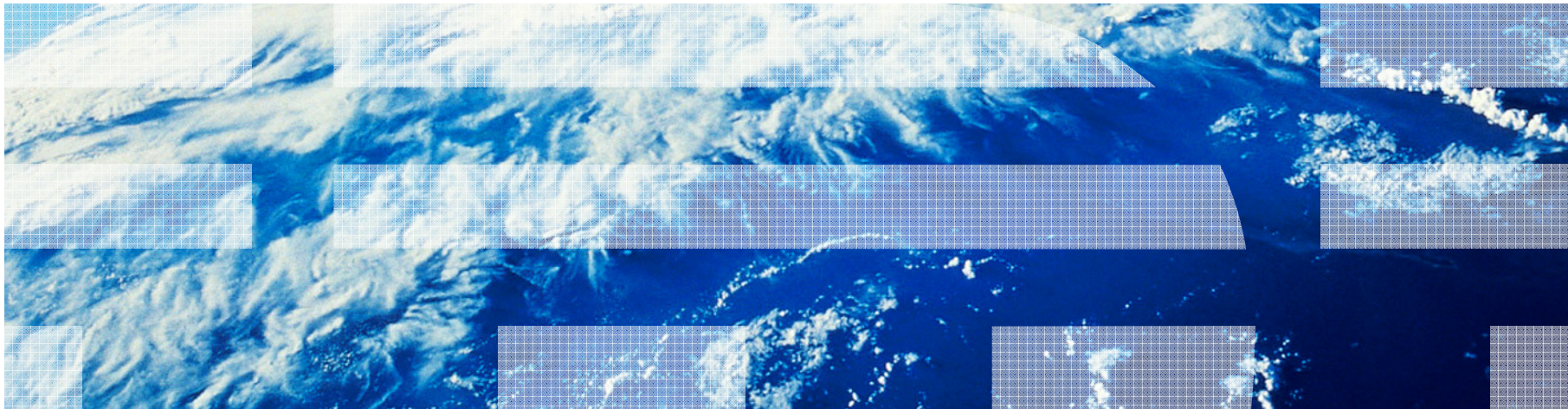

Backup Solutions with Linux on System z and z/VM



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Resiliency – often called business continuity

Data Center News:

The mainframe in business resiliency

nochan, Contributor
12 Apr 2006 | SearchDataCenter.com

Business resiliency

- the ability of the enterprise to continue to function:
 - as effectively as possible
 - man-made problems and technical errors
 - in the face of natural disasters

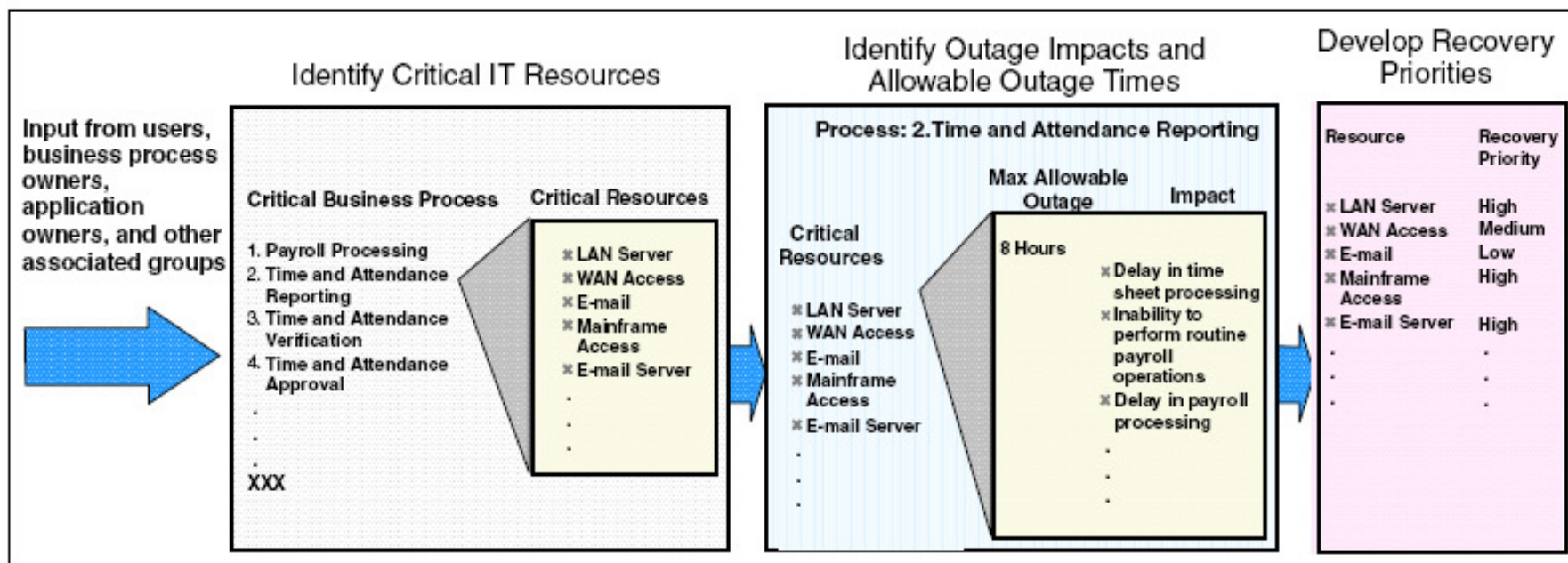
-High Importance:

- recent natural and man-made disasters,
- plus new requirements for business compliance,
- have increased the importance of business resiliency to the point where even SMBs (Small to Medium sized Businesses) must plan and implement resiliency strategies, with input from the highest levels of the organization.

http://searchdatacenter.techtarget.com/news/article/0,289142,sid80_gci1179879,00.html

The Business impact analysis (BIA)

- IT Resource relation and priorities for Recovery
- Consider all environments
- Prioritize based on business importance

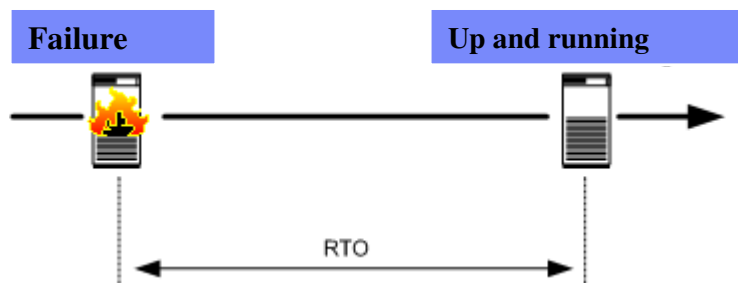


Example of the Business Impact Analysis process

Identify RTO, RPO und NRO

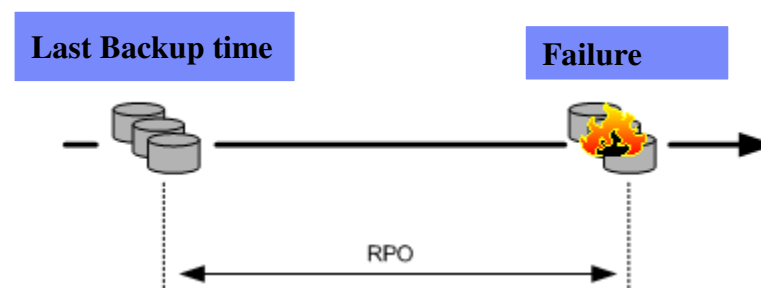


Business Resiliency Plan



Recovery Time Objective (RTO)

What time difference can be between Failure and a total productional run level ?



Recovery Point Objective (RPO)

What is the toleration for data loss?

RPO = "0" means, NULL data loss acceptable

RPO = "5" means, data loss in last 5 min acceptable

TREND: RPO = 0

Network Recovery Objective (NRO)

Time requirements for network availability.

Agenda

- **Step 1: Define your Backup strategy based on BIA (Business Impact Analysis)**
 - Data Level Backup
 - Bare Metal / System Level Backup – High Availability
 - Disaster Recovery Backup

- **Step 2: Select the right products – enterprise focus**
 - Native products (i.e. Acronis, tar, DFSMS)
 - Backup & Restore Manager for z/VM
 - Tivoli Flashcopy Manager
 - TSM – Tivoli Storage Manager

- **Step 3: Define and Implement Your Solution**
 - Reference Solution 1: Native products for special requirements
 - Reference Solution 2: z/VM based recovery
 - Reference Solution 3: Linux/TSM based recovery
 - Get Prepared for the restoration process

- **Hints & Tips**

Agenda

- **Step 1: Define your Backup strategy based on BIA (Business Impact Analysis)**
 - **Data Level Backup**
 - Temporary Backup using Copy Services – Flashcopy
 - Backup using tapes – Virtual Tapes for short time backups
 - Backup on Real tapes - for long time archiving
 - **Bare Metal / System Level Backup – High Availability**
 - **Disaster Recovery Backup**

- **Step 2: Select the right products – enterprise focus**
 - Native products (i.e. Acronis, tar, DFSMS)
 - Backup & Restore Manager for z/VM
 - Tivoli Flashcopy manager
 - TSM

- **Step 3: Define and Implement Your Solution**
 - Reference Solution 1: Native products DFSMS based disaster recovery
 - Reference Solution 2: z/VM based recovery
 - Reference Solution 3: Linux/TSM based recovery
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- Hints & Tips

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 - Backup on Real tapes - for long time archiving
 - **Bare Metal / System Level Backup – High Availability**
 - Periodically full system/disk backups
 - Automatically with Replication services
 - **Disaster Recovery Backup**

- **Step 2: Select the right products – enterprise focus**
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 - TSM

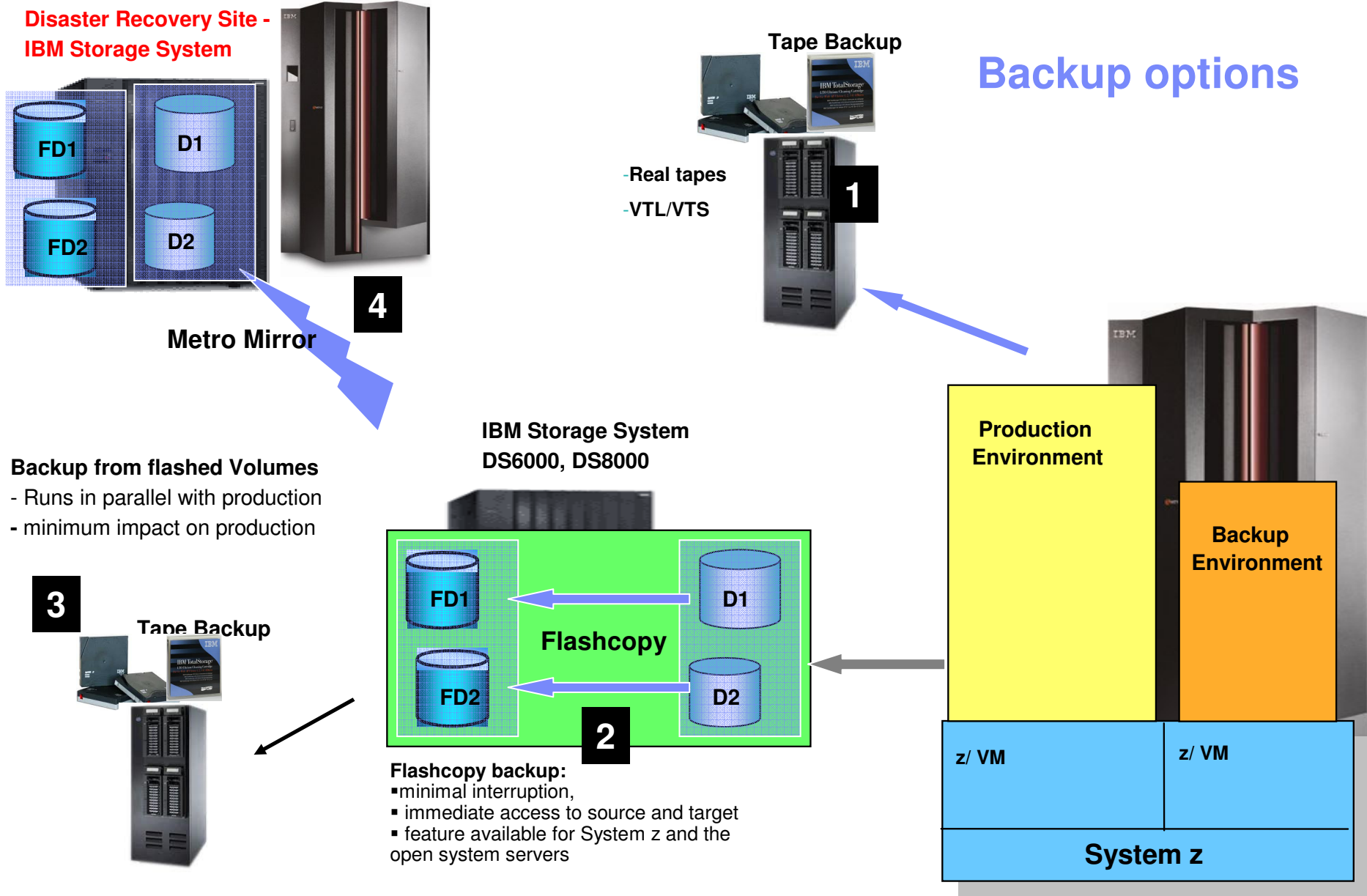
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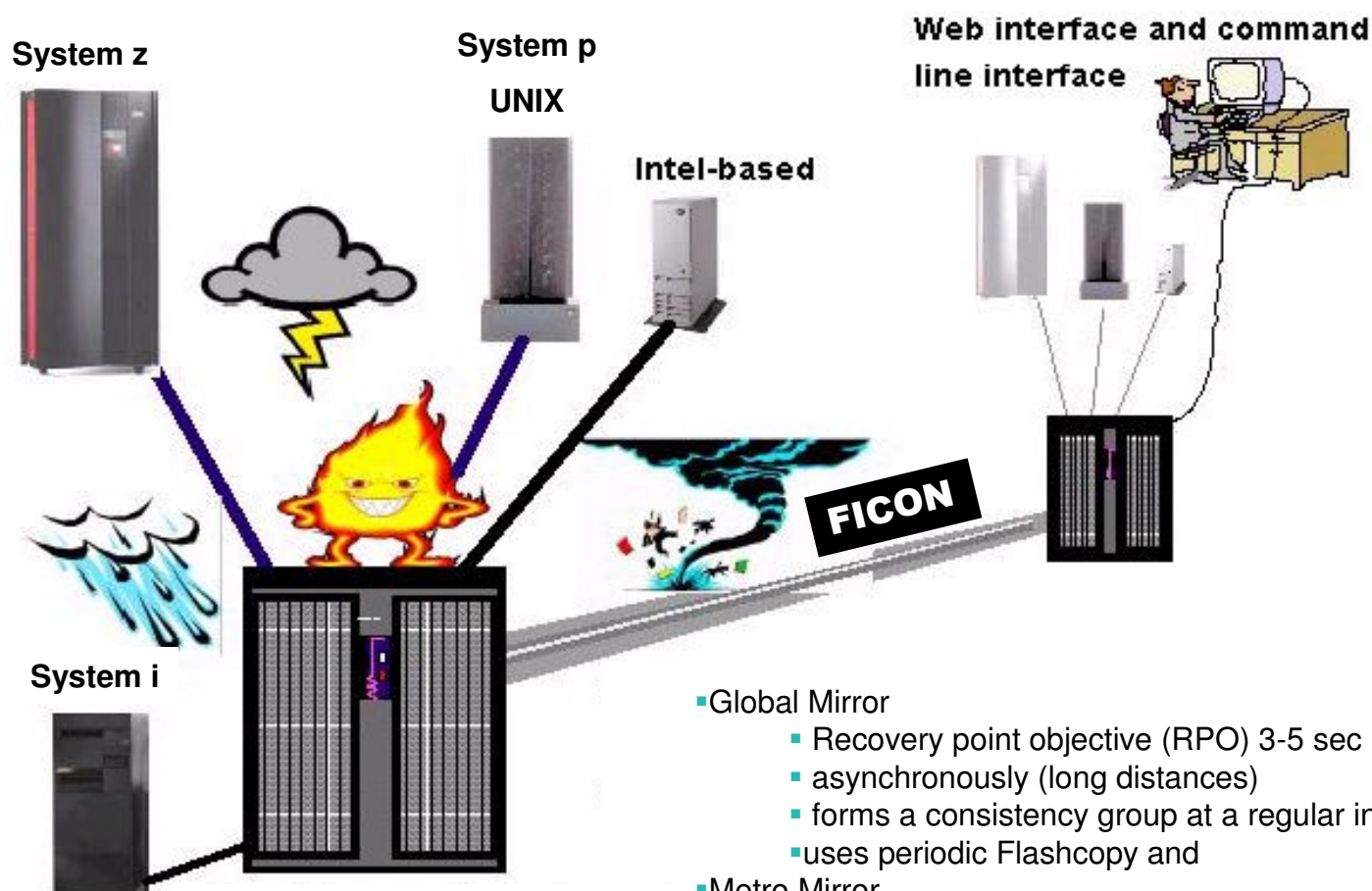
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 - **Data Level Backup**
 - Temporary Backup using Copy Services – Flashcopy
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 - Backup on Real tapes - for long time archiving
 - **Bare Metal / System Level Backup – High Availability**
 - Periodically full system/disk backups
 - Automatically with Replication services
 - **Disaster Recovery Backup**
 - Disk Replication services
 - Off-site tapes for entire environment
- **Step 2: Select the right products – enterprise focus**
 - Native products (i.e. Acronis, tar, DFSMS)
 - Backup & Restore Manager for z/VM
 - Tivoli Flashcopy manager
 - TSM
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Backup options



Enterprise Storage Backup solutions

– Mirroring methods and the ‘Peer to Peer Remote Copy’ (PPRC)



TotalStorage System families:

- DS8000, DS6000, ESS Series
- SVC, XIV, Storwise 7000

- Global Mirror
 - Recovery point objective (RPO) 3-5 sec
 - asynchronously (long distances)
 - forms a consistency group at a regular interval
 - uses periodic Flashcopy and
- Metro Mirror
 - synchronous (< 300 km)
 - instant FlashCopy

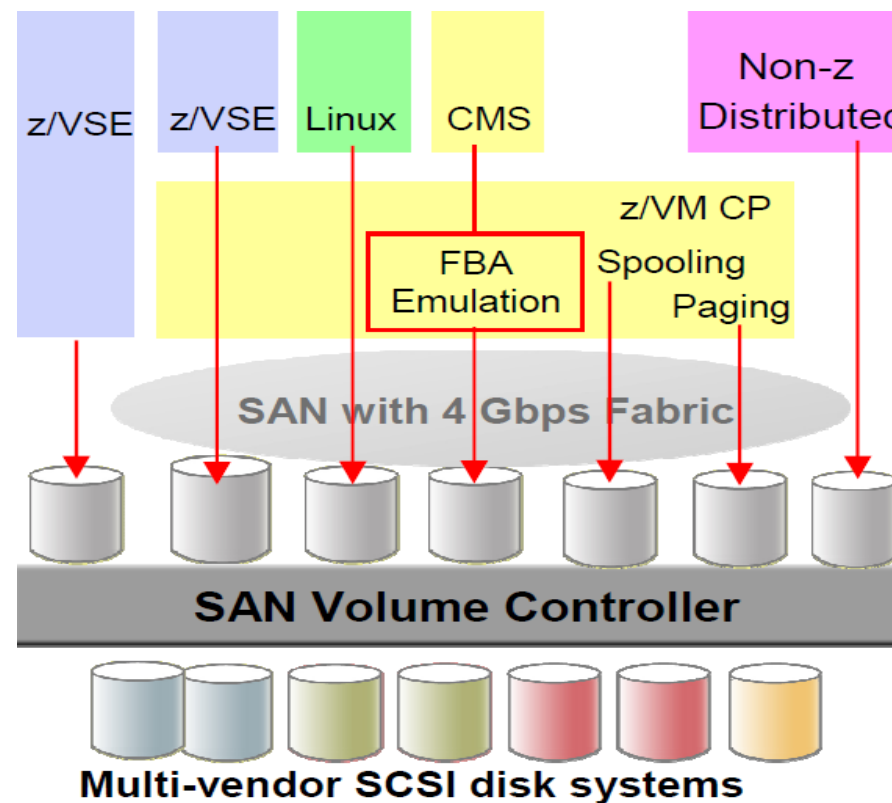
Storage Virtualization -SVC

SVC (SAN Volume Controller) :

-SAN Volume Controller (SVC) creates a single pool of SCSI disk capacity

-Disk storage options include IBM DS8000, DS4000, etc. XIV, Storvise 7000 plus qualified systems from various non-IBM vendors

- Copy Services available via SVC (i.e disk `Flashcopy` and HA via streched SVC)
- Tivoli Flashcopy Manager handles and automates Totalstorage Flashcopy and SVC Copy Services



Agenda

- **Step 1: Define your Backup strategy based on BIA (Business Impact Analysis)**
 - Data Level Backup
 - Bare Metal / System Level Backup – High Availability
 - Disaster Recovery Backup

- **Step 2: Select the right products – enterprise focus**
 - **Native products (i.e. Acronis, tar, IDCAMS, DFSMS)**
 - Are covering a small area or one backup point (i.e. raw data vs. database)
 - **Backup & Restore Manager for z/VM**
 - System Backup for z/VM data and z/VM guests
 - Raw Disk backup
 - **Tivoli Flashcopy Manager**
 - Copy services (incl. Flashcopy), for disk based backup
 - **Tivoli Storage Manager (TSM)**
 - Automated Backup for various heterogeneous platforms
 - Integration with Databases and different disk organizations (SCSI, ECKD)

- **Step 3: Define and Implement Your Solution**
 - Reference Solution 1: Native products for special requirements
 - Reference Solution 2: z/VM based recovery
 - Reference Solution 3: Linux/TSM based recovery
 - Get Prepared for the restoration process

- **Hints & Tips**

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- **Step 1: Define your Backup strategy based on BIA (Business Impact Analysis)**
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 - Tivoli Storage Manager (TSM)

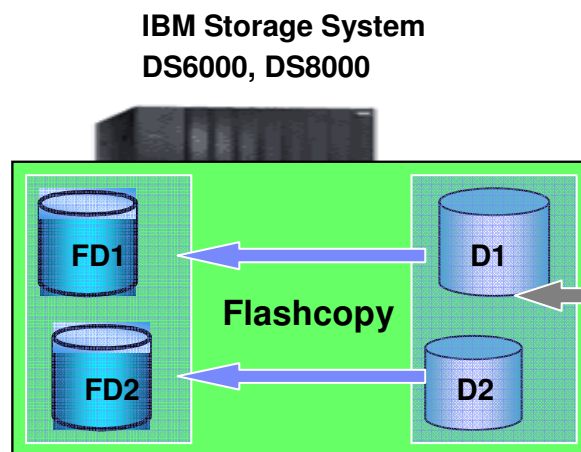
- **Step 3: Define and Implement Your Solution**
 - **Reference Solution 1: Native products for special requirements**
 - z/VSE or z/OS based Backup for FICON attached tape units
 - **Reference Solution 2: z/VM based recovery**
 - z/VM Backup for Full volume Backup and full System
 - **Reference Solution 3: Linux/TSM based recovery**
 - TSM Backup for all platforms and application data
 - **Get Prepared for the restoration process**
 - Define procedures for automatic Restore or Recovery to meet RTO and RPO

- **Hints & Tips**

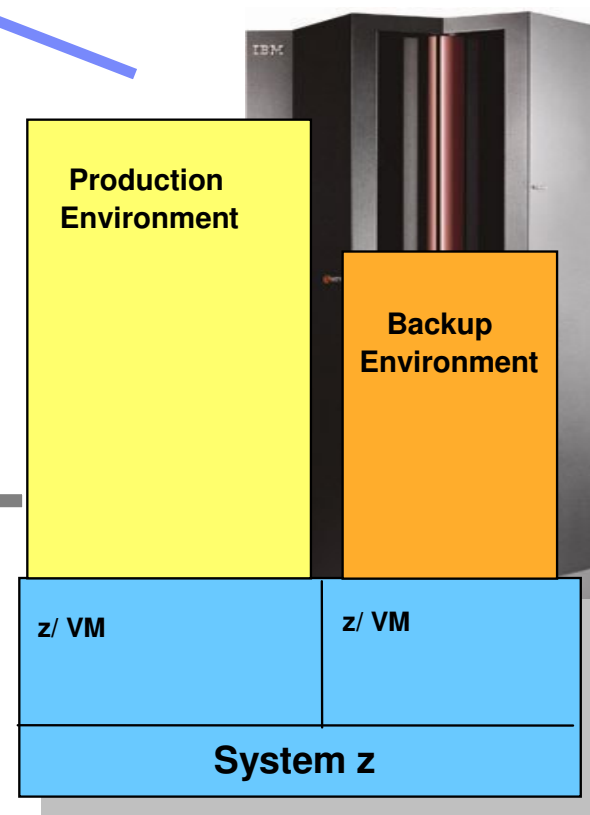
Backup via native products

Native products for special requirements

- z/VSE or z/OS based Backup require:
- FICON attached tape units
 - Linux Backup via native functions is not efficient with less control
 - Backup z/VM data in Linux requires SLES11 SP2 or RHEL6 for R/W CMSFS access
 - Flashcopy brings efficiency
 - Tivoli Flashcopy Manager helps automate and control



- Flashcopy backup:**
- minimal interruption,
 - immediate access to source and target
 - feature available for System z and the open system servers

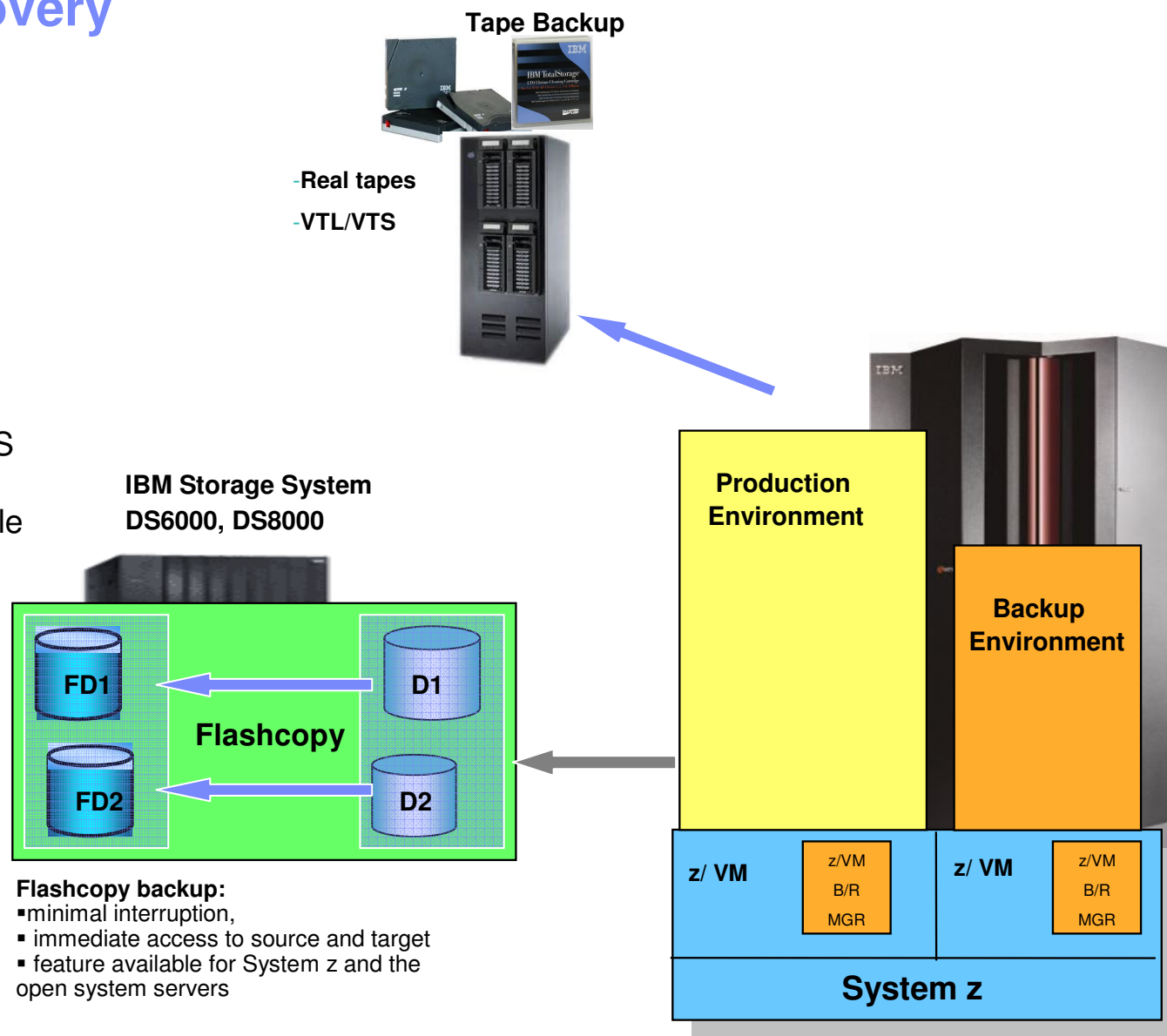


z/VM based recovery

z/VM Backup and Restore Manager

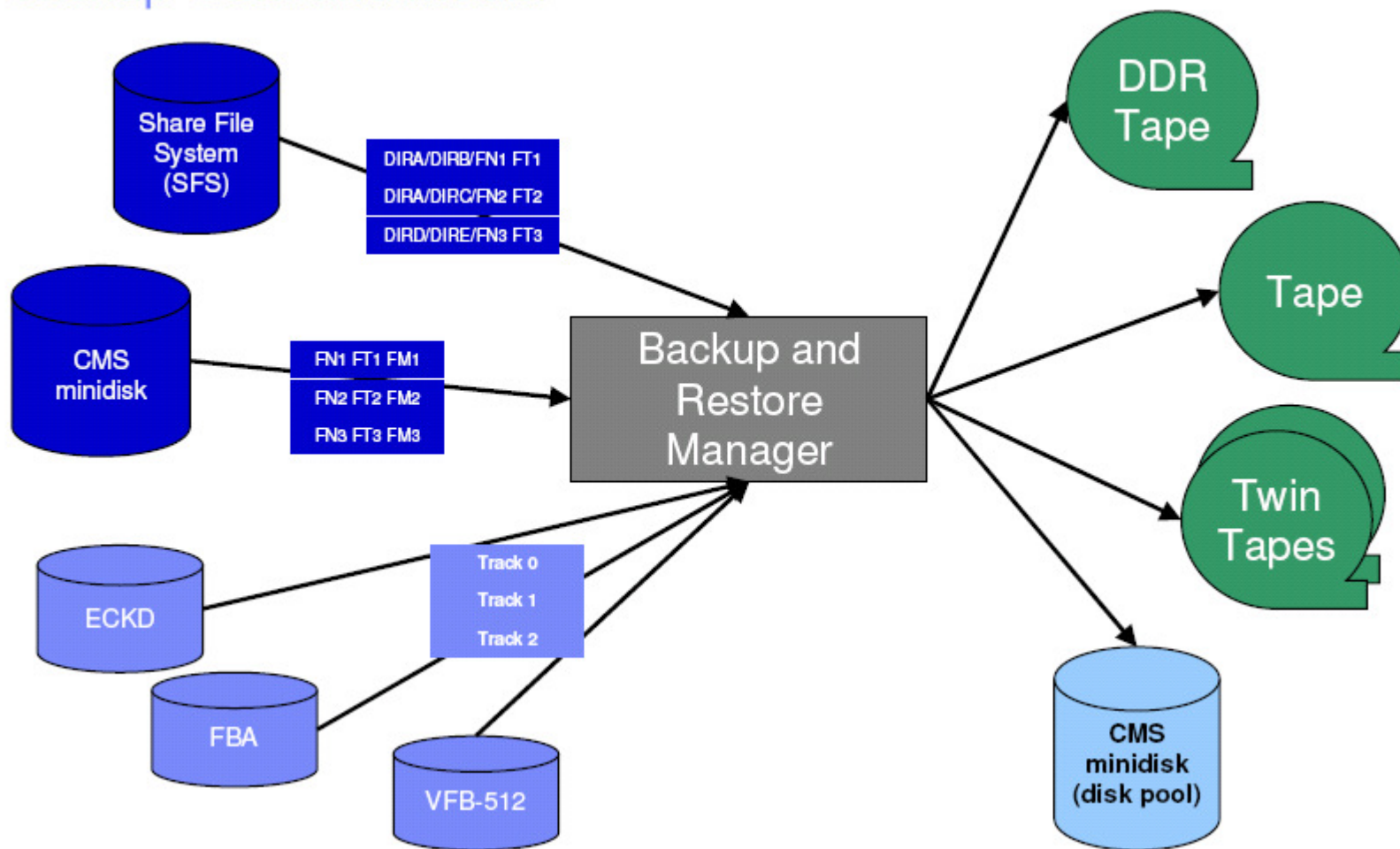
z/VM based Backup requires:

- FICON attached tape units
- Linux Backup via its native functions on NFS device, is not very efficient but manageable
- Flashcopy brings efficiency
- Tivoli Flashcopy Manager helps



z/VM based Recovery Backup / Restore Manager - for System and Bare metal Restore

Backup Data and Media



z/VM Backup and Restore Manager

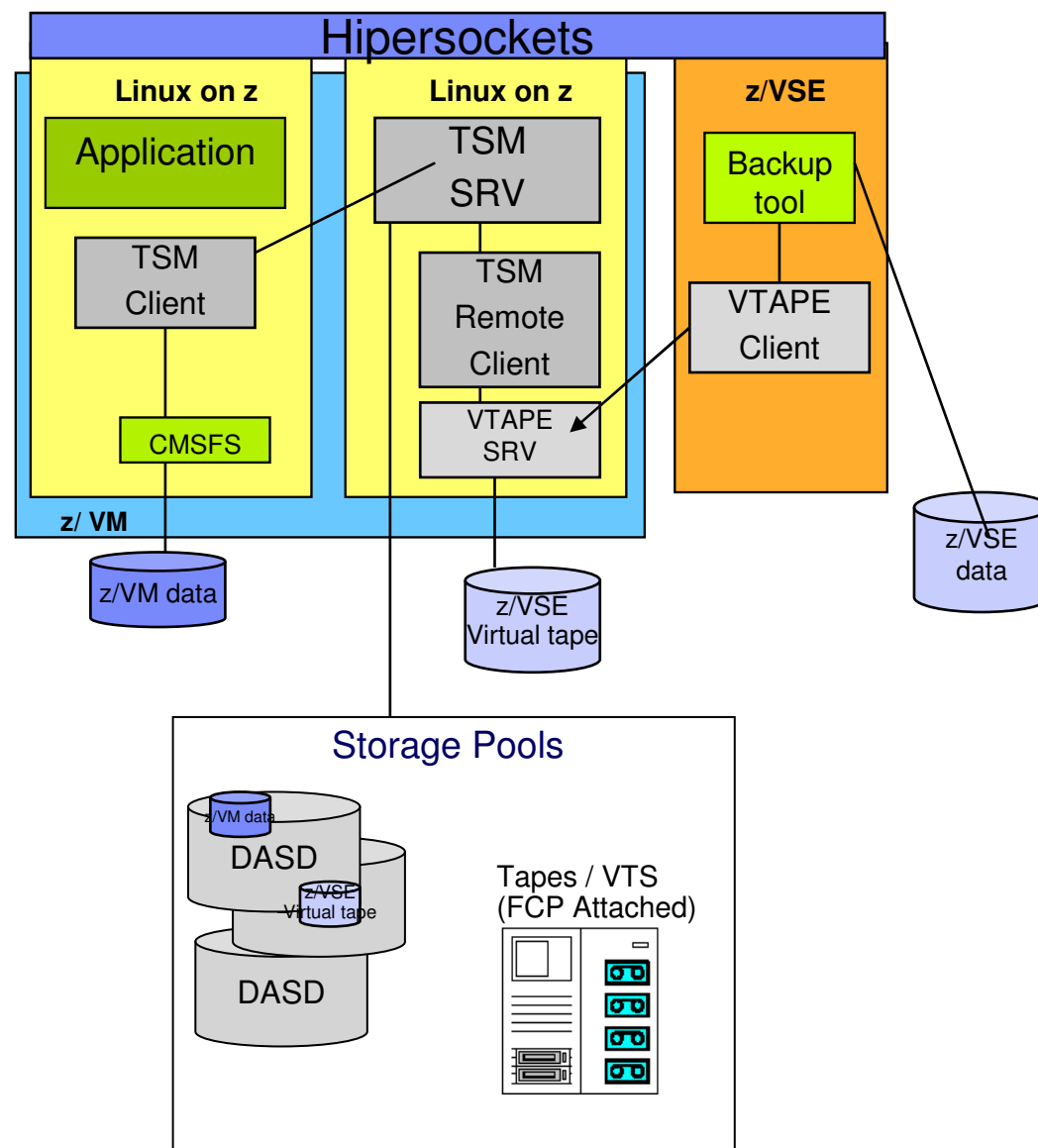
Backup and Restore Manager enables you to back up and restore the following types of data:

- Files on CMS formatted minidisk or in SFS (Shared File System)
- Raw image dumps of non-CMS data on minidisk
- Raw image dumps of CKD (Count Key Data) volumes, including those containing z/OS, Linux on System z, and z/VSE data
- Raw image dumps of FBA (Fixed-Block Architecture) DASD devices

TSM based recovery

TSM based Backup requires:

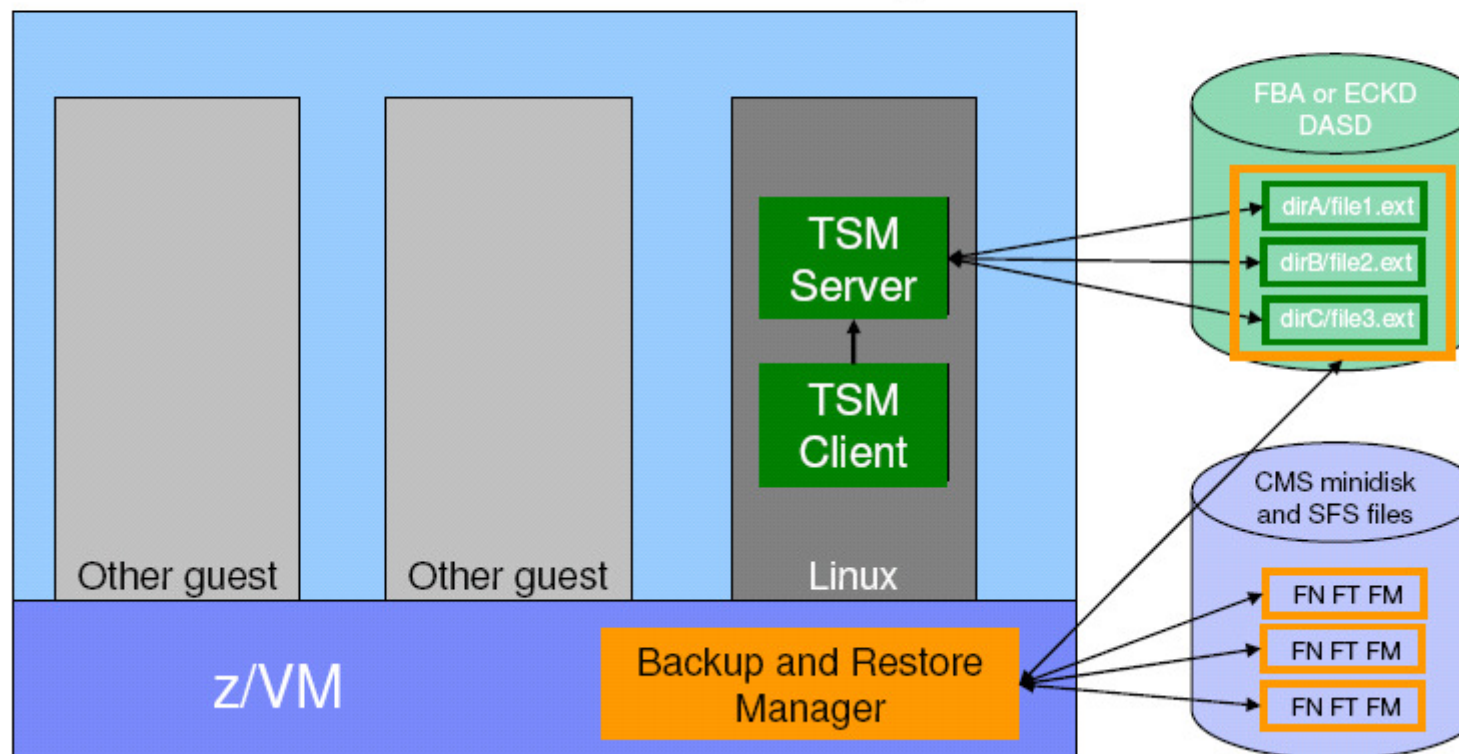
- FCP attached tape units
- Linux Backup via TSM Agents and clients
- z/VM data backup via Linux CMSFS
- Flashcopy brings efficiency and decouples from production interrupt
- NOT possible – full System Backups
- Tapes can only be assigned to zEnterprise, not to zBX
- zBX backup can be fully integrated with TSM



Most complete and integrated Backup Strategy: TSM and z/VM Backup / Restore Manager

- **TSM for automated well managed Backup of data**
- **z/VM Backup / Restore Manager for System / Volume Backup/Restore**

Choose the solution that meets your needs



Strategies to achieve tiers of DR using TSM

- IBM Tivoli Storage Manager (TSM) can be used to help provide all the tiers of DR
- Use of Disaster Recovery Manager (DRM) which can automate the TSM server recovery process and manage offsite volumes.
- Vaulting of TSM database, recovery log, volume history information, device configuration information, DRP file (if using DRM) and copy pools for storage at an offsite location.
- Use of TSM server-to-server communications to enable enterprise configuration (multiple TSM servers), enterprise event logging and monitoring, and command routing.
- TSM servers installed at multiple locations, optionally setup as peer to peer servers (that is, each server able to recover at the alternate site).
- Use of TSM virtual volumes over TCP/IP connection to allow storage of TSM entities (TSM database backups, recovery log backups, and primary and copy storage pools, DRM plan files) on remote target servers.
- Use of high bandwidth connections and data replication technology (such as IBM PPRC, EMC SRDF) to support asynchronous/synchronous data replication of TSM databases backups, recovery log backups, TSM database and recovery log mirrors, and storage pools.
- Use of remote electronic tape vaulting of TSM database and recovery log backups, primary or copy storage pools. Extended distances can be achieved by using distance technologies, for example, extended SAN, DWDM, IP/WAN channel extenders.

DR Plan Generation for TSM Server

- Generate the recovery plan using the PREPARE command in TSM
- The plan is stored in a time-stamped file in the local directory as defined in **SET DRMPLANPREFIX**

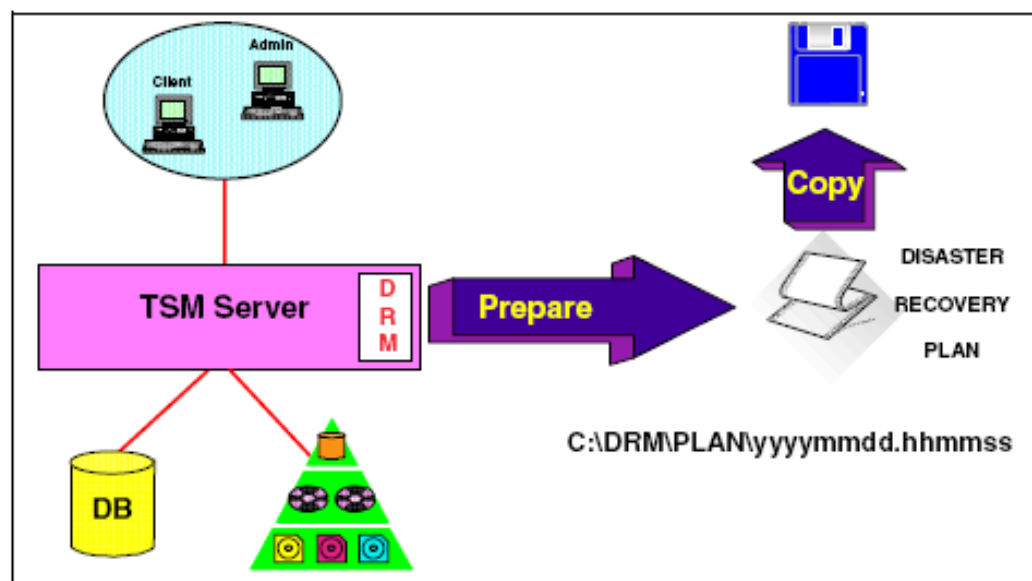


Figure 8-12 Disaster Recovery Plan generation

TSM with warm DR site

- DRM output sent to the remote site using a secure network using FTP
- The TSM database backups can be manually vaulted along with the copy storage pool data to the warm site environment for disaster

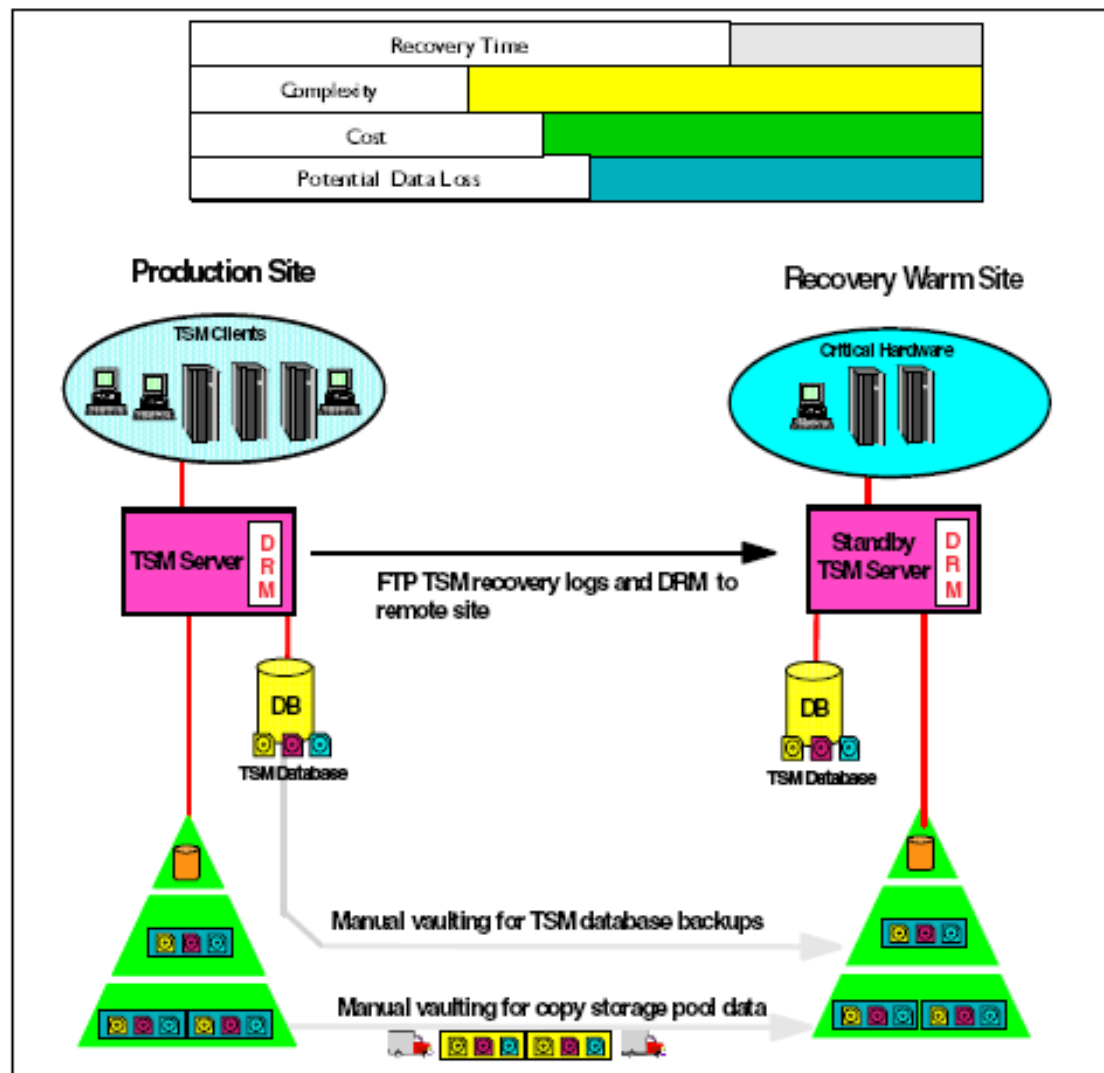
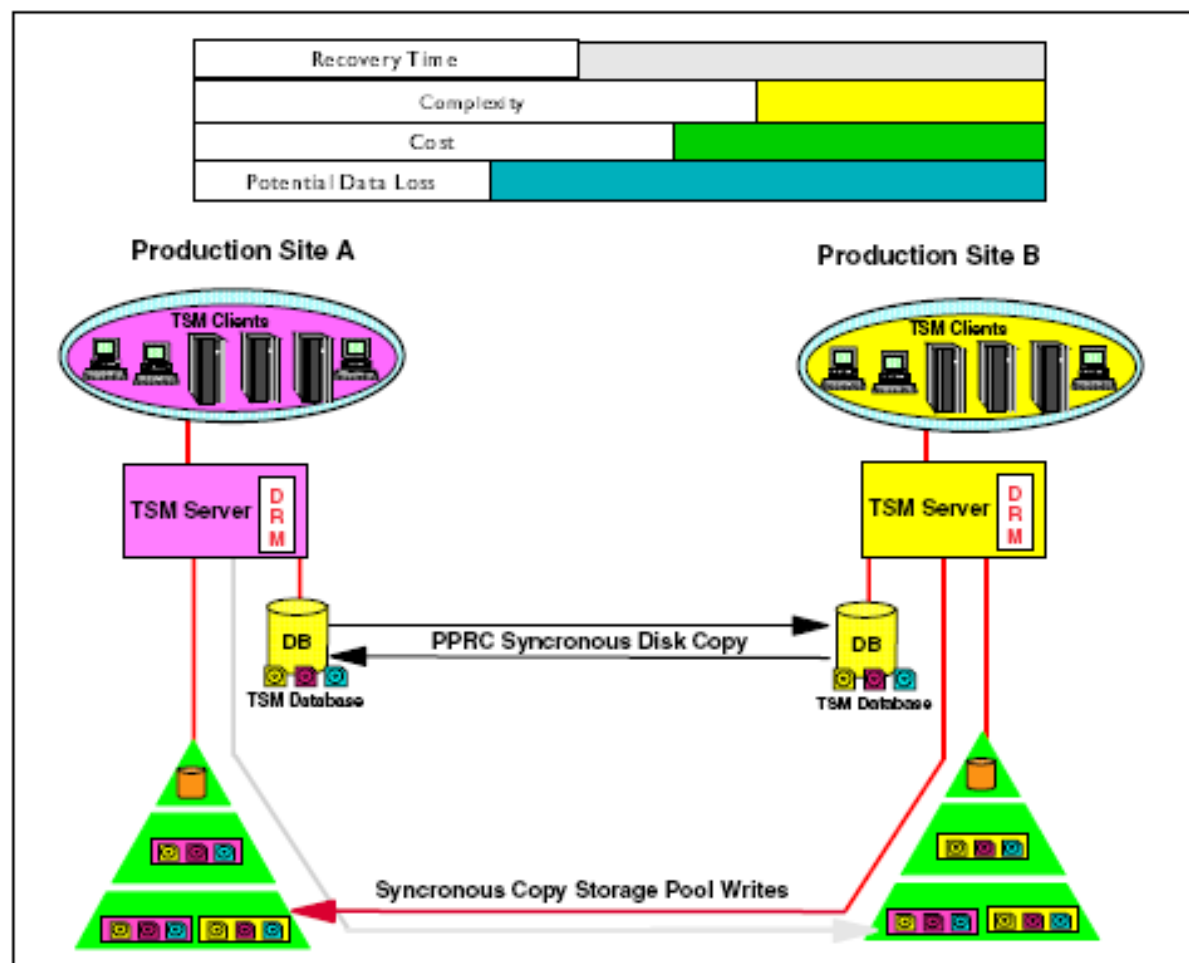


Figure 14-6 Electronic vaulting of TSM DRM, manual DB, and copy pool vaulting

DR mirrored site with TSM Backup setup

- each TSM environment functions independently,
- it vaults its data to the alternate TSM site.
- In the case of a disaster, the existing TSM environment is used to recover the lost TSM environment and associated



Dual production sites, electronic TSM DB and copy pool vaulting

IBM Tivoli Storage Manager at a glance

- **Tivoli Storage Manager** — automates data backup and restore (B/R) functions, on a broad range of platforms and storage devices
- **Tivoli Storage Manager Extended Edition** — expands B/R with data de-duplication and disaster recovery functionality
- **IBM Tivoli Storage Manager for Mail** — helps secure IBM Lotus® Domino® and Microsoft Exchange data
- **IBM Tivoli Storage Manager for Databases** — helps secure IBM Informix®, Oracle and Microsoft SQL data
- **IBM Tivoli Storage Manager HSM for Windows** — provides Hierarchical Storage Management with a policy-based management system
- **IBM Tivoli Storage Manager for Advanced Copy Services** — protects your mission-critical data that requires 24x7 availability with snapshot backup
- **IBM Tivoli Storage Manager for Copy Services** — high-efficiency B/R of data and applications, eliminating backup-related performance impacts.
- **IBM Tivoli Storage Manager for Enterprise Resource Planning** — helps protect vital SAP R/3 system data efficiently, consistently and reliably.
- **IBM Tivoli Storage Manager for Space Management** — automatically moves inactive data to free online disk space for important active data.
- **IBM Tivoli Storage Manager for Storage Area Networks** — for SAN-connected Tivoli Storage Manager servers and client computers
- **IBM Tivoli Storage Manager for System Backup and Recovery** — offers a comprehensive system B/R and reinstallation tool with bare-metal restore
- **IBM Tivoli Storage Manager FastBack™** — provides a continuous data protection and recovery management platform for Microsoft Windows servers.
- **IBM Tivoli Storage Manager FastBack for Microsoft Exchange** — provides the ability to quickly and easily recover granular Microsoft Exchange data
- **IBM Tivoli Storage Manager FastBack for Bare Machine Recovery** — restores entire systems, whether to comparable hardware, dissimilar hardware, or a virtual machine.
- **IBM Tivoli Storage Manager FastBack Center** — combines the features of the IBM Tivoli Storage Manager FastBack family of products into one solution.
- **IBM Tivoli Continuous Data Protection for Files** — provides continuous, automated backup of desktop and laptop workstations.

Prepare for Restore

- Include TSM Server recovery
 - take it into account when defining Restore procedures
 - Bare Metal Restore, Installation from scratch or Flashcopy might be required
 - host TSM Server on System z AND
 - Perform disaster backup with z/VM (ECKD and EDEV)
 - OR allow to restore TSM server via z/VM cloning or Flashcopy
- If TSM Server is run on System z, you should make sure:
 - It can be IPLed in z/VM guest or LPAR alternatively
 - It can be IPLed in all target environments
 - SAN Zoning, Host Mapping, LUN masking
 - Predict initiator WWPNs using the WWPN Prediction Tool (see Links)
- Linux is configured for all intended environments
 - Prepare alternate initrd and system config per environmen

Hints & Tips

- **Plan your Backup to have a consistent synchronization point**
- ***Define the Recovery point from which you want to start***

Option 1: Fresh Install from scratch - most expensive one - risky

- Requires unattended install process
 - High Risk to result in same configuration as before failure because there are many configuration options during installation

Option 2: Fresh Install from Template (Cloning-Golden Image) – expensive but less risk

- Recommended option if:
 - system cloning procedures are in place and coordinated with backup/recovery
 - RTO allows to apply further incremental backups after recreation of system

Option 3: Restore from periodic Snap Shots of System Volumes

- Recommended option if:
 - Automated recreation of systems from golden images does not apply
 - Minimal complexity of system restoration procedure is required
 - Solution with Additional pre-requs:
 - Snap Shot feature in disk storage subsystem
 - Shared access with external backup system plus maintenance window

Hints & Tips

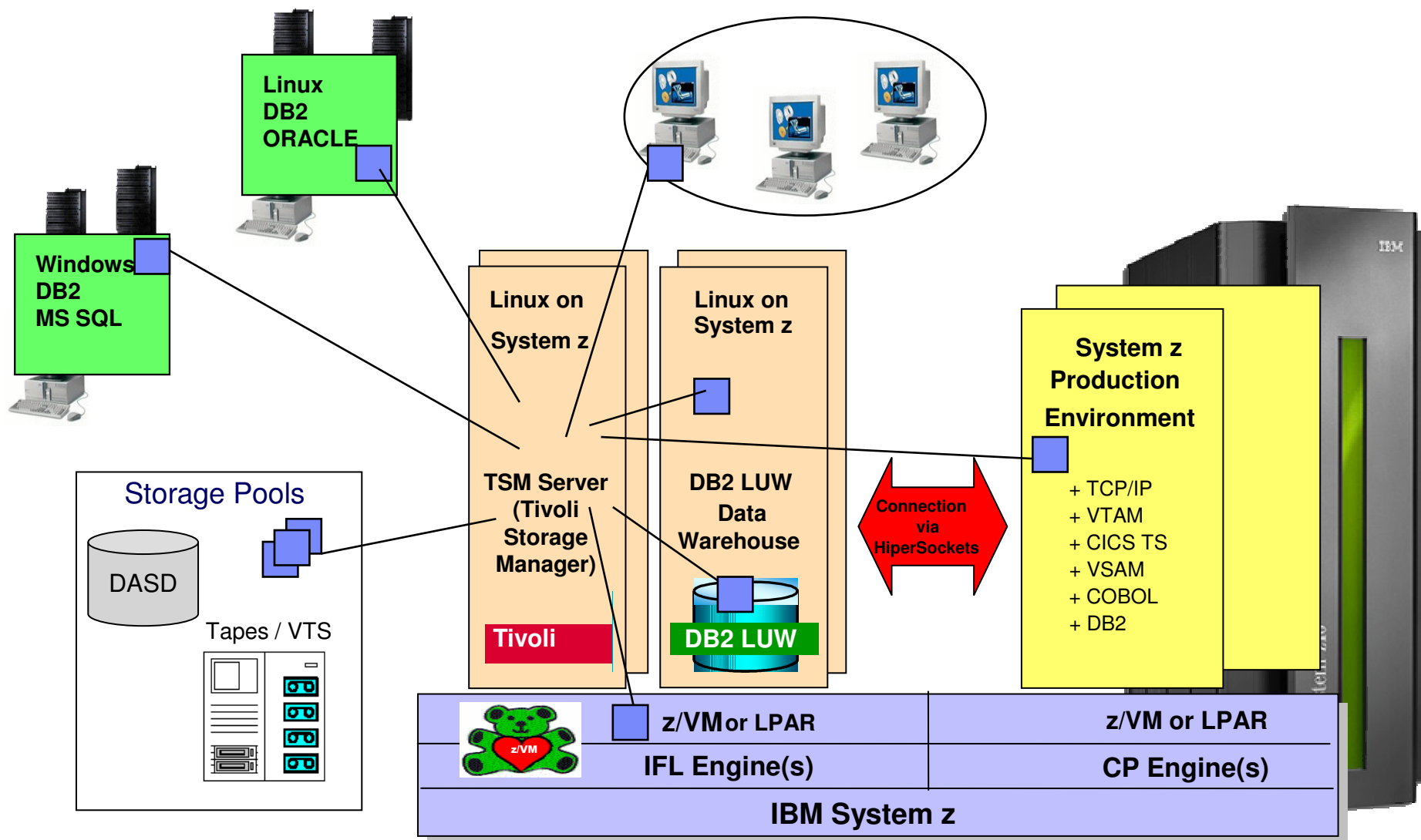
➤ Ensure data Consistency during Backup

- Define all volumes to be members of the same consistency group before performing the snap shot
- Application Data
 - Avoid Backup for data without support of online backup
 - Shut down/freeze application during backup
 - If using Flashcopy, define all data belonging to one data source (database) are in a consistency group
- System data
 - Shut down system/hypervisor during backup
 - Instant Backup
 - Take a snap shot of the volumes using disk storage subsystem functions, then perform the backup with the snap shot as backup source.
 - Journaling file systems will ensure data consistency in the snap shot
 - LVM/Oracle ASM managed or other multi-volume data spaces
 - z/VM system data
 - Define z/VM owned volumes to be member of the same consistency group before performing the snap shot

Backup and Performance Tips

- Separate Backup/Archive workload from normal production workload
 - Use separate LAN Adapter or HiperSockets/Guest LAN for client/server communication
 - Use separate disk storage subsystem (rank) for TSM storage pool
 - Use separate FICON cards for disk and tape attachments
- TSM Storage Pool
 - Provide sufficient capacity - more than estimated data to be backed up
 - Use SCSI LUNS attached via FCP to zEnterprise, when possible, OR
 - Use many small ECKD DASD plus a significant number of Hyper PAV aliases.
- Tune the disk IO for maximum disk write performance
 - In order to reduce elapsed time of backup window
 - Read performance is secondary due to delayed destaging from storage pool to tape.

Implement TSM on Linux on System z as central Backup Hub



Mori Information

- IBM Tivoli Storage Manager Version 6.2 information center:
<http://publib.boulder.ibm.com/infocenter/tsminfo/v6r2/topic/com.ibm.itsm.ic.doc/welcome.html>
- Backup and Restore Manager for z/VM:
<http://www01.ibm.com/software/stormgmt/zvm/backup/>
- What Differentiates IBM's Backup and Restore Manager for z/VM from IBM's Tivoli Storage Manager in z/VM and Linux on System z Environments? By Michael Sine, Tracy Dean, Randy Larson:
<http://www-03.ibm.com/support/techdocs/atmastr.nsf/WebIndex/WP101879>
- Tuning Disk IO with Linux on System z:
http://www.ibm.com/developerworks/linux/linux390/perf/tuning_diskio.html
- WWPN Prediction Tool for System z FCP Channels, on IBM Resource Link,
<https://www.ibm.com/servers/resourceLink> (Resource Link ID required)

Questions?



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