monitoring, storage switch operations, replication suspends/resumes, and monitoring of FSR-initiated storage functions

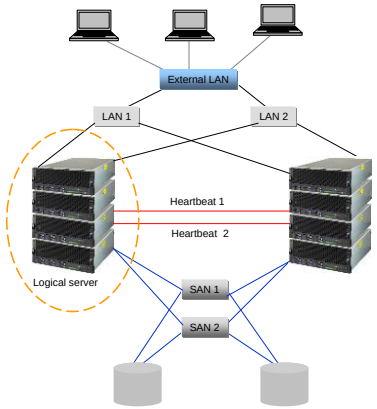
- **SAN Replication with SVC/Storwize Family**
  - Metro mirror – synchronous replication
  - Global mirror – asynchronous continuous copy
  - Global mirror with change volumes – multi-cycling asynchronous copy with continuous remote flashcopy

NB: In the rest of the presentation: PowerHA / iASP / Clustered Based environment for HA and DR

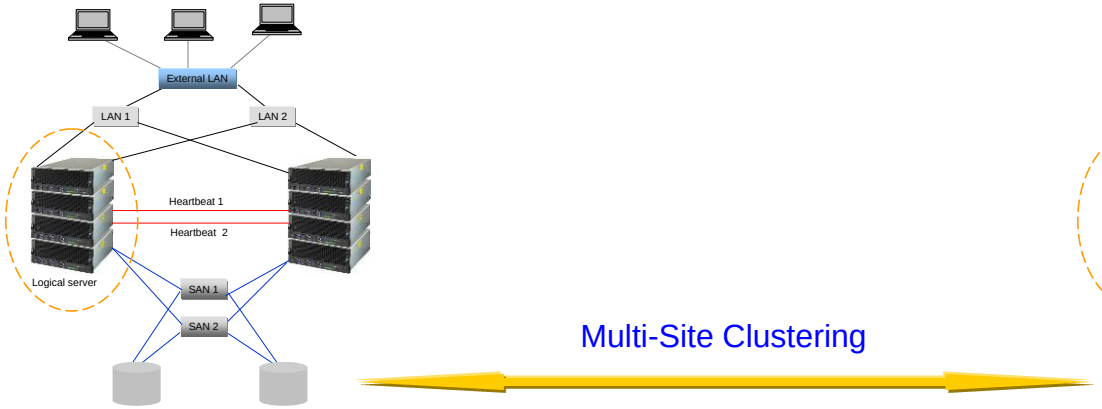
PowerHA shared storage clustering solutions

- **High Availability (HA) Management – data center – Standard Edition**
  - Clustering for mission critical application availability
  - Planned and unplanned outage management
  - Shared storage resiliency

- **Disaster Recovery (DR) Management – multi-site – Enterprise Edition**
  - Multi-Site clustering (covers both HA and DR)
  - Integrated storage based replication
  - Simplified compliance testing

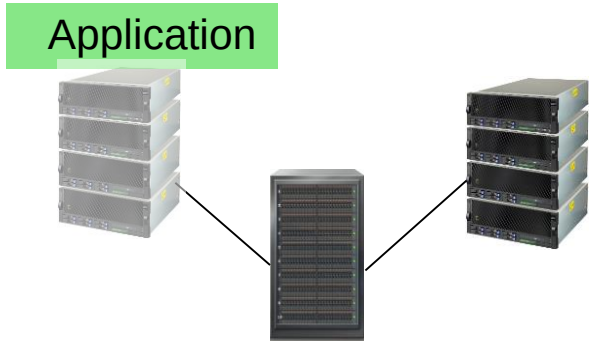


Data Center Clustering

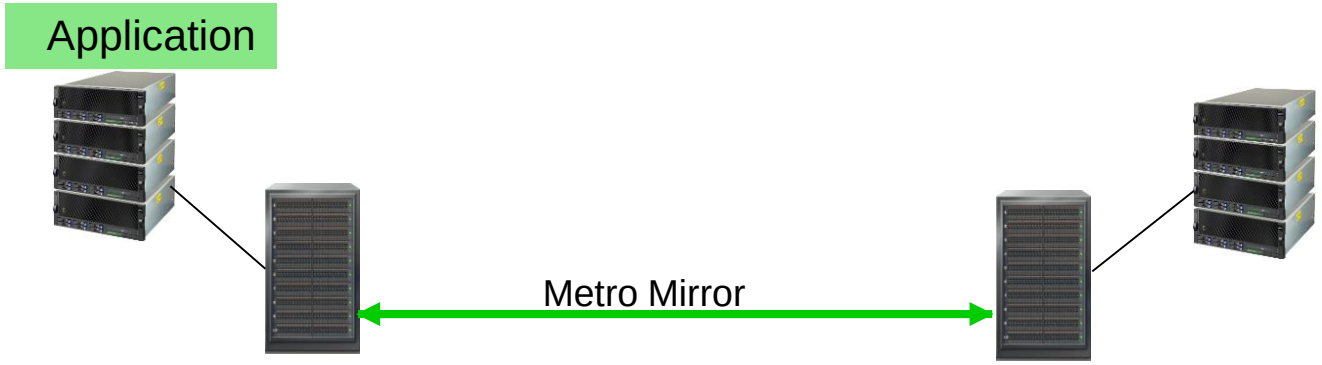


Multi-Site Clustering

PowerHA IBM storage based high availability configurations



Example: high availability configuration,
PowerHA Standard Edition cluster

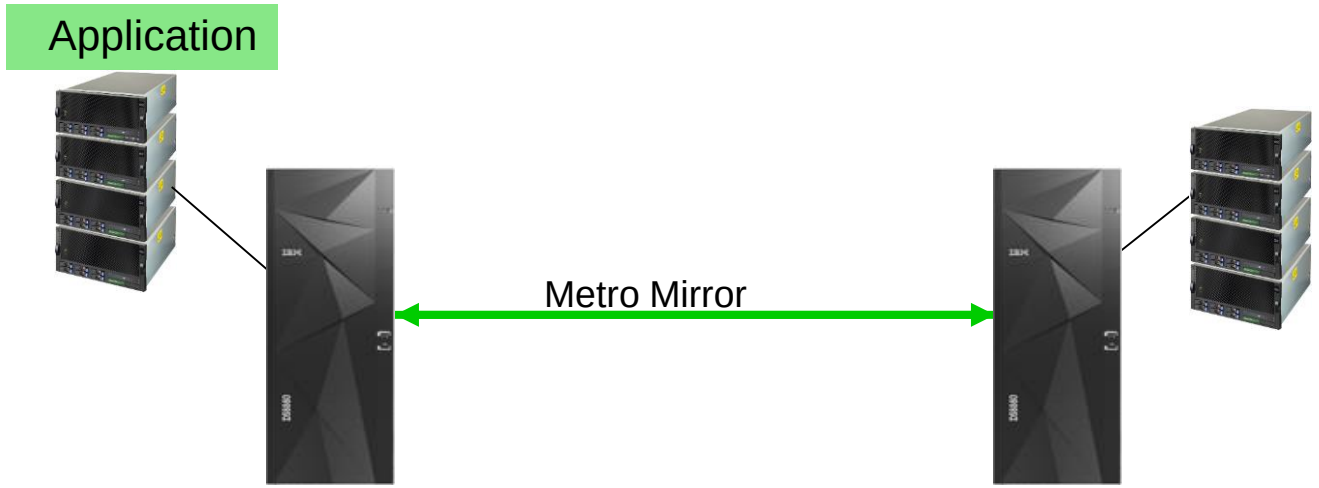


Example: high availability configuration
PowerHA Enterprise Edition Cluster

PowerHA storage based disaster recovery configuration

- PowerHA Enterprise Edition with Global Mirror replication
- Unlimited distance
- Typically used for disaster recovery

PowerHA two site traditional cluster with Metro Mirror



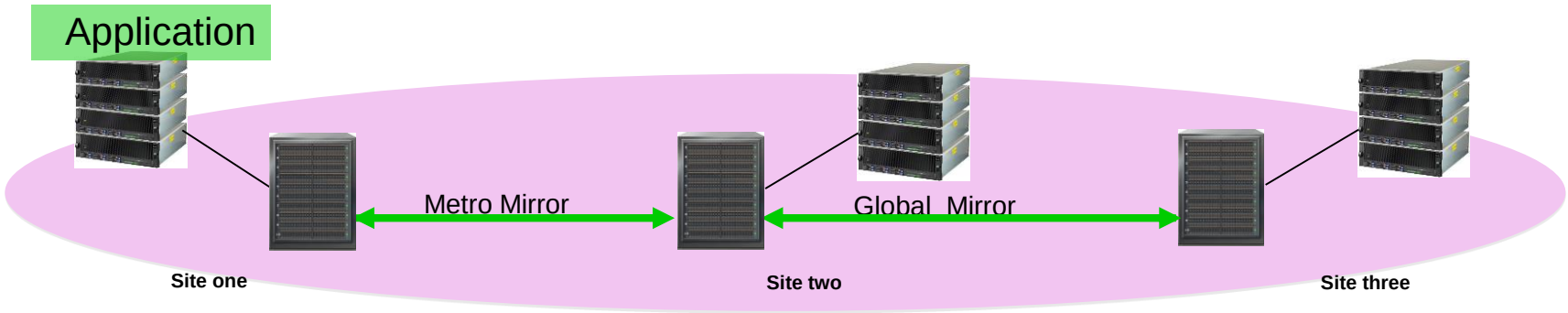
- Traditional two-site Metro Mirror cluster configuration
- Synchronous replication limits effective distance due to lag
- IASP replication synchronous to application state (real-time identical copies)
- Server outage management via a PowerHA cluster operation
- Storage outage management via a PowerHA cluster operation

PowerHA unified two-site HA/DR solution

- Requirements
  - Multi-site configurations
  - Data center/campus component for HA
  - Second site for DR

- Solution Strategy:
  - Unified clustering solution for data center & multi-site resiliency
  - PowerHA SystemMirror Enterprise Edition

PowerHA Three site PowerHA on i MGM cluster



Metro Global Mirror (MGM) cluster

- Three systems, three sites, three copies of data in a singel cluster
- Metro Mirror portion of cluster provides two synchronous copies
- Global mirror link provides the disaster recovery systems

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Metro Mirror

- Synchronous mirroring of IASP controlled by DS
- Both systems are active – IBM i „knows“ status of environment
- Based on clustering -> automatic failover possible
- Distance limited to about 180 km

- **Advantages**
  - – Easy management
  - – Very good solution for storage spaces (hosted partition) and IFS
  - – Data on backup system is protected against accidental changes
  - – No additional CPU resources needed
  - – Good solution if multiple platforms involved
- **Disadvantages**
  - – Applications must reside in IASP – requires some application changes
  - – Requires Fibre connection – normally campus solution
  - – Access to data on backup system only after detach
    - Requires partial synchronization afterwards
    - NO data sent over to backup while in detached mode
    - NO failover possible while synchronisation is running

Global Mirror

- Asynchronous Mirroring of IASP – managed by DS
- Consistency Group guaranties consistent data
- Both systems are active, IBM i „knows“ status of environment
- Based on clustering -> automatic failover possible
- Supported by PowerHA
- Enhanced since 2015 : GM with Change Volume for Storwize/SVC (7.1/7.2+) – tunable RPO

- **Advantages**
  - Easy management
  - Very good solution for storage spaces (hosted partition) and IFS
  - Data on backup system is protected against accidental changes
  - “No” limitations in distance
- **Disadvantages**
  - Applications must reside in IASP – some application changes required
  - Access to data on backup system only after detach
    - Requires partial synchronization afterwards
    - NO data sent over to backup while in detached mode
    - NO failover possible while synchronisation is running
  - NO guarantee for last transaction -> Disaster Recovery, not High Availability
  - No automatic way back if there are no consistency groups on production system

Agenda

- Understand the concepts of IASP and shared storage clustering
- Typical Storage Based HA/DR PowerHA configurations
- **Flashcopy**
- New PowerHA HyperSwap clustering
- Lun-level switching and SVC Split Cluster
- PowerHA with geomirroring and internal disk
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Flashcopy

- Point-in-Time copy of IASP or Full System
- IASP can be attached to another LPAR – saves are done there
- Consistency of data guaranteed by

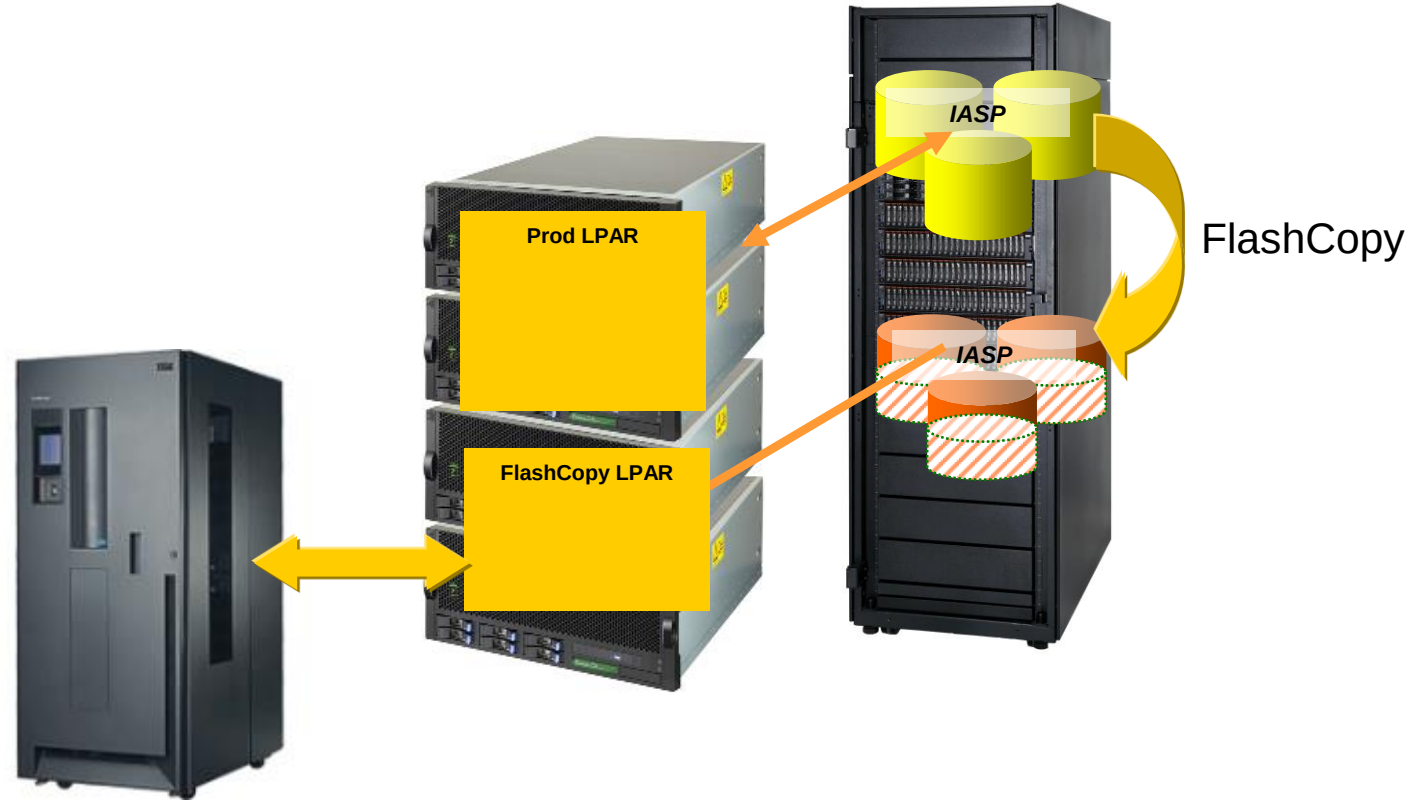
– Vary off of IASP – Partition shutdown for full system flashcopy

OR

– QUIESCE function to stop database access and to „dump“ data from main storage to disk (Wait for the pending transactions to commit) – For System ASP and iASP

- Completely under control of IBM i (no manuel intervention on DS)
- Compatible without IASP : Sysbas Flashcopy (abnormal IPL on target when started)

PowerHA+ flash copy to minimize backup window

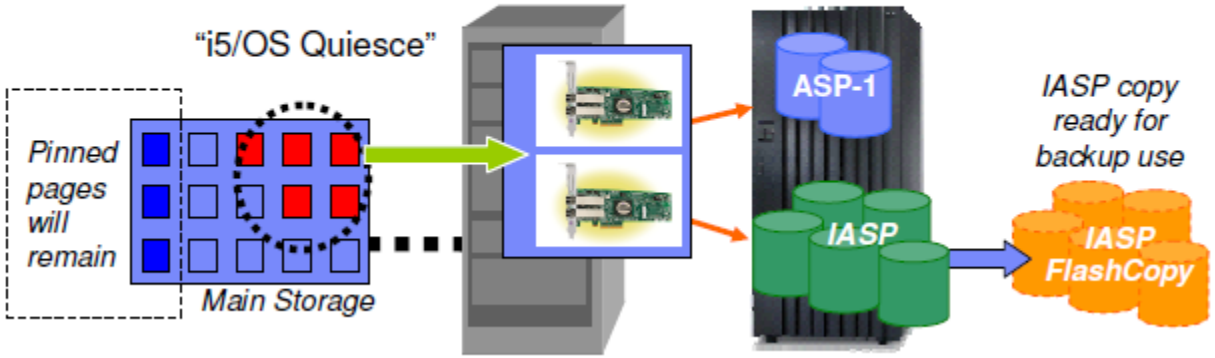


- FlashCopy is an integral part of a PowerHA on IBM i cluster
- It effectively eliminates your backup window
- Full system flash copy is also an option though not as seamless as with IASPs

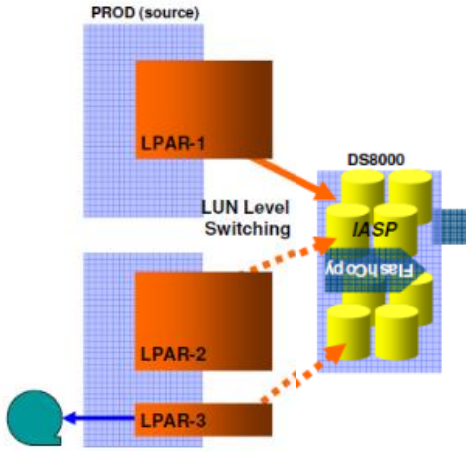
PowerHA IASP Flashcopy

Scheduled Downtime: Online Backups

- (6.1) Quiesce Function – reduced disruption backup
  - Suspends transactions and operations to ensure as much in-flight data as possible is written to disk before a snapshot is taken
    - More than a memory dump – places transactions at database boundaries if possible
    - Intended for use with applications running commitment control
    - Backup will still be seen as 'abnormal' but much friendlier
  - Best use is with storage based copy technologies (not direct tape)
    - Use with IASP FlashCopy or Geographical Mirroring solutions
  - Command or API support - CHGASPACT *SUSPEND, or *RESUME
  - Requires assessment and testing, esp. applications without commitment control



PowerHA IASP Flashcopy – Setup Example



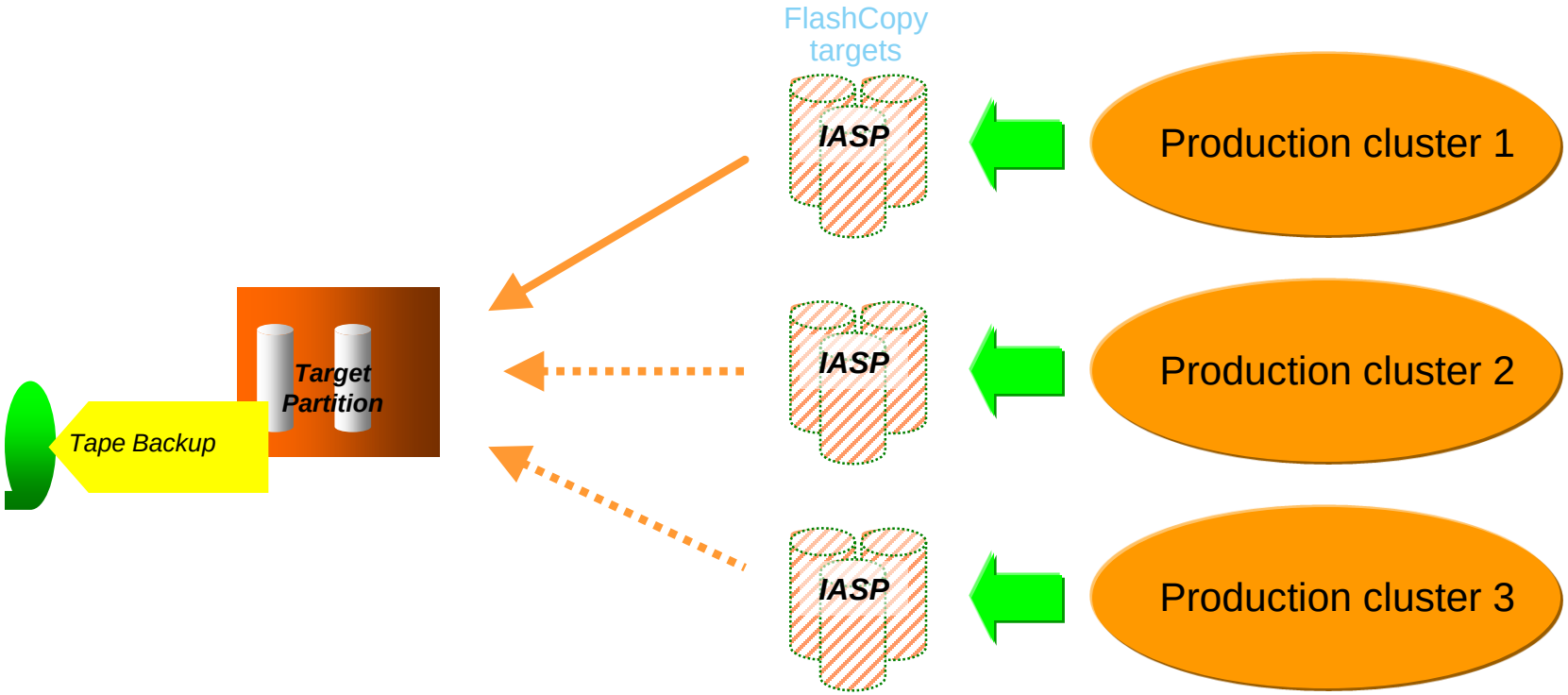
Add ASP Copy Description with Storage information (Storage IP, LUNs for source & target)
=> a Simple PowerHA CL Command will trigger the Storage Flashcopy.

Source:
ADDASPCPYD ASPCPY(FCIASPSRC) ASPDEV(IASPSW) STGHOST(cust () ('10.15
.8.13')) LOCATION(LPAR-A) LUN('IBM.2107-7582581' ('8200-8202' '8300-8302') ())

Target:

ADDASPCPYD ASPCPY(FCIASPTGT) ASPDEV(IASPSW) STGHOST(cust () ('10.15
.8.13')) LOCATION(LPAR-B) LUN('IBM.2107-7582581' ('82a0-82a2' '83a0-83a2') ())

PowerHA V7.2 universal FlashCopy target partition



Enables use of one partition to save multiple production environments

Allows attachment of an IASP to a partition not in the cluster device domain

Only one IASP can be attached to the partition at a time

Eliminate dedicated flash partitions per cluster

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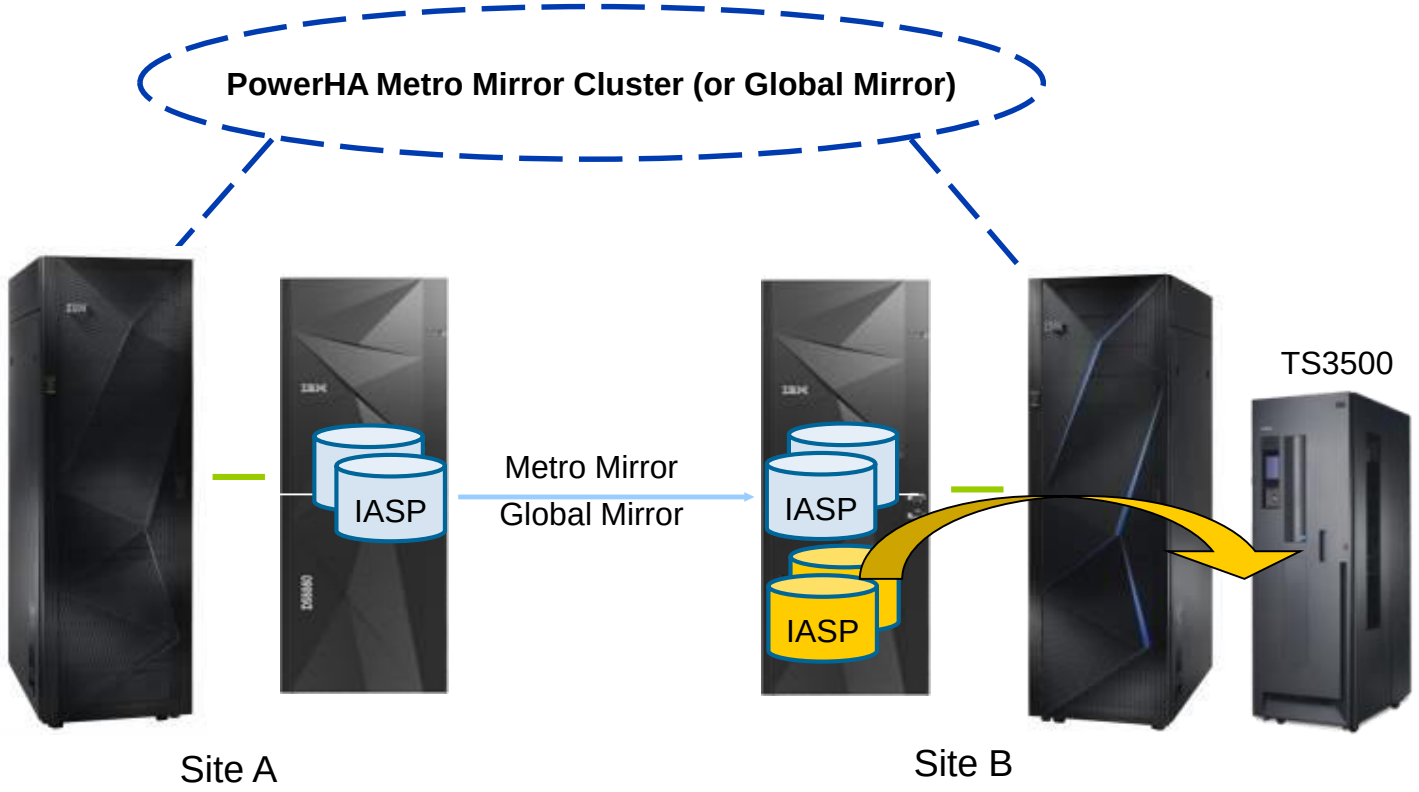
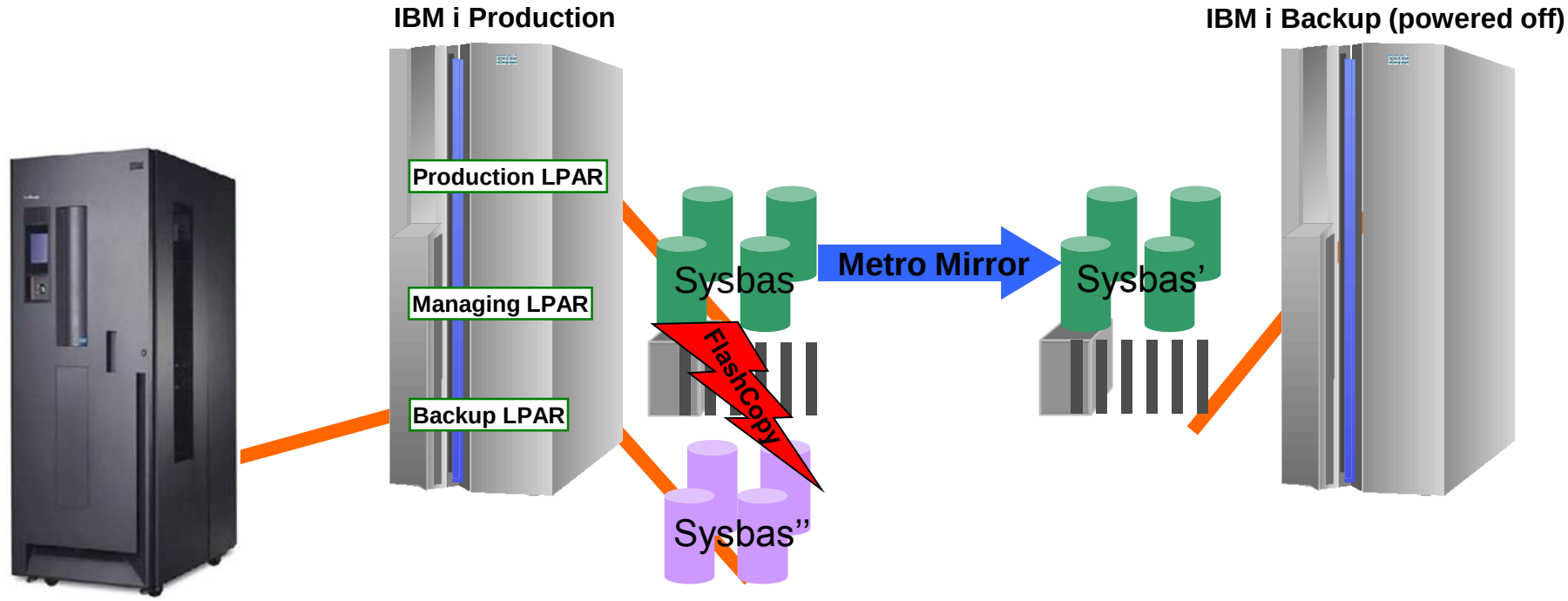
Two site PowerHA cluster with tape backup



V3700, V5000,V7000, V9000, SVC, DS8000

- HA/DR with Metro Mirror (or Global Mirror, or Switchable LUNs or all of them combined)
- Backup window elimination save automation with FlashCopy and BRMS

IBM i Full System FlashCopy



Non/low disruptive Backup Solution with IBM i Full System FlashCopy

- instant IBM i production system cloning with FlashCopy for online backup, testing, dev.
- only minimal disruption (~1 min.) for system quiesce with IBM i 6.1 or later
- FlashCopy integration with BRMS Network
- FlashCopy automation supported either from Metro Mirror primary or secondary volumes
- full automation by *Full System FlashCopy Toolkit* IBM STG LS service offering

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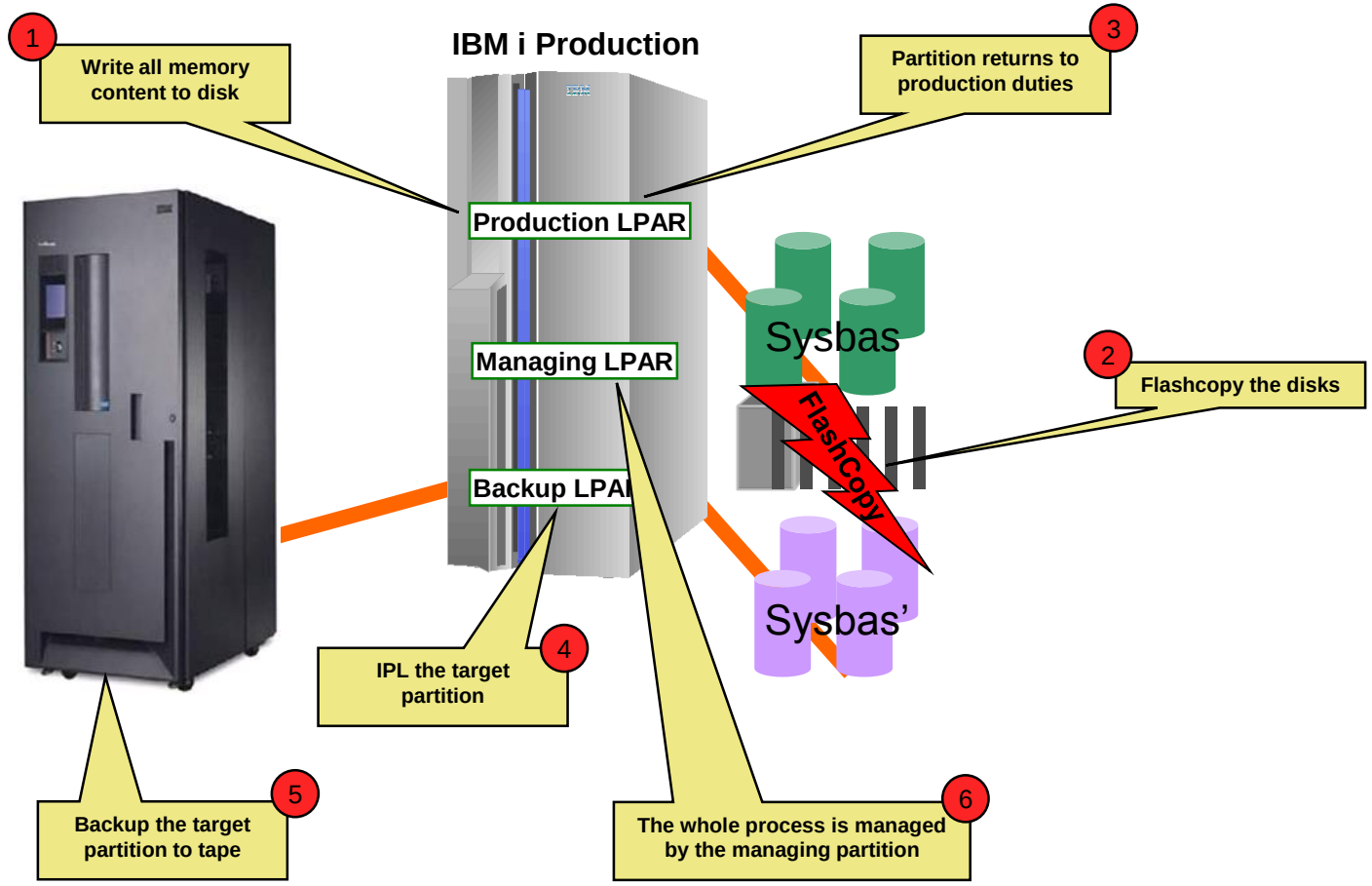
IBM i Full System FlashCopy Process



Managing LPAR with IP connection to production/backup LPARs, HMC and storage CLI is key to manage the full system FlashCopy process as FlashCopy cannot be invoked from a quiesced or powered off production LPAR

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BRMS Network FlashCopy Integration

Production System Name: PROD

BRMS System Name: PROD

- Allows to perform a backup on a system that has been copied by FlashCopy with a BRMS history appearing as if the backup was performed on the production system
- *Full System FlashCopy Toolkit* automates these steps
  - DS8000/DS6000 storage support
  - SVC/V7000 storage support (newly added with FSFC Toolkit version 7.4)

1. Stop all BRMS activities
2. Prepare BRMS for FlashCopy
3. Quiesce System or PWRDWNSYS to ensure all main storage content written to disk
4. FlashCopy
5. Resume or Restart System
12. Call post FlashCopy BRMS function / restore QUSRBRM
13. Resume BRMS activities on PROD

Backup System Name: PROD

BRMS System Name: PROD

6. System attributes and network configuration changed by IPL startup program
7. Set BRMS system state to FlashCopy mode
8. Backup System treated as “PROD” in BRMS Network
9. Complete saves using BRMS
10. Set BRMS state to FlashCopy backup complete mode
11. Save QUSRBRM and transfer the library to PROD system

For more information refer to *IBM System Storage Copy Services and IBM i: A Guide to Planing and Implementing*, SG24-7103

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Agenda

- Understand the concepts of IASP and shared storage clustering
- Typical Storage Based HA/DR PowerHA configurations
- Flashcopy
- **New PowerHA HyperSwap clustering**
- Lun-level switching and SVC Split Cluster
- PowerHA with geomirroring and internal disk
- PowerHA geomirror price example (amazingly low cost solution)
- PowerHA and CBU for i example
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- Additional Solutions: GDR / SRR
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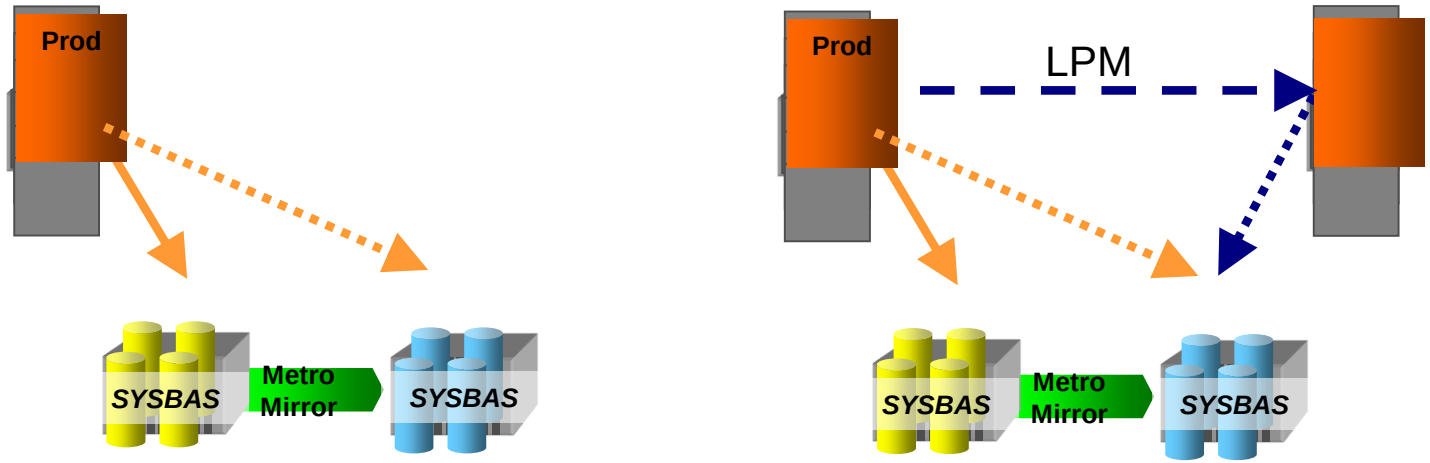
HyperSwap in a nutshell

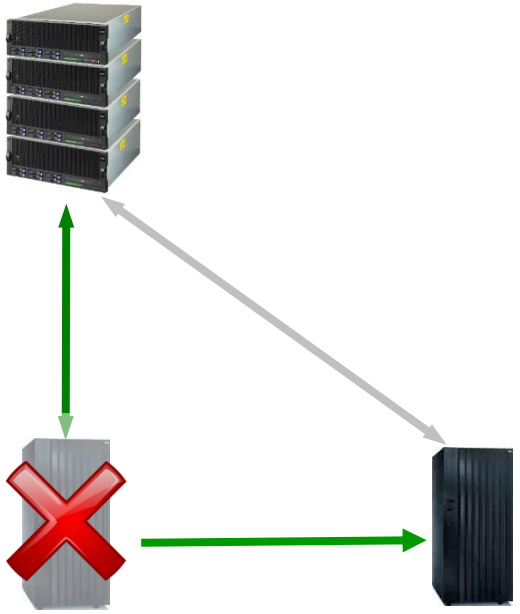
- HyperSwap is a System Storage function which allows an application to switch between two storage servers with essentially zero downtime, using Metro Mirror to synchronize the data between the storage servers.
- Automatic Switchover / Failover in case of storage Maintenance / Failure (HA / DR scenarios)
- Full System or PowerHA (iASP)
- Can be used in conjunction with Flashcopy for seamless backups
- Can be used in conjunction with PowerHA - iASP LUN Level Switching for server-level HA/DR process.
- Can be used with DS8K & Storwize Family only
- PowerHA for V7R2 and V7R3 is being enhanced to enable support for SVC and Storwize HyperSwap in combination with PowerHA's LUN level switching technology
- PowerHA Express and Enterprise Editions

PowerHA Express Edition - Full system HyperSwap

- Support for DS8000 /SVC / Storwize HyperSwap in full system replication environments
- HyperSwap by itself is a hardware availability solution
  - ‘Zero’ downtime switch for storage planned and unplanned outages
  - Single partition solution, although can be combined with partition mobility
  - Not a disaster recovery solution
  - No protection against software planned or unplanned outages
- Once configured, HyperSwap switch will occur automatically in the case of a Storage failure, or can be triggered manually before a planned outage

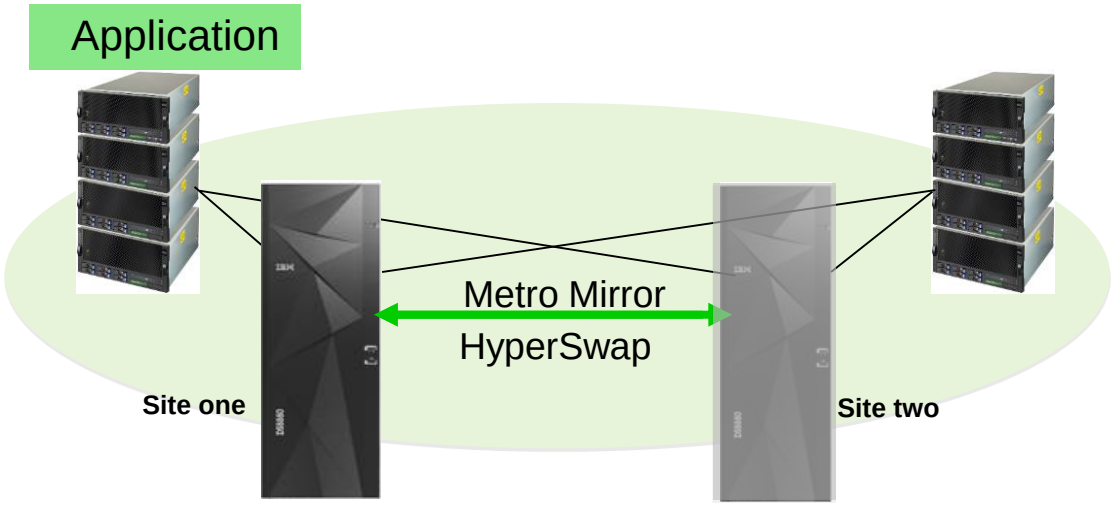


IBM i Full System Copy with HyperSwap



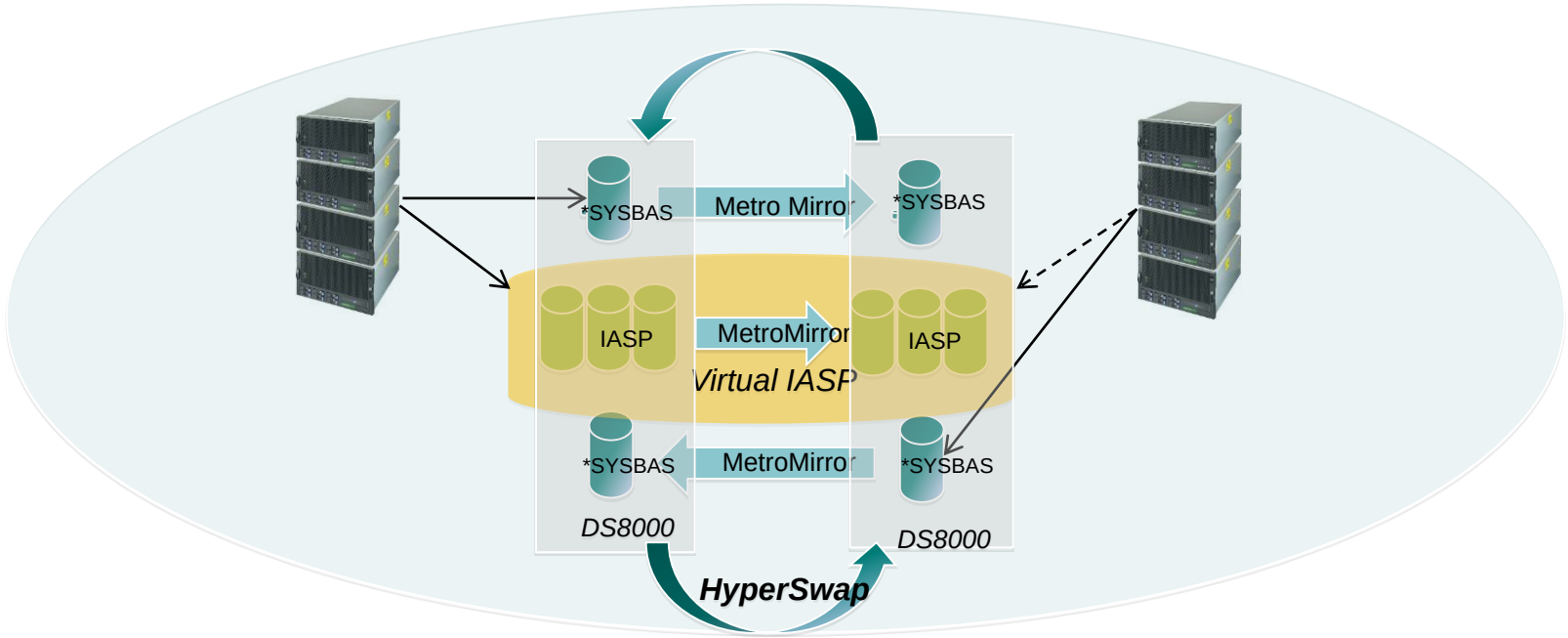
- One Node HyperSwap
  - Configure a single IBM i LPAR for HyperSwap
  - No need for compute node on the second site
  - Full LPAR or IASP based
- IBM i 7.2 – Power HA Express Edition
- The IBM i environment can be provisioned natively or through VIOS
- Provides ability to switch access from production to remote storage
  - Automatic or manually triggered
- HA solution: planned storage outages
- DS8000 or SVC (TR3)) or Storwize (Vxxxx)

PowerHA Enterprise edition HyperSwap solution for high availability



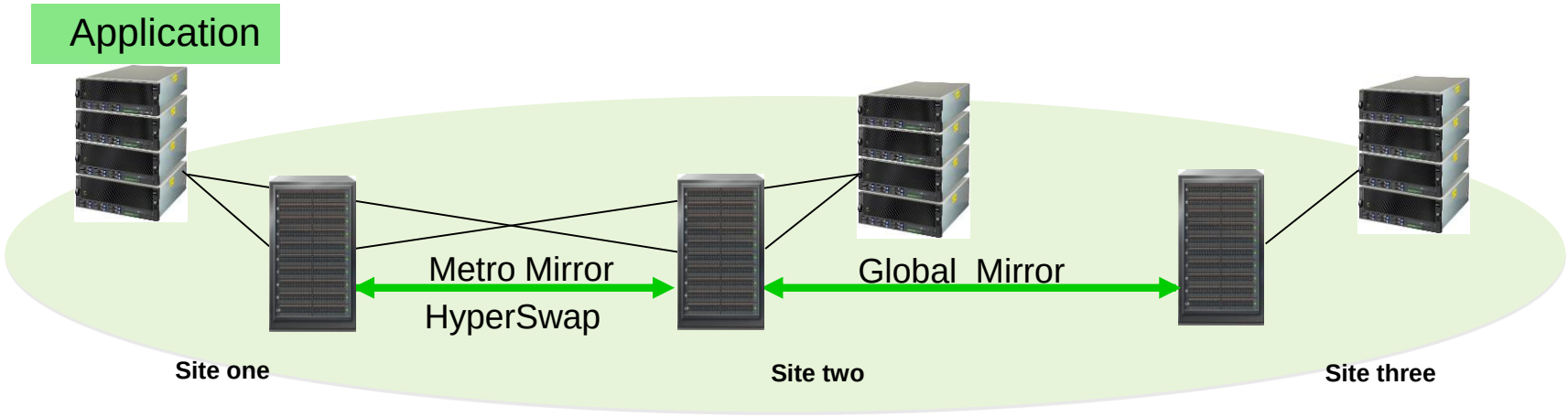
- Two-site DS8K or SVC/Storwize HyperSwap PowerHA Enterprise Edition cluster configuration
- Server outage management via a PowerHA cluster operation
- Storage outage management via a HyperSwap switch

PowerHA Enterprise edition HyperSwap cluster “under the hood”



- HyperSwap has the effect of making the replicated pair of IASPs appear as a single virtual IASP
  - HyperSwap switches the source and target IASP and SYSBAS in the event of a storage outage
  - The source IASP is mirrored to the target IASP via Metro Mirror
  - The source and target SYSBAS data are mirrored via Metro Mirror
- In the event a storage outage event, the source system switches to the mirrored IASP and the mirrored SYSBAS
- In the event of a production server outage, PowerHA conducts a failover to the target production server, (the virtual IASP is switched to target) Metro Mirror will reverse direction of replication and production resumes on the secondary power server
- If VIOS is deployed, LPM can be used for firmware updates, load balancing etc
- **DS8800 and above (TPC-R not utilized) - Storwize Family**

Three site PowerHA MGM cluster with HyperSwap (Plan)



Metro Global Mirror (MGM) cluster with Hyper Swap

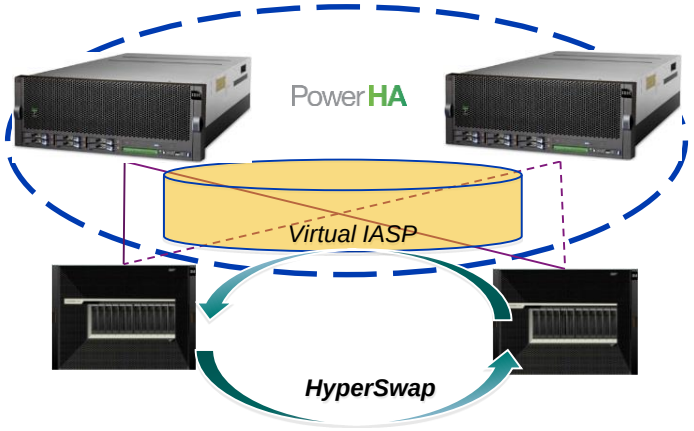
IBM PowerHA System Mirror for i Planning Insights:

IBM plans to introduce the capability to add a third system connected to the PowerHA for i HyperSwap pair via either a Metro Mirror or Global Mirror link.

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

PowerHA for i SVC HyperSwap clustering

- Announce Oct 11, GA Nov 11
- **PowerHA SystemMirror for i** V7.2 TR 5 & V7.3 TR 1
- **Continuous two-site SVC storage availability** within a PowerHA cluster
- PowerHA switchable LUN HA cluster configuration for production outages
- Note: no Global Mirror link support !



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- Understand the concepts of IASP and shared storage clustering
- Typical Storage Based HA/DR PowerHA configurations
- Flashcopy
- New PowerHA HyperSwap clustering
- **Lun-level switching and SVC Split Cluster**
- PowerHA with geomirroring and internal disk
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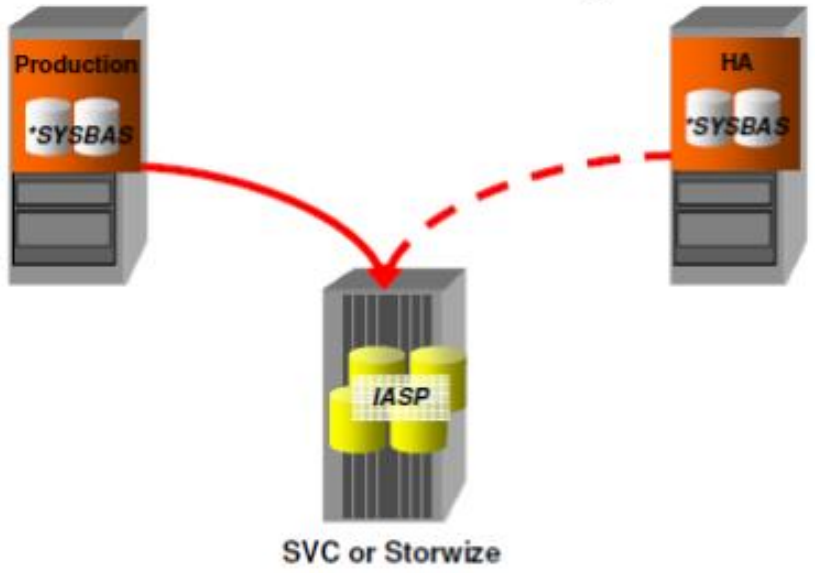
LUN Level Switching for SVC / Storwize

- Local HA solution providing server level redundancy for protection from server outage but not disk outage
  - IBM i 7.1 TR6 or later required
  - Requires NPIV or native attachment of SVC / Storwize storage device
  - Single-copy, i.e. non-replicated, IASP in a device domain can be switched between two systems in a cluster (can be combined though with Metro or Global Mirror)
  - IASP accessible only from single system at a time
  - PowerHA remaps host connections within the storage to switch



LUN Level Switching for SVC Stretched Cluster

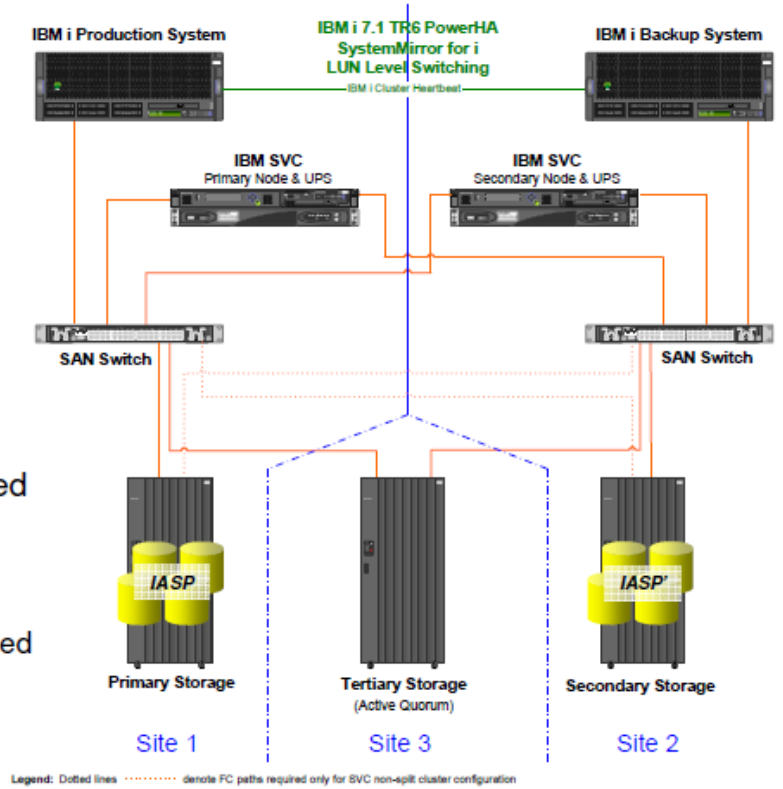
- Two-site HA solution using a combination of IBM i PowerHA LUN level switching for server redundancy with SVC split-cluster volume mirroring for storage redundancy
  - Available via PowerHA group PTF SF99706 level 5
  - IBM i 7.1 TR6 or later required
  - Requires NPIV or native attachment of SAN Volume Controller
- Provides the following benefits over previously available IBM i full-system replication SVC support
  - High degree of automation for planned and unplanned site-switches respectively failovers
  - Shorter recovery times by using IASP technology
  - Reduced mirroring bandwidth requirements by using IASP technology (temporary writes in SYSBAS like for index builds are not mirrored)

Note: Stretched Cluster = SVC ONLY (no Storwize support)

LUN Level Switching for SVC Stretched Cluster

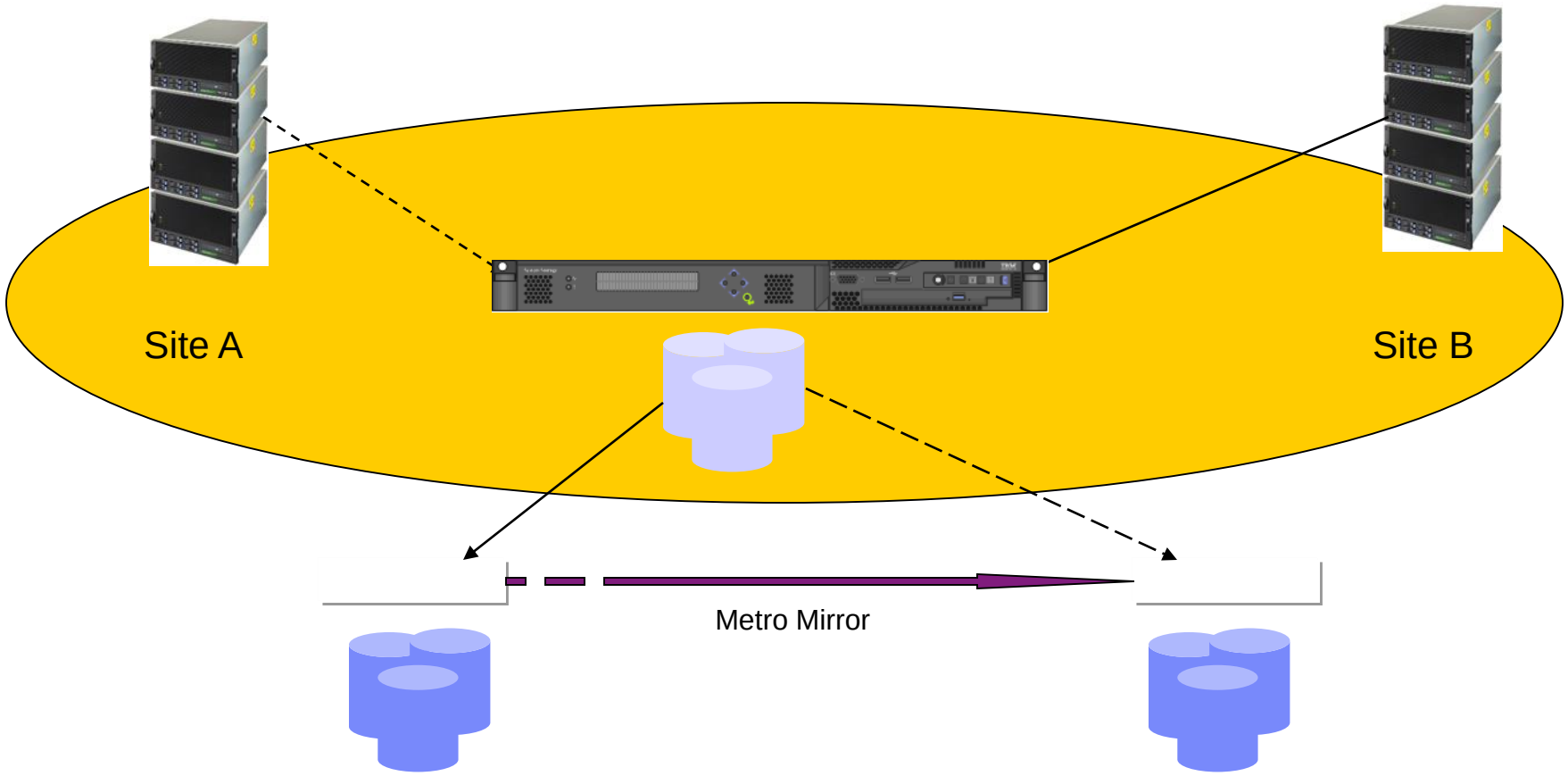
LUN Level Switching for SVC Split-Cluster

- Schematic view of IBM i PowerHA LUN level switching with SVC split-cluster and SVC volume mirroring of IASP volumes between site 1 & site 2
- Storage „failover“ managed transparently by SVC volume mirroring
- IBM i server failover managed by PowerHA LUN level switching
  - for a site switch or failover IASP volumes get re-assigned to other IBM i cluster node



Note: Stretched Cluster = SVC ONLY (no Storwize support)

PowerHA with SVC Stretch Cluster



- L'application IBM i ne voit qu'un seul volume logique (un groupe de).
- Le split du SVC (séparation physique des 2 noeuds) génère une réplication des volumes logiques de la partition entre les 2 noeuds.
- Metro Mirror = synchrone (courte distance).

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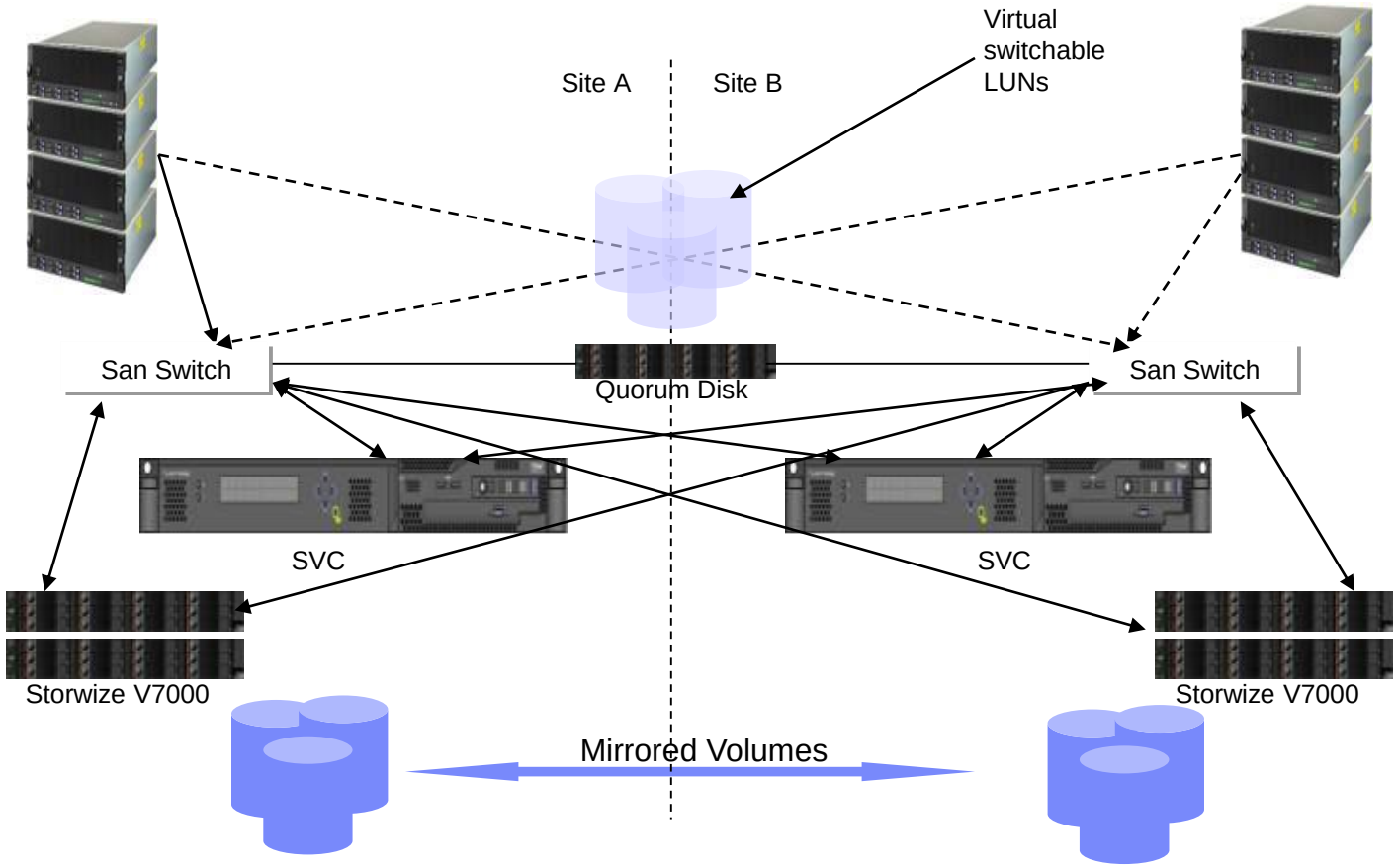
PowerHA SVC stretch cluster



- PowerHA Standard Edition (appears as a switchable LUN cluster)
- Site A and Site B volumes are mirrored by the SVC (under the covers)
- Solution provides cross-campus continuously available storage in a PowerHA cluster

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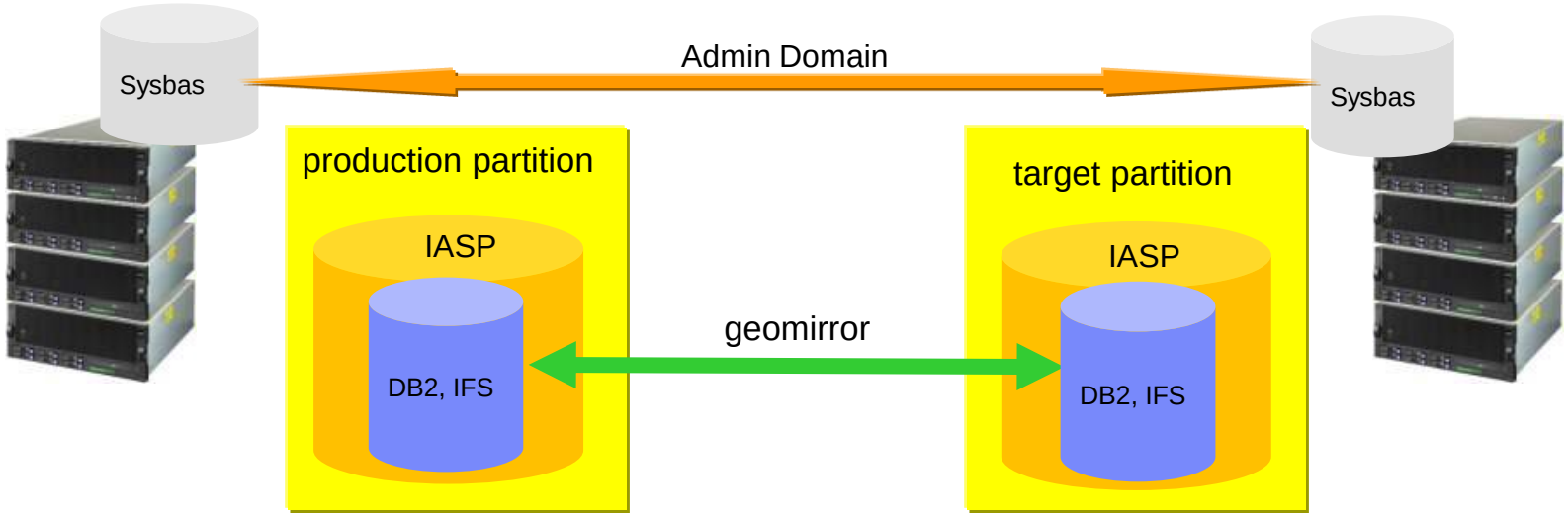
PowerHA with Geomirroring

- PowerHA with geographic mirroring is popular with our smaller IT shops
  - Inexpensive compared to logical replication solutions, its easy to use and requires little day to day monitoring and maintenance.
  - Typically used by shops with under 2 Tbytes and on internal disk
  - After an unplanned outage the target data is replicated back to the source therefore the larger the IASP the longer the resync time
  - Doing a tape backup off of the target works great, *Quiesce the* IASP on the current production copy system (see speaker notes) *if you want to get a "clean transaction boundary. If you choose to do the quiesce (recommended), do it during a quiet time.*

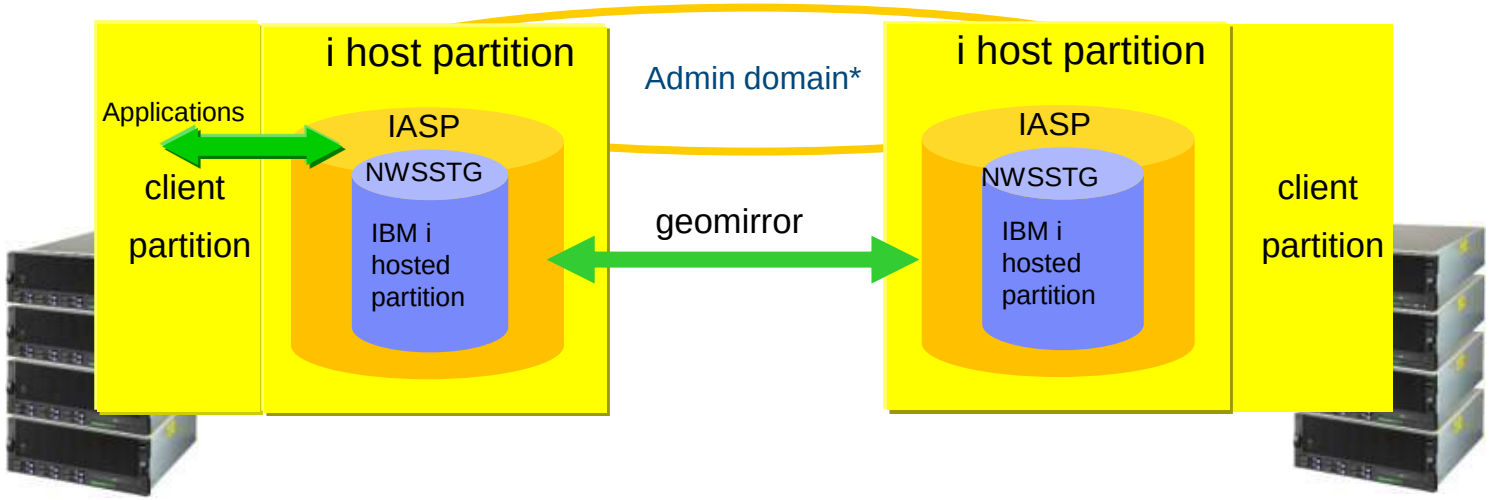
- Geomirroring is IBM i mirroring of the data writes to the IASP source and target over IP
  - Referred to as host based replication (as opposed to storage based replication)
  - IBM i storage management sends the memory pages to both the remote and local server either synchronously or asynchronously
  - Synchronous distance is typically under 30 or 40 KM but distance is driven by application response time requirements
  - Bandwidth and quality of service are both important. When we've seen issues they usually come down to network quality.

Geomirroring– HA/DR clustering



- PowerHA geomirror cluster (typically with internal disk and < 4 Tbytes)
- Complete HA/DR coverage for all outage types (hardware, middleware, operator error)
- Off line back-up followed by source side /target side tracking change resynchronization
- Both bandwidth and network quality are important.
- Synchronous mode up to 40 KM, production and target always identical
- Asynchronous mode unlimited distance, production and target ordered and consistent

Geomirroring – i hosting i remote VM restart for DR



* Admin Domain on host is optional

- Non-cluster PowerHA configuration, full system replication, this is disaster recovery setup, this is not a HA solution
- IBM client placed into a network storage space which is placed into an IASP
- Guest and host partition must be shut down before remote host and client can be restarted
- Limitation: no heart beating, can't do concurrent OS upgrades, is more resource intensive than a PowerHA cluster
- Note that everything is being replicated so network bandwidth and quality is critical
- Any roll over or failover requires an abnormal IPL of target

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Geographic Mirroring

- Storage pages in the IASP on production system are mirrored to backup system (controlled by IBM i)
  - Additional CPU capacity of 10 – 15% needed
- Synchronous mode -> requires gigabit connection
- Asynchrounous mode (7.1 ONLY) for larger distances
- No access to data in backup IASP while mirroring is active
- Based on clustering -> automatic failover possible

- **Advantages**
  - Easy management
  - Very good solution for storage spaces (hosted partition) and IFS
  - Data on backup system is protected against accidental changes
- **Disadvantages**
  - Applications must reside in IASP – requires some application changes
  - Synchronous mode requires gigabit connection – normally campus solution
  - Access to data on backup system only after detach
    - Requires partial synchronization afterwards
    - NO data sent over to backup while in detached mode
    - NO failover possible while synchronisation is running

Small Environment price example with PowerHA and geomirror

6 500 € for a complete HA/DR solution

PowerHA SystemMirror for i	Standard Edition Price/core	Enterprise Edition Price/core
Small Tier	2.486 €	3.250 €
Medium Tier	3.490 €	5.018 €

- Production server S814 has one core,CBU server S814 has one core.
- Since geomirror consumes only a fraction of the CPW you only need one core on the CBU Production site and DR site are 400 miles apart therefore we will need geomirror async mode. Geomirroing async mode costs 3250€ per core. Since customers in this environment typically use internal disk and therefore can not do switchable luns, we put geomirroring sync mode into the standard edition. In all other cases, storage replication requires the Enterprise Edition.
- In this case the customer needed 100Mbits of bandwidth (lab services will do the sizing for bandwidth)
- So let's do the math to see what this HA solution cost us. Do we need a calculator **?** **3 250 € x 2 = 6 500 €**

- **6 500 € for an HA/DR solution that requires very little care and feeding.**

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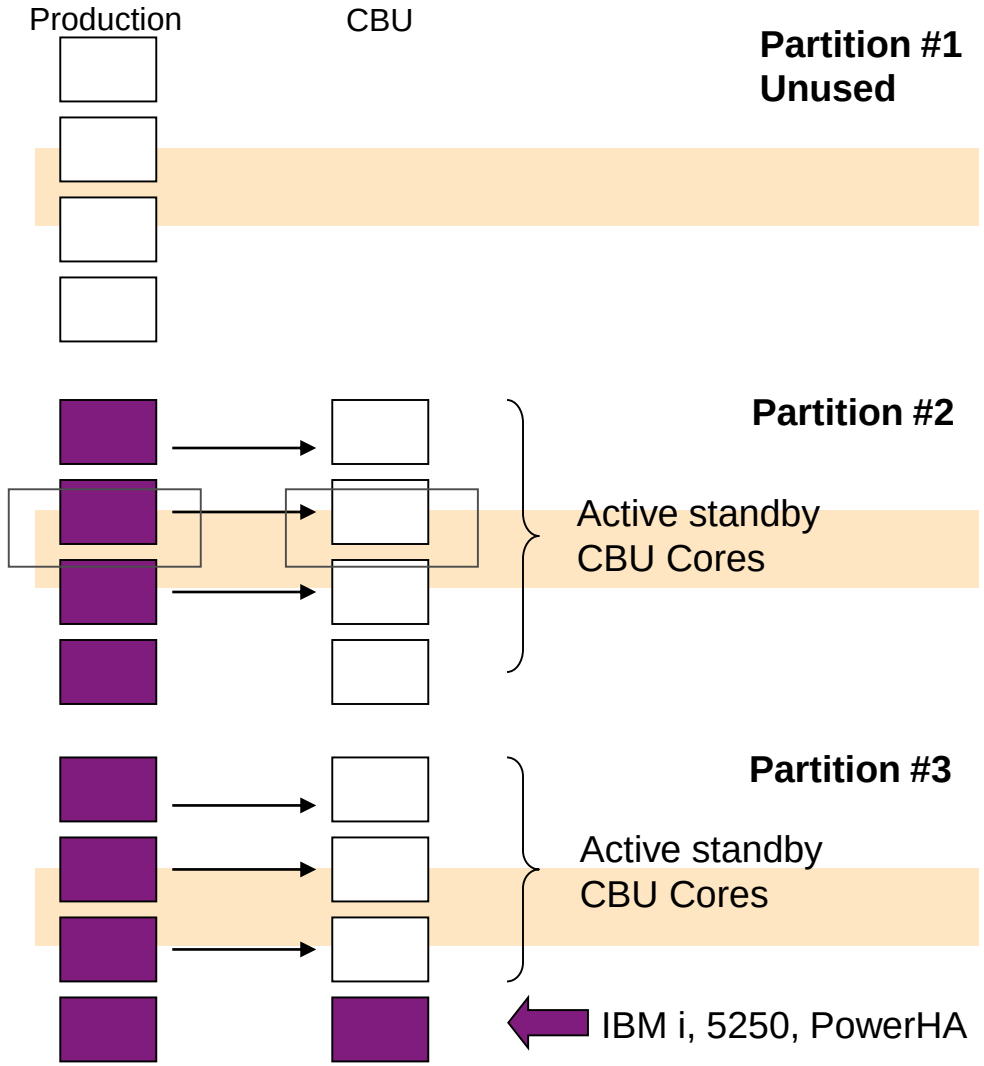
PowerHA IBM i Capacity Back Up (CBU) Licensing Example

Planning

- CBU allows PowerHA licenses entitlement fail-over from the registered production server
  - Minimum 1 entitlement required on the CBU box
  - CBU server allows the temporary transfer of entitlements from primary server for non concurrent usage on the CBU server
  - Round-up when using partial processors
  - 3.5 processors = 4 entitlements

Example

- No HA/DR required for Partition 1
  - No PowerHA licenses
- HA required for Partition 2 and 3
  - All processors in the production server partitions 2 and 3 are licensed for PowerHA
  - One key, 8 entitlements
  - The license key will be a permanent key installed on partition 2 and 3
- A single processor is licensed on the CBU server
  - One key, one entitlement
  - The license key will be a temporary key for 8 cores good for two years installed on partitions 2 and 3



PowerHA SystemMirror IBM i Editions

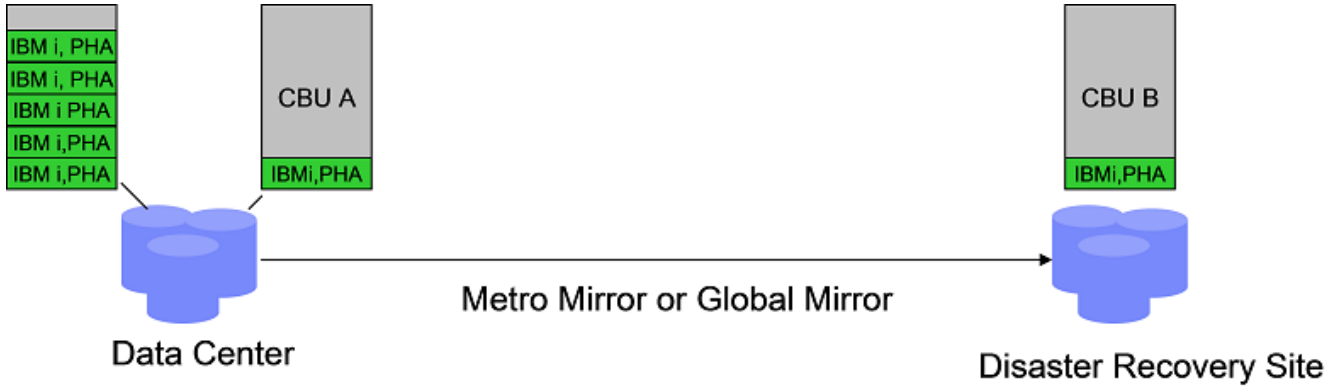
PowerHA SystemMirror for i		Standard Edition	Enterprise Edition
Offering Focus		Data Center HA (per core)	Multi Site HA/DR (per core)
Small Tier Blade & Entry Power	Scale	**$2,500**	**$3,250**
Medium Tier Mid-range Power		**$3,500**	**$5,000**
Large Tier Enterprise Servers		**$4,500**	**$6,500**

US list prices, prices vary by geo

- Standard Edition PID 5770-HAS
- Enterprise Edition is a feature of 5770-HAS and is the multi site solution
- No charge upgrades from PowerHA 6.1 to 7.1 Standard Edition or Enterprise Edition
- HASR (opt 41) is included with purchase of PowerHA SystemMirror 7.1
- Sub capacity pricing, license only the cores in the partitions covered by PowerHA

PowerHA Price Example

PowerHA SystemMirror for i	Standard Edition Price/core	Enterprise Edition Price/core
Small Tier	2.486 €	3.250 €
Medium Tier	3.490 €	5.018 €



- PowerHA is priced per processor core used in the HA/DR cluster
- Taking advantage of the CBU topology in the example topology:
- Assume E880 cluster, 7 IBM i and 7 PowerHA
- **PowerHA price: 5 018 €/core * 7 = 35 126 €**

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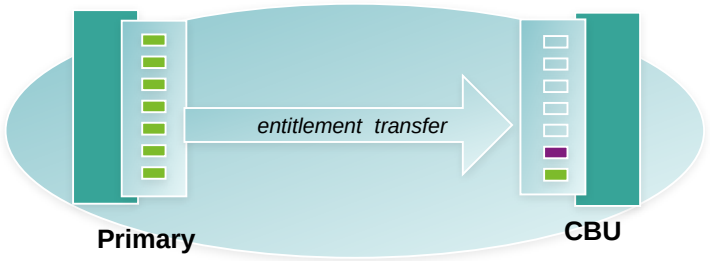
PowerHA for IBM i

- ✓Comprehensive HA/DR solutions for multi-site or data center
- ✓Shared storage clustering technology
- ✓Provides automation for ease of use
- ✓Implemented in IBM i, SLIC, and storage management
- ✓Data replication is provided by IBM storage
- ✓FlashCopy enables off line tape backup
- ✓Designed for regular role swap operations and automated failovers
- ✓Developed and supported by IBM

New Capacity Backup For Power Enterprise Systems

- New offering replaces the Capacity Backup for PowerHA offering
  - More flexible than previous offering
  - Eliminates many of the configuration requirements
  - Provides support for the Power E880,E870,E880C and E870C
  - Provides lower hardware and hardware maintenance pricing for clients looking for HA/DR solution
  - Fast failover to ***active*** memory on the CBU
    - To add 256GB of memory to the partition it can take 3 or 4 minutes, the more being added the longer the time



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Order Process/Registration

- Prior to ordering the CBU with PowerHA fill in the worksheet posted on the CBU registration website to determine number of eligible discounted CBU processor nodes no charge memory ECOD activations
  - Submit CBU entitlement worksheet (pwrhacbu@us.ibm.com)
  - IBM verifies client configuration entitlements (discounted processor nodes and ECOD days)
- Customer agrees to CBU terms and conditions via registration website
- Send configuration files to pwrhacbu@us.ibm.com
- After project office approval, order the approved CBU configuration
  - Specify the # of CBU processor nodes & feature code
  - Econfig will automatically add the CBU system feature code: EB3J or EB3K
- After CBU system is installed, configuration of Primary and CBU system is sent to PowerHACBU@us.ibm.com
  - CBU project office will apply the appropriate number of ECOD days to CBU for Enterprise Systems
- Implement TCOD (temporary COD) via standard process
  - TCOD contract signed by client
  - ECOD enablement codes ordered via MES

Registration website: http://www-03.ibm.com/systems/power/hardware/cbu/

PowerHA and storage options

Recommend viewing IBM i POWER External Storage Support Matrix Summary – TechDoc - PRS4563
http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS4563 and
Quick reference - Storage options for PowerHA SystemMirror for IBM i – TechDoc - TD106243
http://www-304.ibm.com/jct03001c/support/techdocs/atsmastr.nsf/WebIndex/TD106243

	Internal SAS/SSD	DS8000	SVC V840,V9000 Storwize	XIV	DS5000	Other Storage
Geographic Mirroring	✓	✓	✓	✓	✓	✓
Metro Mirror		✓	✓			
Global Mirror		✓	✓			
Metro Global Mirror		✓				
LUN switching		✓	✓			
FlashCopy		✓	✓			
HyperSwap		✓	✓			

A PowerHA Technology for Every Outage Type

	Planned /Unplanned Partition Outages	Planned /Unplanned Server Outages	Planned /Unplanned Storage Outages	Site Outage	Offline Backups	>2 copies of real-time data
Synch Geo Mirroring	✓	✓	✓			
Asynch Geo Mirroring	✓	✓	✓	✓		
Metro Mirror	✓	✓	✓			
Global Mirror	✓	✓	✓	✓		
Metro Global Mirror	✓	✓	✓	✓	✓	✓
LUN switching	✓	✓				
Flashcopy					✓	
HyperSwap			✓			

IBM PowerHA SystemMirror on i data resiliency options

Supported Solutions

Geographic Mirroring
- IBM i host-based mirroring between data in IASPs

LUN-level switch
- DS8000, SVC, or Storwize hosted IASP LUNs switchable between IBM i partitions

Metro Mirror
- Synchronous DS8000, SVC or Storwize storage-based mirroring

Global Mirror
- Asynchronous DS8000, SVC or Storwize storage-based mirroring

Flash Copy
- DS8000, SVC or Storwize point-in-time copy

PowerHA Tools for IBM i

- Complement and extend PowerHA and IBM Storage capabilities for HA/DR
- Helps reduce business risk and improve resiliency for critical applications
- Simplifies set up and automation of HA/DR and backup solutions
- Reduces cost of maintaining and regular testing of an HA/DR environment
- Facilitates flexible deployment options for single or multi-site protection
- Assures consistent deployment using best practices and experienced consultants

PowerHA Tools for IBM i is a service offering from IBM Systems Lab Services

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PowerHA Tools for IBM i

PowerHA Tools for IBM i	Capability	Benefit	DS8000	Storwize	Internal
Smart Assist for PowerHA on IBM i	Provides operator commands and scripts to supplement PowerHA installation and ongoing operations for IASP enabled applications.	Simplifies deployment and ongoing management of high availability for critical IBM i applications.	**Yes**	**Yes**	**Yes**
IASP Copy Services Manager (Automated recovery with faster IASP-level vary on, no system IPL)					
Flashcopy	Automates Flashcopy of IASP for daily off-line backup with seamless BRMS integration.	Increases application availability by reducing or eliminating backup window for routine daily backups.	**Yes**	**Yes**	
LUN-level Switching	Simplifies deployment and automates switching of an IASP between IBM i cluster nodes in one data center.	Enables a business continuity manager to provide a simple, single site HA solution.	**Yes***		
Metro Mirror or Global Mirror	Simplifies initial deployment and automates ongoing server and storage management of two-site Metro Mirror or Global Mirror HA or DR solutions. Requires IASP enabled applications..	Enables a business continuity manager to provide seamless operation of integrated server and storage operations for two-site high availability or disaster recovery.	**Yes**		
Metro Global Mirror (MGM)	Extends PowerHA functionality to provide three-site server/storage replication solution combining Metro Mirror for HA with Global Mirror for DR. Requires IASP enabled applications and IBM Tivoli Productivity Center – Replication (TPC-R).	Enables a business continuity manager to further lower business risk and maximize business resilience for highly critical business applications that require three-site HA/DR protection.	**Yes**		
Full System Copy Services Manager (Automated recovery, requires full system IPL on target LPAR)					**XIV**
Flashcopy	Automates full system Flashcopy for daily off-line backup with integrated support for BRMS without IASP-enabled applications.	Increases application availability by reducing or eliminating backup window for routine daily backups. Enables an entry solution while planning IASP enablement.	**Yes**	**Yes**	**Yes**
Metro Mirror or Global Mirror	Simplifies initial deployment and automates ongoing server and storage management of two-site Metro Mirror or Global Mirror HA or DR solutions. without IASP-enabled applications.	Enables a business continuity manager to provide seamless operation of integrated server and storage operations for HA or DR. Enables an entry solution while planning IASP enablement.	**Yes**	**Yes**	

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SmartAssist for PowerHA on IBM i

Highlights

- Complements and extends PowerHA on i
  - Provides CL commands for PowerHA functions where only API's are available
  - Provides automation around repetitive tasks
    - Adding entries in Admin domain
    - Starting all cluster nodes
    - Etc.
- Helps automate the installation and operation of a PowerHA environment
- Provides commands, utilities, and program examples
  - Many clustering functions contain lists of items. Examples are provided for CL programmers not used to dealing with lists
- Useful toolset for geographic mirroring and storage-based solutions

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Sample PowerHA Assist Commands

- ADDCADUSR - adds all user profiles in the Admin Domain
- Create user profile exit point to auto add user profiles on creation
- DLTPRFCLU - delete profiles around a cluster
- CHKDUPLIBS - check for duplicate libraries in SYSBAS and IASP across the cluster
- CHKENVRCY – Analysis tool for files, journals etc to ensure an unscheduled switch can come online as fast a possible
- Global Mirror statistics programs to monitor performance and recovery points
- SET/RTVFACT – control the PowerHA failover actions to be able to turn on/off automatic failover for specific cluster events
- STRALLNOD - start all cluster nodes
- Sample programs for automatically starting PowerHA and Geographic mirroring on IPL
- RTVCPYSSN - used multiple API's to retrieve PowerHA session status and primary node information into a CL program

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IBM Lab Services Offerings for PowerHA for IBM i

PowerHA Service Offering	Description
IBM i High Availability Architecture and Design Workshop	An experienced IBM i consultant will conduct a planning and design workshop to review solutions and alternatives to meet HA/DR and backup/recovery requirements. The consultant will provide an architecture and implementation plan to meet these requirements.
PowerHA for IBM i Bandwidth Analysis	An experienced IBM i consultant will review network bandwidth requirements for implementing storage data replication. IBM will review I/O data patterns and provide a bandwidth estimate to build into the business and project plan for clients deploying PowerHA for IBM i.
IBM i Independent Auxiliary Storage Pool (IASP) Workshop	An experienced IBM i consultant will provide jumpstart services for migrating applications into an IASP. Training includes enabling applications for IASPs, clustering techniques, plus managing PowerHA and HA/DR solution options with IASPs.
PowerHA for IBM i Implementation Services	An experienced IBM consultant will provide services to implement an HA/DR solution for IBM Power Systems servers with IBM Storage. Depending on specific business requirements, the end-to-end solution implementation may include a combination of PowerHA for IBM i and/or PowerHA Tools for IBM i, plus appropriate storage software such as Metro Mirror, Global Mirror and/or Flashcopy.

For more information on PowerHA Tools for IBM i offerings and services, contact: Mark Even even@us.ibm.com 507-253-1313

www.ibm.com/systems/services/labservices stgls@us.ibm.com

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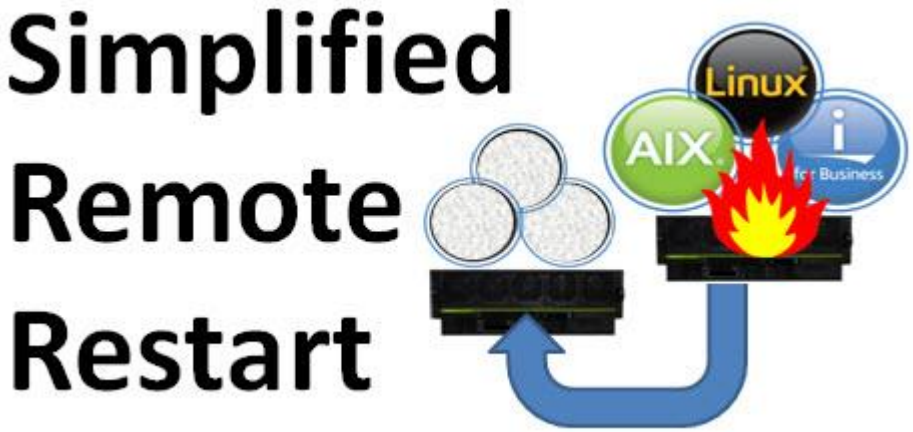
Agenda

- Understand the concepts of IASP and shared storage clustering
- Typical Storage Based HA/DR PowerHA configurations
- Flashcopy
- New PowerHA HyperSwap clustering
- Lun-level switching and SVC Split Cluster
- PowerHA with geomirroring and internal disk
- PowerHA geomirror price example (amazingly low cost solution)
- PowerHA and CBU for i example
- PowerHA Offering, Tools & Services Summary
- **Additional Solutions: GDR / SRR**
- Discussion , Q&A

Simplified Remote Restart

- LPM Prerequisites
- VM Restart in case of server failure
- HMC or PowerVC Managed



PowerHA compared to SRR

This list is to point out PowerHA has many "hidden" advantages

PowerHA (Automatic recovery on these conditions)	Simplified Remote Restart
1. Application failure	1. Not noticed
2. AIX failure	2. Not noticed
3. VM failure (partial RAM / CPU)	3. Not noticed, could Static migrate VM
4. Whole machine error / power-off	4. HMC notices then **YOU can SRR** ←←
5. Whole machine dead / unplugged	5. Not noticed – HMC state "unknown"
6. Monitoring by standby AIX (scales)	6. Monitoring by HMC(s)
7. Standby has 2nd AIX running	7. No alternative AIX to use
8. Heartbeat over multiple paths	8. HMC single private network
9. Standby mounts the disks then restarts Apps	9. HMC rebuild VM with VIOS then reboots OS, OS recovers filesystem then restarts Apps
10. Nothing of the failed server is required	10. HMC and FSP of failed server are required

References

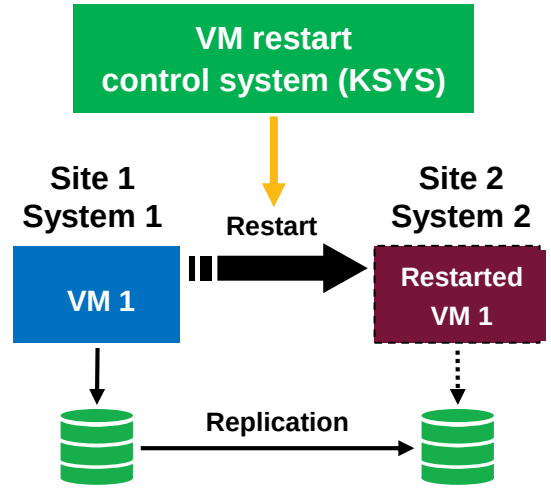
https://www.ibm.com/developerworks/community/blogs/aixpert/entry/POWER8_Simplified_Remote_Restart_via_HMC_or_PowerVC?lang=en

http://www-01.ibm.com/support/docview.wss?uid=isg3T7000738

What is the Geographically Dispersed Resiliency (GDR) for Power Systems DR solution?

A simplified way to manage DR

- Automated DR management
- Improved economics by eliminating the need for hardware and software resources at the backup site
- Easier deployment for disaster recovery operations; unlike clustering or middleware replication technologies, VM restart technology has no operating system or middleware dependencies.
- Support for IBM POWER7® and POWER8® Systems
- Support for heterogeneous guest OSs
  - AIX - Red Hat – SUSE – Ubuntu - IBM i (7.2+ with VIOS 2.2.5.20+)
  - KSYS LPAR (1 CPU 8GB RAM on backup site)



GDR & Shared Storage:

The GDR solution manages disaster recovery across two sites based on storage replication across the sites.
However, the GDR solution also supports a mode of deployment in which disks are shared across sites.
In this case, the **KSYS subsystem does not manage any storage subsystems**.
The disks can be shared across sites that are separated by short distances (0 - 100 km).
The storage technologies (for example, **Storwize® HyperSwap®**) perform synchronous mirroring across sites and abstract the mirroring from the hosts. These storage technologies provide shared disk type of deployment for hosts across sites.

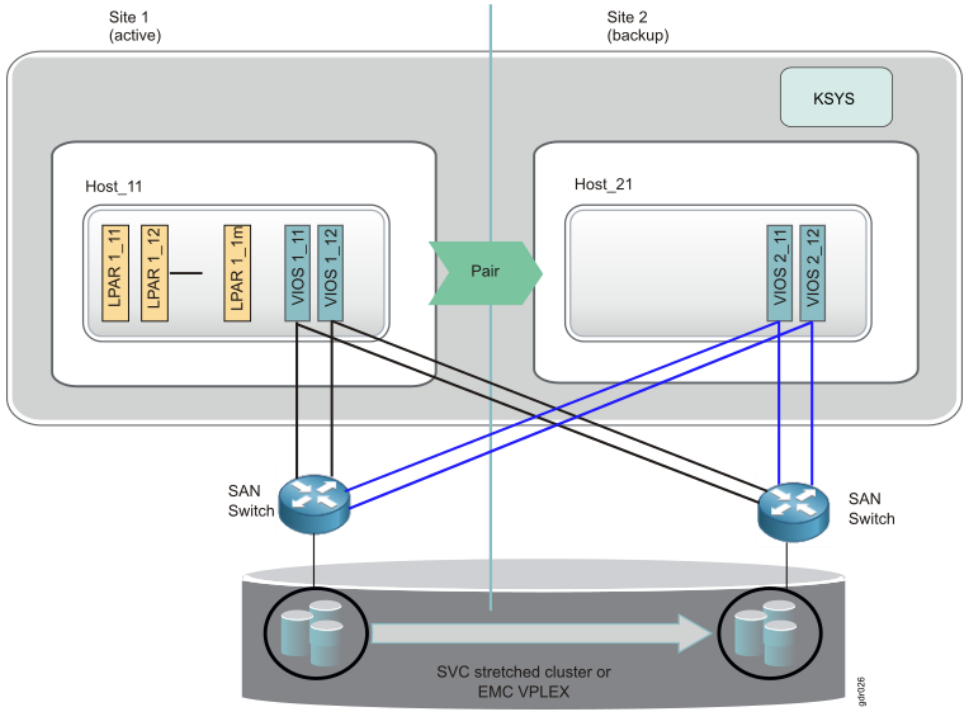
Reference: https://www.ibm.com/support/knowledgecenter/en/SS3RG3_1.2.0/com.ibm.gdr/admin_shared_strg.htm

What is the Geographically Dispersed Resiliency (GDR) for Power Systems DR solution?

GDR & Shared storage without replication management

When the storage device in your environment is a single storage system that is split or separated by distance in two different sites as stretched systems, the storage replication management is hidden from the hosts and VIOS partitions. The storage subsystem is displayed as a single shared storage across the two sites. In this case, the storage recovery and replication are performed entirely by the storage platform.

When you move the virtual machines from the active site to the backup site, the KSYS subsystem considers the storage subsystem as unmirrored shared storage and starts the virtual machines on the backup site. If the disaster recovery operation is unplanned, the storage subsystem performs the entire storage recovery.



Dynamic Solutions
INTERNATIONAL

Virtual Tape Library and Software Solutions Overview

Dynamic Solutions International

Benefits for IBM i Environments

- Non-disruptive operation; IBM does not see any difference between a physical tape and virtual tape
- Supports all IBM i backup tools and methods without any process change (BRMS, ROBOT/SAVE, LXI MMS, SAVLIB, media policies and IPL)
- Ensures business continuity through IPL, bare-metal boot from virtual or physical tape
- Automates backup and recovery processes to eliminate user disruption
- Easy to scale solutions that start at a Terabyte and can scale to Petabytes
- Improves backup reliability and replication performance
- Supports mixed IBM i, Open Systems and VMWare environments

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Dynamic Solutions International

VTL Feature Options and Support Services – Standard On All IBM Solutions

- Data-at-rest-encryption
- IP Replication with encryption
- Backend Tape with encryption
- Share between multiple environments
- Support is 24/7/365 for all DSI Virtual Tape Libraries and Tape storage solutions
- Support is handled internally through DSI's Support and Engineering personnel
- All Virtual Tape Libraries are delivered with full warranties for the term outlined in the purchase agreement

Dynamic Solutions INTERNATIONAL

Dynamic Solutions International

Performance

Improve backup times

Improve replication speeds

Improve RPO’s & RTO’s

Reliability

Eliminate tape read errors

Eliminate mechanical failures

Eliminate user disruption

Recovery

Increased recovery speeds

Replicated data is always available

Immediate recall

Dynamic Solutions INTERNATIONAL

What Is The DSI VTL?

The DSI Virtual Tape Library is a non-disruptive disk based backup solution designed for reliability, performance and protection.

- Ability to perform in-line or post-processing deduplication *
- Deduplication Replication (Many-to-One, Many-to-Many, One-To-Many)
- Enterprise class hardware (Redundancy and RAID configurations are standard)
- Scalable solution (1TB – Multiple Petabytes)
- High Availability configurations
- Encryption (At-Rest, In-Motion, Physical Export)

* EV0/EVD solutions only allow for post processing deduplication

Dynamic Solutions INTERNATIONAL

Why Choose A DSI VTL?

The engineering effort behind the DSI VTL supports some of the worlds largest and most resilient infrastructure

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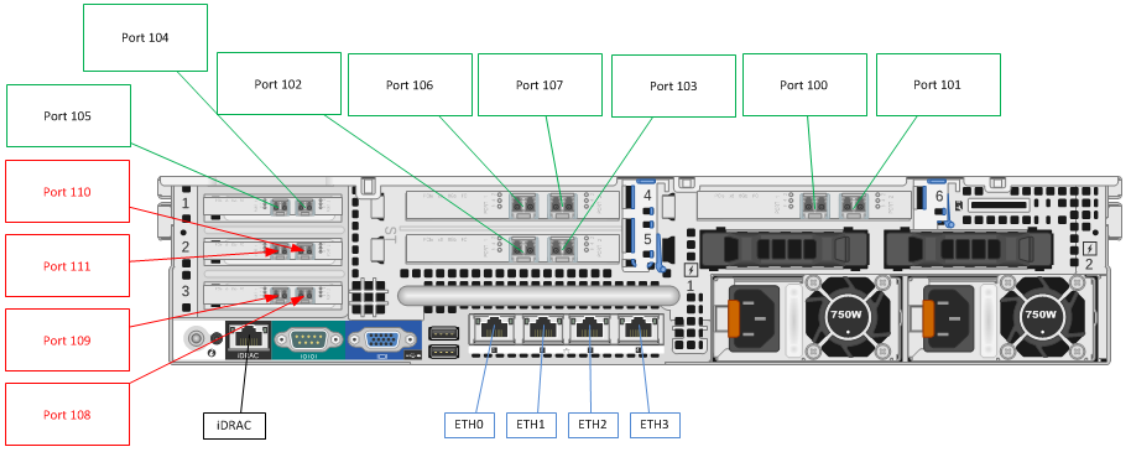
2U

- Deduplication technology reduces data center footprint further than before
- Active-Passive node configurations eliminate single points of failure
- Redundant paths and multiple SFP ports guarantee your data is accessible all the time
- Security is key– VTL encryption ensures your data is secure regardless of the medium

Dynamic Solutions INTERNATIONAL

DSI Node Systems

EV0 (IDSI400101-EV0)	
Rack	2U
Max Virtual Libraries	128
Max Virtual Tape Drives	1,024
Max Virtual Tape Cartridges	250,000
Max Virtual Tapes per Library	64,000



EVD*	Under 500TB (IDSI420101-EVD)	Over 500TB (IDSI420102-EVD)
Rack	2U	2U
Max number of LUNs	240	240
Max LUN Size	16 TB each	16 TB each
Repository (Physical)	Up to 500 TB	500 TB to 3.8 PB

* Additional EVD nodes provide improved performance to the deduplication cluster depending on memory requirements and capacity needs.

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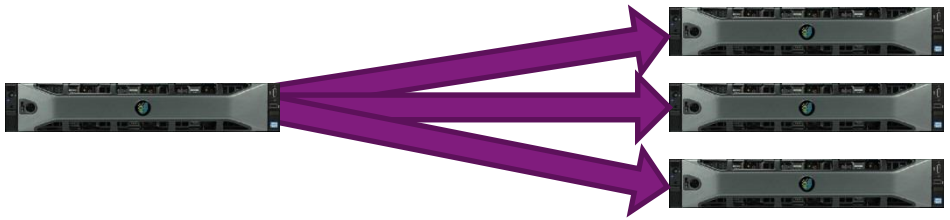
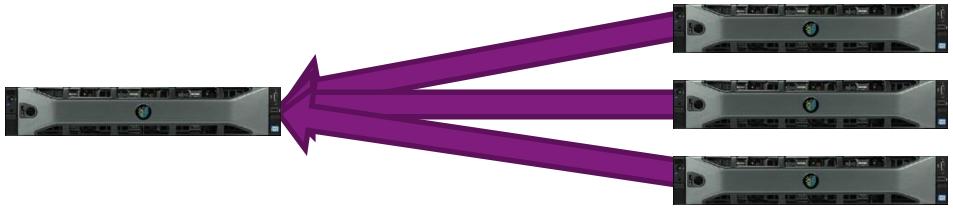
DSI VTL Replication Overview

- **One-to-one configuration: (Single)**
  - One cluster replicates to one cluster.

- **One-to-many configuration:**
  - The source server replicates data to multiple targets:
    - **Cascaded replication - The source server replicates data to target server B, which in turn replicated data to another target server, C.**
    - **Parallel replication - The source server replicates data to two target servers, A and C. This can occur concurrently (replication to both target servers at the same time), or serially (replication first to Replication Target A and then to Replication Target B).**





- **Many-to-one configuration:**
  - Multiple clusters replicate to a single cluster, which would be the case where remote offices replicate data to a corporate data center.

Data Replication Example

Primary Site (Production)

Secondary Site (DR)

Primary 1

Primary 2

Fibre Channel Replication

DR – Backup Server

Primary VTL

IP Connection for Replication

DR VTL

Primary Disk

Disaster Recovery Disk

Replication takes place after Deduplication, meaning only unique data is transferred.

VIT – Virtual Index Tape contains the pointer records for data which has already been replicated

Dynamic Solutions INTERNATIONAL

Power Systems Latest HA/DR offerings & positioning

PowerHA
Clustering

GDR
Replicated VM Restart

SRR
VM Restart

Tape Backup
Minimal downtime with Flashcopy

Pain point	Desired Outcome	Solution Offering	Technology	Benefit	Considerations
Down time for software maintenance	mission critical HA solution requiring minimal admin	**PowerHA**	shared/replicated storage based clustering	all outages; planed and unplanned are covered	-cluster admin -multiple data -active standby OS's -vary-on time
DR compliance testing is labor intensive and disruptive	simple DR solution requiring no admin	**GDR**	replicated virtual machine restart	low cost simple to use automates DR operations	-full frame restart -replicated copies of VMs -reboot time
admin required to manage clustering	simple HA solution requiring no admin	**PowerVC / SRR**	virtual machine restart	low cost simple to use automatic restart	-full frame restart -single copy of VM -primarily CEC outage -reboot time
Tape backup operations and off site storage	low cost alternative to local tape drives	**IBM Cloud Storage Solutions for I** **New! DSI VTL**	cloud object data containers	low cost automated off-site archive and backups	-bandwidth requirements -total restore time

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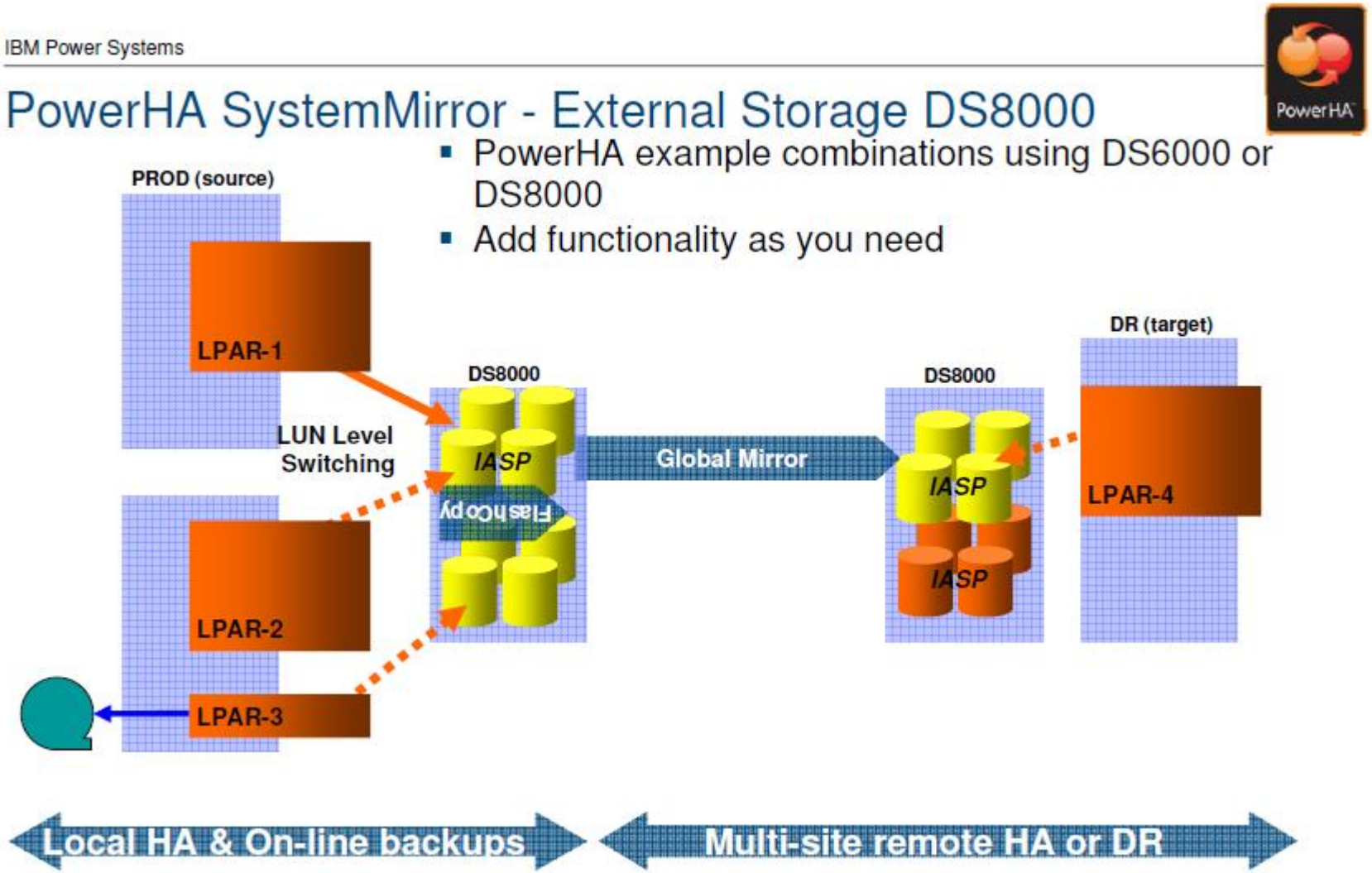
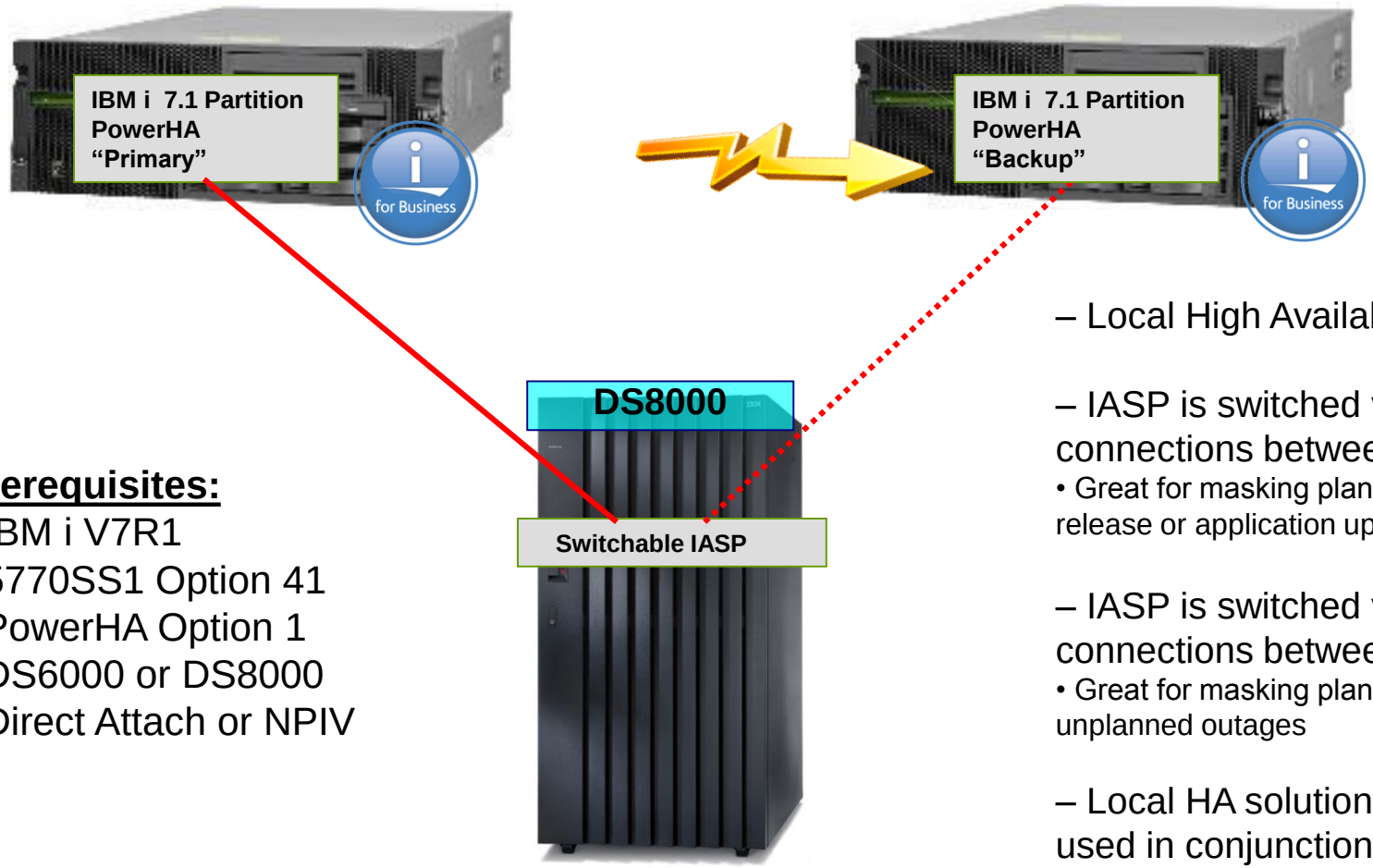
- Additional Solutions: GDR / SRR
- **Discussion , Q&A**

Montpellier PowerHA PoC / PoT Capabilities - Examples



Montpellier PowerHA PoC / PoT Capabilities - Examples



Prerequisites:
- IBM i V7R1
- 5770SS1 Option 41
- PowerHA Option 1
- DS6000 or DS8000
- Direct Attach or NPIV

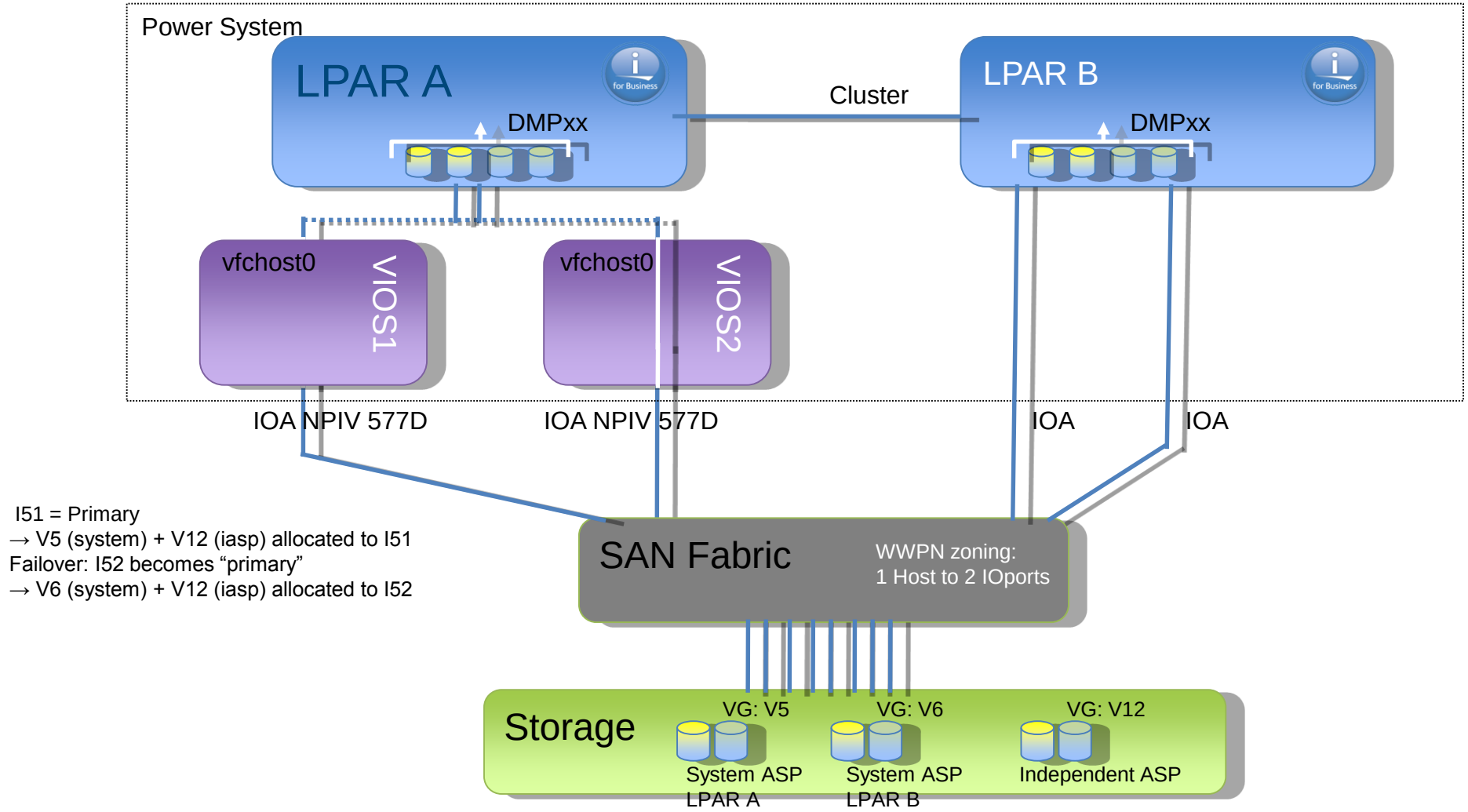
– Local High Availability

– IASP is switched via fiber connections between partitions
• Great for masking planned outages like release or application upgrades

– IASP is switched via fiber connections between servers
• Great for masking planned and unplanned outages

– Local HA solution which can be used in conjunction with:
• Metro Mirror
• Global Mirror
• FlashCopy

Montpellier PowerHA PoC / PoT Capabilities - Examples



Journaling – why is it important?

- Journaling is the base foundation for any hardware based HA solution
- Hardware based HA solutions do NOT replicate data in main storage
- User normally doesn‘t have any control over when which data is written to disk (asynchronous writes)
- Journal entries are written to disk synchronously
- Database recovery „knows“ which files were open and recovers entries from
- journals during IPL / vary on of IASP

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Best practises – User Profiles

- Use Admin Domain to synchronize user profiles between production and backup
  - Passwords
  - UID / GID
  - Can be omitted if only very small number of profiles (SAP)
- Make sure to synchronize UID / GID between production and backup before first switch over
  - Can be done via Management Central
  - If not done correctly – switchover of SAP can take 40 hours.....

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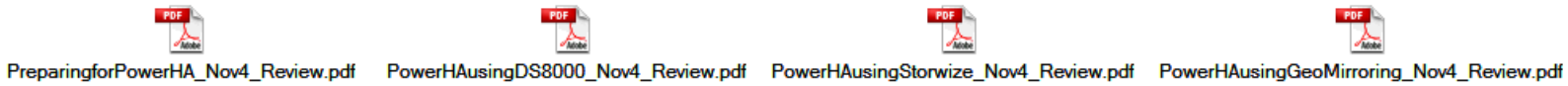
Additional resources for PowerHA IBM i

- **PowerHA Wiki**
  - **www.ibm.com/developerworks/ibmi/ha/**
- **Lab Services**
  - **http://www-03.ibm.com/systems/services/labservices**
- **PowerCare**
  - **http://www-03.ibm.com/systems/power/support/powercare/**
- **Redbooks at www.redbooks.ibm.com**
- **NEW REDBOOKs…Draft Version Available in Jan 2016 !**
  - Preparing for PowerHA SystemMirror for IBM i, Volume 1 of 4, SG24-8400
  - IBM PowerHA SystemMirror for i: Using DS8000, Volume 2 of 4, SG24-8403
  - IBM PowerHA SystemMirror for i: Using IBM Storwize, Volume 3 of 4, SG24-8402
  - IBM PowerHA SystemMirror for i: Using Geographic Mirroring, Volume 4 of 4, SG24-8401



Additional resources for PowerHA IBM i

- **SVC Stretched Cluster Implementation Guide**
  - https://www-356.ibm.com/partnerworld/wps/servlet/download/DownloadServlet?id=GQWZbZU1oFgiPCA$cnt&attachmentName=ibm_system_storage_san_volume_controller.pdf&token=MTUxNjYxNTcxODA2Nw==&locale=en_ALL_ZZ

- IBM PowerHA SystemMirror for i website, http://www-03.ibm.com/systems/power/software/availability/i
- IBM i developerWorks incl. PowerHA wiki www.ibm.com/developerworks/ibmi
- PowerHA SystemMirror for i Cookbook, http://www.redbooks.ibm.com/abstracts/sg247994.html?Open
- Implementing PowerHA for i, http://www.redbooks.ibm.com/abstracts/sg247405.html?Open
- Setup Examples for IBM PowerHA for i (HASM) with IBM System Storage DS8000 MetroMirror, FlashCopy and GlobalMirror, http://w3-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD104652 http://partners.boulder.ibm.com/src/atsmastr.nsf/WebIndex/TD104652
- IBM i 7.1 Technical Overview, http://www.redbooks.ibm.com/redpieces/abstracts/sg247858.html?Open
- IBM i 7.1 Information Center, http://publib.boulder.ibm.com/infocenter/iseries/v7r1m0/index.jsp
- IBM Systems Hardware Information Center, http://publib.boulder.ibm.com/infocenter/powersys/v3r1m5/index.jsp
- IBM STG Lab Services website, http://www-03.ibm.com/systems/services/labservices/platforms/labservices_power.html

Thank You

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