

# Backup Strategies for z/VM and Linux on zSystems or LinuxONE

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# Agenda

- Positioning
- Recommended practices and available options
- Backing up and restoring data in a z/VM SSI cluster
- Summary
- Additional information in handouts for your reference
  - Starting on slide 36
  - IBM Backup and Restore Manager for z/VM
  - IBM Tape Manager for z/VM
  - Additional demos

# IBM z/VM Management Solutions

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

# IBM Infrastructure Suite for z/VM and Linux

- IBM bundle/suite
- Tools needed to manage the z/VM and Linux on z Systems infrastructure
  - OMEGAMON XE on z/VM and Linux
  - Operations Manager for z/VM
  - Backup and Restore Manager for z/VM
  - Spectrum Protect (aka Tivoli Storage Manager) Extended Edition
  - Optional separately priced features
    - Tape Manager for z/VM
    - Cloud Infrastructure Center
- Discounted price as a bundle
- Website:
  - <https://www.ibm.com/products/infrastructure-suite-zvm-and-linux>



# 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.

- Recover from operational errors
- Long term retention

## Image level backup of (some?) Linux virtual servers

- Operating system
- Applications
- Application data (maybe)

## File level backup of Linux virtual servers

- Configuration files
- Log files
- Tools

## Recovery of z/VM system, including Linux virtual servers

- Dependence on z/OS  
versus
- Independent recovery

# Backups for **Short Term Recovery**

## Image level backup of the z/VM hypervisor

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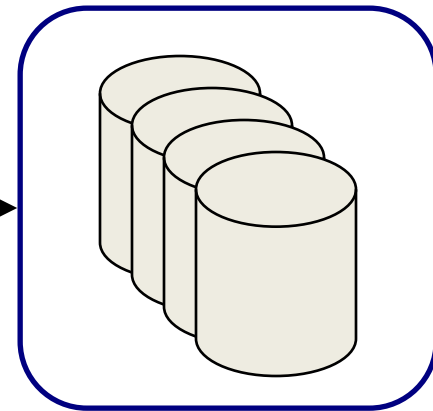
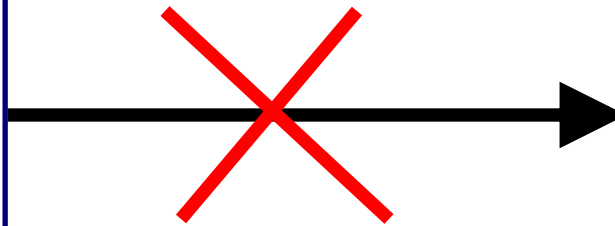
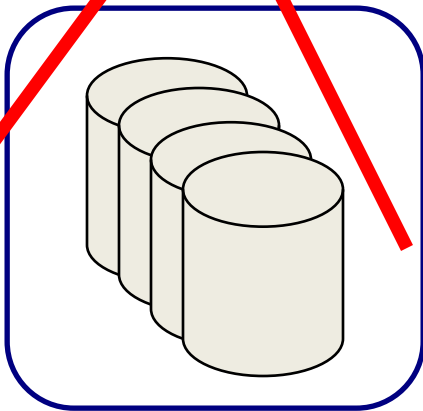


# Disk or DASD Replication

Location A



Location B



# Replication and Backup/Recovery are **NOT** the Same

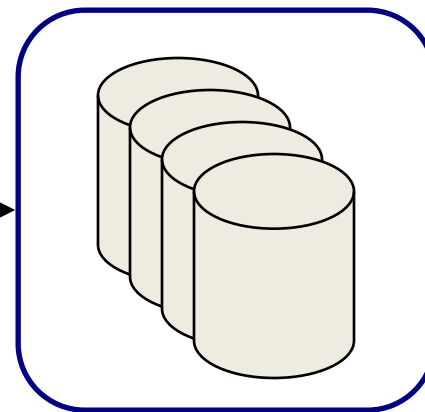
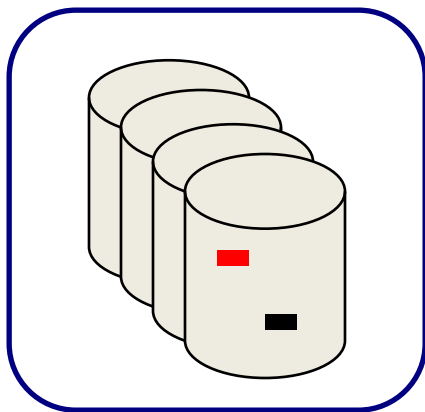
Location A



Location B



Does not address operational recovery needs



# Available Options: Image Level Backup & Recovery

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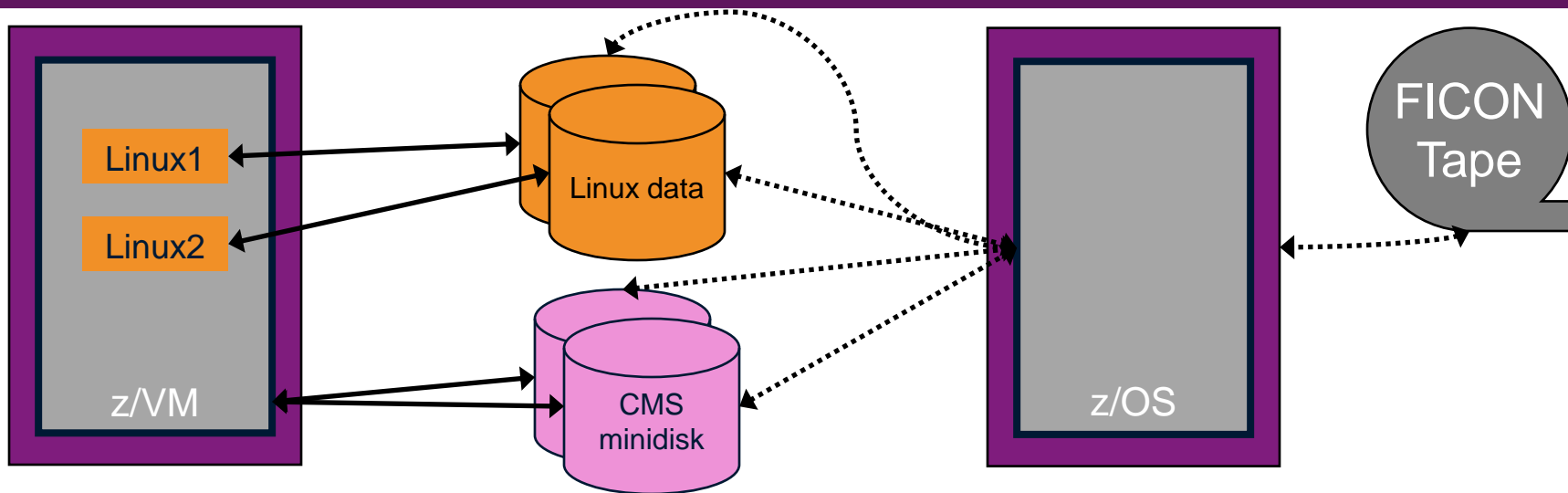
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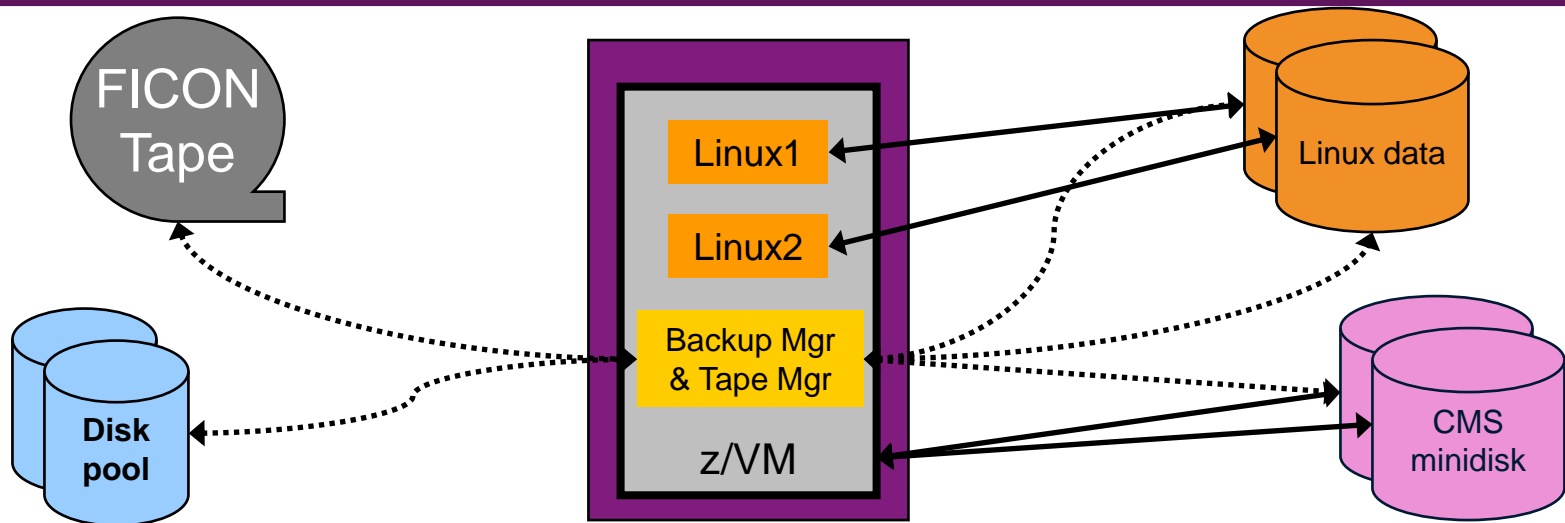
## Image Level Backup/Recovery of z/VM and Linux Virtual Servers from z/OS



### • Image level backup and recovery of DASD volumes from z/OS

- Existing z/OS procedures and tools in place - fast
- Use existing tape infrastructure
- Does not include FCP-attached DASD
- Does not include image level backups at minidisk level (only at volume level)
- Linux should be down
  - Flashcopy can minimize downtime
- Dependent on z/OS for recovery and DR
  - 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
  - Using/breaking “white space”
  - Impacts pricing if using Tailored Fit Pricing

# Image Level Backup/Recovery of z/VM and Linux Virtual Servers from z/VM



## Image level backup and recovery of DASD volumes from z/VM

- **Low risk if z/VM is running – but not zero risk**
- **Includes FCP-attached DASD (defined to z/VM as EDEVICES)**
  - **Guest must be logged off if volumes DEDICATED to guest**
- **Includes image level backup at minidisk or guest level**
- **Linux should be down**
  - Flashcopy can minimize downtime
- **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 – plus tape software if backing up to physical tape or virtual tape**
  - 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

## Do I Need to Perform Image Back Ups of **Every** Linux Virtual Server ?

- It depends ...
- Is each guest image unique?
  - Are required logs or other output stored within each guest?
  - Is configuration of each guest automated?
- Can a new guest be recreated from a golden image more easily than restoring it?

*Is backing up just the “golden images” sufficient?*

# Available Option: z/VM File Level Backup & Recovery

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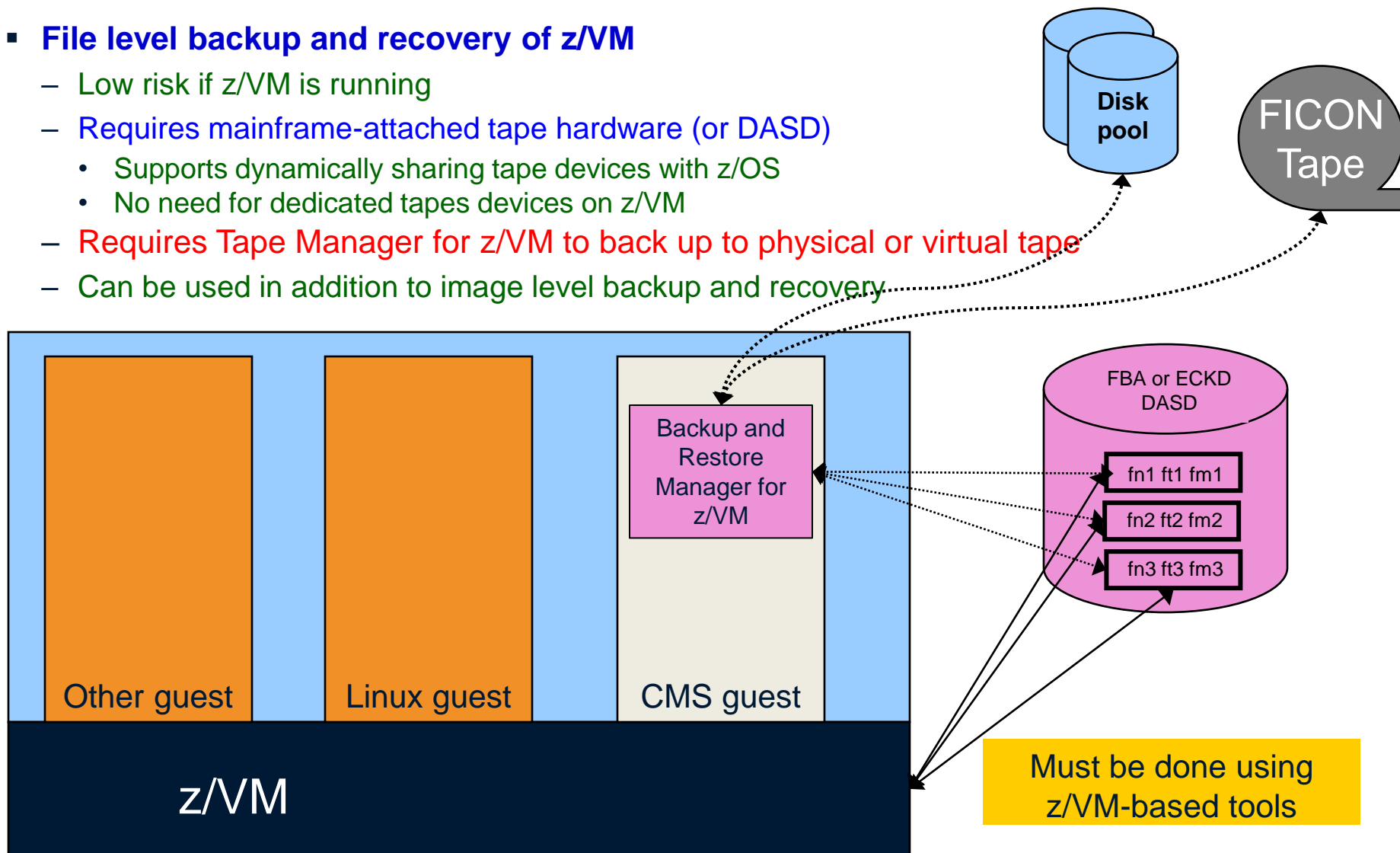
## Recovery of z/VM system, including Linux virtual servers

- Dependence on z/OS
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# 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
- Requires Tape Manager for z/VM to back up to physical or virtual tape
- Can be used in addition to image level backup and recovery





# Available Option: Linux File Level Backup & Recovery

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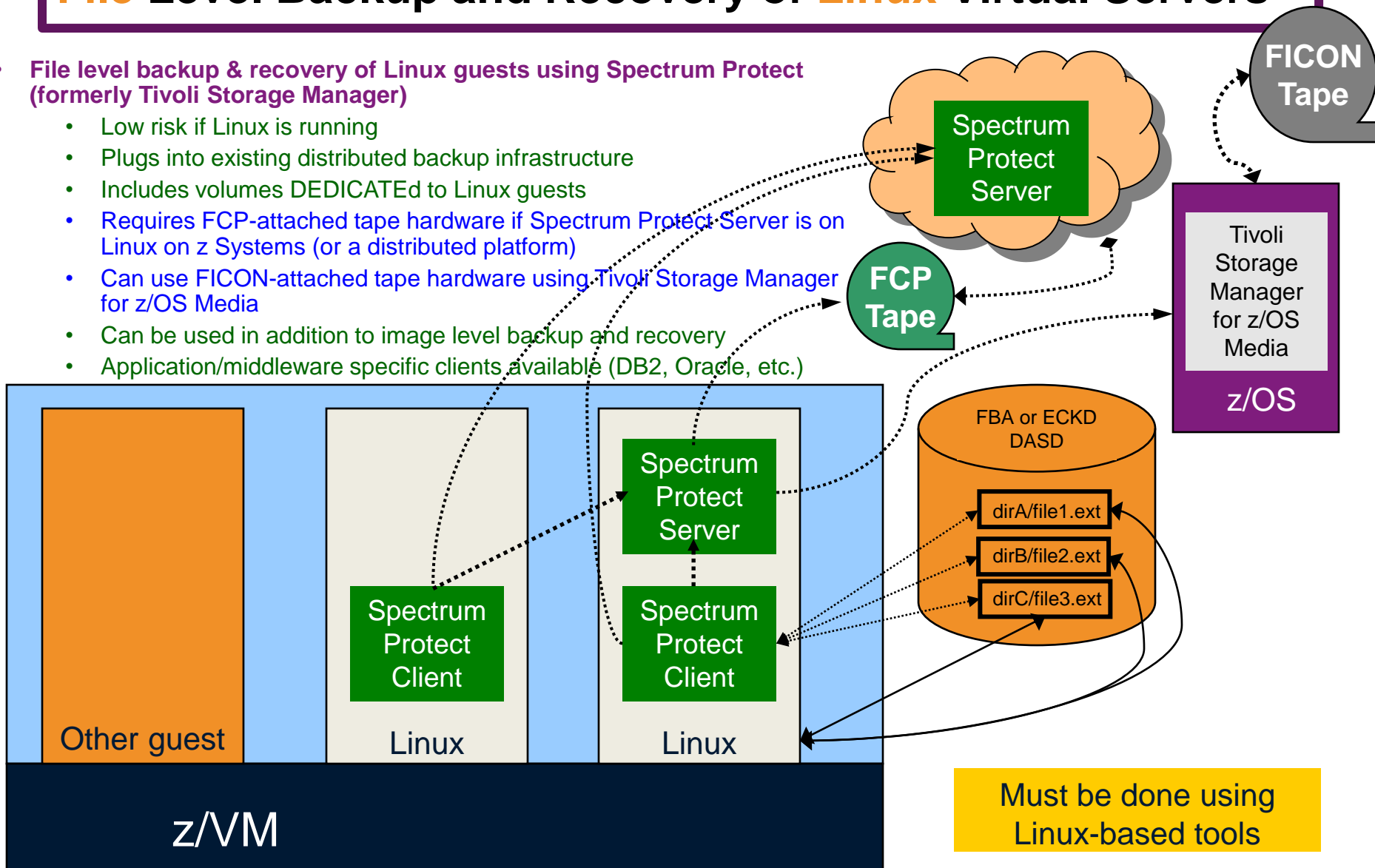
## Recovery of z/VM system, including Linux guests

- Dependence on z/OS
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# File Level Backup and Recovery of Linux Virtual Servers

- File level backup & recovery of Linux guests using Spectrum Protect (formerly Tivoli Storage Manager)

- Low risk if Linux is running
- Plugs into existing distributed backup infrastructure
- Includes volumes DEDICATED to Linux guests
- Requires FCP-attached tape hardware if Spectrum Protect Server is on Linux on z Systems (or a distributed platform)
- Can use FICON-attached tape hardware using Tivoli Storage Manager for z/OS Media for z/OS Media
- Can be used in addition to image level backup and recovery
- Application/middleware specific clients available (DB2, Oracle, etc.)



## What About DDR?

- DDR - DASD Dump Restore utility in z/VM
- Basic ability to copy data from one location to another
  - Command driven
  - Specify a source location
  - Specify a target location (disk or tape)
- Useful when copying/cloning minidisks or volumes
  - No ability to do file level backup/recovery
  - Be aware of “changing data” on active disks or volumes
- Very limited in terms of production level backup and recovery

## What About DDR?

- Advantages of Backup and Restore Manager for z/VM over DDR
  - File level backup and recovery
  - Incremental backups of z/VM (CMS and SFS) files
  - Cataloging of what has been backed up
    - Including full screen interfaces for finding backup data and restoring it
  - Automated expiration processing of catalog data and backup data on disk or tape
  - Flexibility to define a job once using wildcarding
    - Future invocations of that job will back up any new data that meets the criteria
  - Invoke multiple service machines to share the backup task
    - Completes the backup sooner
  - Integration with a tape management system
    - No need to manage tapes and tape mounts manually

## Quick Summary - 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 z Systems 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**
    - Does not support FCP-attached DASD
    - Does not support image level backup at minidisk level
    - File level recovery of z/VM or Linux data
      - 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

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

- 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 volumes and minidisks (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
  - **Separate short term and long term recovery options**
    - Short term retention and recovery at the image level
    - Long term retention and recovery at the file level

## 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 do not 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
    - Best case is a crash consistent backup
      - Generally worse – backup occurs over a period of time
      - DASD A backed up, then while backing up DASD B, DASD A changes again

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

- **Reduce risk** by
  - “**Right-sizing**” Linux guests – do not 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
  - Use Flashcopy to reduce the downtime
- **Additional notes**
  - For DASD volumes DEDICATED to Linux guests
    - Backups can not be done while guest is running
      - Volume is attached to guest
    - Backups can be done while guest is down
      - Requires some extra steps – see upcoming white paper
      - Steps depend on ECKD vs SCSI



## Using **Suspend** Before Backing Up Linux Guests ...

- SUSPEND/RESUME functions in Linux
- 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 is worth it for each type of guest
  - Otherwise, use shutdown instead of suspend

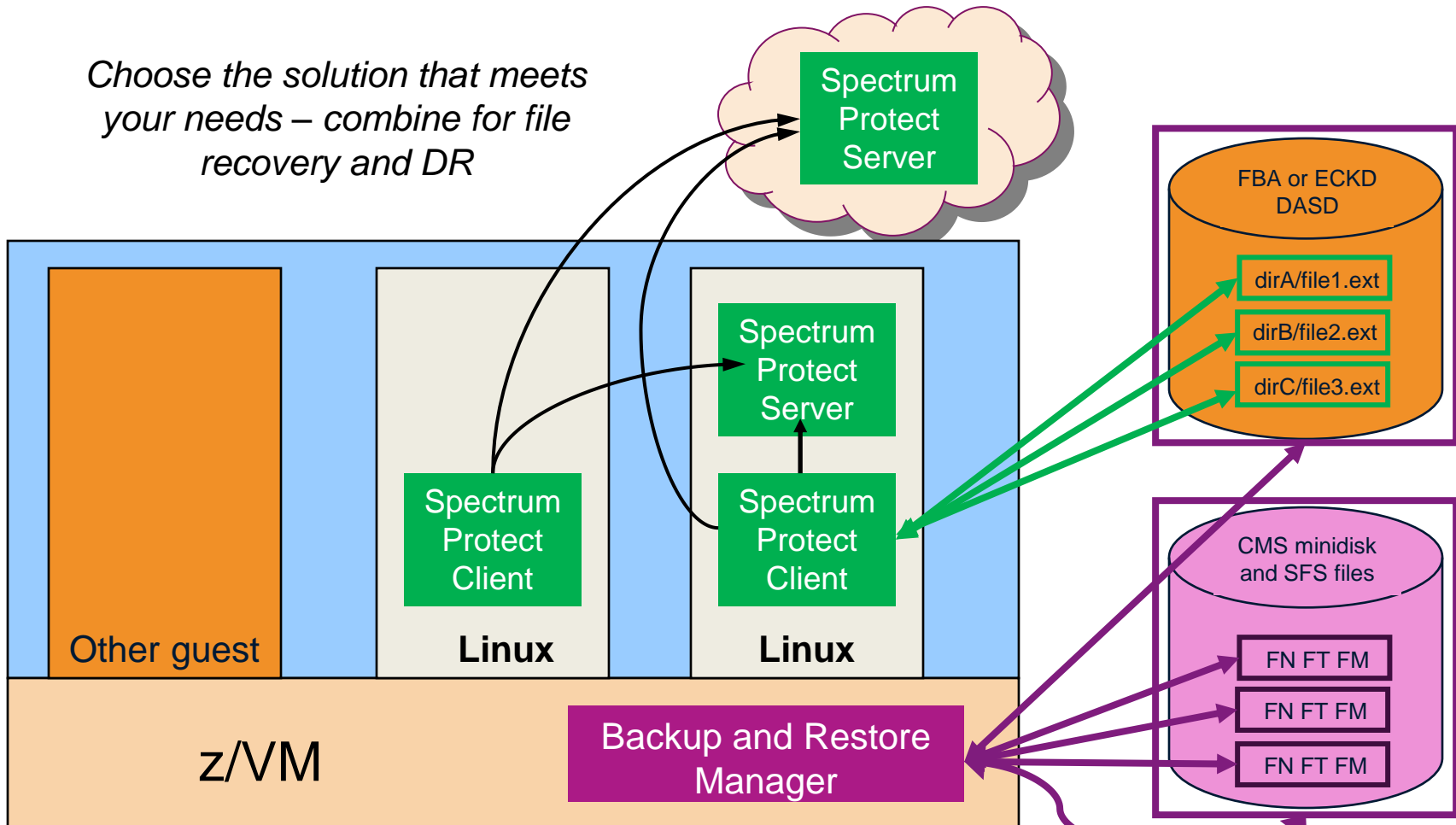


# Summary

# Summary of Backup Solutions

## Using Backup and Restore Manager with Spectrum Protect

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



# Recommended Practices – Backup and Recovery

## Backup and Restore Manager for z/VM

```
graph TD; A[Backup and Restore Manager for z/VM] --> B[Image level backup of z/VM]; A --> C[Image level backup of (some?) Linux guests]; A --> D[File level backup of z/VM data]; A --> E[File level backup of Linux guests]; F[Spectrum Protect] --> E;
```

### Image level backup of z/VM

- Operating system

### Image level backup of (some?) Linux guests

- Operating system
- Applications
- Application data (maybe)

### File level backup of z/VM data

- Recovery from operational issues
  - Directory information
  - Configuration files
  - Tools – REXX EXECs, automation scripts
- Long term retention
  - Log files

### File level backup of Linux guests

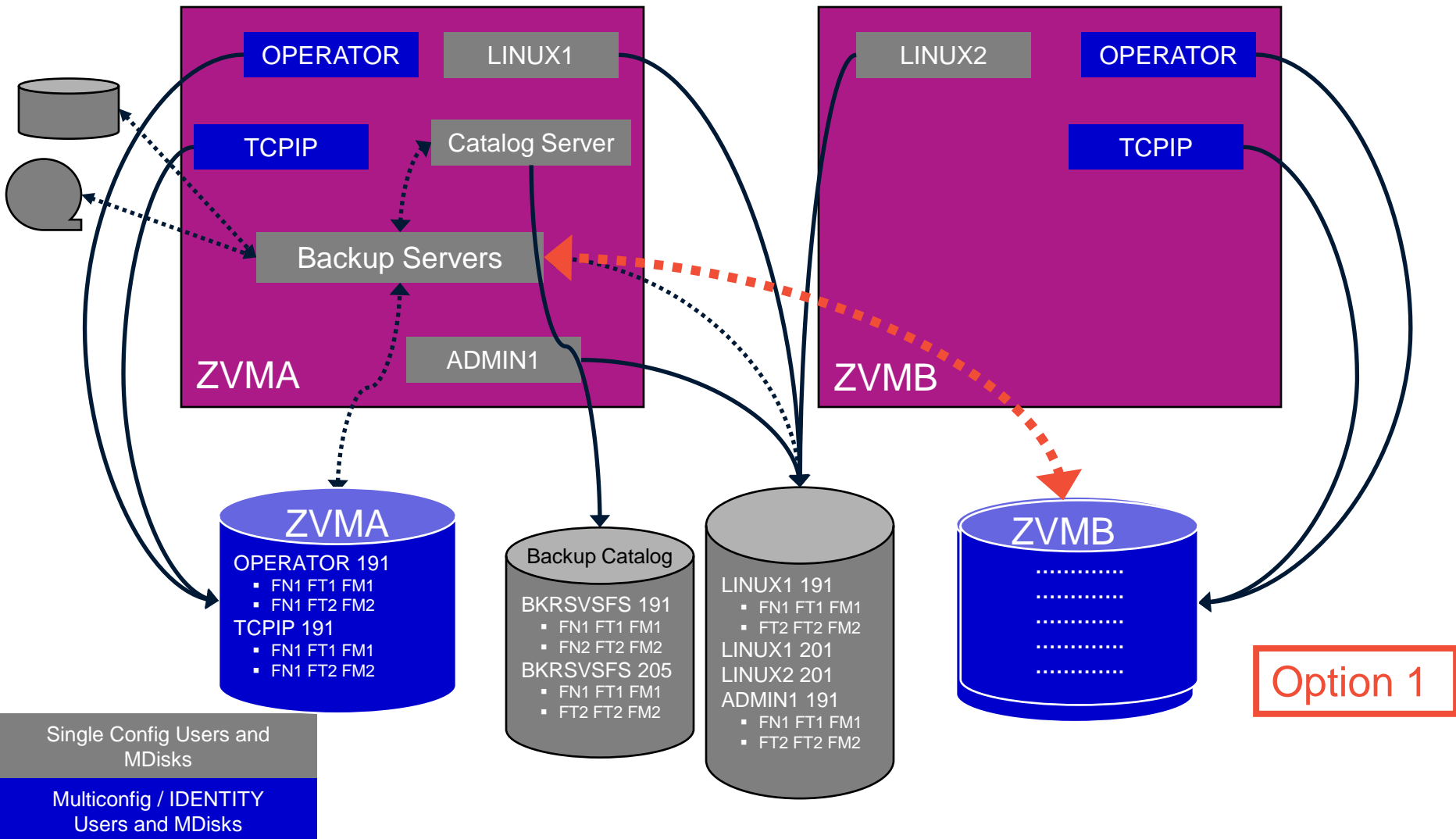
- Configuration files
- Log files
- Tools

Spectrum Protect

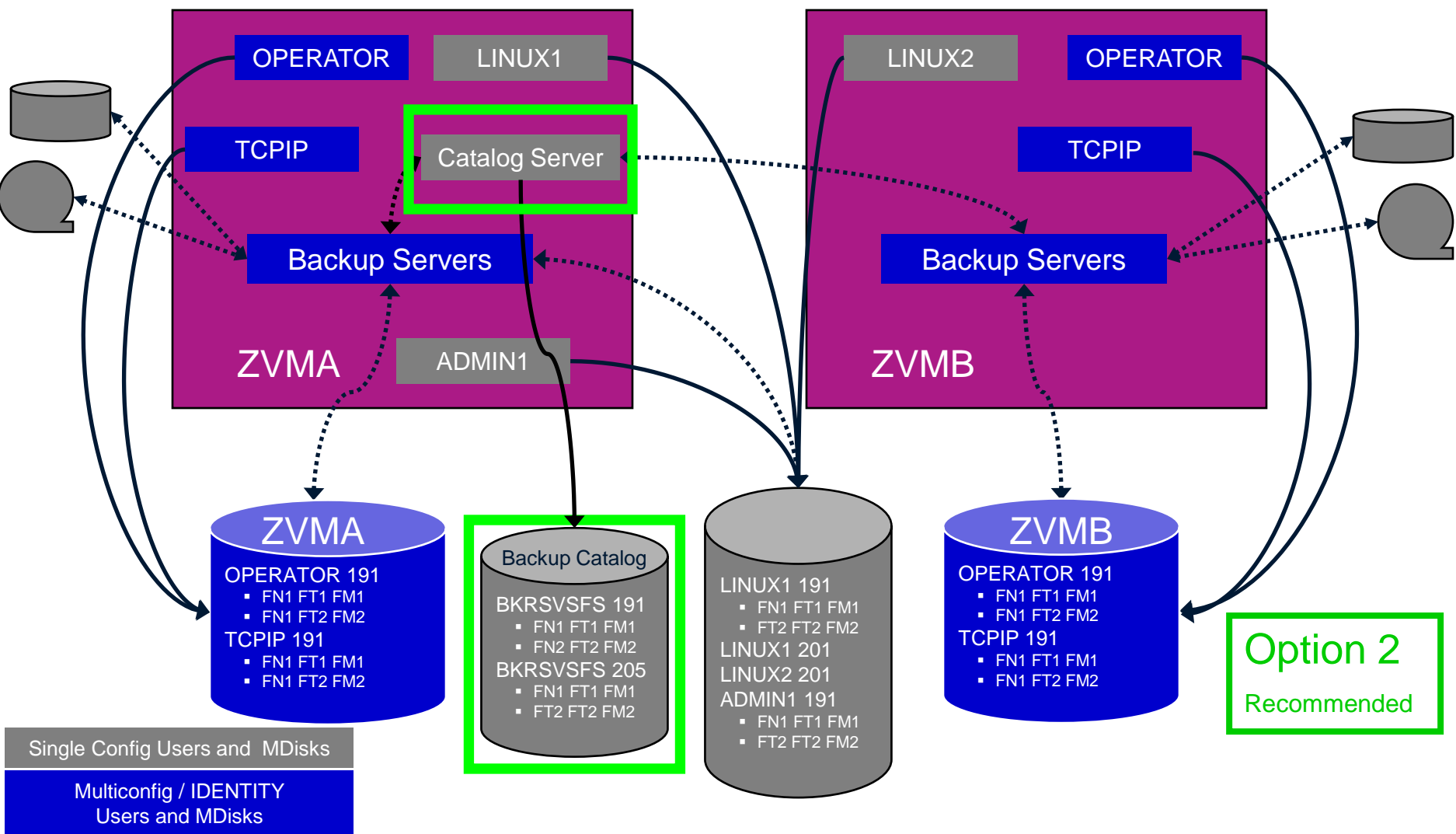


# Backing up and Restoring Data in a z/VM SSI Cluster

# SSI Considerations for Backup and Restore



# 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



# SSI Considerations for Backup and Restore

## ➤ Recommendation

- Create Backup **service machines** as **IDENTITY** users on each member
  - For IBM Backup and Restore Manager: BKRBKUP, BKRCATLG, BKRWRKnn
- Create **one backup catalog for the entire cluster**
  - Place the backup catalog in SFS
    - One single configuration user for SFS server/filepool (e.g. BKRSVSFS)
    - Configure as SSI (or REMOTE) in DMSPARMS file
  - Allows **admins to see all backup data from all members** of the cluster in one view
  - Allows single configuration users to restore their own data when logged onto any member

# SSI Considerations for Backup and Restore

## ➤ Recommendation

- Create separate backup jobs for single configuration users vs IDENTITY users
  - Backup job(s) for **single configuration users** – only run them from one member
    - Running them on other members will just back up the same data twice
  - 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



## Additional Information

See additional slides in handouts

IBM Backup and Restore Manager for z/VM

IBM Tape Manager for z/VM

Additional Demos

# Reference Information

- Product Web site
  - Start at <https://www.ibm.com/products/backup-and-restore-manager-for-zvm>
  - Start at <https://www.ibm.com/products/tape-manager-for-zvm>
  - Product pages include
    - Publications
    - Pre-requisites
    - Presentations
    - White papers
    - Support
- e-mail
  - Tracy Dean, tld1@us.ibm.com, Product Manager
- White papers and presentations on Backup and Restore Manager and Tape Manager websites (Resources tab)
  - Getting Started with Installation, including SFS server creation and installation of Backup Mgr
    - z/VM V6.4 and later
  - Backing up z/VM and Linux on IBM Z – Spectrum Protect vs Backup Manager
  - Pausing (including SUSPENDING) a Linux Guest
  - Enabling the FACILITY Class for Use by RACF for z/VM
- **IBMVM mailing list:** <http://listserv.uark.edu/archives/ibmvm.html>

धन्यवाद

Hindi

多謝

Traditional Chinese

감사합니다

Korean

Спасибо

Russian

Ndzi khense ngopfu

Tsonga

Gracias

Spanish

شكراً

Arabic

Thank You

English

Obrigado

Brazilian Portuguese

Grazie

Italian

Danke

German

多谢

Simplified Chinese

Merci

French

Ke a leboha

Tswana

நன்றி

Tamil

ありがとうございました

Japanese

ขอบพระคุณ

Thai



# Demonstration Scenarios

## Backup and Recovery – Demos Available

- A. Performing an incremental backup
- B. Restoring files from backup
- C. Back up and restore single and multiconfiguration users in an SSI environment
- D. Scheduling image backups of Linux guests
- E. Suspend and resume a guest as part of backup
- F. Pause and resume a long-running backup for system IPL
- G. Reviewing a disaster recovery backup
- H. Reviewing data in the backup catalog for recovery