

IBM Enterprise2013

*Options for Backing Up and Restoring z/VM
and Linux Guests*



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Agenda

- **Recommended practices and available options**
 - Backing up and restoring z/VM
 - Backing up and restoring Linux on System z
- **Backing up and restoring data in a z/VM SSI cluster**
- **Overview of IBM products**
 - Backup and Restore Manager for z/VM
 - Tape Manager for z/VM
- **Backup scenarios**
 - Live demos
 - Configuration options and sample code
- **Summary and reference information**



IBM z/VM Management Solutions

- **Security**
 - RACF and zSecure Manager for z/VM
- **Performance monitoring**
 - OMEGAMON XE on z/VM and Linux
- **Backup and recovery**
 - Backup and Restore Manager for z/VM
 - Tape Manager for z/VM
 - Tivoli Storage Manager
- **Automation and operational monitoring**
 - Operations Manager for z/VM
 - Including integration with existing monitoring and alert systems



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Options for Backing Up and Restoring z/VM and Linux Guests

Recommended Practices and
Available Options



Recommended Practices – Backup and Recovery

Image level backup of z/VM

- Operating system

File level backup of z/VM data

- Directory information
- Configuration files
- Log files
- Tools – REXX EXECs, automation scripts, etc.

Image level backup of Linux guests

- Operating system
- Applications
- Application data (maybe)

File level backup of Linux guests

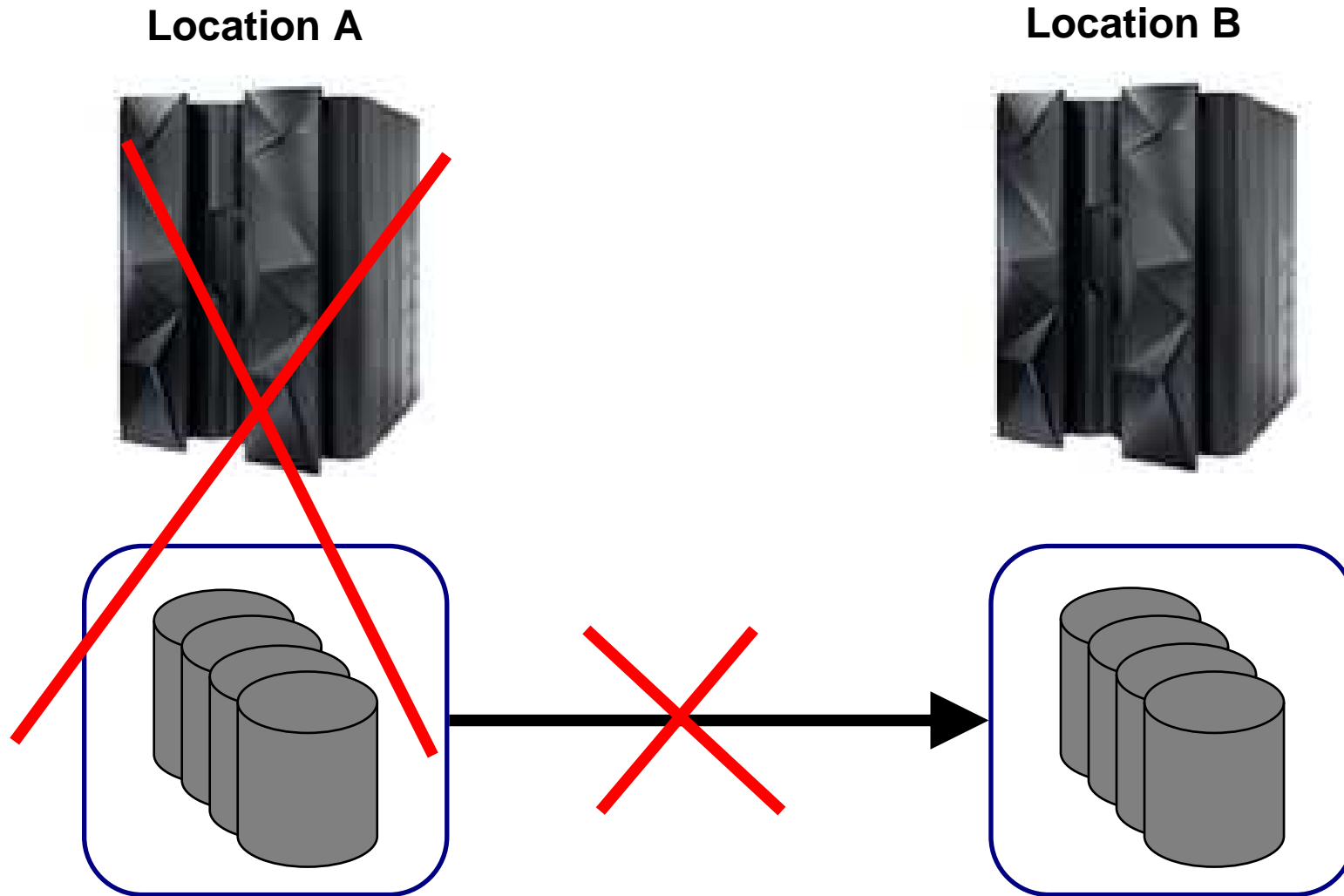
- Configuration files
- Log files
- Tools

Recovery of z/VM system, including Linux guests

- Dependence on z/OS
versus
- Independent recovery



High Availability



High Availability and Backup/Recovery are NOT the Same

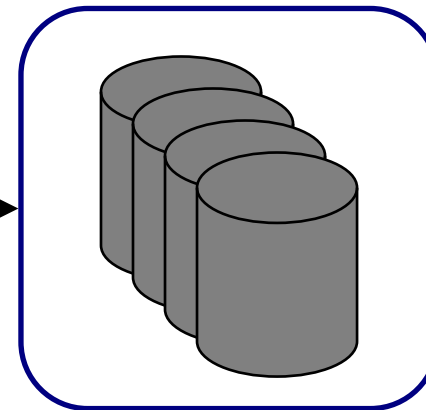
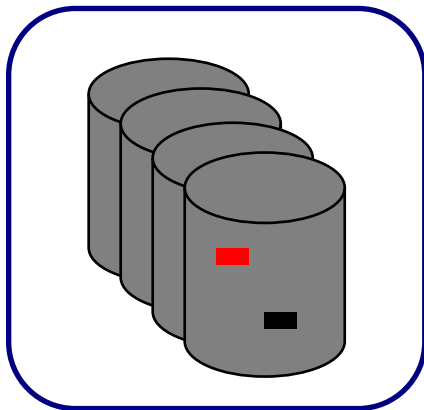
Location A



Location B



Does not address
operational recovery
needs



Recommended Practices – Backup and Recovery

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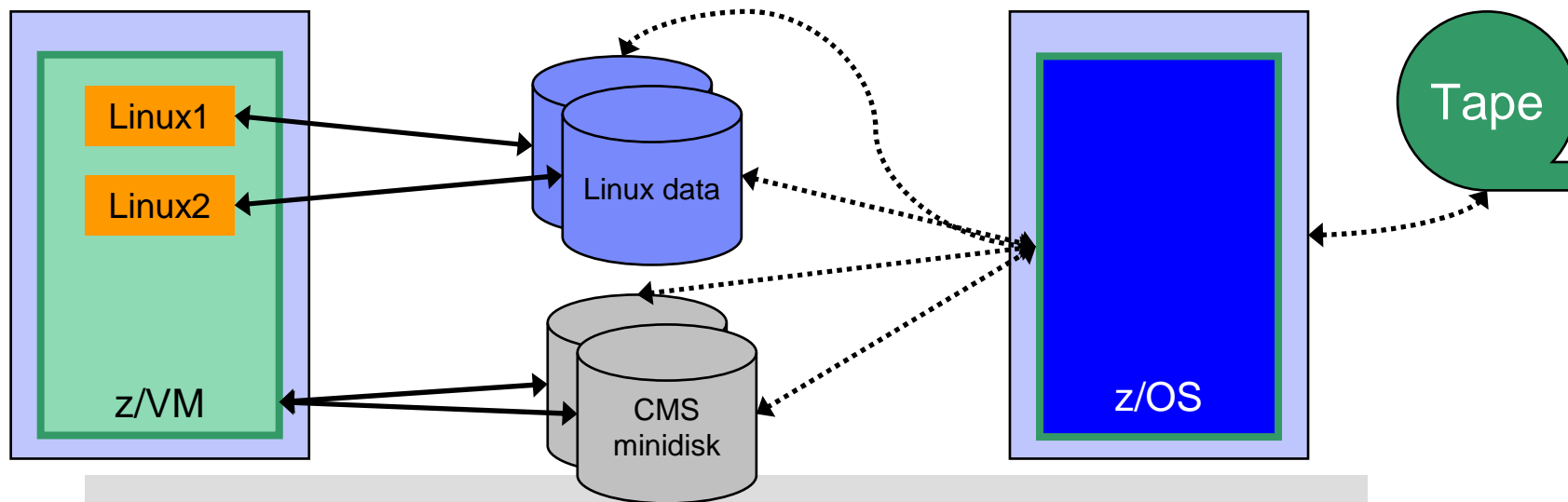
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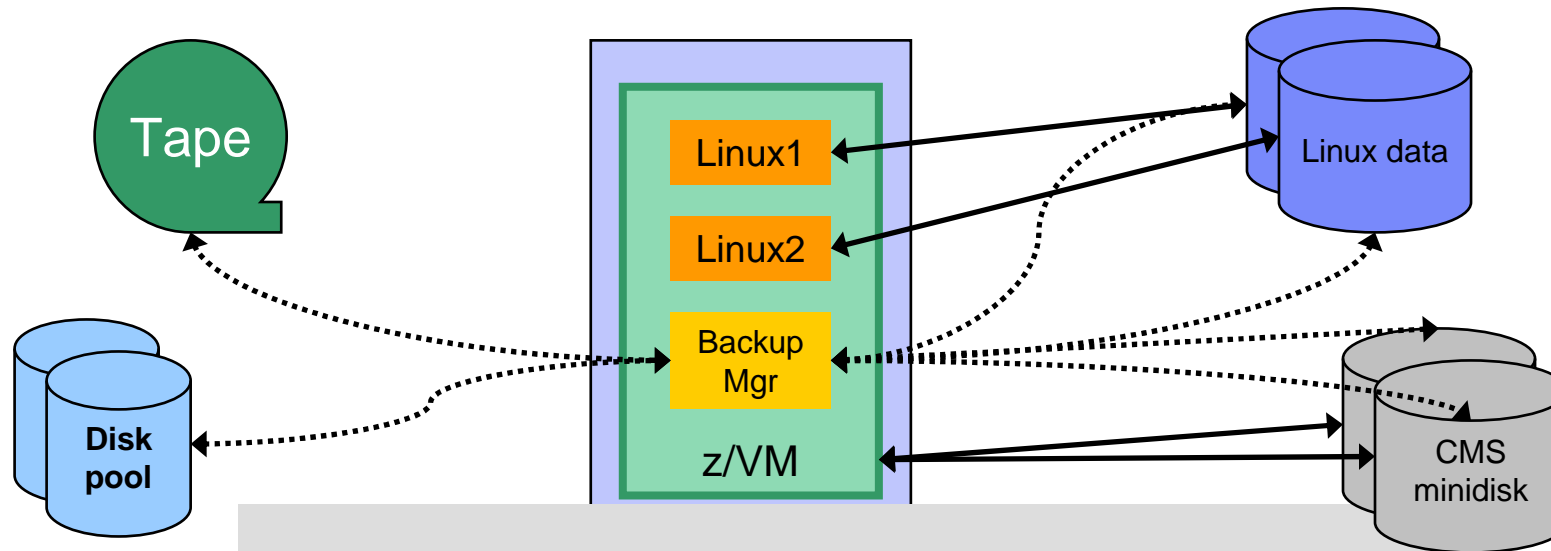
Image Level Backup/Recovery of z/VM and Linux Guests from z/OS



- **Image level backup and recovery of DASD volumes from z/OS**
 - Existing z/OS procedures and tools in place
 - Use existing tape devices
 - Fast
 - Doesn't include FCP-attached DASD
 - Linux should be down
 - Dependent on z/OS for recovery
 - Is Linux workload critical – recovery required in parallel with z/OS in event of disaster?
 - Using z/OS cycles (on general purpose processors) to back up z/VM and Linux



Image Level Backup/Recovery of z/VM and Linux Guests from z/VM



- **Image level backup and recovery of DASD volumes from z/VM**
 - Low risk if z/VM is running
 - Includes FCP-attached DASD (defined to z/VM as EDEVICEs)
 - **Linux should be down**
 - Recovery of z/VM and Linux independent from recovery of z/OS
 - Critical Linux workload recovered in parallel with z/OS in event of disaster
 - Faster recovery of z/VM and Linux overall
 - **Backup software required on z/VM**
 - Use z/VM cycles on IFL processors to back up z/VM and Linux
 - **Requires mainframe attached tape devices**
 - Share tape devices with z/OS – does not require both systems to be up



Recommended Practices – Backup and Recovery

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File level backup of Linux guests

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- Log files
- Tools

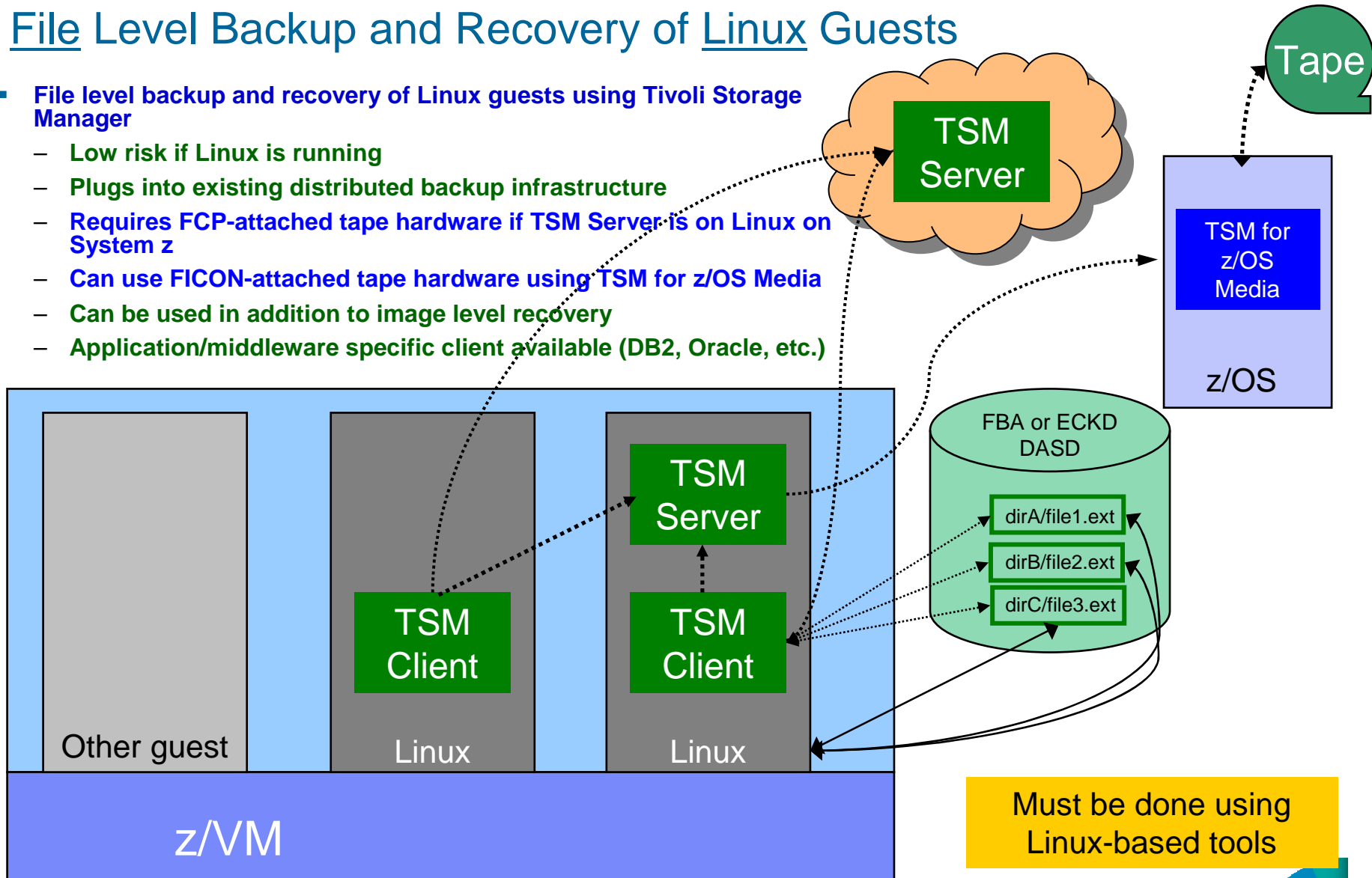
Recovery of z/VM system, including Linux guests

- Dependence on z/OS
versus
- Independent recovery



File Level Backup and Recovery of Linux Guests

- File level backup and recovery of Linux guests using Tivoli Storage Manager
 - Low risk if Linux is running
 - Plugs into existing distributed backup infrastructure
 - Requires FCP-attached tape hardware if TSM Server is on Linux on System z
 - Can use FICON-attached tape hardware using TSM for z/OS Media
 - Can be used in addition to image level recovery
 - Application/middleware specific client available (DB2, Oracle, etc.)



Recommended Practices – Backup and Recovery

Image level backup of z/VM

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Image level backup of Linux guests

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File level backup of Linux guests

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- Tools

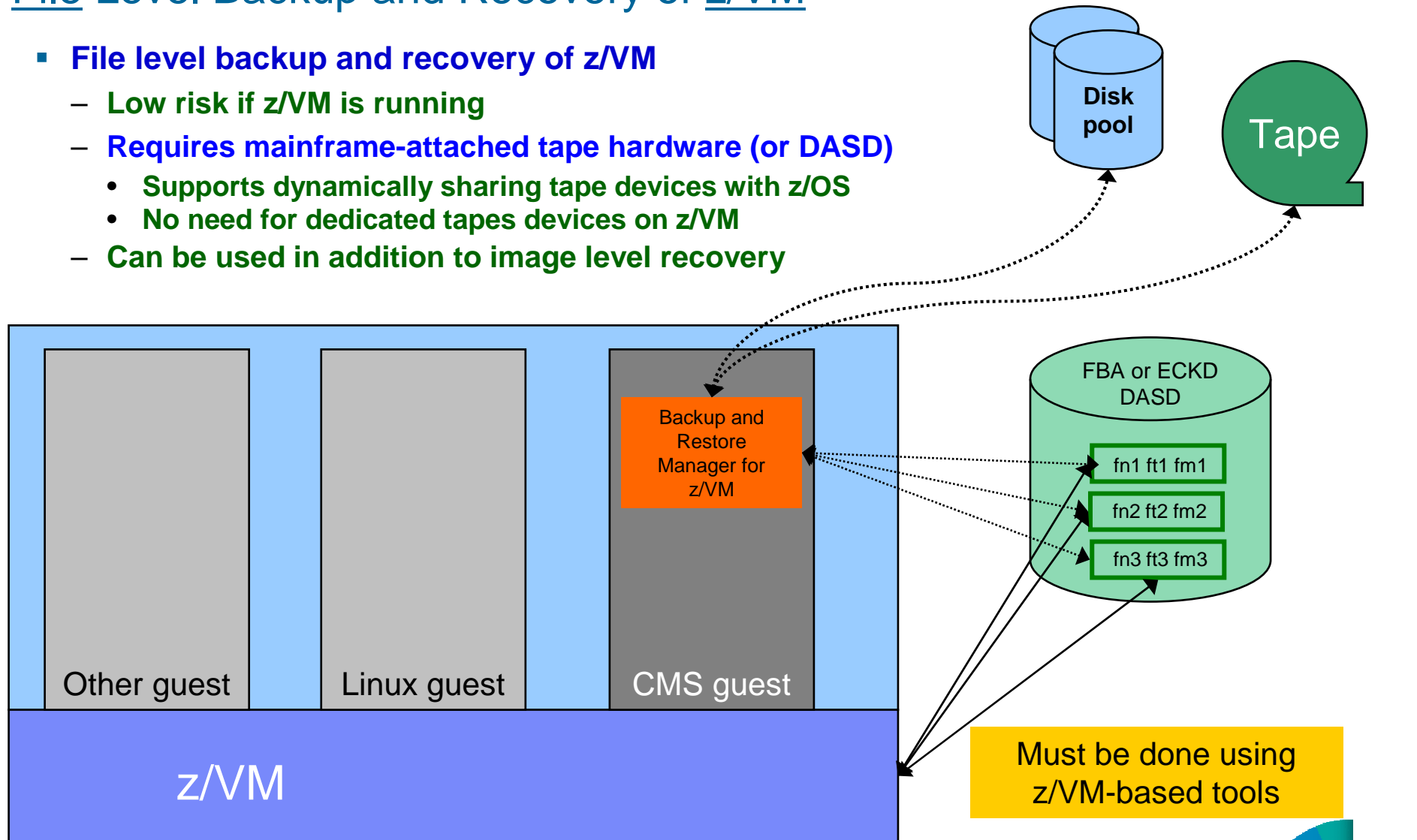
Recovery of z/VM system, including Linux guests

- Dependence on z/OS
versus
- Independent recovery



File Level Backup and Recovery of z/VM

- **File level backup and recovery of z/VM**
 - **Low risk if z/VM is running**
 - **Requires mainframe-attached tape hardware (or DASD)**
 - **Supports dynamically sharing tape devices with z/OS**
 - **No need for dedicated tapes devices on z/VM**
 - **Can be used in addition to image level recovery**



Where and How to Back Up z/VM and Linux Guests

- **Using z/OS to back up and restore z/VM and Linux**
 - Useful during Linux on System z POC or early stages of Linux roll-out
 - Easy and fast to implement for existing z/OS customers
 - Provides disaster/volume level recovery (not file level recovery)
 - **Concerns or issues long term as Linux workload grows or becomes critical**
 - Doesn't support FCP-attached DASD
 - File level recovery of z/VM or Linux data is time consuming and manual – backups only contain volume images
 - In disaster situation, z/VM and Linux must wait for z/OS recovery before beginning their recovery
 - Increased use of z/OS CPU cycles to support z/VM and Linux
- **Using native z/VM and Linux solutions for backup and recovery**
 - **Supports operational errors and disaster situations**
 - File level backup and recovery of both z/VM and Linux
 - Image level backup and recovery of FCP and FICON-attached DASD (z/VM and Linux)
 - **Independent of z/OS**
 - Backups run on (less expensive) IFLs
 - Recovery in parallel with z/OS
 - Dynamically sharing of tape devices with z/OS is still possible
 - Does not require both systems to be up



Backing Up Linux – Should the Guest Be Up or Down?

- **Linux keeps pending I/O's in memory when possible**
 - Designed for distributed platforms where I/O is assumed to be slow
- **Backup solutions that read Linux DASD volumes but run outside Linux don't have a view of these pending I/Os**
 - Data on DASD may be in inconsistent state due to pending I/Os
 - Restoring data that has been backed up while Linux is running may not yield usable results
 - SYNC command exists to force all I/Os to be processed
 - Linux will immediately start caching new I/Os
 - Dependent on type of application running on Linux
 - Similar to pulling the plug on a distributed Linux server, then restarting it
- **Reduce risk by**
 - “Right-sizing” Linux guests – don't give more memory than needed
 - Recommended for performance reasons anyway
 - Using FLASHCOPY to flash the disks and back up the flashed copy
- **For guaranteed recovery, shut down or suspend the guest before backing it up from z/VM or z/OS**
 - Your experience may (will) vary
 - Evaluate the risk based on the application



Using Suspend Before Backing Up Linux Guests ...

- **SUSPEND/RESUME functions available in most recent Linux on System z distributions**
- **Similar to hibernate function in Windows**
 - Suspend
 - Completes all pending I/Os
 - Writes memory to disk
 - Resume
 - Detects suspend state
 - Reads memory from disk to restore previous state of the guest
- **Requires setup and planning**
 - Verify the effort it worth it for each type of guest
 - Otherwise, use shutdown instead of suspend



... Using Suspend Before Backing Up Linux Guests

■ Setup

- Specify swap disk in zipl.conf
 - Example: resume=/dev/disk/by-path/ccw-0.0.010f-part1
- In list of swap disks
 - Specify this one with lowest priority
 - Use real disk (not VDISK)
 - Needs to have enough room for all memory of Linux guest + swap space

■ Issue suspend via one of the following:

- echo disk > /sys/power/state
- CP SIGNAL SHUTDOWN
 - Must update config file on Linux to specify suspend rather than kill in response to signal shutdown

■ Reference:

- White paper – “Methods to pause a z/VM guest: Optimize the resource utilization of idling servers”
 - <http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101981>



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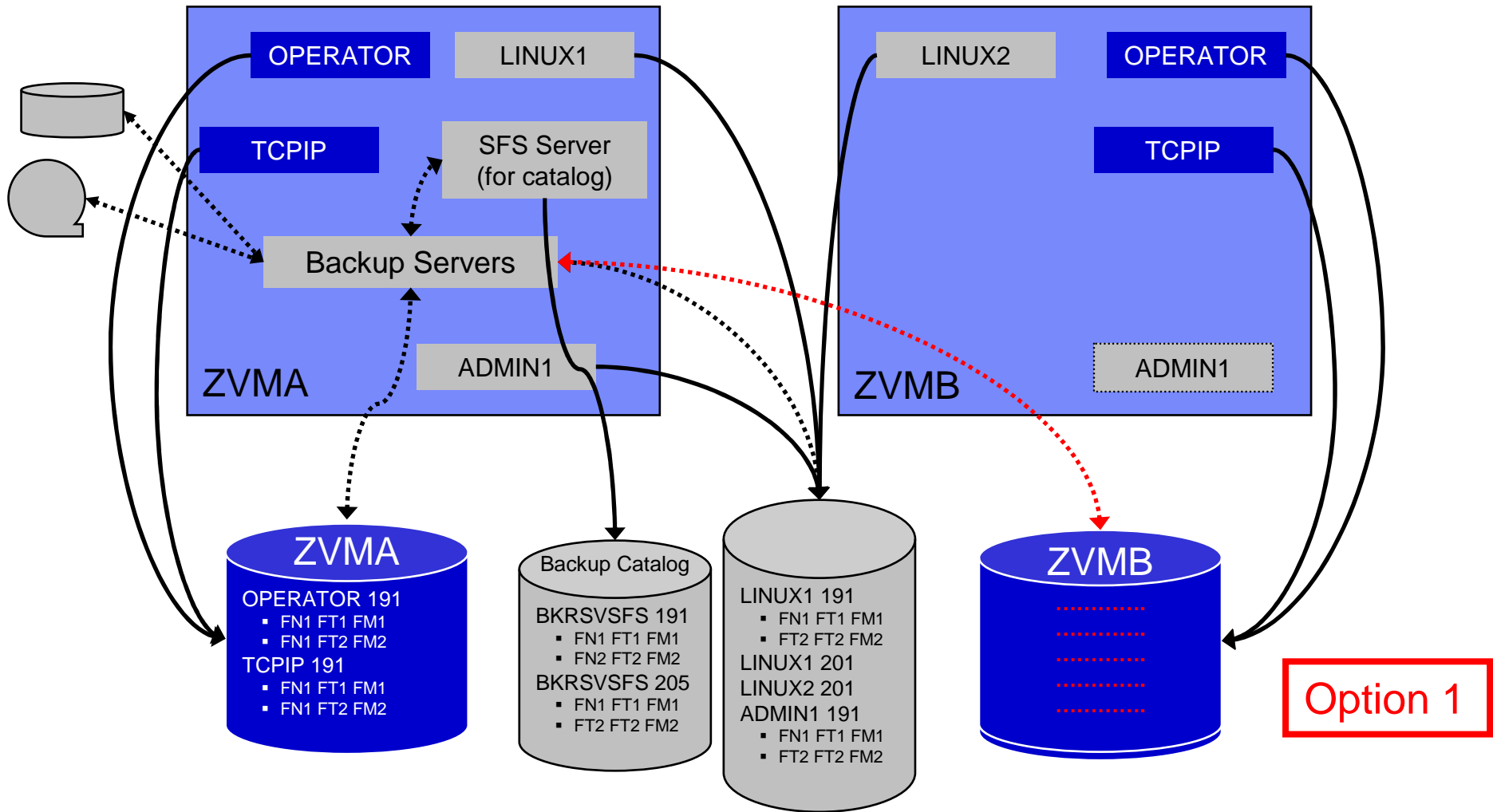
Backing Up and Restore Data in
a z/VM SSI Cluster



Single Config Users and MDisks

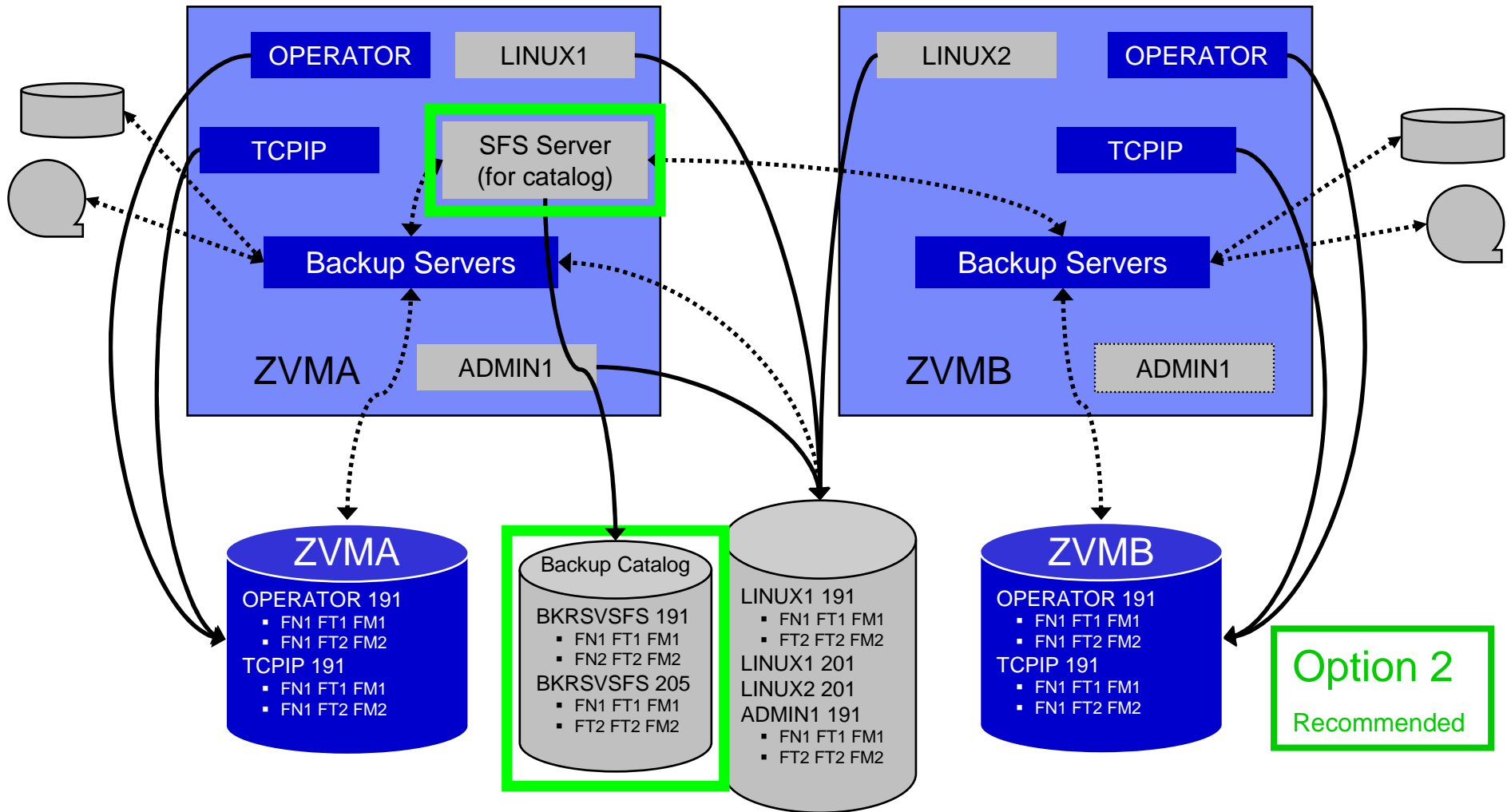
Multiconfig / IDENTITY Users and MDisks

SSI Considerations for Backup and Restore



Single Config Users and MDisks
 Multiconfig / IDENTITY
 Users and MDisks

SSI Considerations for Backup and Restore



SSI Considerations for Backup and Restore

- **Backup service machines on any member can see all minidisks of single configuration users**

- **Backup service machines on any member can see all minidisks of local multiconfiguration (IDENTITY) users**
 - Can not see minidisks of IDENTITY users on other members
 - Can only see DASD volumes (if shared/available) of IDENTITY users on other members

- **Recommendation**
 - Create Backup service machines as IDENTITY users on each member
 - BKRBKUP, BKRCATLG, BKRWRKnn in the case of IBM Backup and Restore Manager
 - Create one single configuration user for SFS server/filepool for the backup catalog
 - Configure as SSI (or REMOTE) in DMSPARMS file
 - Allows single configuration users to restore their own data when logged onto any member
 - Create multiple backup jobs
 - One job for all single configuration users – only run it from one member
 - For multiconfiguration (IDENTITY) users
 - One job per member
 - Use a unique job name on each member
 - Run the member specific job on that member's backup server



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Options for Backing Up and Restoring z/VM and Linux Guests

Managing Backup and Recovery
IBM Backup and Restore Manager for z/VM



Product Overview

▪ Backup

- Requested by administrators
- Full or incremental
- Flexible selection of disks and files to back up
- Review job before submitting for backup

▪ Restore

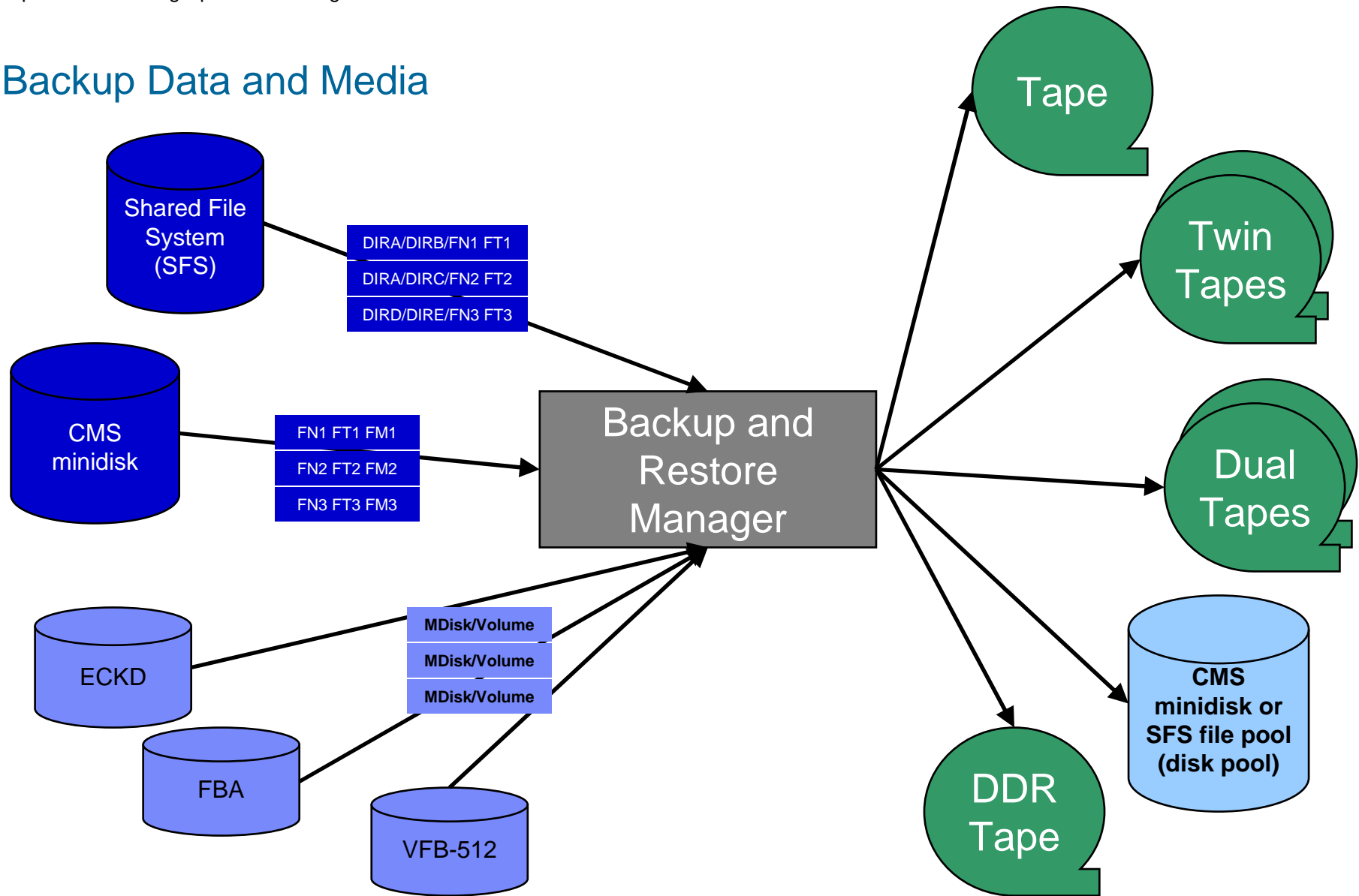
- Restore data via full screen interface or commands
- Performed by users for their own data
- Extending to other users available via exit
- Performed by administrators for any data

Catalog in Shared File System (SFS) – presentation on web site for installation and setup

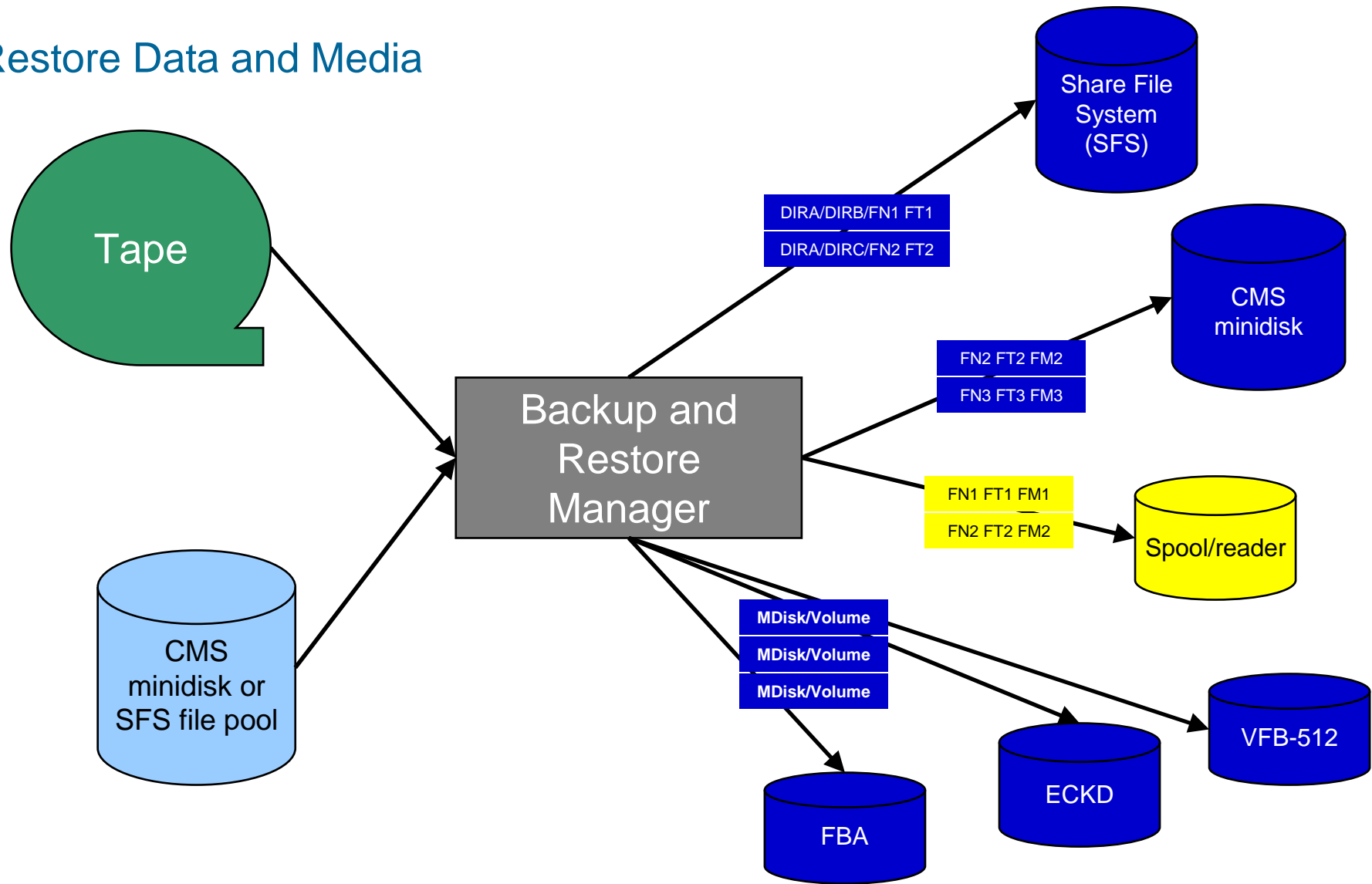
- **Integration with Tape Manager for z/VM**
- **Optional compression of data during backup via exits**
 - Call your own compression algorithm
 - Use IBM provided routine
- **Encryption available via exits**
 - Call your own routine
 - Use vendor-written routine, such as V/Soft Software's Encrypt/Backup for z/VM
 - Use encryption capable tape devices



Backup Data and Media



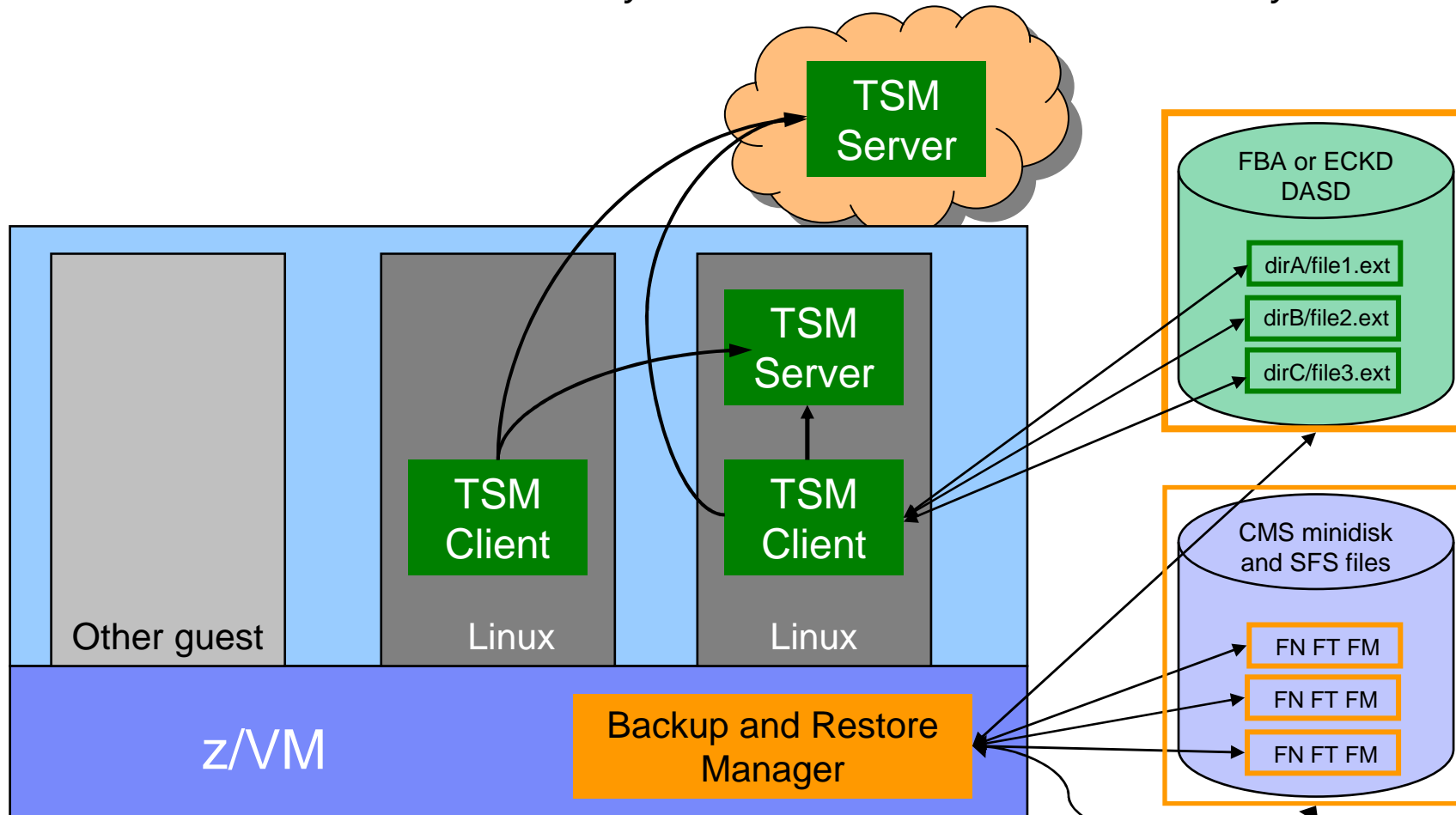
Restore Data and Media



Backup and Restore Manager and Linux Guests

Using Backup and Restore Manager with Tivoli Storage Manager

Choose the solution that meets your needs – or combine for file recovery and DR



Key Benefits

- **System backups available for Disaster Recovery**
 - Option to restore using DDR or Backup and Restore Manager
 - Manage retention of DR backups
 - Retrieve a list of tapes associated with a specific backup
 - Pull list for movement to off-site storage
- **Guest backups available for restoring to a previous state or level**
- **Backups of user data available for**
 - Restoring to a previous state or level
 - Replacing files accidentally erased or corrupted
- **Users restore their own data**
 - No administrator interaction required



Key Benefits Cont...

- **Flexible selection of data to back up**
 - Include/exclude
 - Minidisks, directories
 - Real device addresses or volsers
 - Extents
 - Mask by filename, filetype, or SFS path
 - Review a defined backup job before submission
- **Management of backup data**
 - Retention set as part of the backup job
 - Automatic aging and pruning of the backup catalog
 - Including associated tapes and disk pools
 - View/query the list of expired backups
- **Reduced backup window with concurrent processing**
 - Multiple worker service machines sharing the job
 - Suggest one worker service machine for each available tape drive



Defining a Backup Job

```

/* Include/Exclude definitions */
/*****/
FUNCTION  MEDIATYPE  OWNER      VDEV VOLUME DEVTYPE      START      END      SIZE
-----|-----|-----|---|-----|-----|---|-----|---|-----|
INCLUDE  MINIDISK   *          = *    *    *          = *      = *      = *
EXCLUDE  MINIDISK   *LNX*     = *    *    *          = *      = *      = *
EXCLUDE  MINIDISK   MAINT     = 0123 *    *          = *      = *      = *
EXCLUDE  MINIDISK   MAINT     = 0124 *    *          = *      = *      = *
EXCLUDE  MINIDISK   *          = *    *    *          = *      = END    = *
EXCLUDE  MINIDISK   *          = *    *    *          = *      = *      > 3300
INCLUDE  MINIDISK   MAINT     = 012* *    *          = *      = *      = *

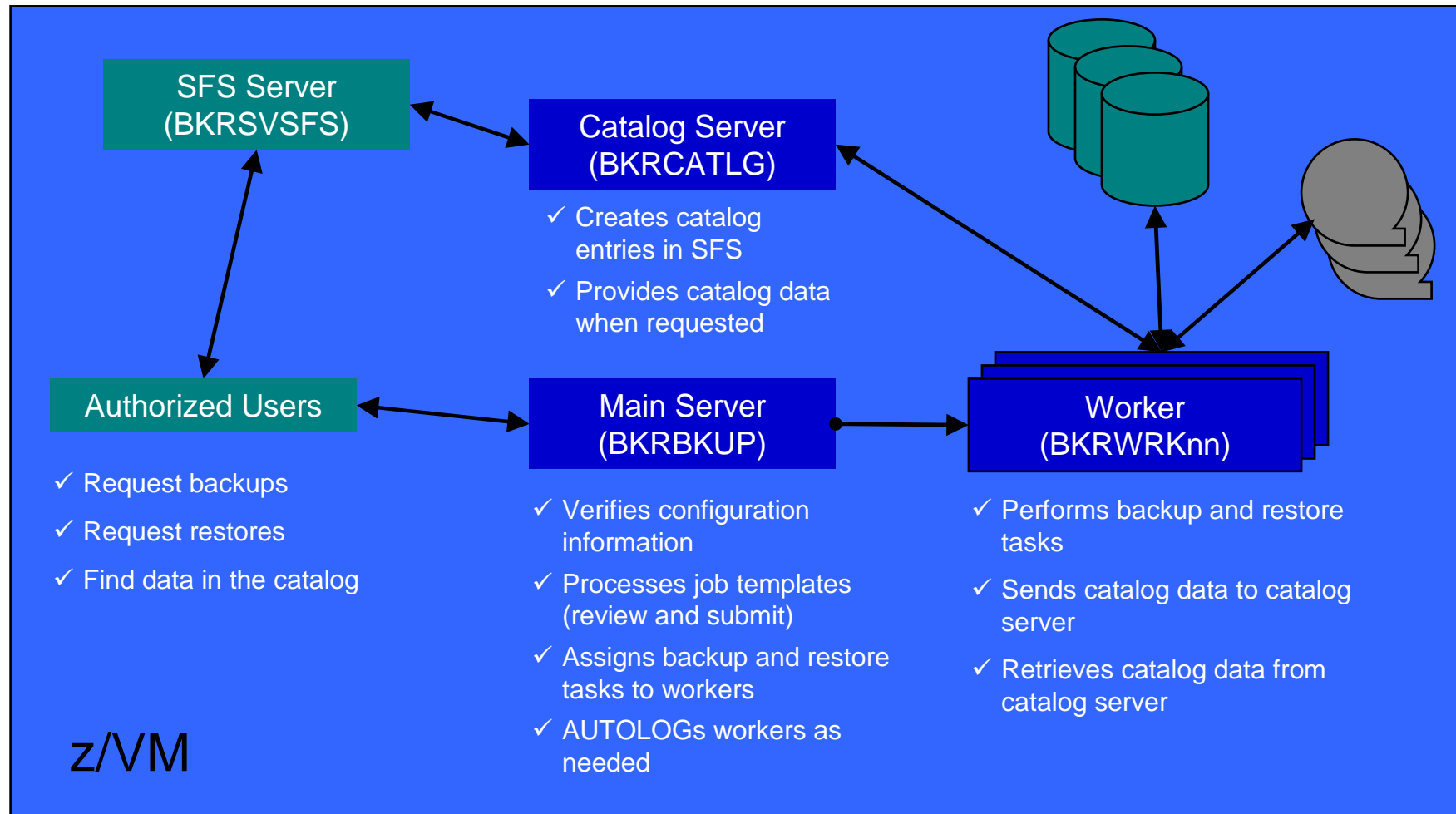
FUNCTION  MEDIATYPE  ADDRESS
-----|-----|-----|
INCLUDE  RDEVICE    900-90F
EXCLUDE  RDEVICE    *B

FUNCTION  MEDIATYPE  VOLSER
-----|-----|-----|
INCLUDE  RDEVVOL    610*

FUNCTION  MEDIATYPE  POOLNAME  OWNER  FS
-----|-----|-----|-----|----|
INCLUDE  SFS        VMSYSU:  *      SFS
EXCLUDE  SFS        VMSYSU:  VMSERVU SFS
    
```



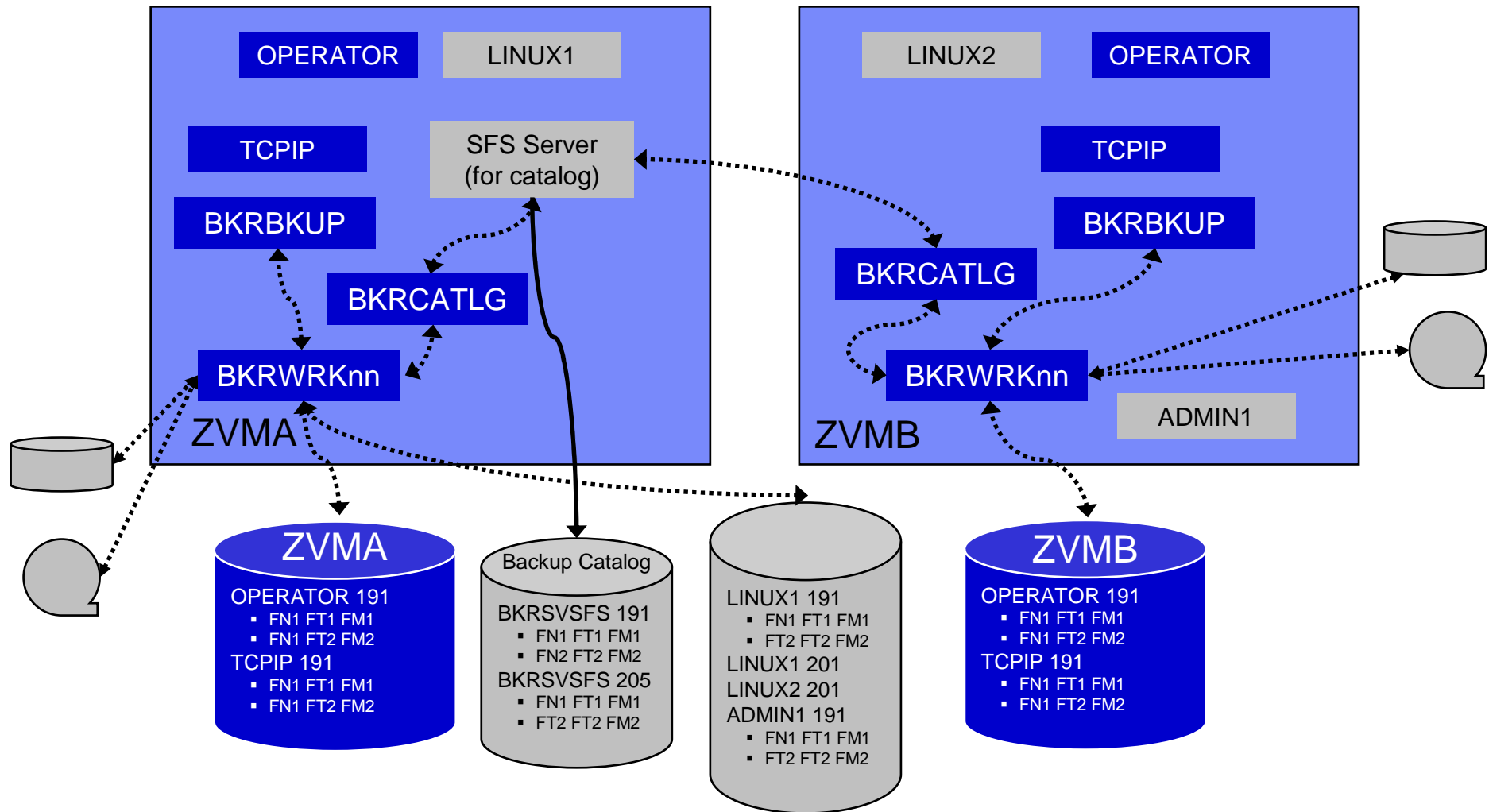
Backup and Restore Manager Architecture – non-SSI



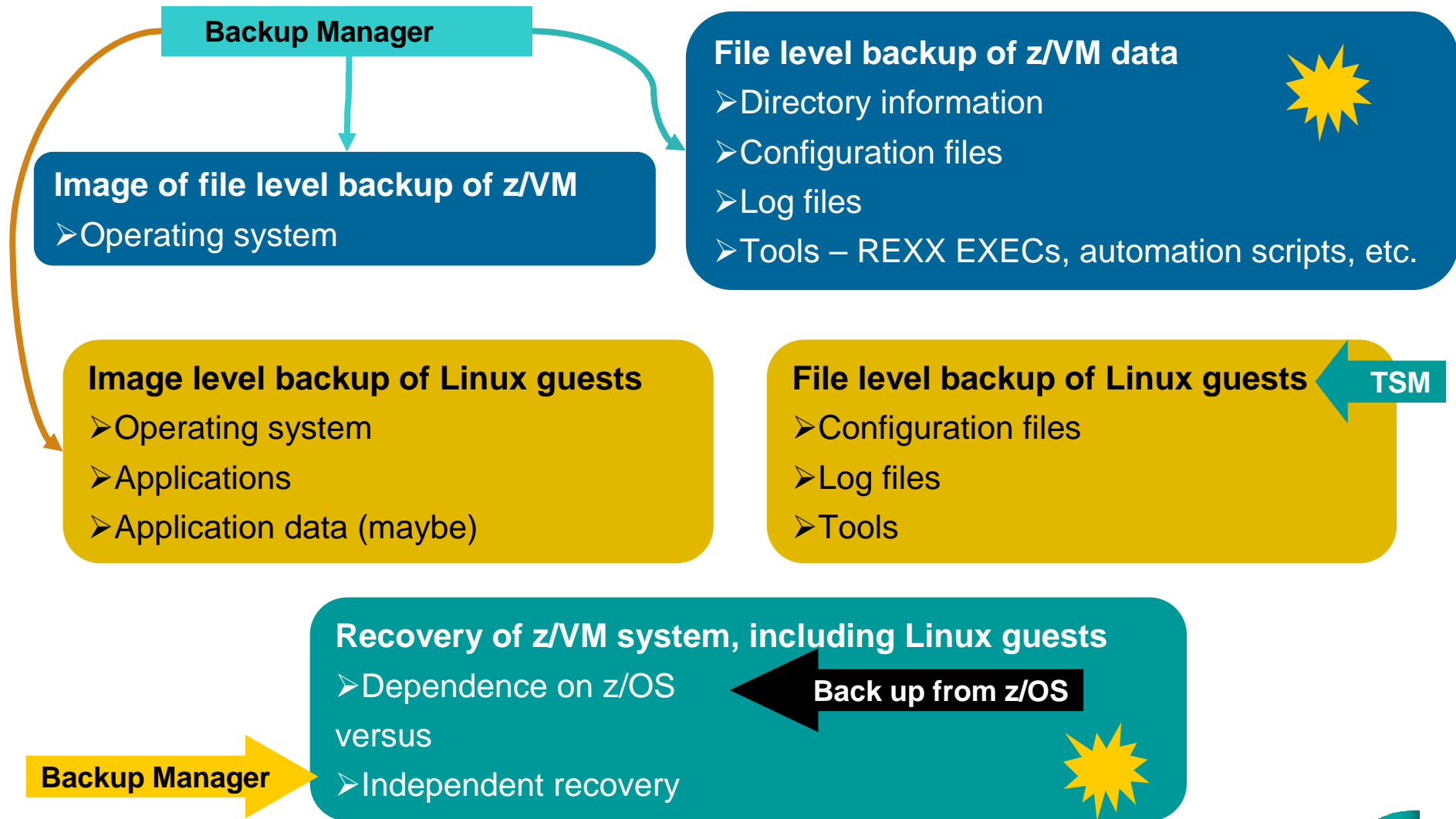
Single Config Users & MDisks

Multiconfig / IDENTITY Users & MDisks

Backup and Restore Manager Architecture – SSI



Recommended Practices – Backup and Recovery



Summary

- **Use Backup and Restore Manager to**
 - Perform file-level backups of z/VM data
 - Perform image level backups of non-z/VM guest data
 - Use Tivoli Storage Manager for file level backups of Linux
 - Perform disaster recovery backups of entire system
 - Easily find and restore data as needed
 - Automatically manage retention of backup data
 - Carefully plan for SSI configurations



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Options for Backing Up and Restoring z/VM and Linux Guests

Managing Tapes & Tape Devices

Tape Manager for z/VM



Product Overview

■ Manage tapes

- Define tapes in a catalog, including:
 - Free or used
 - Retention/expiration information
 - ATL/VTs or manual mount
 - Data Security Erase
- Group tapes together into pools
 - Ownership and access control
 - Media type

■ Manage devices

- Define available devices
 - Dedicated or assignable
- Group devices together into device pools
 - ATL/VTs or manual mount
 - Any other grouping you choose
(read only vs. write, location, etc.)
- Share devices with other systems

■ Manage mount requests

- Volume specific and scratch requests
 - Standard Label
 - Non-Label
 - Bypass Label Processing



Key Benefits

- **Effective management of tapes in ATL or VTS**
 - Granular access control
 - Expiration processing
 - Notification for low threshold for tape resources
 - Interacts with IBM devices through DFSMSRMS on z/VM
 - Interacts with STK devices through STK Host Software Component for VM, or STK VM Client

- **Improved accuracy of manual tape processing**
 - Granular access control
 - Automated interface to Operator for manual mounts
 - Internal label verification at attach/give and detach (SL only)
 - Read/Write verification at attach/give

- **Integrated management of z/OS and z/VM tapes using DFSMSrmm on z/OS**
 - Optionally use RMM on z/OS as the tape catalog for z/VM and z/OS tapes
 - Tapes, access control, and retention managed by the existing RMM catalog
 - Accessible via Tape Manager on z/VM
 - Tapes managed by RMM
 - Devices managed by Tape Manager
 - Not available for STK libraries

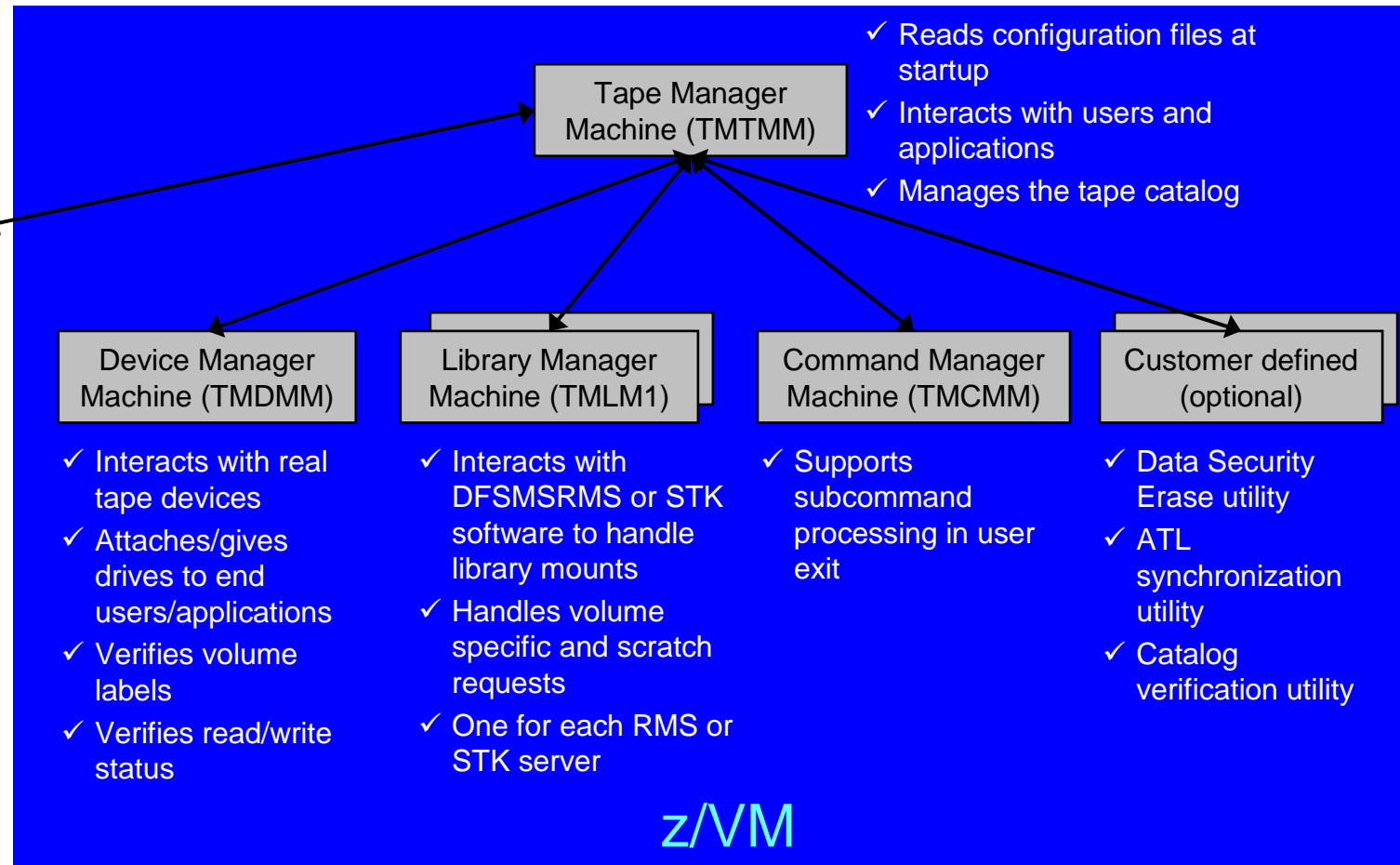


Data Security Erase (DSE)

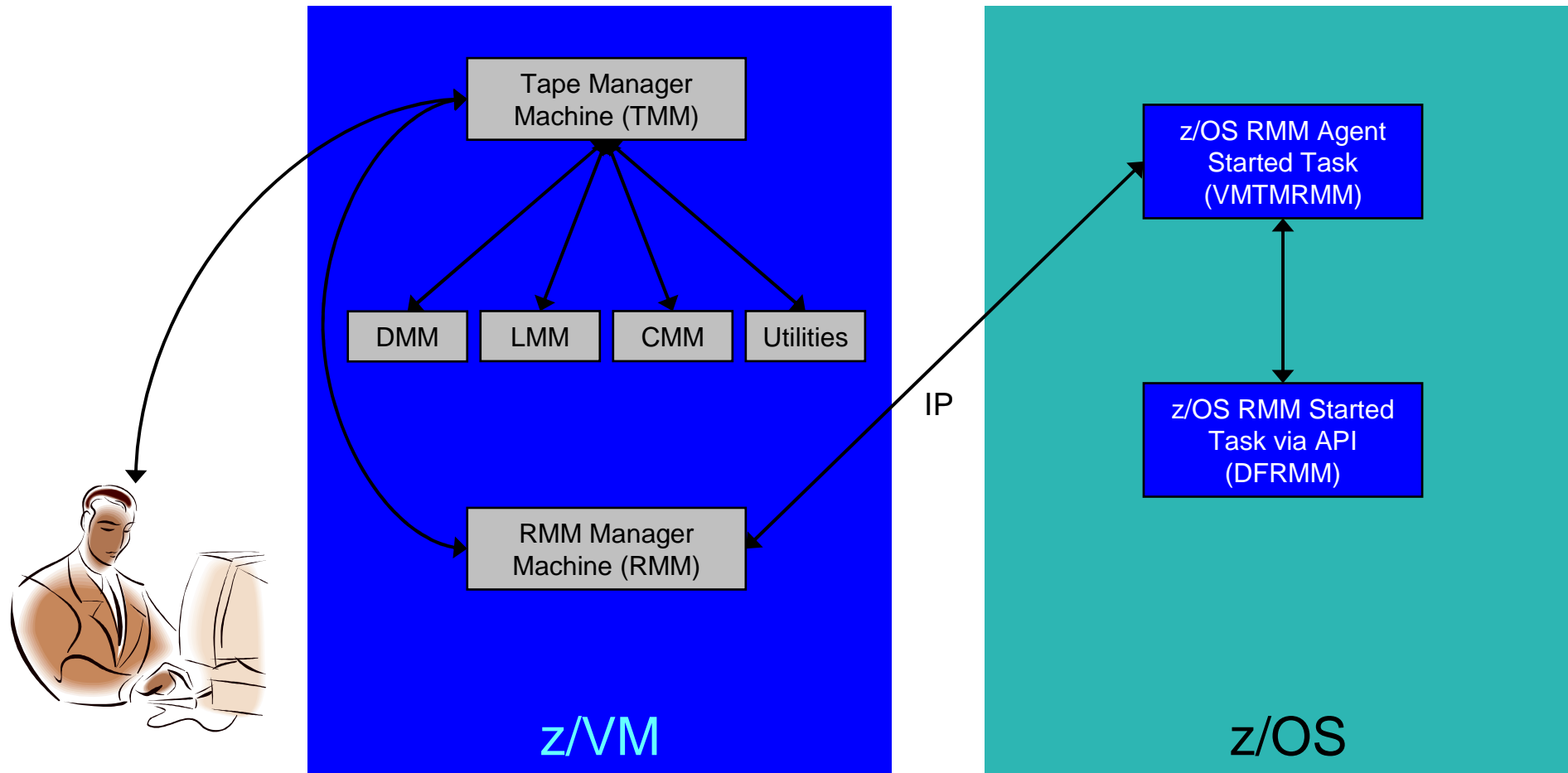
- **Erase (sensitive) data before tape is reused**
- **Option to enable DSE at tape pool or individual tape level**
 - DSE-enabled flag included in each catalog entry
- **DSE-enabled tapes marked as DSE-ready when freed**
- **Tape Manager DSE utility (TMDSE) executed on a separate user ID**
 - Started manually or automatically with Operations Manager
 - Queries the catalog to find all tapes with DSE-ready flag on
 - Mounts each tape
 - Verifies volume label if possible
 - Configuration option to perform DSE on NL tapes or not
 - Erases tape
 - Turns off DSE-ready flag in catalog
 - Tape is now available for scratch unless its HOLD flag is on



Tape Manager in Standard Mode



Tape Manager in RMM Mode

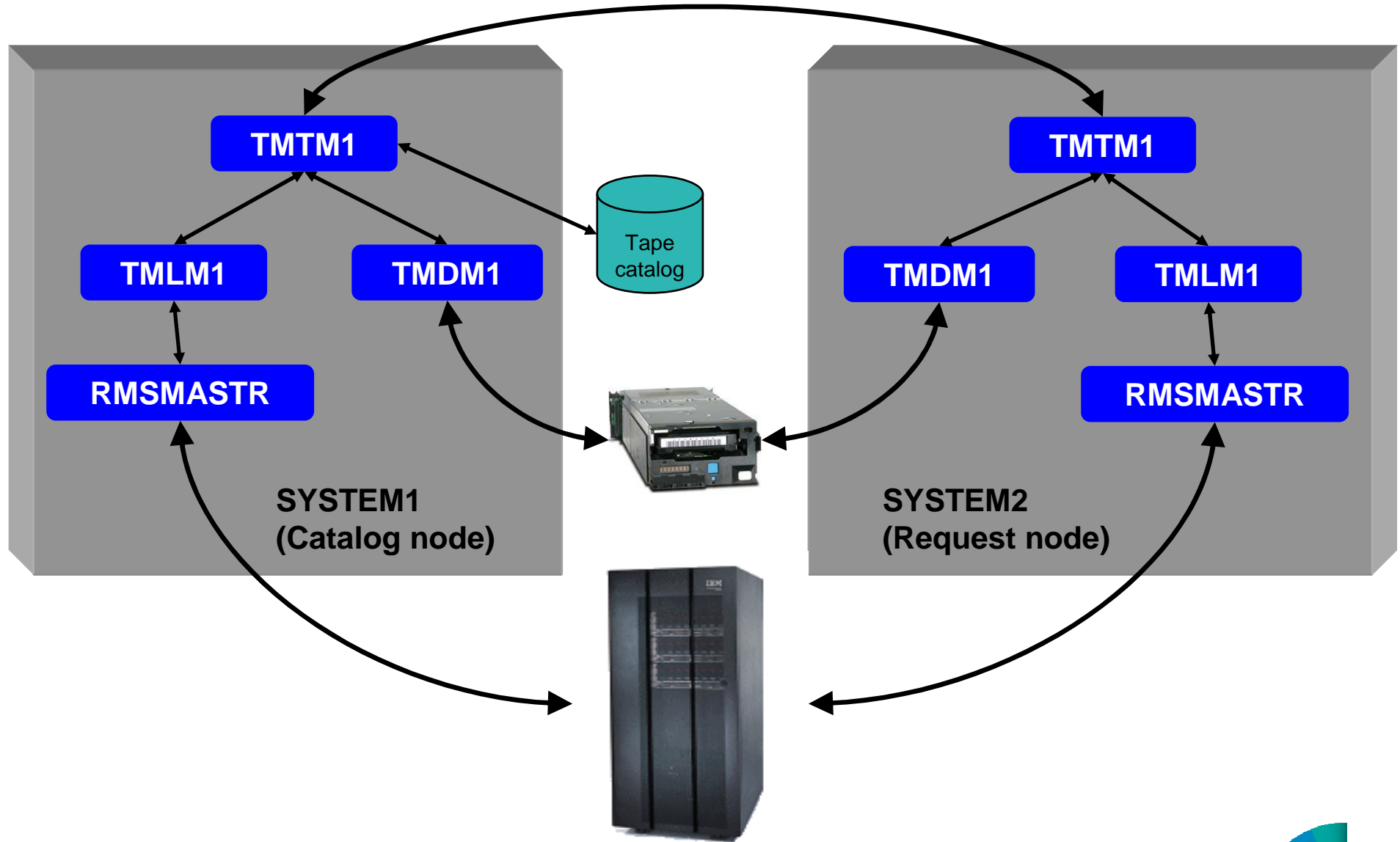


Support for One Tape Catalog Across Multiple z/VM Systems

- **One “catalog node”**
 - Responsible for the tape catalog contents
- **Multiple “request nodes”**
 - Manage requests on the local system
 - Communicate with catalog node to read or update catalog data
- **One catalog used by multiple z/VM systems**
 - No longer need to create a catalog on each z/VM system, each with its own range of volsers
 - All z/VM systems share one catalog
- **IP used for communication between systems**



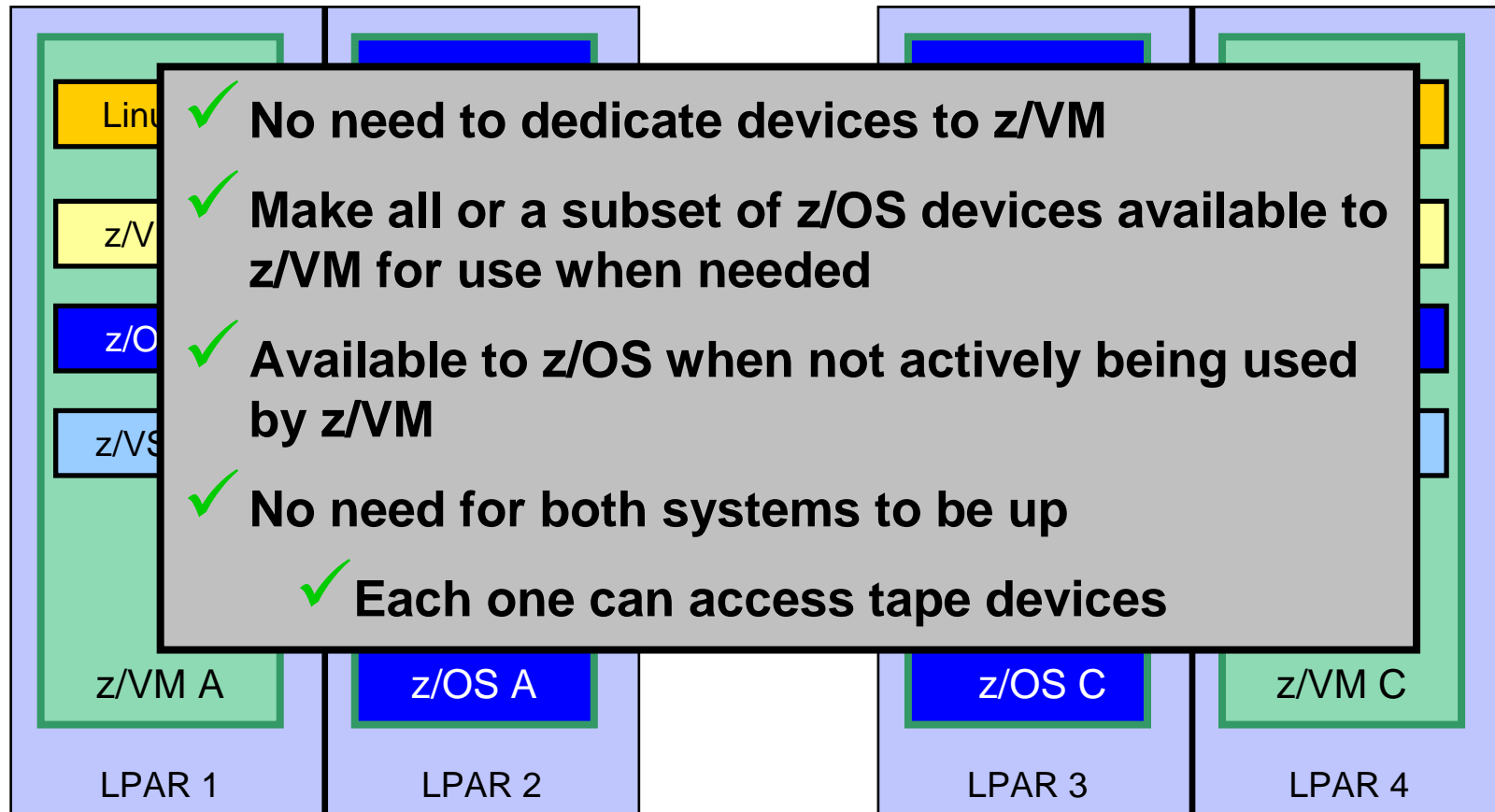
Communication Between Service Machines and Systems



Dynamically Share Tape Devices

- z/VM systems with IBM Tape Manager
- z/OS systems with IBM Automated Tape Allocation Manager
- Linux systems with software supporting mainframe tape devices

* No multi-user attach support



- ✓ No need to dedicate devices to z/VM
- ✓ Make all or a subset of z/OS devices available to z/VM for use when needed
- ✓ Available to z/OS when not actively being used by z/VM
- ✓ No need for both systems to be up
- ✓ Each one can access tape devices

z196

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Summary

- **Use Tape Manager to**
 - Manage and share devices
 - Manage tape volumes
 - Access control
 - Retention
 - Data Security
 - Improve accuracy of mount requests

Summary

- **Management of z/VM systems with Linux guests requires monitoring and management tools**
- **IBM solutions exist**
 - OMEGAMON XE on z/VM and Linux
 - zSecure Manager for z/VM
 - Operations Manager for z/VM
 - Tape Manager for z/VM
 - Backup and Restore Manager for z/VM
 - Archive Manager for z/VM
- **Demos are available**



Reference Information

- **Product Web site**
 - Start at <http://www.ibm.com/software/stormgmt/zvm/>
 - Product pages include
 - Publications
 - Pre-requisites
 - Announcements
 - Presentations
 - White papers
 - Support
- **e-mail**
 - Mike Sine, sine@us.ibm.com, Technical Marketing
 - Tracy Dean, tld1@us.ibm.com, Product Manager
- **White paper and presentation on Backup and Restore Manager website (Library page)**
 - Getting Started with Installation, including SFS server creation and installation of Backup Mgr
 - z/VM V6.2 (and later)
 - z/VM V5.4 and earlier
 - Backing up z/VM and Linux on System z – Tivoli Storage Manager vs Backup Manager



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Options for Backing Up and Restoring z/VM and Linux Guests

Demonstration Scenarios



Backup Demos Available (Including Automation)

- A. Perform an incremental backup**
- B. Find and restore a file from the backup catalog**
- C. Backup and restore single and multiconfiguration users in an SSI environment**
- D. Automatically shut down, back up, and restart a Linux guest**
- E. Suspend and resume a Linux guest**
- F. Reviewing a disaster recovery backup**
- G. Reviewing other ways to find data in the backup catalog**



Scenario A: Performing an Incremental Backup

- **Administrator previously performed a full backup**
- **Incremental job defined, using last full backup as its base**
- **Change a file on user's A-disk**
- **Submit incremental job for review**
- **Submit incremental job for backup processing**
- **Use Operations Manager to monitor backup servers**



Scenario B: Restoring Files from Backup

- **Full and incremental backups performed previously**
- **User accidentally erases or corrupts a file**
- **User restores the file from backup**
 - Full screen interface to see all files available in backup
 - Including multiple “versions” of the same file
 - Filters and sorting available to easily find the needed file
 - Request restore directly to disk or to reader
- **No administrator intervention required**



Scenario C: Backup and Restore Single and Multiconfiguration Users in SSI

- **Two member SSI cluster**
 - TEST7SSI, TESTCSSI
- **Three backup jobs for full backups**
 - USERFULL – all single configuration users across the SSI cluster
 - Always run from TEST7SSI (required (for now))
 - IDSSI7FL – all multiconfiguration (IDENTITY) users on TEST7SSI
 - Always run from TEST7SSI (required)
 - IDSSICFL - all multiconfiguration (IDENTITY) users on TESTCSSI
 - Always run from TESTCSSI (required)
- **Three similar jobs for incremental**
- **Restore files in multiple ways**
 - Single configuration users
 - Restore to disk or reader from any member of the cluster
 - Multiconfiguration users
 - Restore to disk from the local member
 - Restore CMS files to reader from any member



Scenario D: Scheduling Image Backups of Linux Guests

- **Initiated or scheduled by Operations Manager**
 - Schedule defined in Operations Manager to initiate backups at specific times/intervals
 - Action associated with each schedule
 - Linux guest is shut down
 - Operations Manager watches for shutdown complete
 - Sends request to Backup and Restore Manager to back up the specific DASD/minidisks associated with the guest
 - Alternatively use FLASHCOPY to copy DASD, restart guest, then perform backup of copy of DASD.
 - Operations Manager watches for backup complete message
 - Restarts Linux guest
 - Guest is down for minimum time required for backup



Scenario E: Suspend and Resume a Linux Guest

- **From DEMOADMN, view the console of the Linux guest**

```
gomcmd opmgrm1 viewcon user(rhel6d)
```

- **From MAINT, suspend a Linux guest using CP SIGNAL SHUTDOWN**

```
cp signal shutdown rhel6d within 90
```

- **On DEMOADMN, note the guest suspending and logging off**
- **From MAINT, resume a Linux guest**

```
cp xautolog rhel6d
```

- **On DEMOADMN, note the guest resuming**



Scenario F: Reviewing a Disaster Recovery Backup

- **Create a backup job based on sample provided**
- **Perform image backup of DASD volumes for Disaster Recovery (DR) purposes**
 - Can include z/VM and Linux guests
- **Output of backup is a DDR tape**
 - Compatible with DDR for restore at recovery site
- **Submit DR job for review**
- **Review output of review processing**



Scenario G:

Reviewing data in the Backup catalog for recovery

- **Various backup jobs have previously been submitted and completed**
- **Full screen interfaces available for searching the backup catalog and finding data available for recovery**
 - BKRLIST
 - Useful when looking for a specific file or set of files owned by a specific user ID
 - Users with ADMIN authority beware of size
 - Use parameters to narrow the search
 - BKRUSER
 - Useful when looking for backup jobs associated with a specific user ID
 - BKRJOB
 - Useful when looking for backup jobs by job name
 - BKRVOL
 - Useful when looking for backup jobs associated with a specific DASD volume



Options for Backing Up and Restoring z/VM and Linux Guests

धन्यवाद

Hindi

多謝

Traditional Chinese

감사합니다

Korean

Спасибо

Russian

Gracias

Spanish

شكراً

Arabic

Thank You

English

Obrigado

Brazilian Portuguese

Grazie

Italian

Danke

German

多谢

Simplified Chinese

Merci

French

நன்றி

Tamil

ありがとうございました

Japanese

ขอบคุณ

Thai

Enterprise2013

