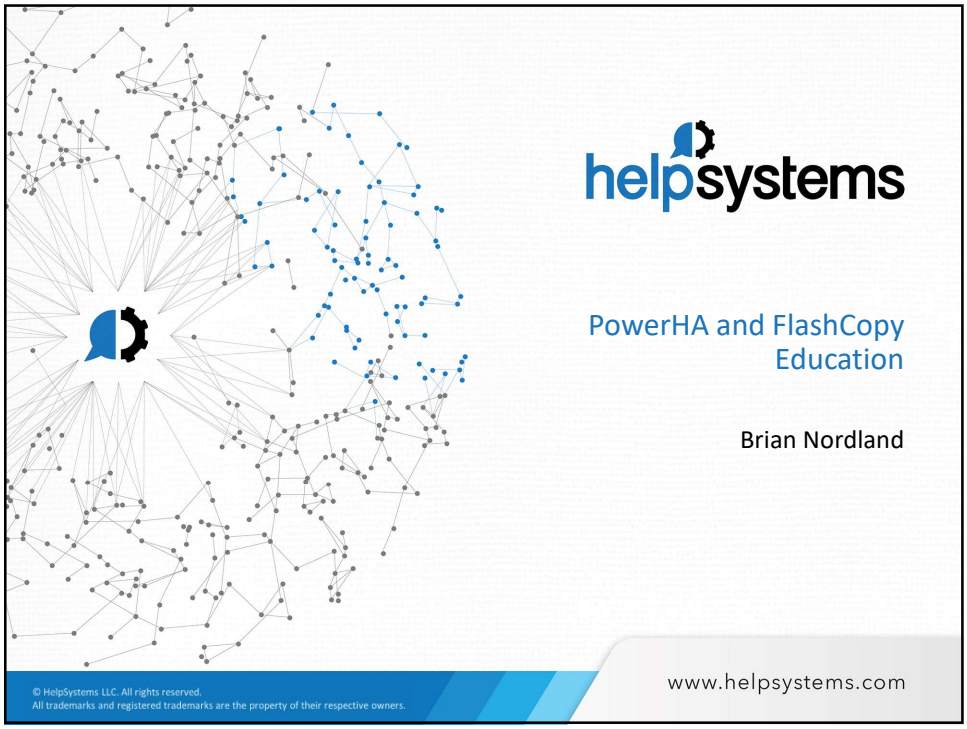

Agenda

- Part 1 – High Availability
  - The state of High Availability
  - Meet the PowerHA Family
  - POWER9 and PowerHA
  - Concepts and Live Demo of PowerHA Cluster and Role Swap
- Part 2 – FlashCopy
  - FlashCopy overview/Demo
  - Full System FlashCopy
  - Hidden FlashCopy Feature!
  - Advanced Concepts
- Q & A

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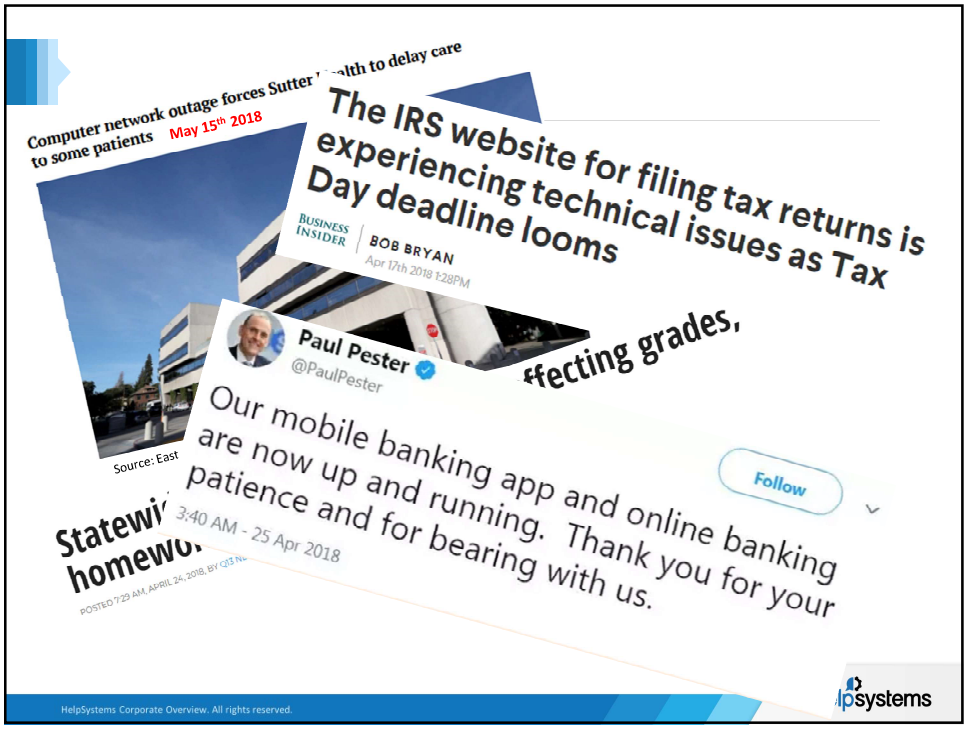

How long can you be down for?

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How long can you be down for?

Recovery Time Objective

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Student data lost after Washington County Public Schools server outage

CJ Lovelace May 9, 2018 Updated May 9, 2018

Washington County Public Schools is trying to recover student data — including grades and attendance records — that was apparently not properly backed up and **permanently lost** following a **minor fire** that downed multiple servers more than a week ago

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How much data can you afford to lose?

Recovery Point Objective

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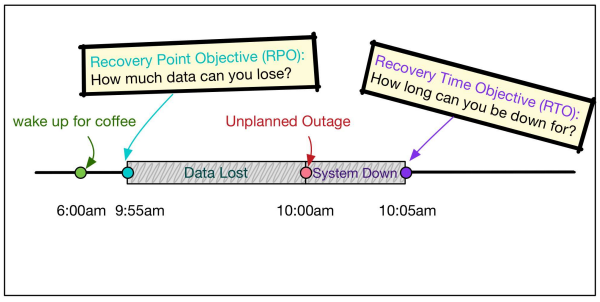

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The State of HA

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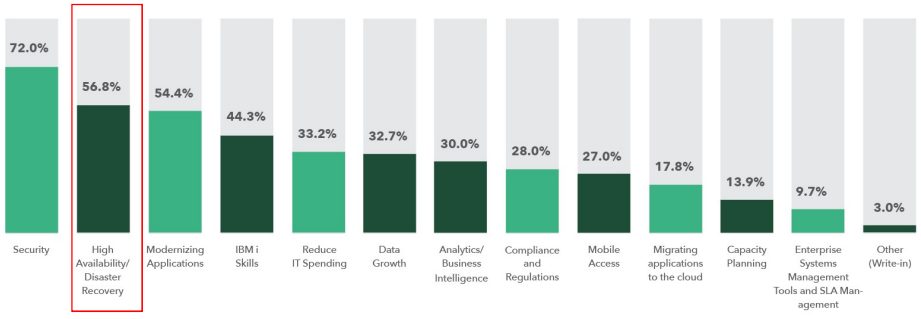
Top IT Concerns

What are your top concerns as you plan your IT environment? Check all that apply.



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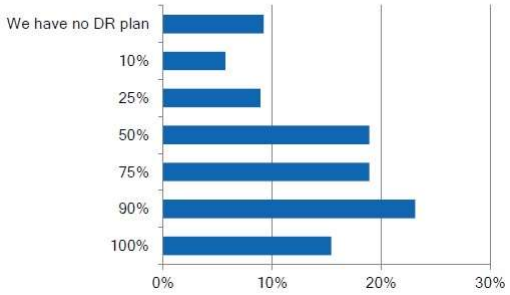
Current State of Affairs with Software/Logical Replication

How confident are you that your company's Disaster Recovery (DR) plan for IT Systems is complete, tested and able to meet your recovery time and recovery point objectives?



Source: Syncsort 2018 Report

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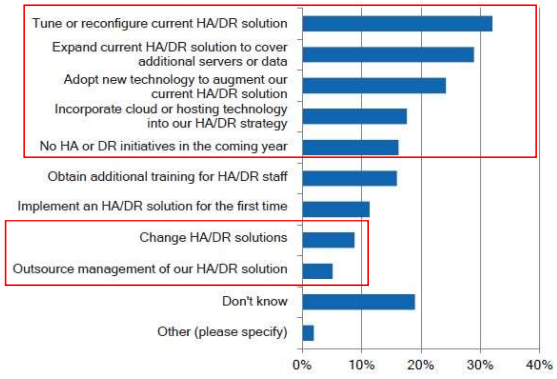
Customers Are Looking for a Better Solution

What initiatives does your business have regarding high availability or disaster recovery solutions in the coming year? Select all that apply.



Source: Syncsort 2018 Report

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- Simplifying HA with Hardware Replication

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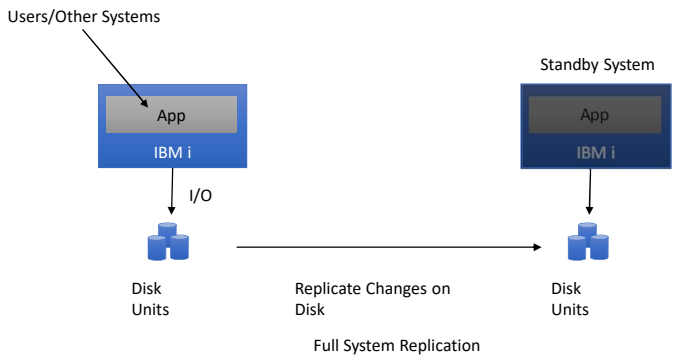
Hardware Replication



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Need to consider…

What are the causes of my outages?

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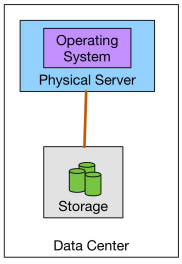
Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
	Planned	Unplanned			



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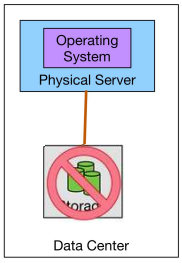

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Outage Type					
Storage Outage	**Server/Hardware Outage**		OS/Software Outage	Data Center Outage	Offline Backups
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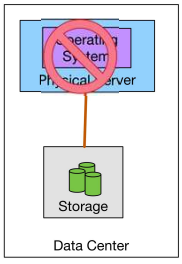

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Outage Type					
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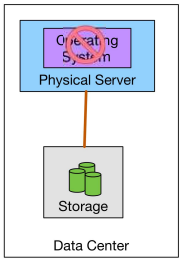

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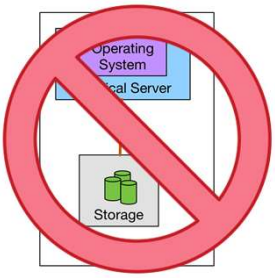

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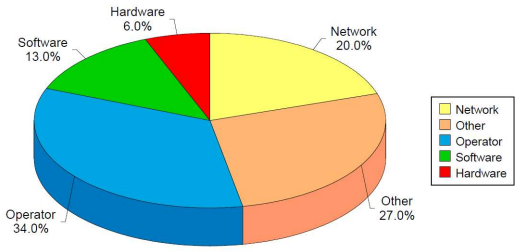
Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
	Planned	Unplanned			
----------Hardware---------- ----------6%----------			-Software- ----13%----	Network+Other?	Other



Source: The Standish Group International, Inc.

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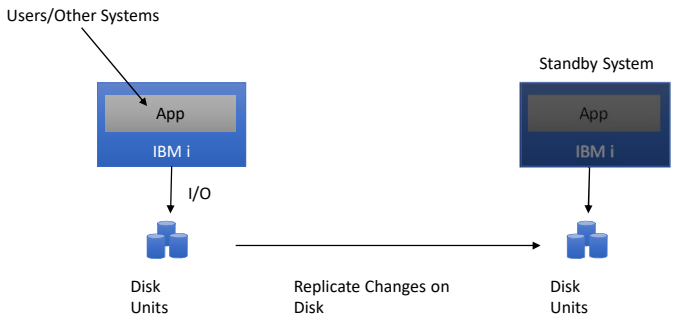
Hardware Replication

Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
	Planned	Unplanned			



Full System Replication

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Hardware Replication

Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
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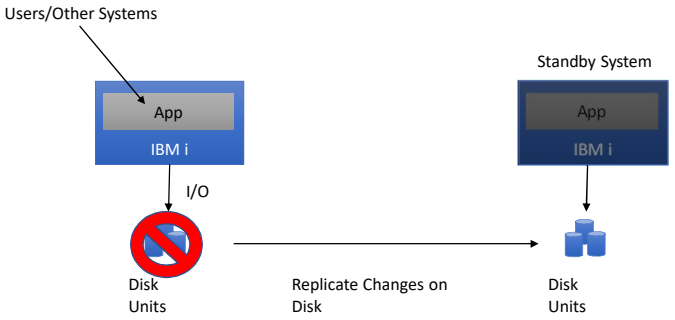

Full System Replication

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Hardware Replication

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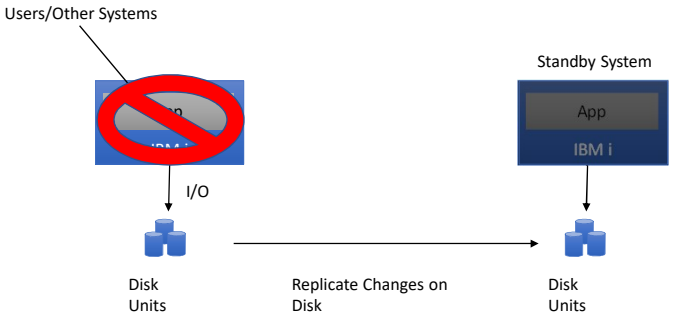

Full System Replication

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Hardware Replication

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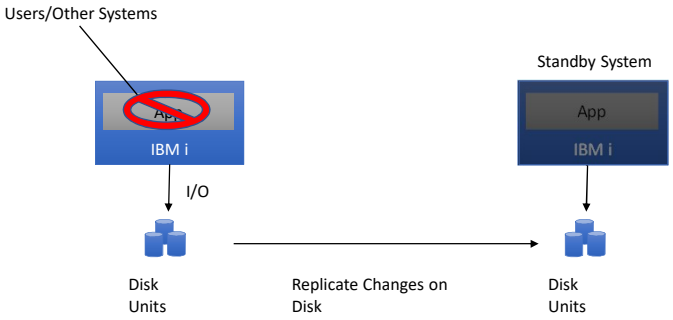

Full System Replication

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Hardware Replication

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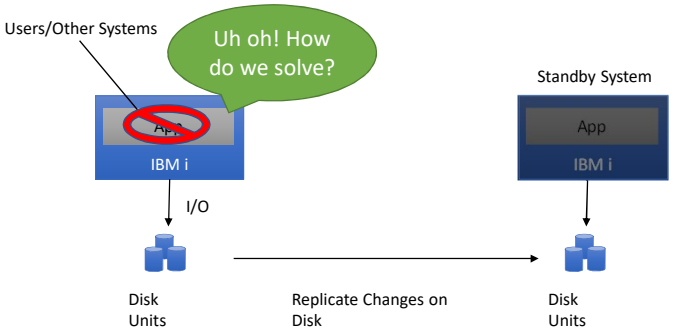

Full System Replication

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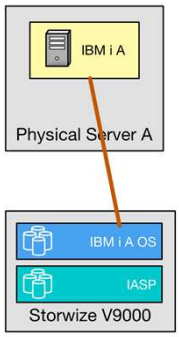
Independent Auxiliary Storage Pools (IASPs)

- Separates the OS from Applications/Data
- Separate namespace and database
- Can be taken online and offline without a system restart
- Foundation for PowerHA technologies
- Some objects do not make sense in an IASP, for this there is the administrative domain



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Hardware Replication

Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
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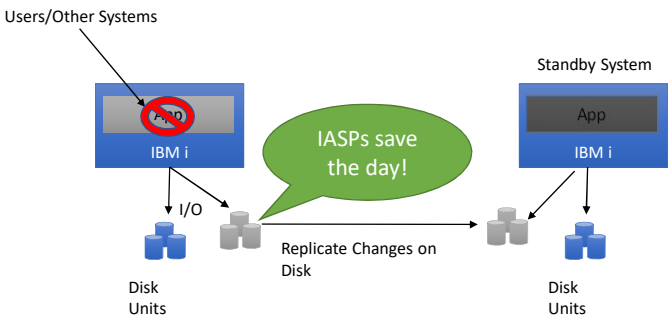

Independent Auxiliary Storage Pool (IASP)

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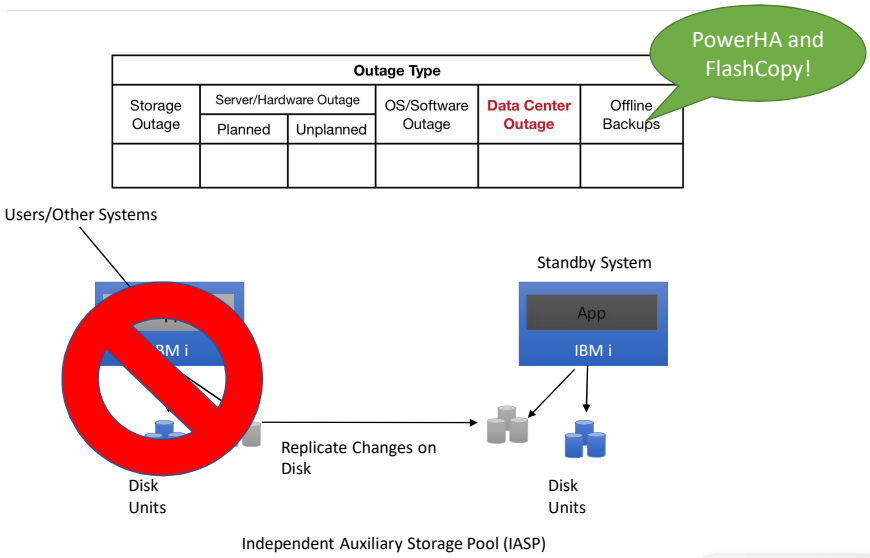
Hardware Replication



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Hardware Replication with IASPs

- Advantages
  - Ease of management (1 thing)
  - Peace of mind with switching
- Considerations
  - Bandwidth
  - Up front work required to move into an IASP

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Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
	Planned	Unplanned			

You need to have an RTO and RPO for every type of outage

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Meet the PowerHA Family

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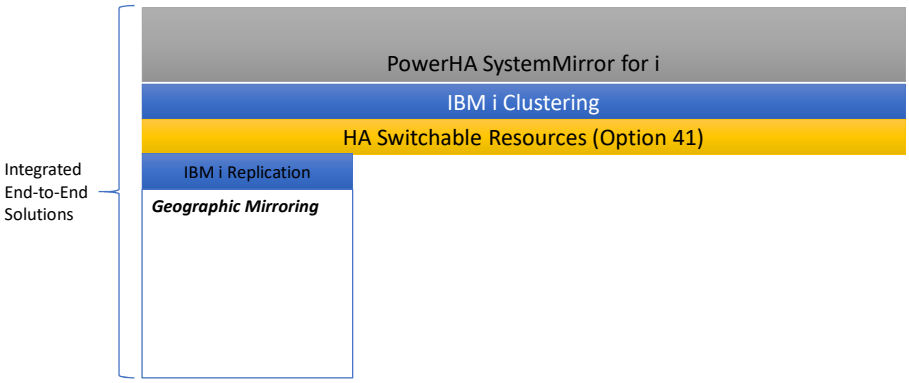
Meet the PowerHA Family



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What is Geographic Mirroring?

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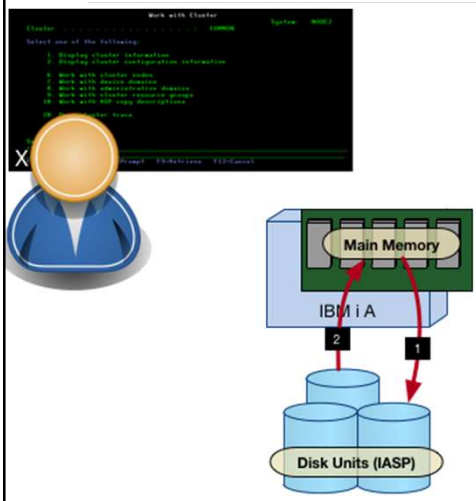
Stand-alone system operation



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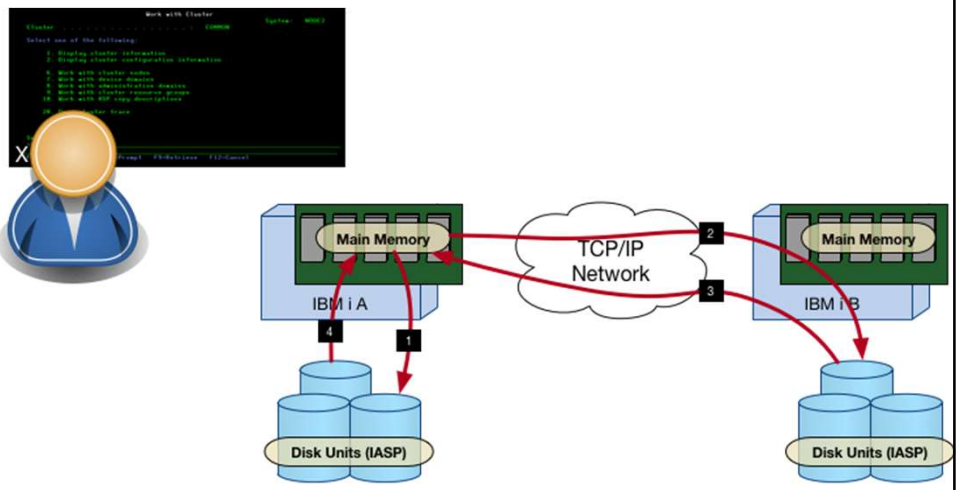
What is geographic mirroring?



Geographic Mirroring: "IASP replication using IBM i networking"

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Features of Geographic Mirroring

- Independent Auxiliary Storage Pool (IASP) replication technology
- IBM i storage management controls replication
  - Replication is done on at the page level, not object level
- Storage agnostic
- Tunable for synchronous or various levels of asynchronous replication.
- Partial resynchronization of suspend or detach of data
- Full resynchronization of data required after *unplanned* failure.
  - How much data can you tolerate to resync? 2TB, 4TB, 40TB?

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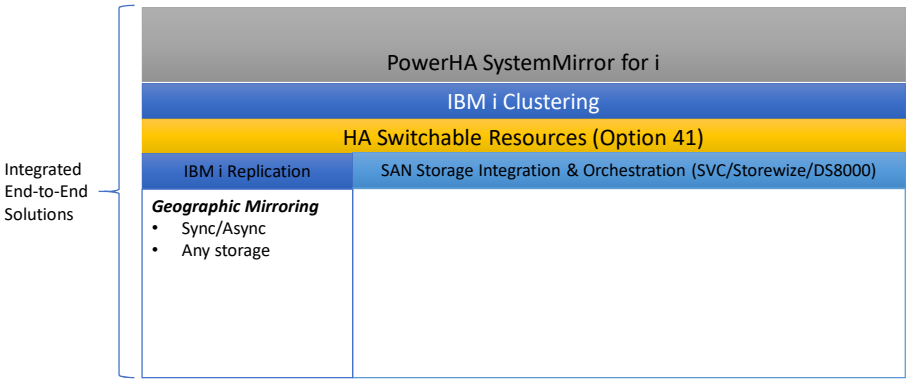
Meet the PowerHA Family



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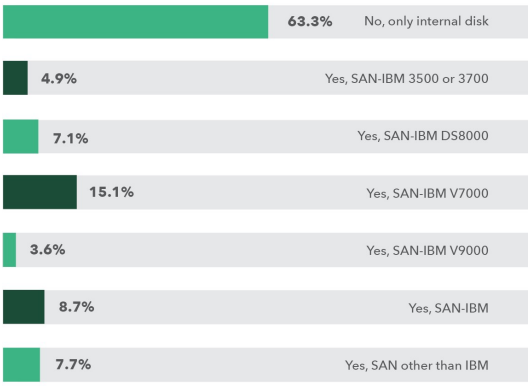
SAN: External Storage and SSD is the direction

Do you use external disk (SAN) with IBM i?



Only internal disk: 2017 64.2% | 2016 68.5% | 2015 75.9%

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Why SAN on IBM i?

- Performance
  - SSD and more IO
- Flexibility
  - Virtualization is easier and sharing with other technologies
- Space
  - Physical storage in data center
- Availability
  - PowerHA
- It's the present and future

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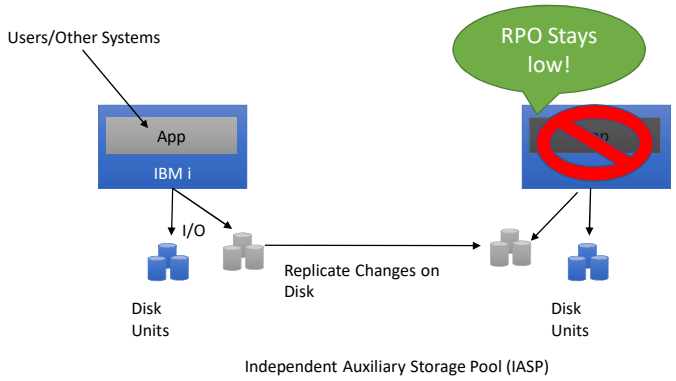
Bonus when using External Storage

- **The only HA solutions that continues when the target system down for upgrades, PTFs, maintenance!**



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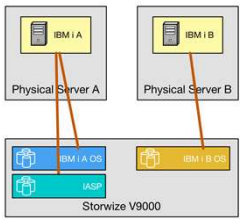
LUN Level Switching



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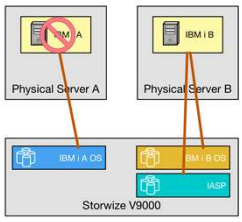
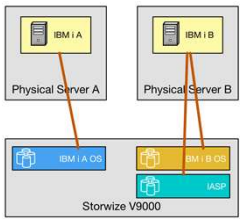
LUN Level Switching



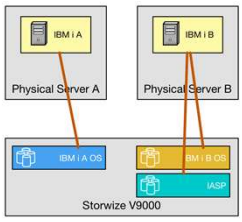
LUN Level Switching

- Data is switched between servers
- Provides protection against software and server hardware outages
- Switch requires a vary off and a vary on of an Independent ASP



LUN Level Switching

Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
	Planned	Unplanned			
	●	●	●		



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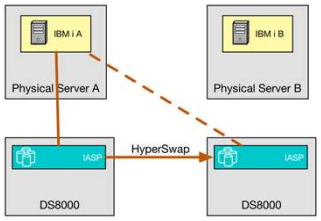
HyperSwap with IASP LUN Level Switching



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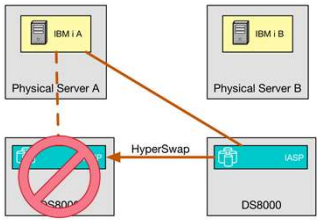
HyperSwap with IASP LUN Level Switching

- Near-Zero application impact for planned storage outages



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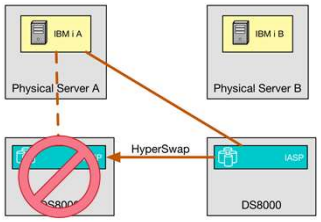
HyperSwap with IASP LUN Level Switching

- Near-Zero application impact for planned storage outages
- Minimal application impact for unplanned storage outages



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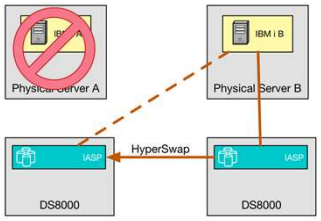
HyperSwap with IASP LUN Level Switching

- Near-Zero application impact for planned storage outages
- Minimal application impact for unplanned storage outages
- Added benefit of LUN Level switching for server hardware, and OS outages



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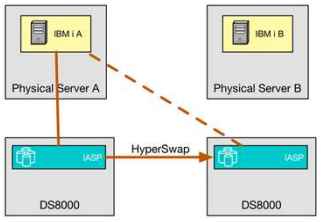
HyperSwap with IASP LUN Level Switching

Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
	Planned	Unplanned			
●	●	●	●	Maybe	



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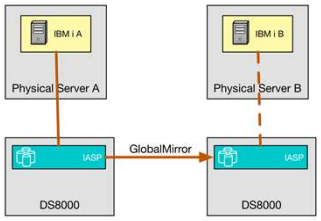
PowerHA MetroMirror or GlobalMirror

- Provides protection of IBM i Software outage or Storage Outage
- MetroMirror is synchronous, GlobalMirror is asynchronous
- Allows for detaching of remote copy for testing purposes



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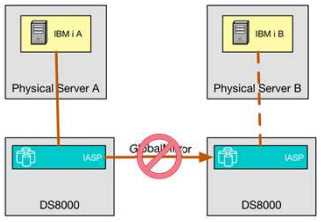
PowerHA MetroMirror or GlobalMirror

Outage Type					
Storage Outage	Server/Hardware Outage		OS/Software Outage	Data Center Outage	Offline Backups
	Planned	Unplanned			
●	●	●	●	●	●



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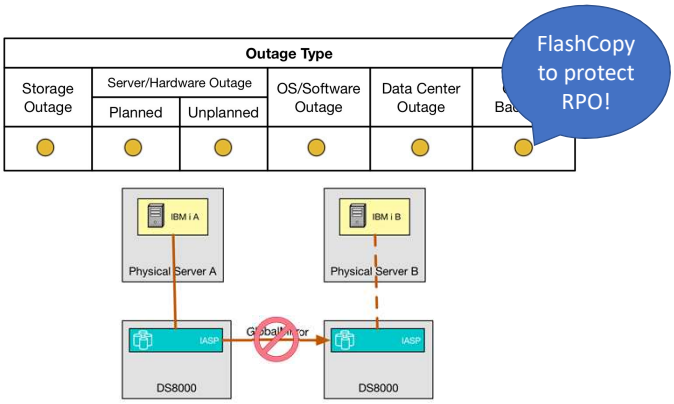
PowerHA MetroMirror or GlobalMirror



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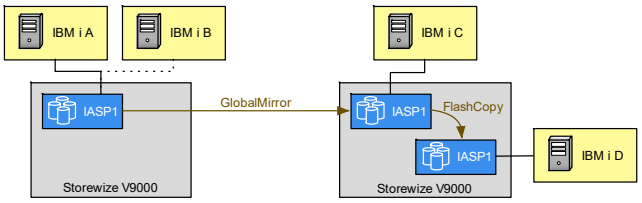
Combining Technologies

LUN Level Switching plus GlobalMirror for DR



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Meet the PowerHA Family

Integrated End-to-End Solutions

PowerHA SystemMirror for i

IBM i Clustering

HA Switchable Resources (Option 41)

IBM i Replication	SAN Storage Integration & Orchestration (SVC/Storewize/DS8000)
Geographic Mirroring • Sync/Async • Any storage	***LUN Level Switching*** • HA protection of OS/System ***FlashCopy*** • Snapshot • Space Efficient ***MetroMirror/GlobalMirror*** • Synchronous(Metro), Asynchronous(Global) • Storage & Site Outage Protection

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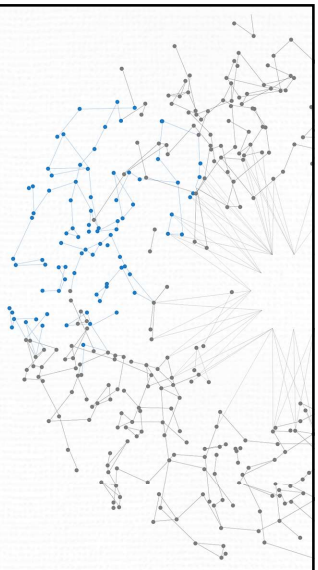
PowerHA and POWER9



UP NEXT

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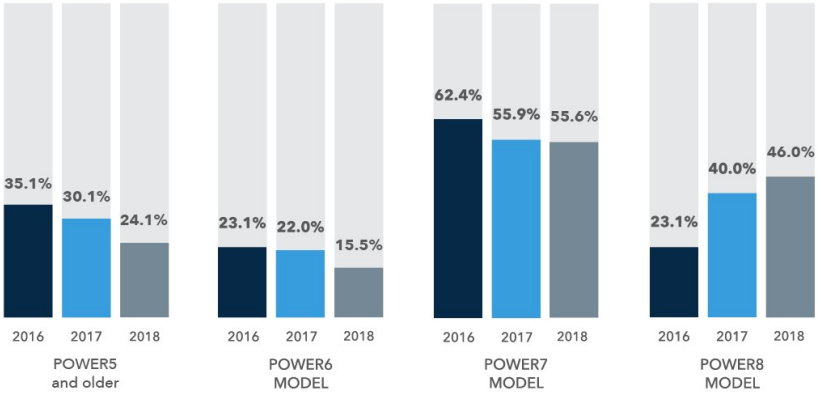
Staying Current in the Data Center

What IBM Power servers do you own?



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- Tip: A new POWER system can be a good opportunity to implement a new HA solution.

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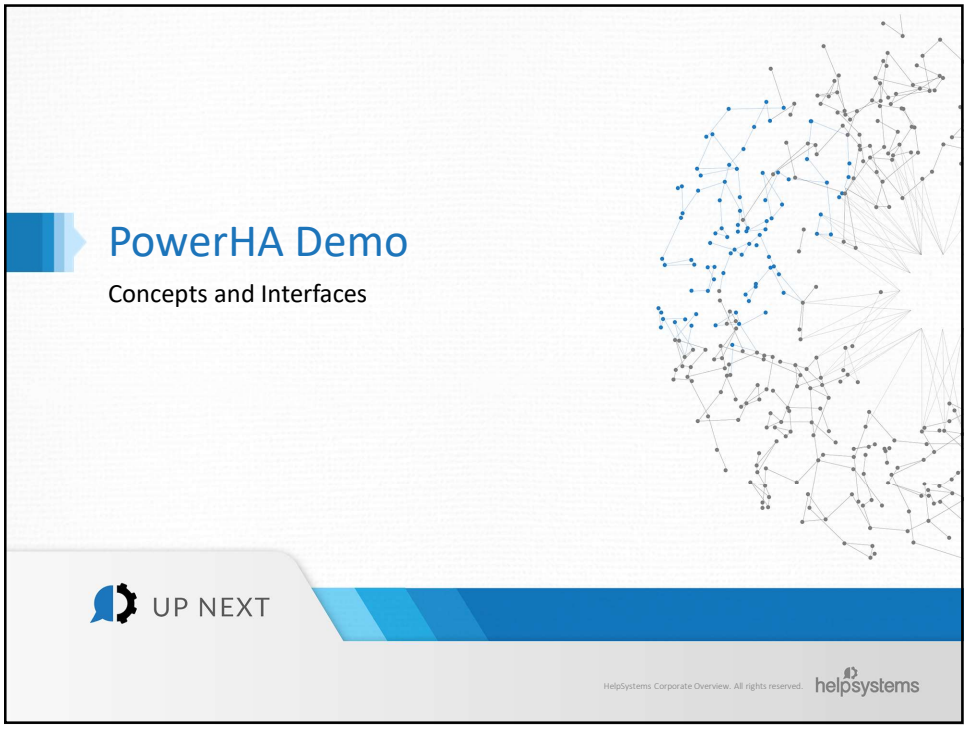
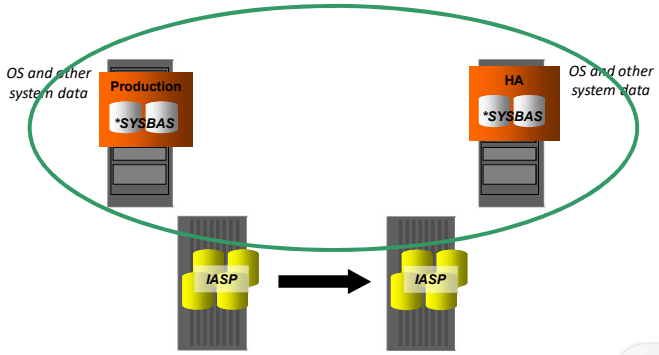


Concepts and Interfaces

- Concepts
- Two interfaces
  - GUI or green screen
- The cluster and simple monitoring
- How to failover

Cluster

- The cluster provides the communication infrastructure between systems and/or partitions
- Facilitates the execution of cluster events
- Simplified management, single point of control



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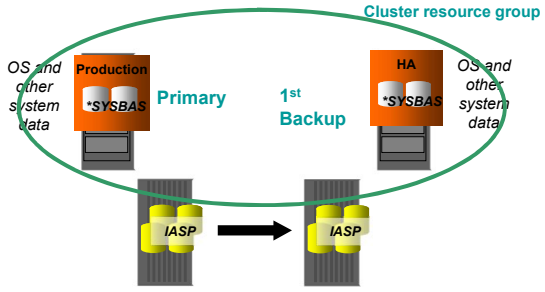
Cluster Resource Group

- The cluster resource group defines which IBM i nodes are potential hosts for the IASP (replicated or switched)
- The recovery domain (list of nodes) is ordered
  - This determines replication direction
- An IP address can also be defined and PowerHA will activate it on whichever node is currently primary



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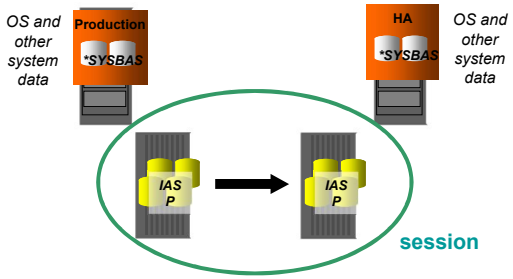
Session

- The session describes the relationship between copies of the IASP
- The session will determine the type of replication from a system storage perspective
- PowerHA uses the session to control the replication



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Live Demo

PowerHA Cluster and Role Swap

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Part 2 - FlashCopy

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FlashCopy is…

an *instantaneous* point in time copy of your data

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Quick Demo

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You can use FlashCopy with

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Full System FlashCopy

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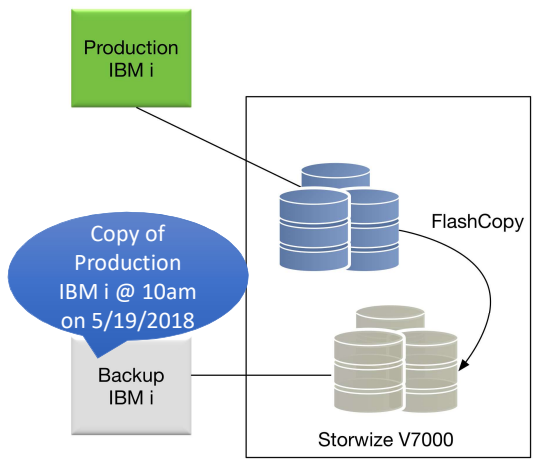
Full System FlashCopy



- Take FlashCopy
- Power on 'Backup IBM i'

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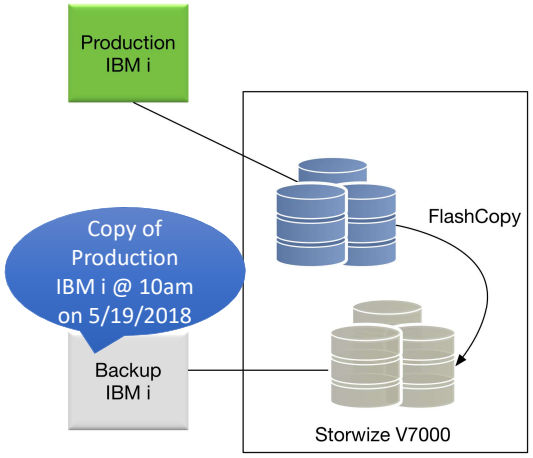
Full System FlashCopy



- Take FlashCopy
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- Perform backup/testing/etc.

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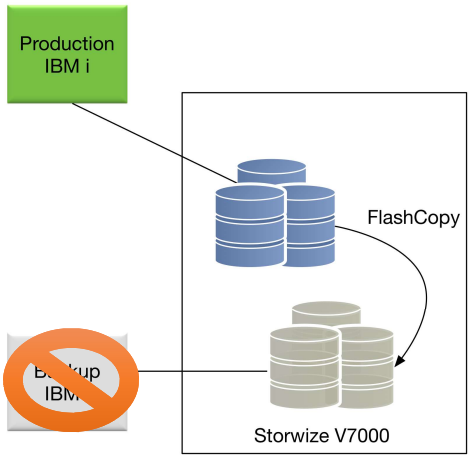
Full System FlashCopy



- Take FlashCopy
- Power on 'Backup IBM i'
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- Once done
  - Power down 'Backup IBM i'

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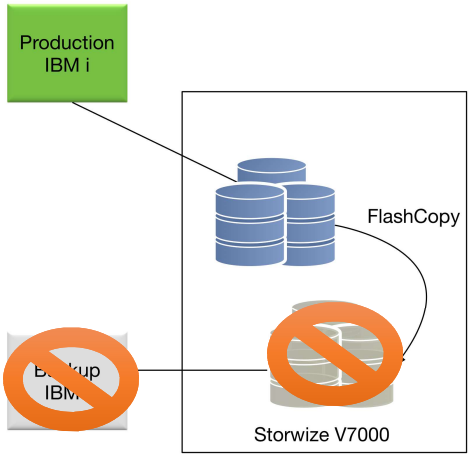
Full System FlashCopy



- Take FlashCopy
- Power on 'Backup IBM i'
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- Once done
  - Power down 'Backup IBM i'
  - End/Destroy FlashCopy

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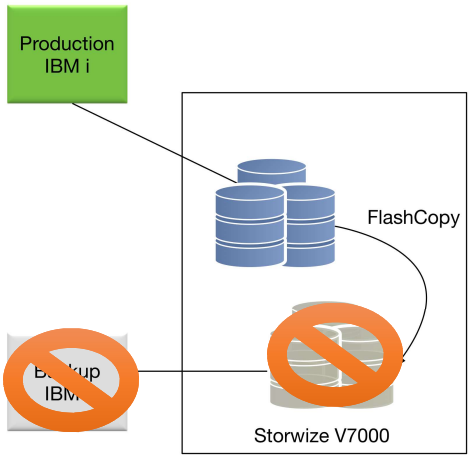
Full System FlashCopy



- Take FlashCopy
- Power on 'Backup IBM i'
- Perform backup/testing/etc.
- Once done
  - Power down 'Backup IBM i'
  - End/Destroy FlashCopy
- Repeat

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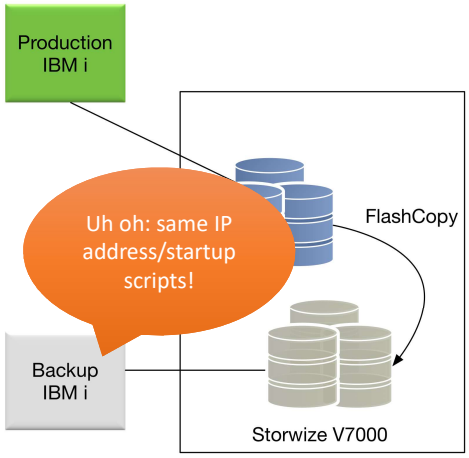
Full System FlashCopy



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How can I solve the issue? (IP address/Startup Scripts)

- Option 1 – Configure the system to not automatically start anything
  - Disadvantage – makes it a pain to start your normal system
- Option 2 – Create a custom startup script to selectively start correct IP, and jobs depending on the system
  - Need a way to tell which is which system since all of the disk unit data is identical between the systems.
    - If on separate systems - Serial number (QSRLNBR system value)
    - Materialize MI instructions – Lpar name
    - Etc.
- Option 3 – IBM Lab Services Full System Copy Services Manager

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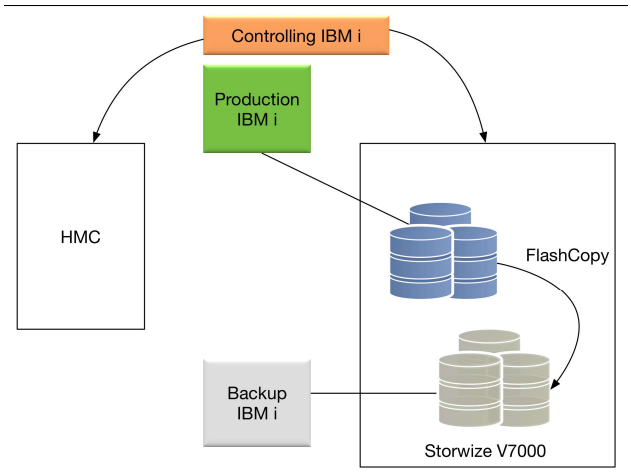
IBM Lab Services Full System Copy Services Manager



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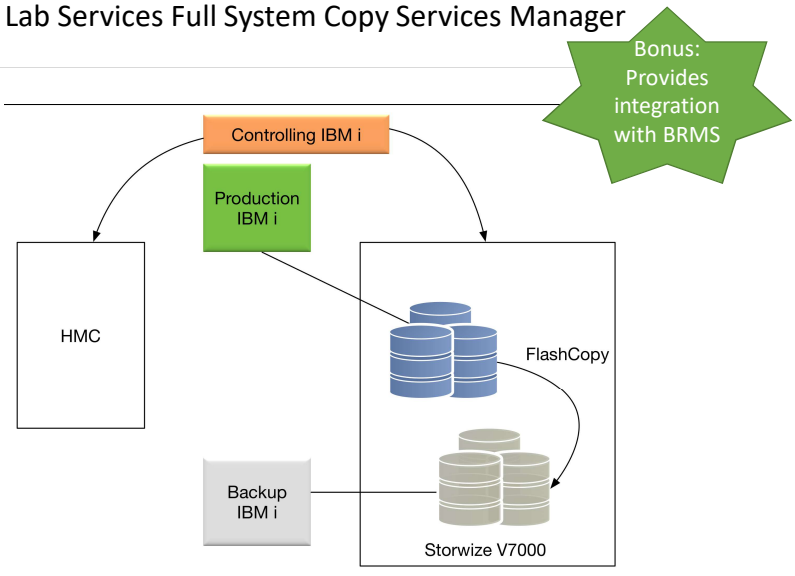
IBM Lab Services Full System Copy Services Manager



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    - Materialize MI instructions – Lpar name
    - Etc.
- Option 3 – IBM Lab Services Full System Copy Services Manager
- Option 4 – FlashCopy is fully integrated with PowerHA

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Advantages of IBM i PowerHA over Full System

- No “fixup” required
- Integrated clustering interfaces
- Application data only – no OS/Temporary Data
- Typically faster availability of data
- Greater flexibility with OS Release/etc.
- IASPs are the foundation for other PowerHA technologies

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Hidden Feature - Independent ASP Assigner

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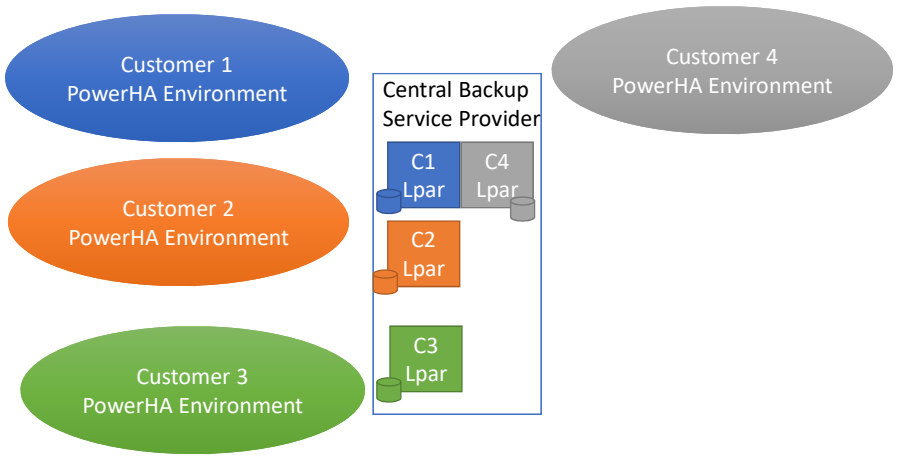
Independent ASP Assigner (PowerHA 7.2)



How can we reduce the resources required for doing backups?

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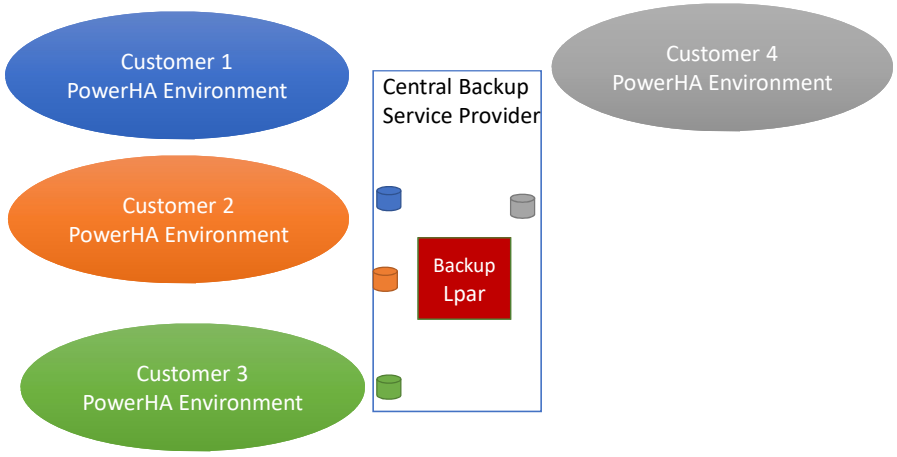
Independent ASP Assigner (PowerHA 7.2)



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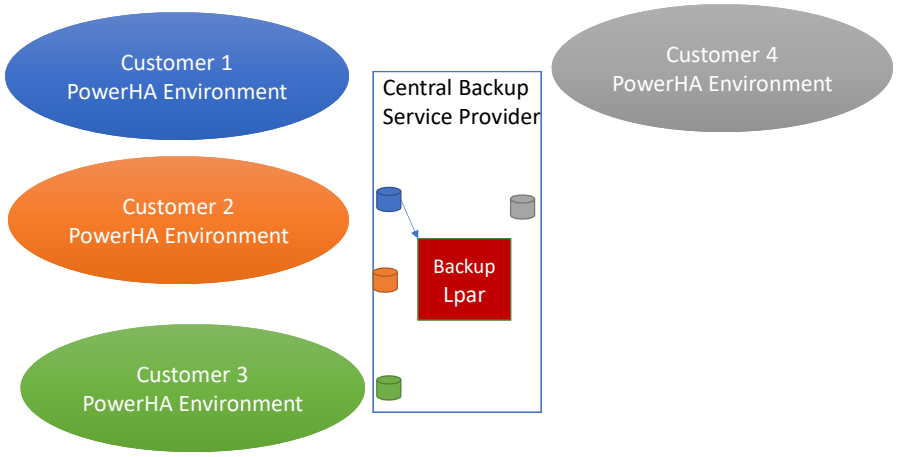

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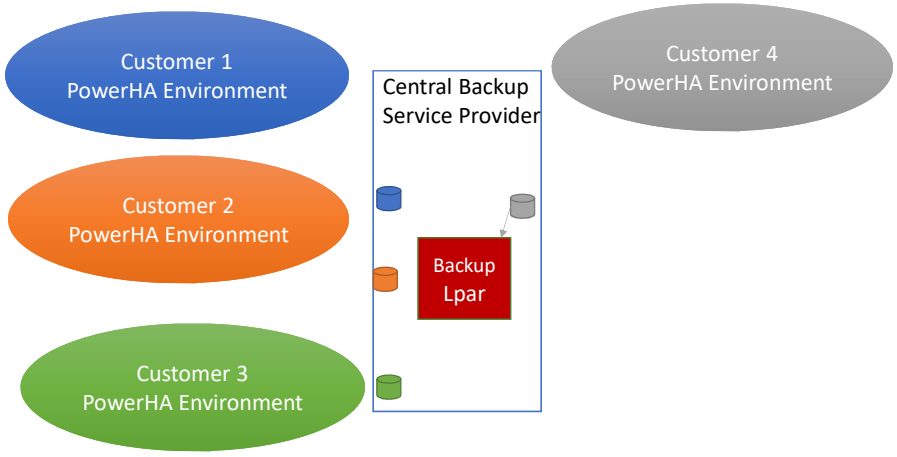

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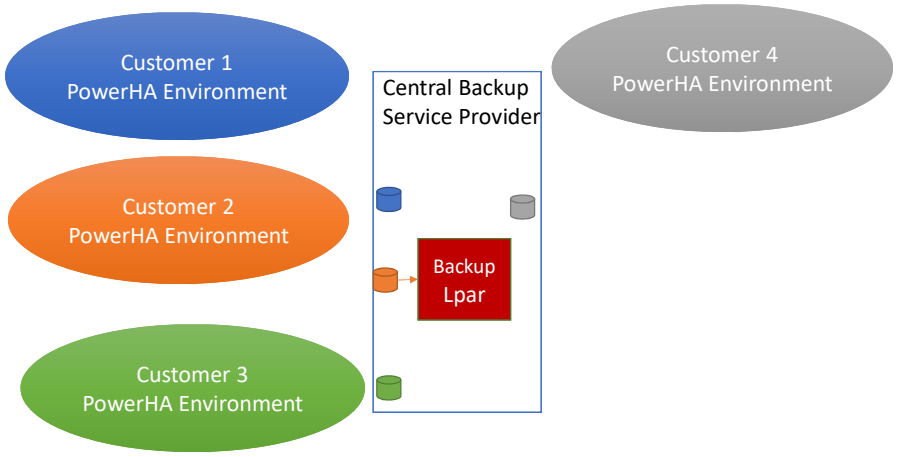

How can we reduce the resources required for doing backups?

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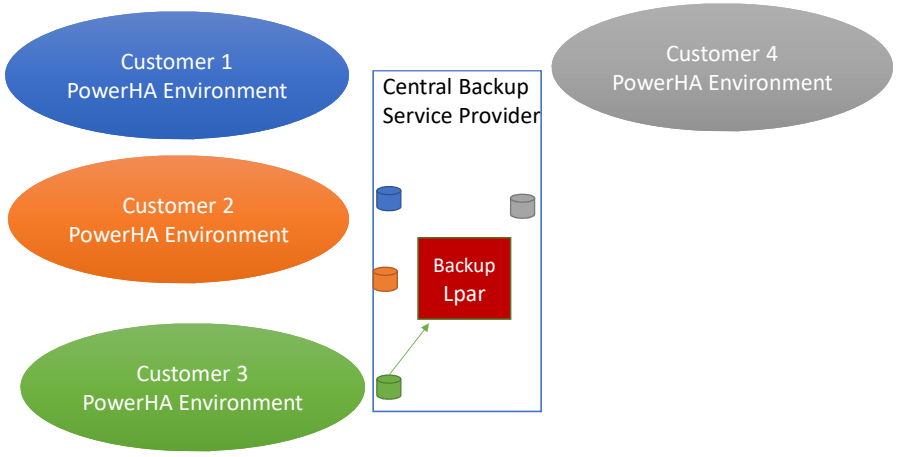

How can we reduce the resources required for doing backups?

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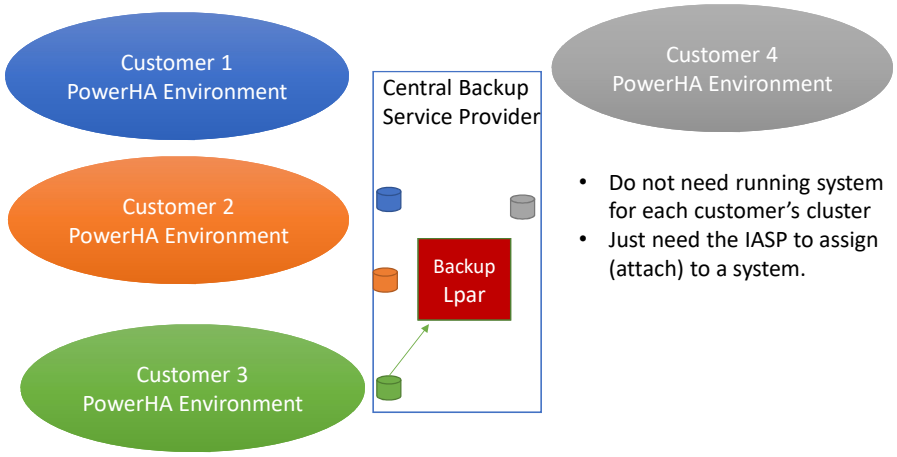
Independent ASP Assigner (PowerHA 7.2)



- Do not need running system for each customer's cluster
- Just need the IASP to assign (attach) to a system.

How can we reduce the resources required for doing backups?

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- Speaking of backups - can FlashCopy replace my backup strategy?
- No

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- Since FlashCopy can happen when my system is running, how 'good' is my data? What happens to everything in memory?

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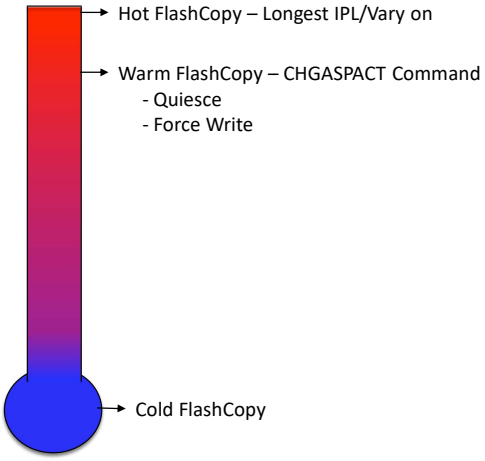
Full System FlashCopy Temperature



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Advanced Concepts

UP NEXT

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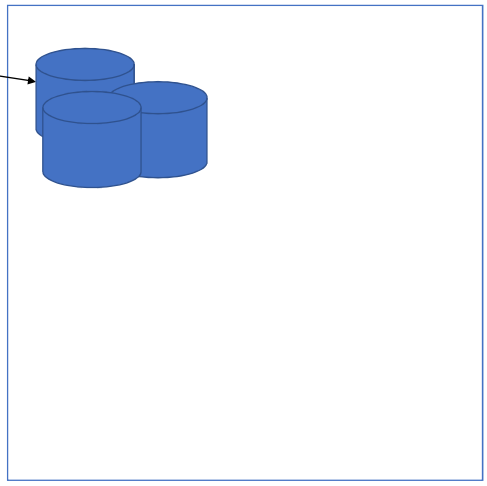
Instantaneous...?

Production IBM i



Storage Controller (DS8000, SVC, etc.)

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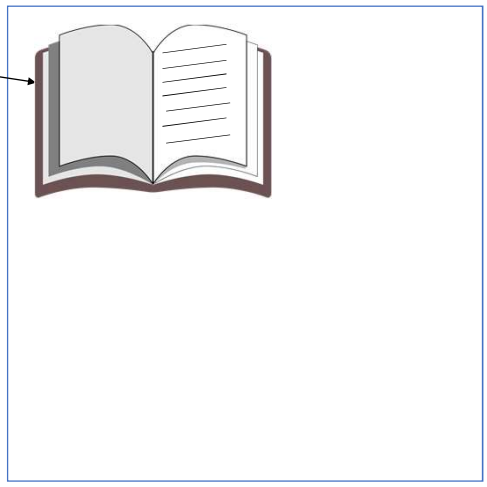
Instantaneous...?

Production IBM i



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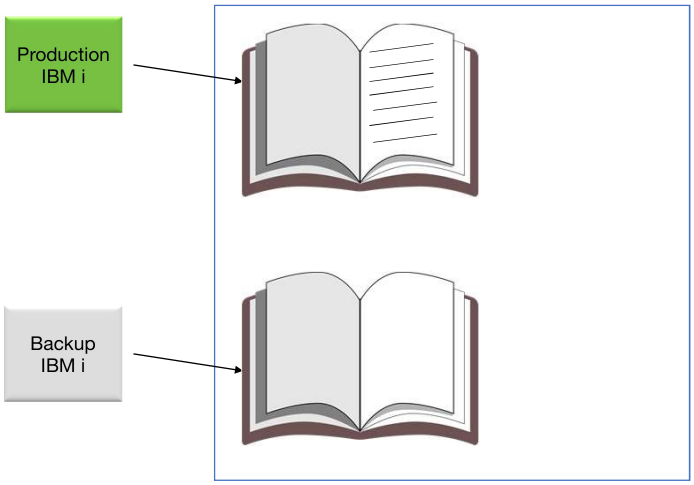

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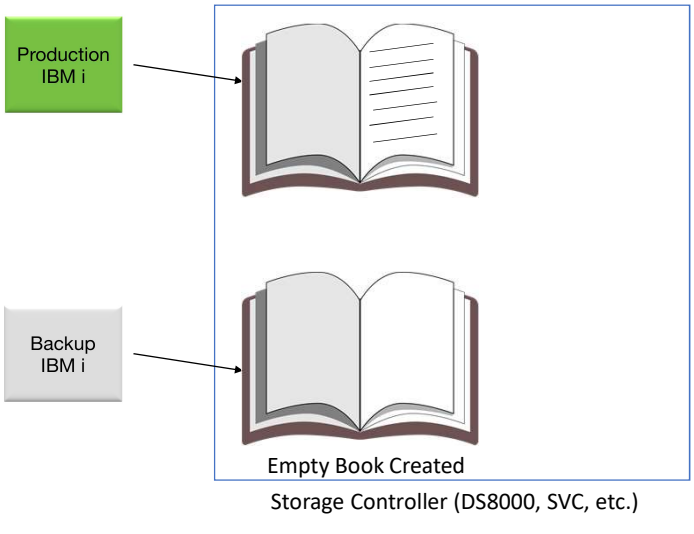
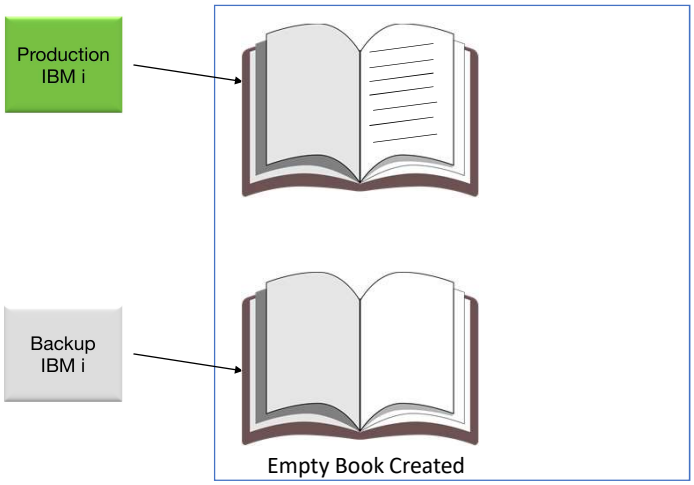


Read data from backup IBM i



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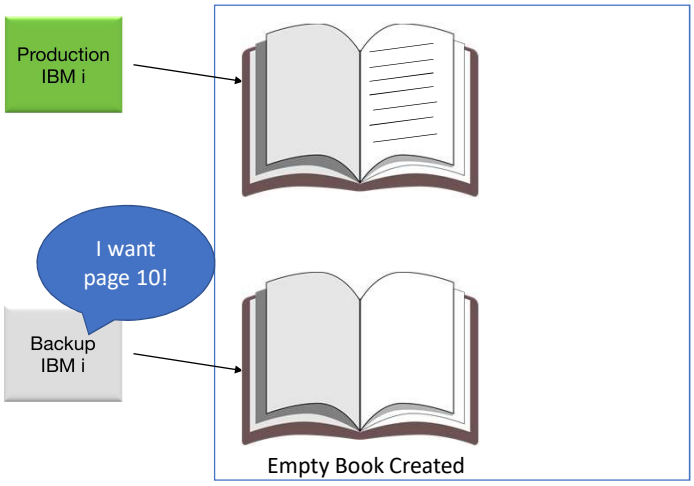

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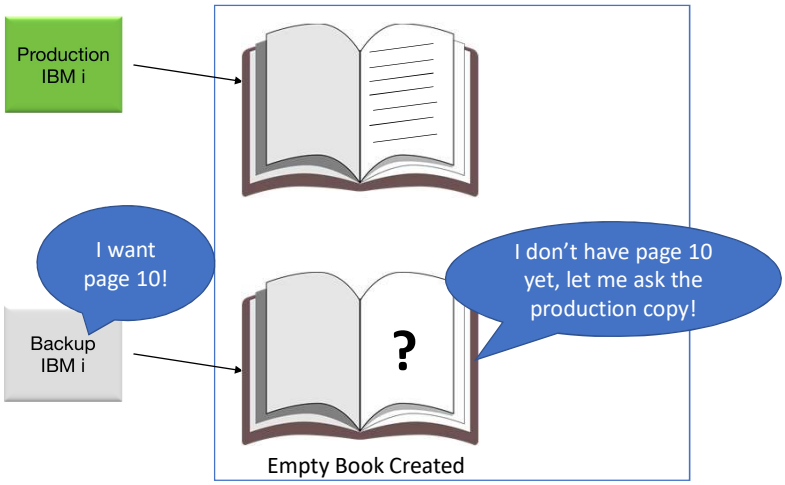
Read data from backup IBM i



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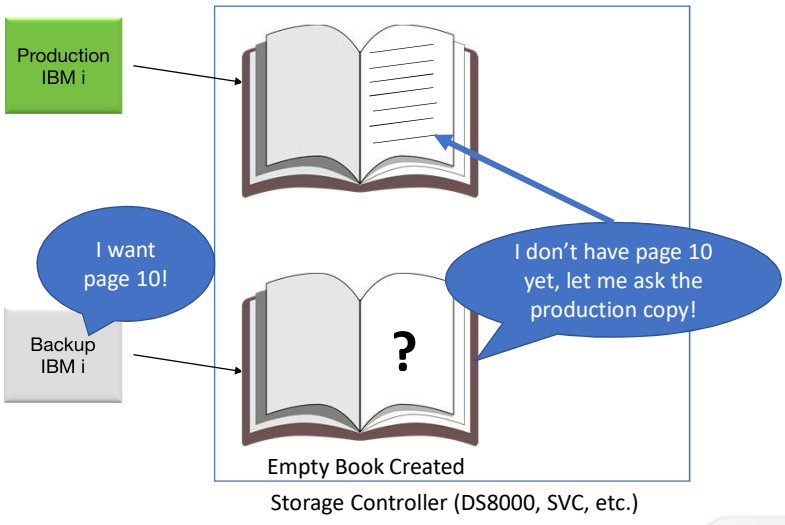

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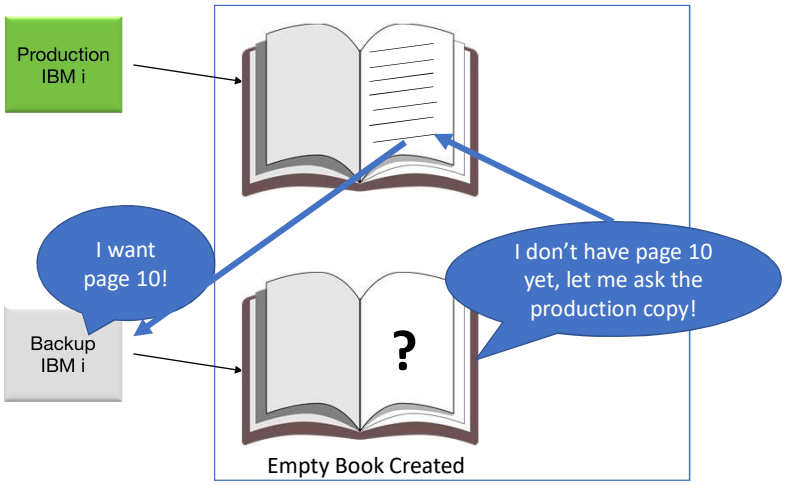

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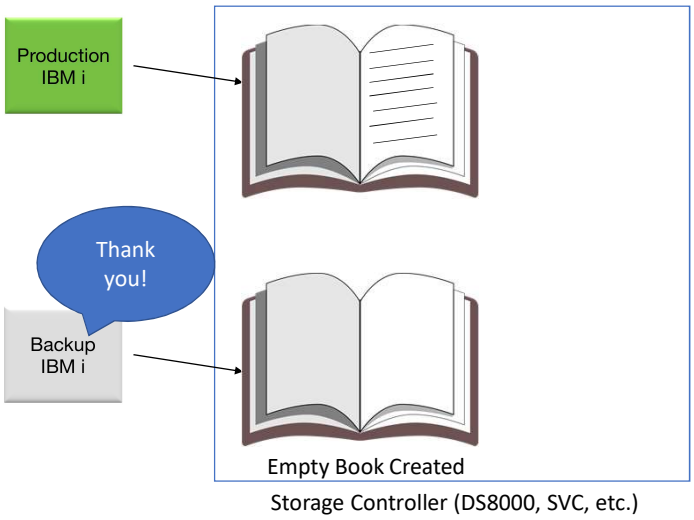
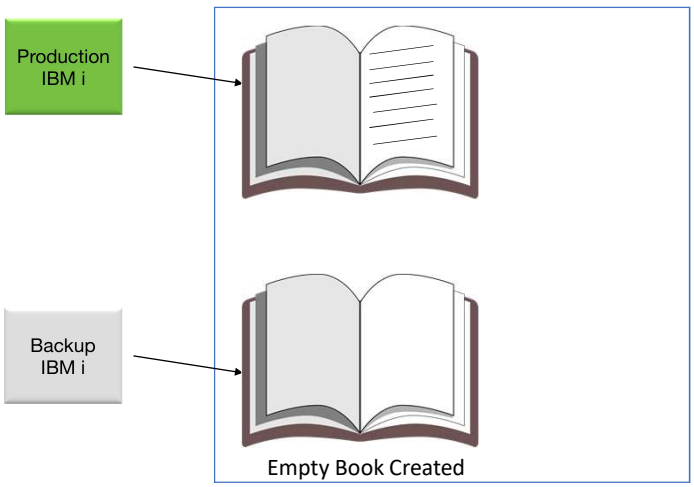


Change data on production



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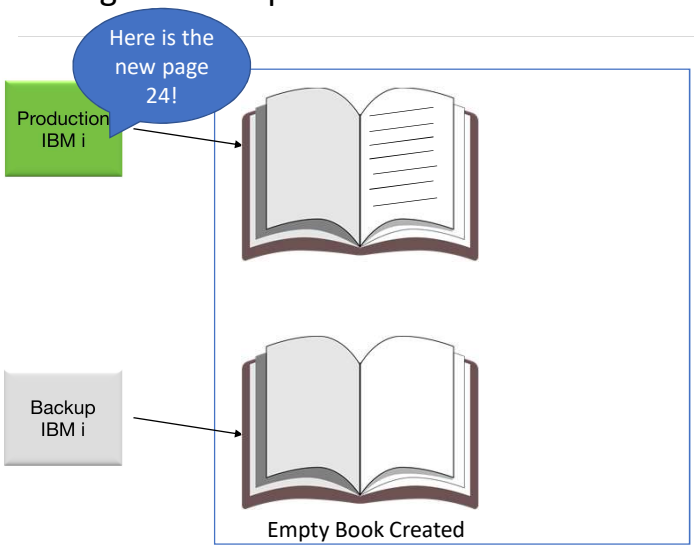

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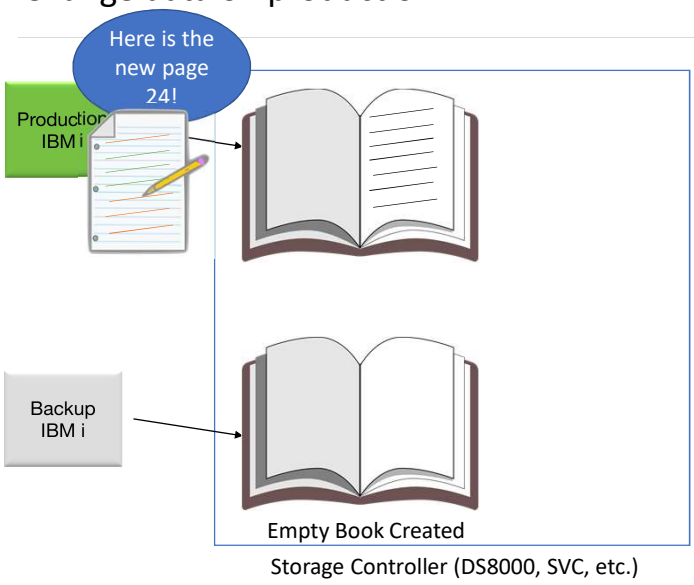

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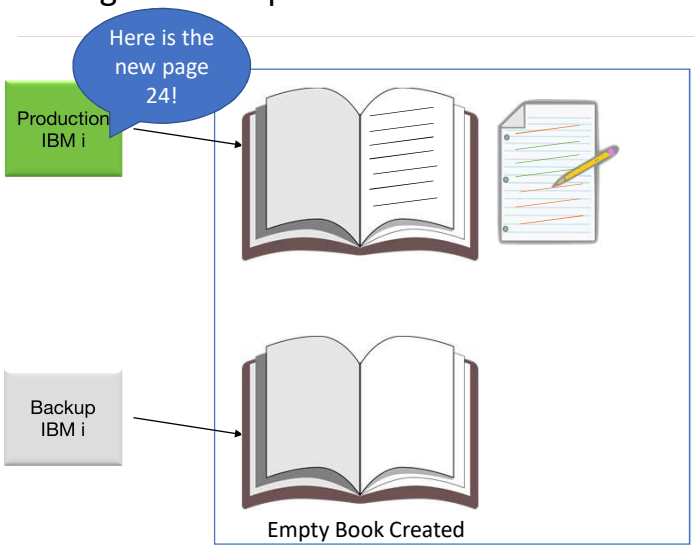

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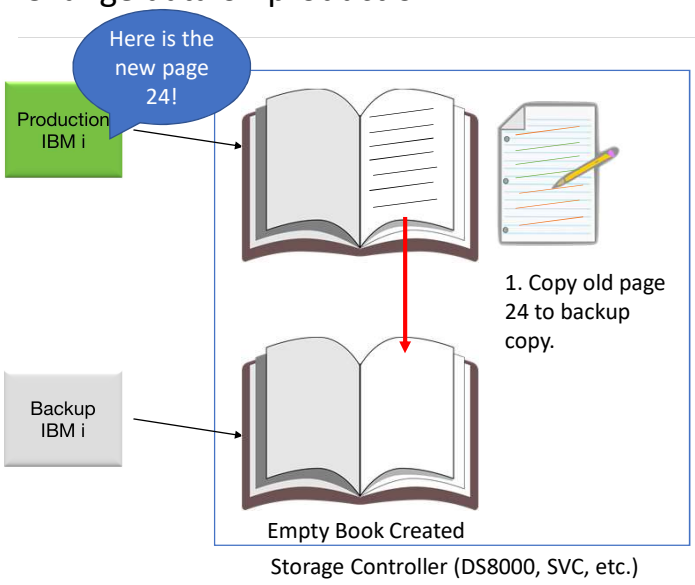

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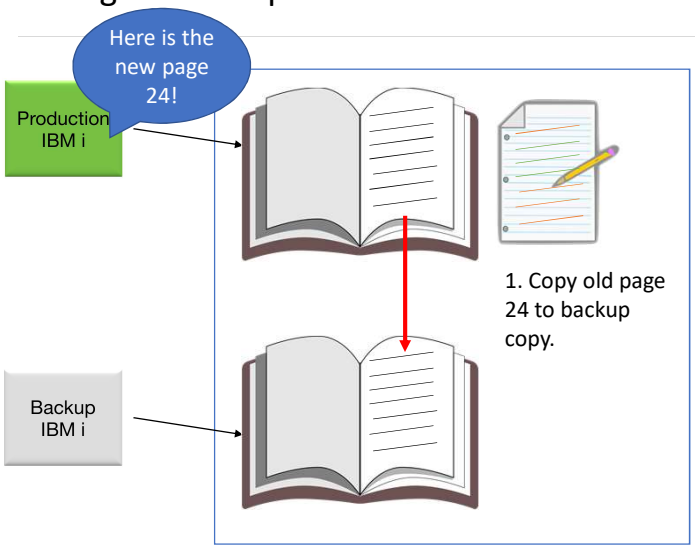

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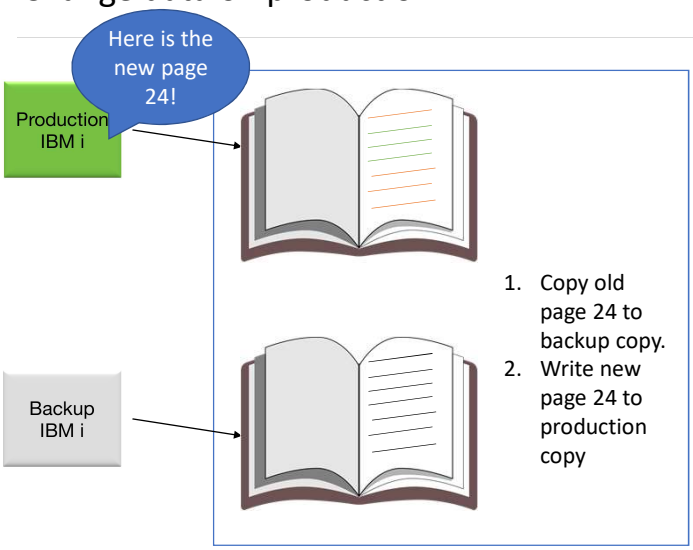

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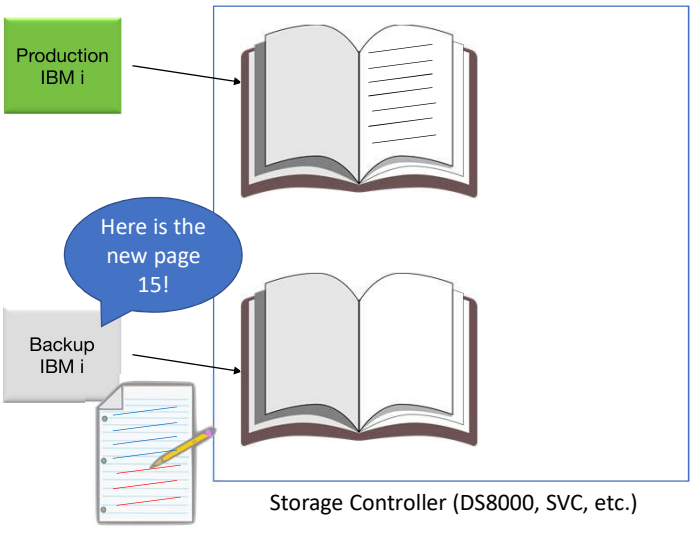
Change data on Backup IBM i



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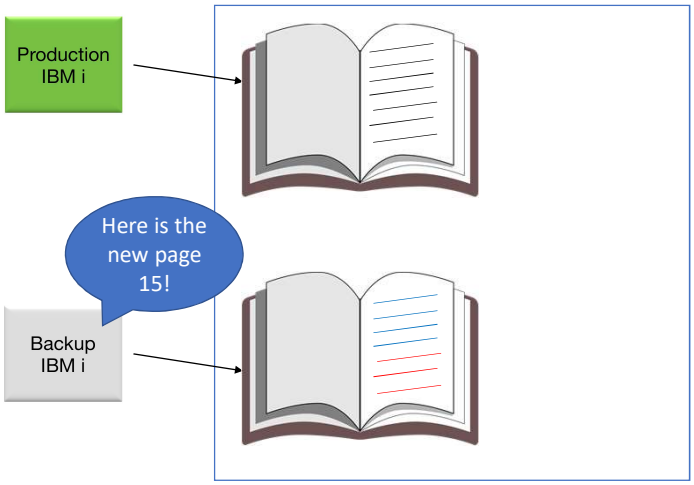
Change data on Backup IBM i



Storage Controller (DS8000, SVC, etc.)

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- With thin provisioning in the storage, you only use as much space as what has changed between the copies!

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What does this mean for performance?

- Copy vs. No Copy (DS8000)
- Copyrate (SVC/Storwize)

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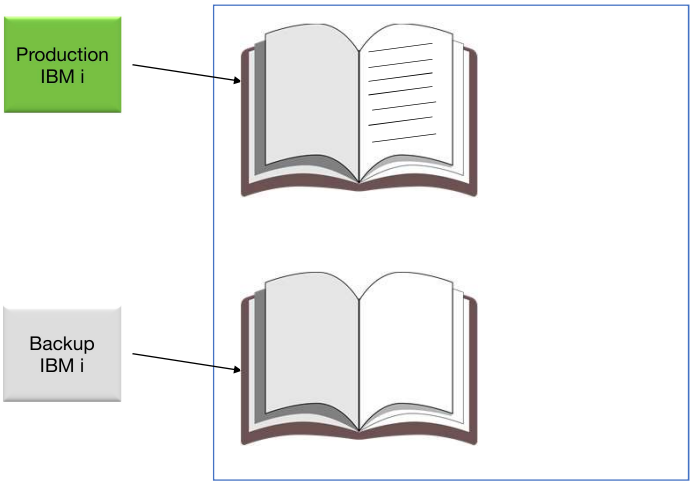

Storage Controller (DS8000, SVC, etc.)

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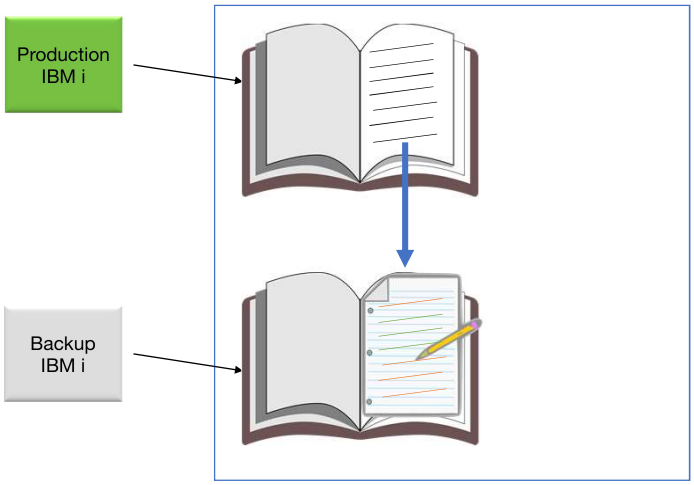

Storage Controller (DS8000, SVC, etc.)

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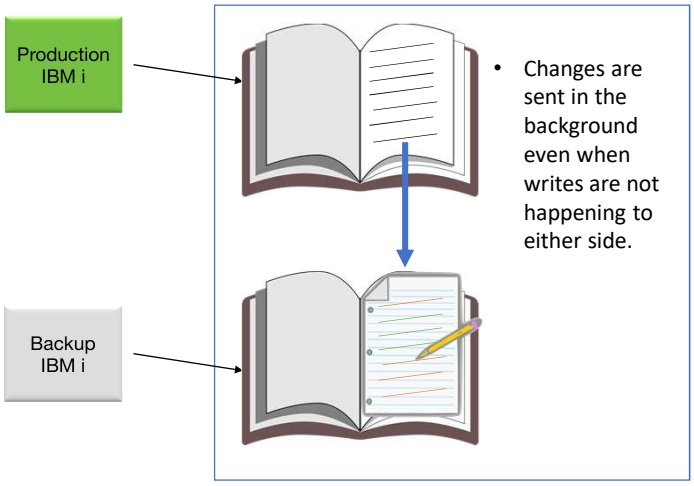

- Changes are sent in the background even when writes are not happening to either side.

Storage Controller (DS8000, SVC, etc.)

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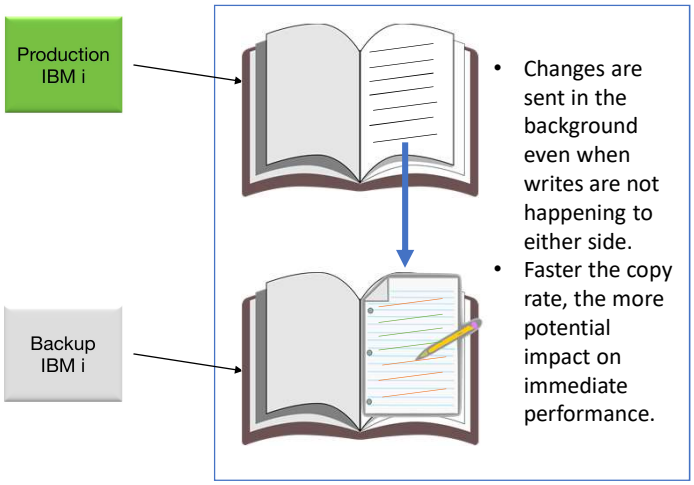

- Changes are sent in the background even when writes are not happening to either side.
- Faster the copy rate, the more potential impact on immediate performance.

Storage Controller (DS8000, SVC, etc.)

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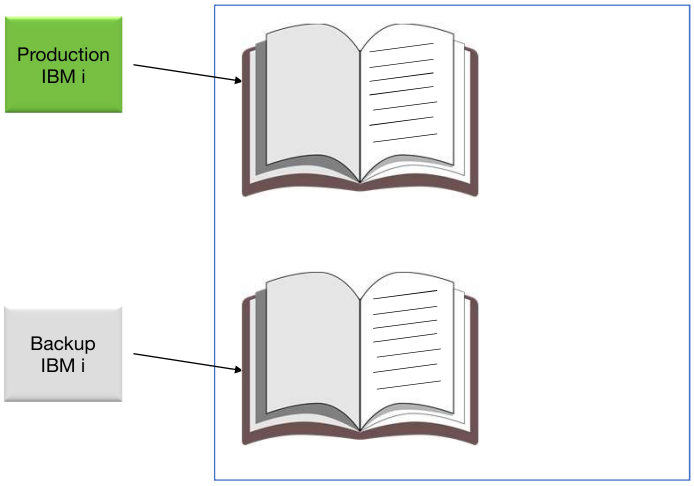
Incremental FlashCopy



Storage Controller (DS8000, SVC, etc.)

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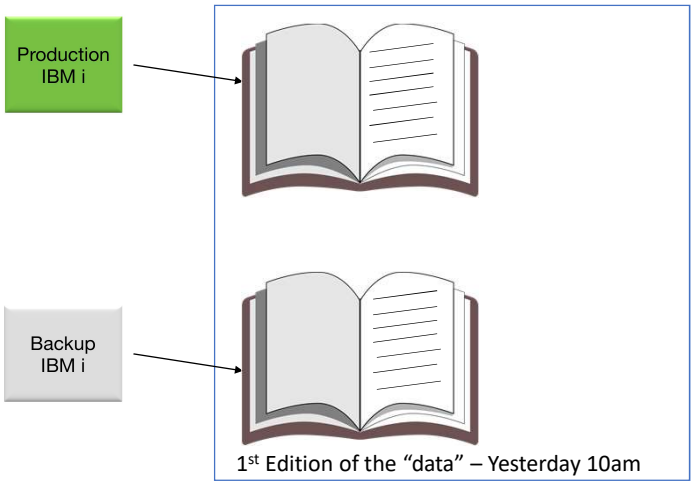

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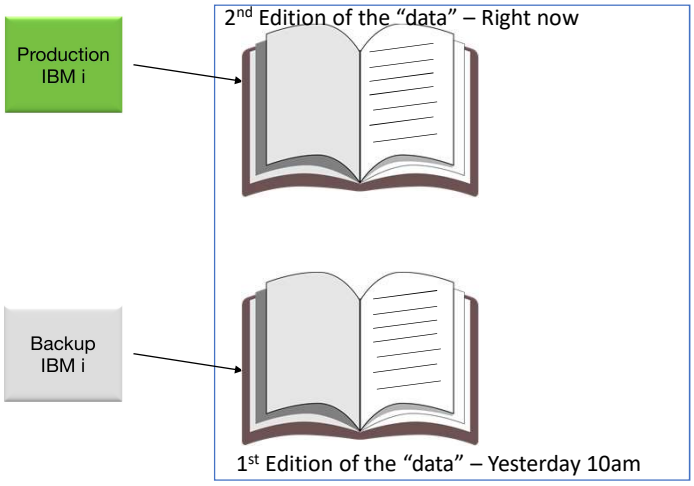

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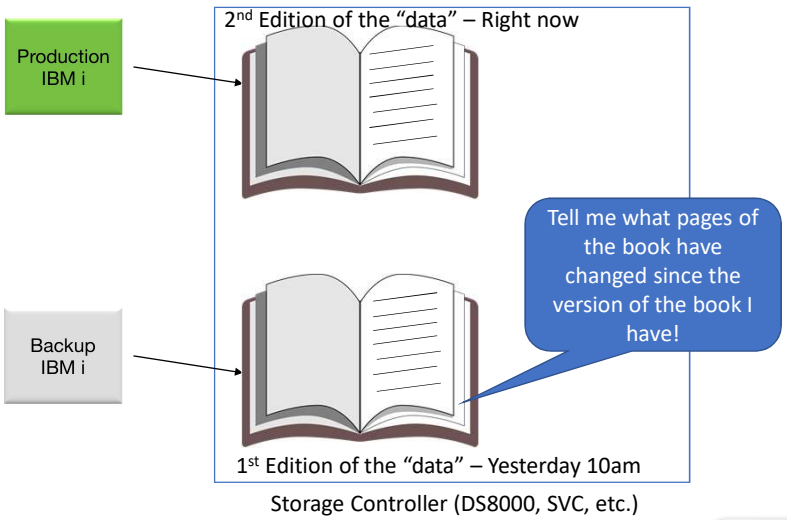

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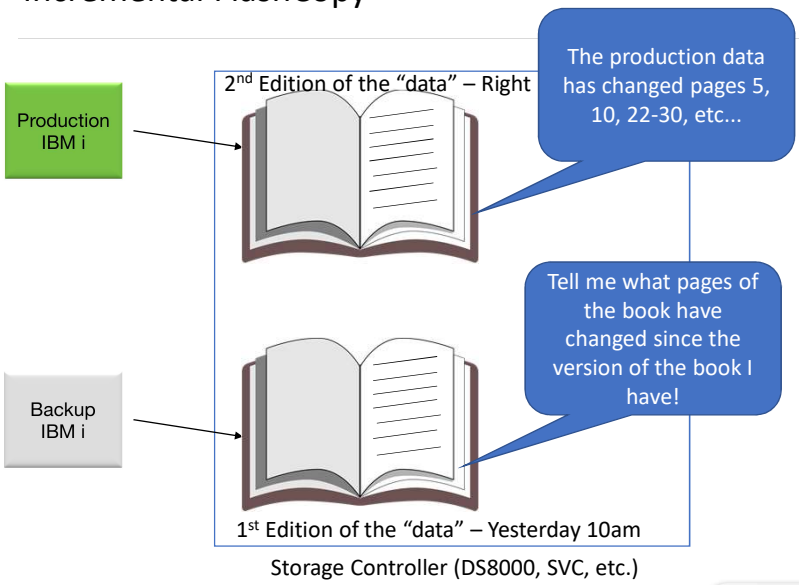

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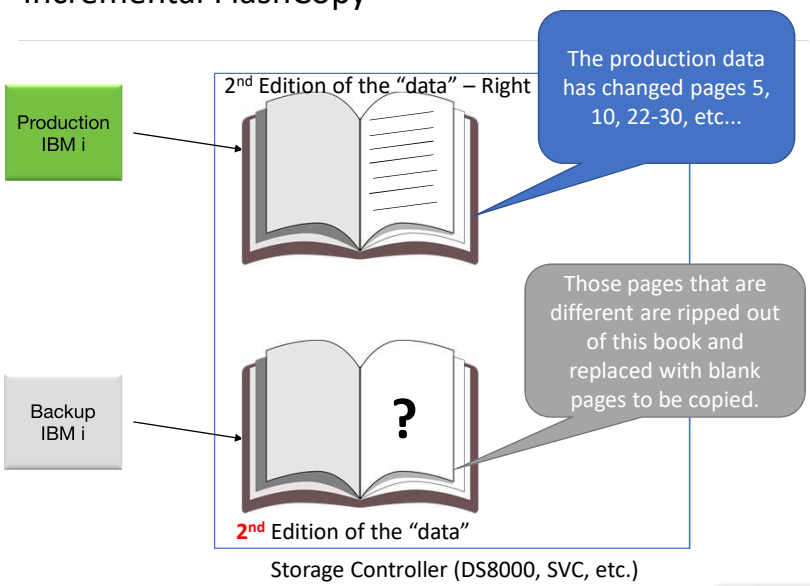

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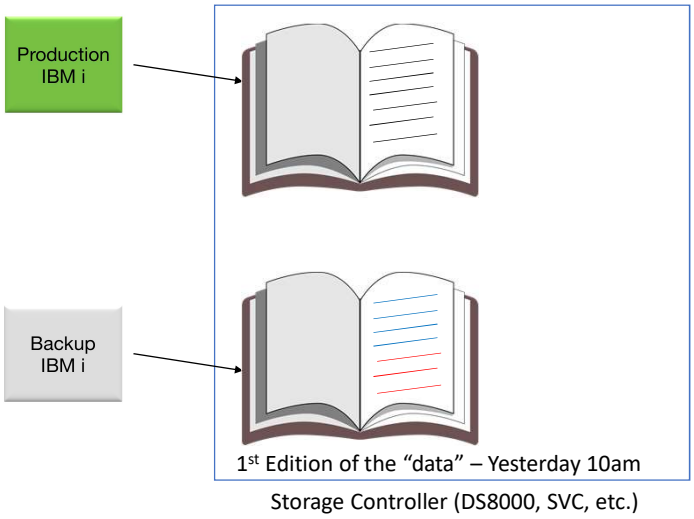

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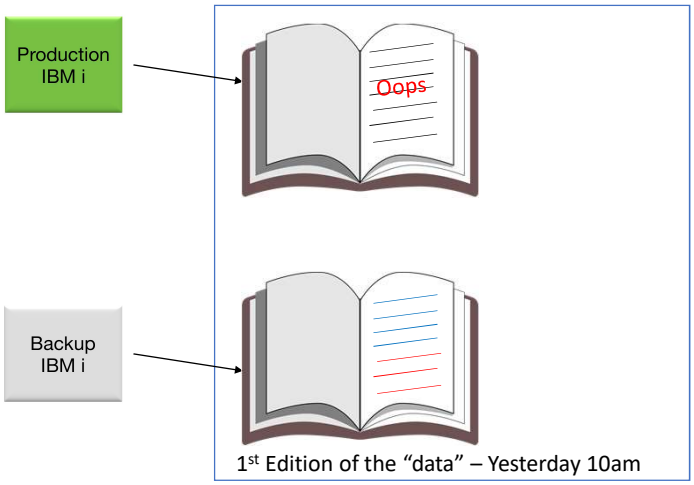

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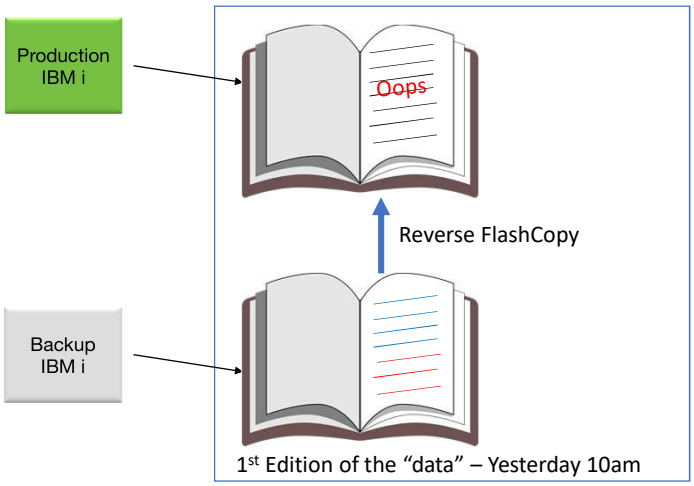

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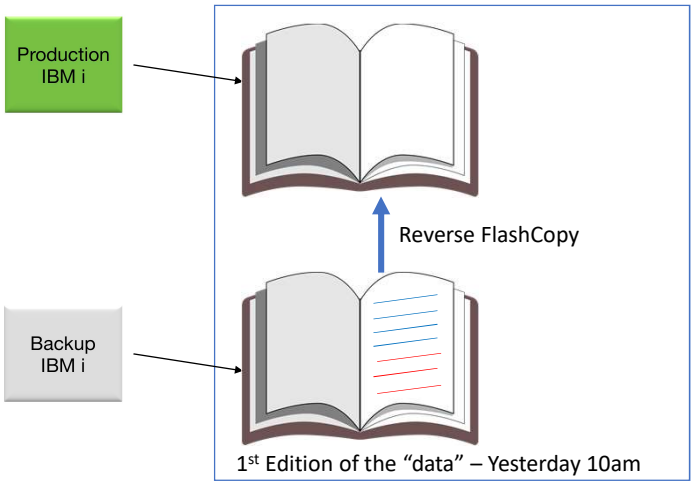

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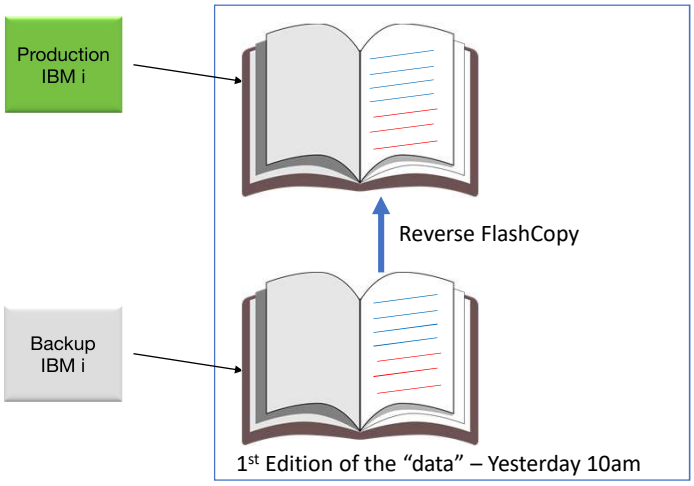

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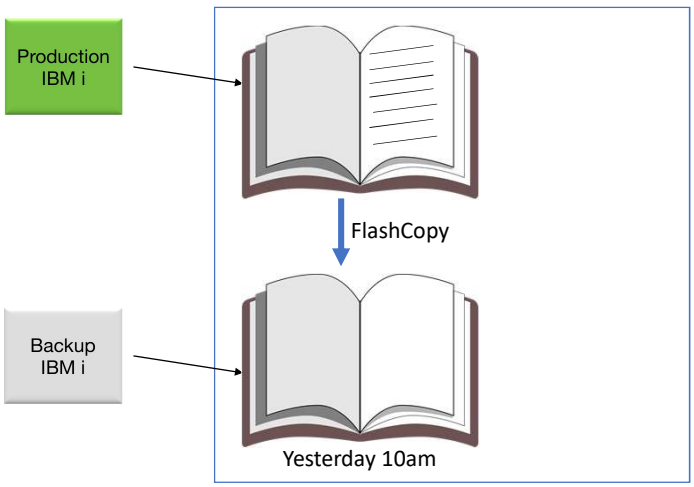
Multi-Target FlashCopy



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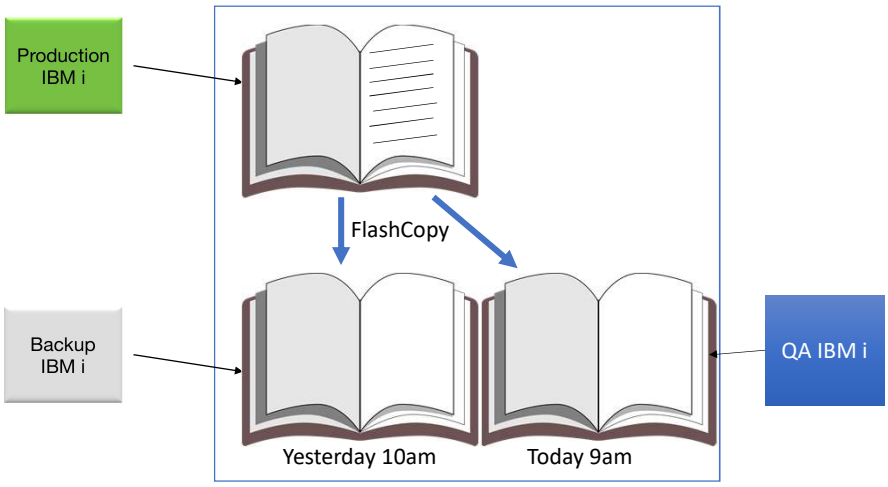

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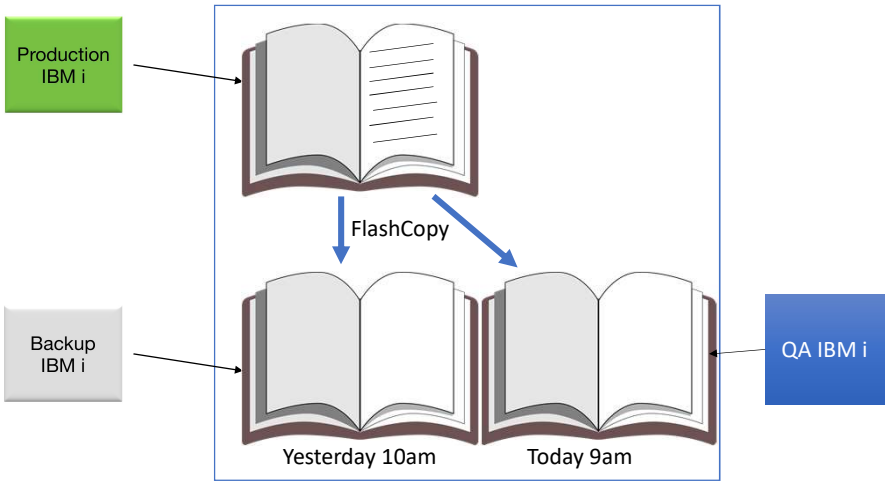

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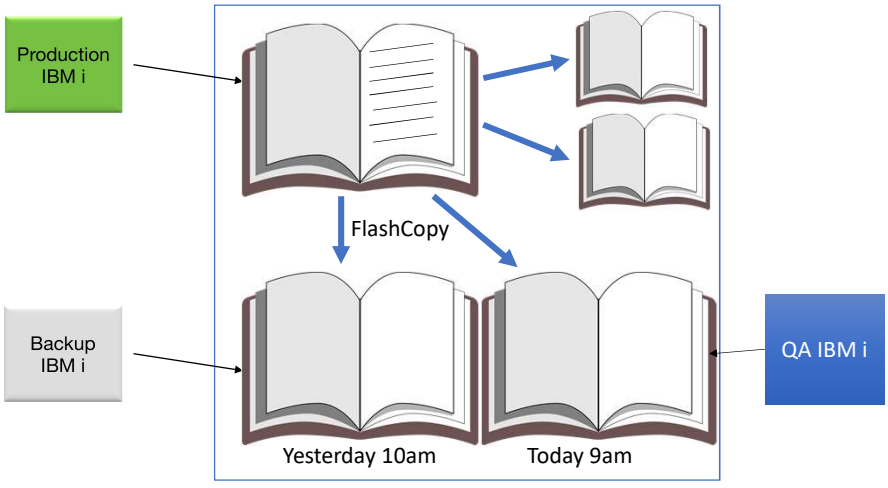

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- A note on PTFs….

http://www-01.ibm.com/support/docview.wss?uid=nas8N1020998

References

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- Lab Services Full System Copy Services Manager (FlashCopy) Information: https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/IBM%20i%20Advanced%20Copy%20Services/page/Full%20System%20Flashcopy%20(FSFC)
- BRMS Full System FlashCopy information: https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/IBM%20Backup,%20Recovery%20and%20Media%20Services%20(BRMS)%20for%20i/page/Full%20System%20Flash%20Copy

Summary

- RTO is important, so is RPO – you need them for every outage type.
- Talked about the different flavors of PowerHA
  - Geographic Mirroring, Metro Mirror/Global Mirror, LUN Switching, etc.
- FlashCopy for Full System or IASPs

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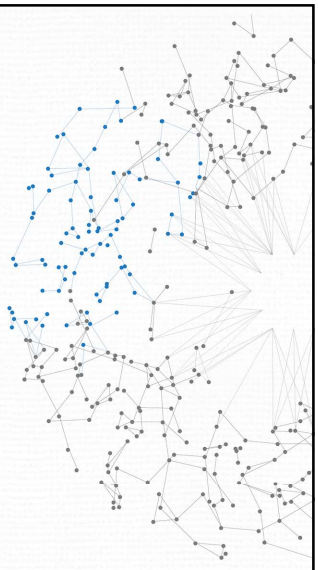
Questions?



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