

End-to-End Data Protection and Legacy Tape Drives

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Introduction



- End-to-End Data Protection proposals have raised concerns in the tape industry:
 - Operation with legacy Tape Drives.
 - Operation with legacy Copy Managers.
 - Will protection-enabled file systems receive what they expect after a restore operation using these legacy devices?
- The cases that follow explore <u>some</u> of the possibilities.

Caveats



- Assumptions
 - Protection-enabled disc drives
 - Legacy tape drives
 - Host-owned App. Tag
 - LBA-locked Ref. Tag

• Where's the DIF (created)?

- Lump Application, drivers, and HBA together
 - Minimise cases
 - A bit of fiction
 - SCSI mini-port driver may be shared between disc and tape
 - HBA may be shared between disc and tape
- Consider Application/Driver/HBA
 - Protection-enabled
 - Legacy





- Server Backup and Restore
 - Protection-enabled Backup-Restore App/Driver/HBA
 - Legacy Backup-Restore App/Driver/HBA
- Copy Manager Backup and Restore
 - Legacy Copy Manager
 - Protection-enabled Copy Manager
- Copy Manager Backup; Server Restore
 - Legacy Copy Manager

Server Backup and Restore Protection-enabled Backup-Restore App/Driver/HBA





- Server applies DIF on Write to disc
 - Sets original Ref. Tag & App. Tag
- Backup Read from disc:
 Server strips DIF
- Backup Write to tape:
 - Legacy Write (due to legacy drive)
 - No DIF on tape

Server Backup and Restore Protection-enabled Backup-Restore App/Driver/HBA





- Restore:
 - Legacy Read from tape (due to legacy drive)
 - Restore App/Driver/HBA recreates DIF in Write to disc.

- LBA and Ref. Tag may differ from original values:
 - Re-mapping through File System
 - Image Restore with new base LBA
- App. Tag may differ from original value.
 - How does Restore App/Driver/HBA know its original value?

Server Backup and Restore Protection-enabled Backup-Restore App/Driver/HBA





- Disc Read after Restore:
 - LBA and Ref. Tag match new location,
 - App. Tag matches recreated value.

- LBA Ref. Tag coherence,
- LBA & Ref. Tag may not match original, and
- App. Tag may differ from original value.





- Server applies DIF on Write to disc
 - Sets original Ref. Tag & App. Tag
- Backup Read from disc:
 - a. Application controls CDB
 - Backup app uses legacy Read
 - Data returned excludes DIF
 - b. Driver/HBA controls CDB
 - Server strips DIF
- Backup Write to tape:
 - Backup App/Driver/HBA uses
 Legacy Write
 No DIF on tape





- Restore Read from tape:
- Legacy Read (due to legacy Restore App/Driver/HBA)
- Restore Write to disc
- a. Application controls CDB
 - Restore app uses legacy Write
 - Default DIF, or
 - CHECK CONDITION
- b. Driver/HBA controls CDB
 - Driver/HBA recreates DIF in Write to disc.





- Consequences (a)
 - If disc cannot insert default DIF, Restore will fail (due to CHECK CONDITION).

- More Consequences
 - LBA and Ref. Tag may differ from original values:
 - Default DIF (a. Application controls CDB)
 - Re-mapping through File System (b. Driver/HBA controls CDB)
 - Image Restore with new base LBA (b)
 - App. Tag may differ from original value.
 - Default DIF (a)
 - How does Driver/HBA know its original value? (b)





- Disc Read after Restore:
 - LBA and Ref. Tag match new location,
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- LBA Ref. Tag coherence,
- LBA & Ref. Tag may not match original, and
- App. Tag may differ from original value.

Copy Manager Back-up and Restore Legacy Copy Manager





- Server applies DIF on Write to disc
 Sets original Ref. Tag & App. Tag
- Backup Read from disc:
 Copy Manager uses legacy Read
 Data returned excludes DIF
- Backup Write to tape:
 - Copy Manager uses Legacy WriteNo DIF on tape



Copy Manager Back-up and Restore Legacy Copy Manager





- Restore Read from tape:
 - Copy Manager uses legacy Read,
 - Data returned excludes DIF
- Restore Write to disc:
 - Copy Manager uses legacy Write,
 - Default DIF, or
 - CHECK CONDITION

- Consequences
 - If disc cannot insert default DIF, Restore will fail (CHECK CONDITION).
 - LBA and Ref. Tag may differ from original values (Default DIF)
 - App. Tag may differ from original value (Default DIF)

Copy Manager Back-up and Restore Legacy Copy Manager





- Disc Read after Restore:
 - LBA and Ref. Tag match due to default values,
 - App. Tag matches default value.

- Consequences
 - LBA Ref. Tag coherence,
 - LBA & Ref. Tag may not match original, and
 - App. Tag may equal default value.

Copy Manager Backup and Restore Protection-enabled Copy Manager





- Equivalent to Server Backup and Restore with protection-enabled Backup-Restore App/Driver/HBA.
- Copy Manager does everything that the protection-enabled Backup-Restore App/Driver/HBA would do.

Copy Manager Back-up; Server Restore Legacy Copy Manager; Protection-enabled Server





- Server applies DIF on Write to disc
 Sets original Ref. Tag & App. Tag
- Backup Read from disc:
 Copy Manager uses legacy Read
 Data returned excludes DIF
- Backup Write to tape:
 - Copy Manager uses Legacy WriteNo DIF on tape



Copy Manager Back-up; Server Restore Legacy Copy Manager; Protection-enabled Server





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Conclusions



- Protection-enabled disc devices that generate CHECK CONDITION on legacy WRITE commands can cause a Restore operation to fail.
- Use of legacy Copy Manager may result in:
 Loss of original LBA-locked Reference Tag, and
 Loss of Host-owned Application Tag.
- If the application controls the CDB used, use of a legacy Backup-Restore application may result in:
 - Loss of original LBA-locked Reference Tag, and
 - Loss of Host-owned Application Tag.





- Proposal to remove the option of a protection-enabled device responding with CHECK CONDITION to a legacy Write command.
- Investigation (along with others I hope) of additional options to SBC Read and Write commands to allow transfer of disc DIF values to tape using legacy tape drives.





• Thanks to Kevin Butt of IBM for his thorough review of this material on short notice.

