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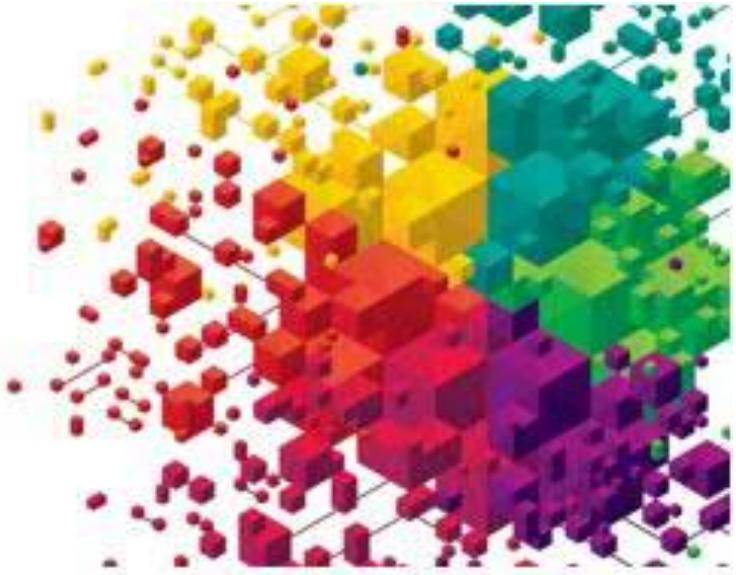
Database Cloning with Tivoli Storage FlashCopy Manager

DOAG Cloning Day
21. September 2015
Leipzig



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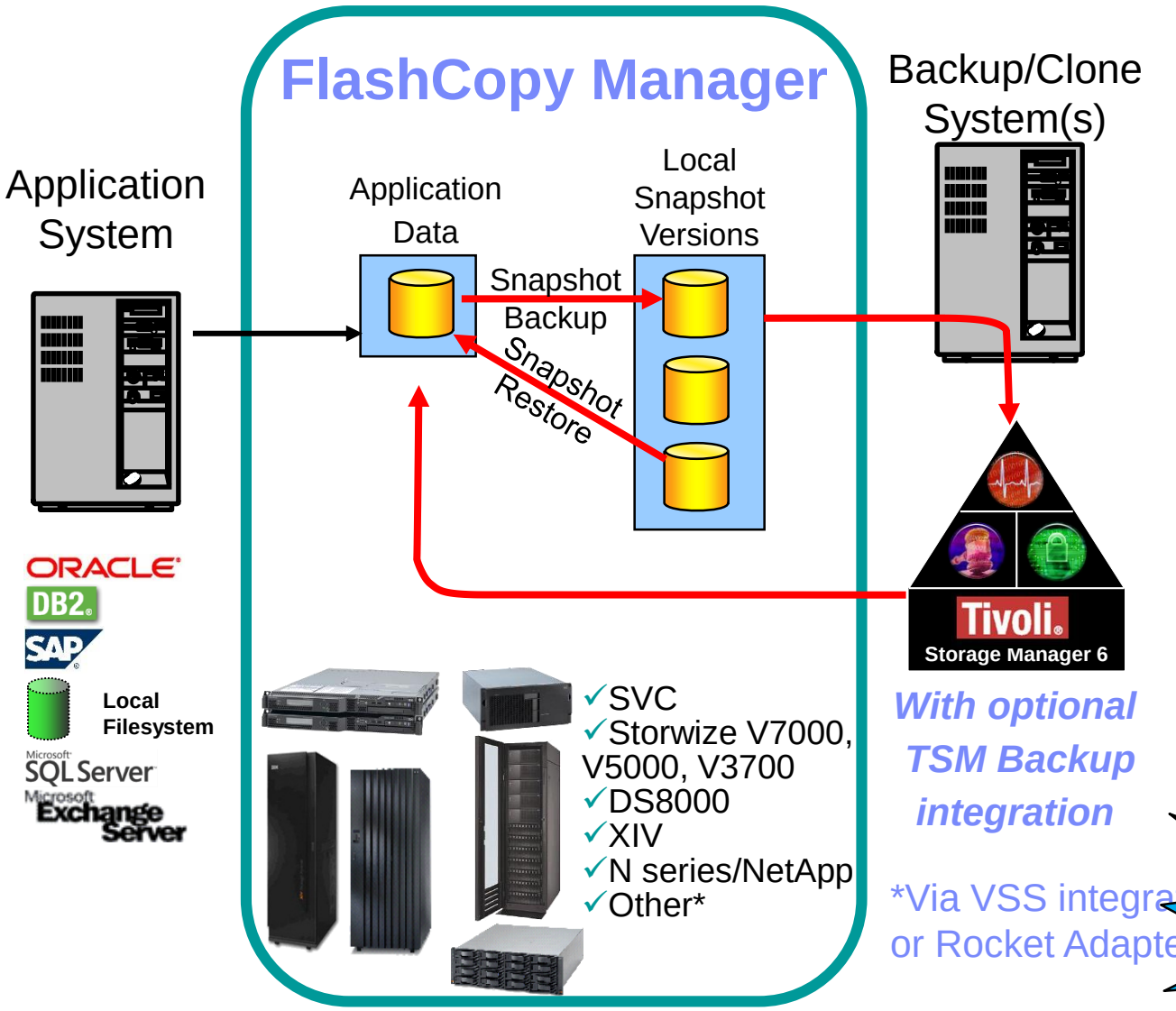
Agenda

- Tivoli Storage FlashCopy Manager Overview
- FlashCopy and Snapshot Technologies
- FlashCopy Manager Functions
  - Database backup/restore and cloning
  - Prerequisites
- Performing backups, restores, and cloning
- Live demonstration
- Summary

Flashcopy Manager Solution Overview



- ✓ Online, near instant snapshot backups with minimal performance impact
- ✓ High performance, near instant restore capability
- ✓ Integrated with IBM Storage Hardware
- ✓ Integrates with Storage & AIX LVM mirroring
- ✓ Database cloning

FCM delivers functions of IBM Spectrum Protect™

FlashCopy Manager flavours

	FCM for UNIX and Linux	FCM for Windows	FCM for VMware
Supported applications or entities	Oracle and IBM DB2 databases with and without SAP	MS Exchange and SQL Server databases	VMware virtual machines (VMs)
Features	Backup/restore and cloning	Backup/restore	Backup/restore
Application database consistency handled?	Yes	Yes	No, but how-to guides are available in IBM Techdocs.
Software location	FCM is installed on the application server.	FCM is installed on the application server.	FCM is installed on an additional proxy server (Linux OS).

FCM can backup and restore „unsupported“ applications using the Custom Applications feature. Available on UNIX, Linux and Windows.

Leveraging Snapshot Technologies

- Offers near-instant disk-only backup
- Creates database clones within minutes
- Focusing IBM Replication technologies
- Utilizes underlying snapshot functions of storage systems,
  e.g. IBM FlashCopy©, XIV Snapshots, Split Mirror©, Shadow Image©, …
- Generates snapshots in seconds
- Works online with no application shutdown
- Almost no backup / cloning related impact on application server
- Backup load can be moved to a secondary Server (TSM Option)
- Quick restores from snapshots

-> Snapshot Backup / Restore and Cloning

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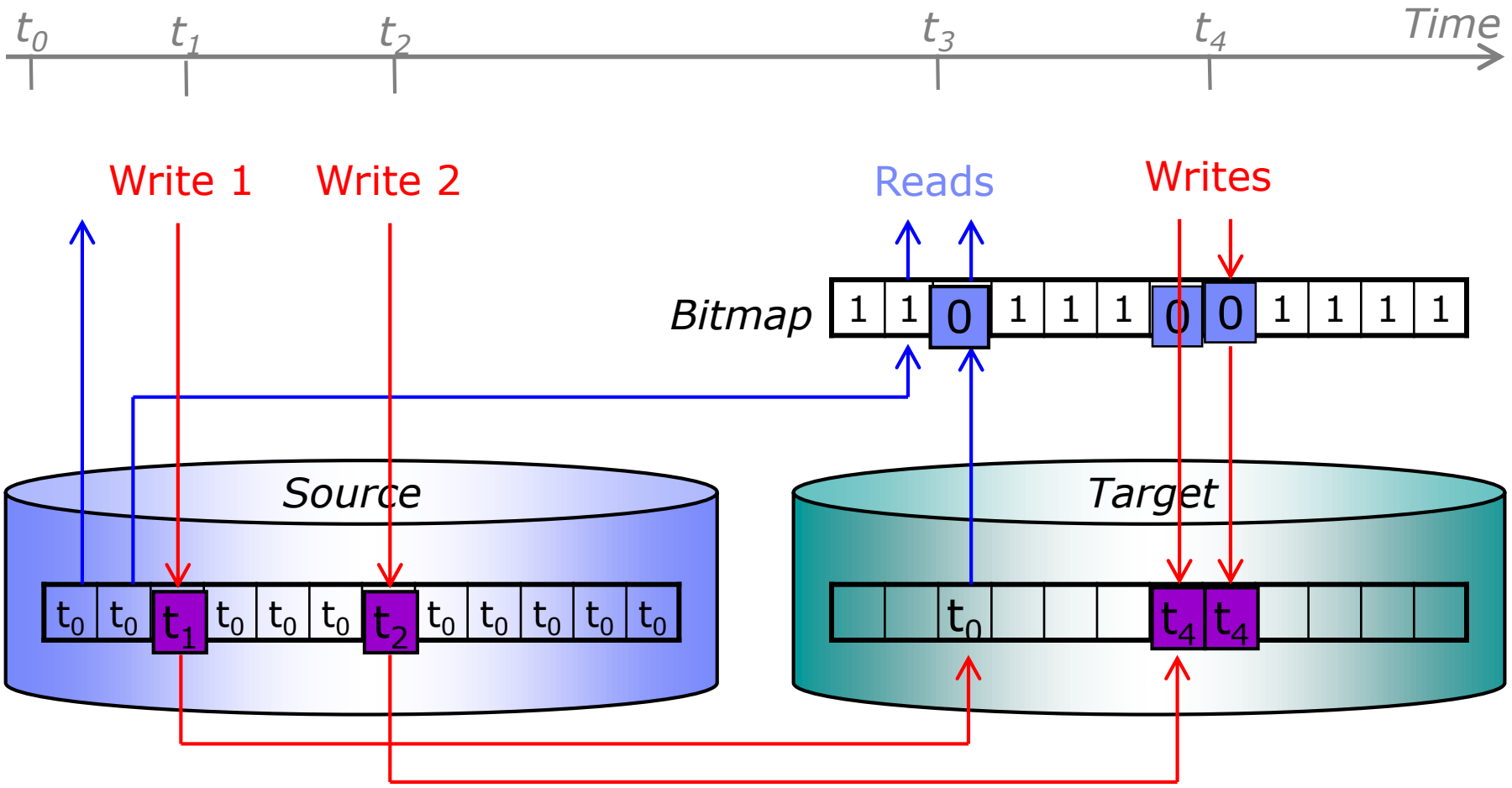
FlashCopy and Snapshot Concept

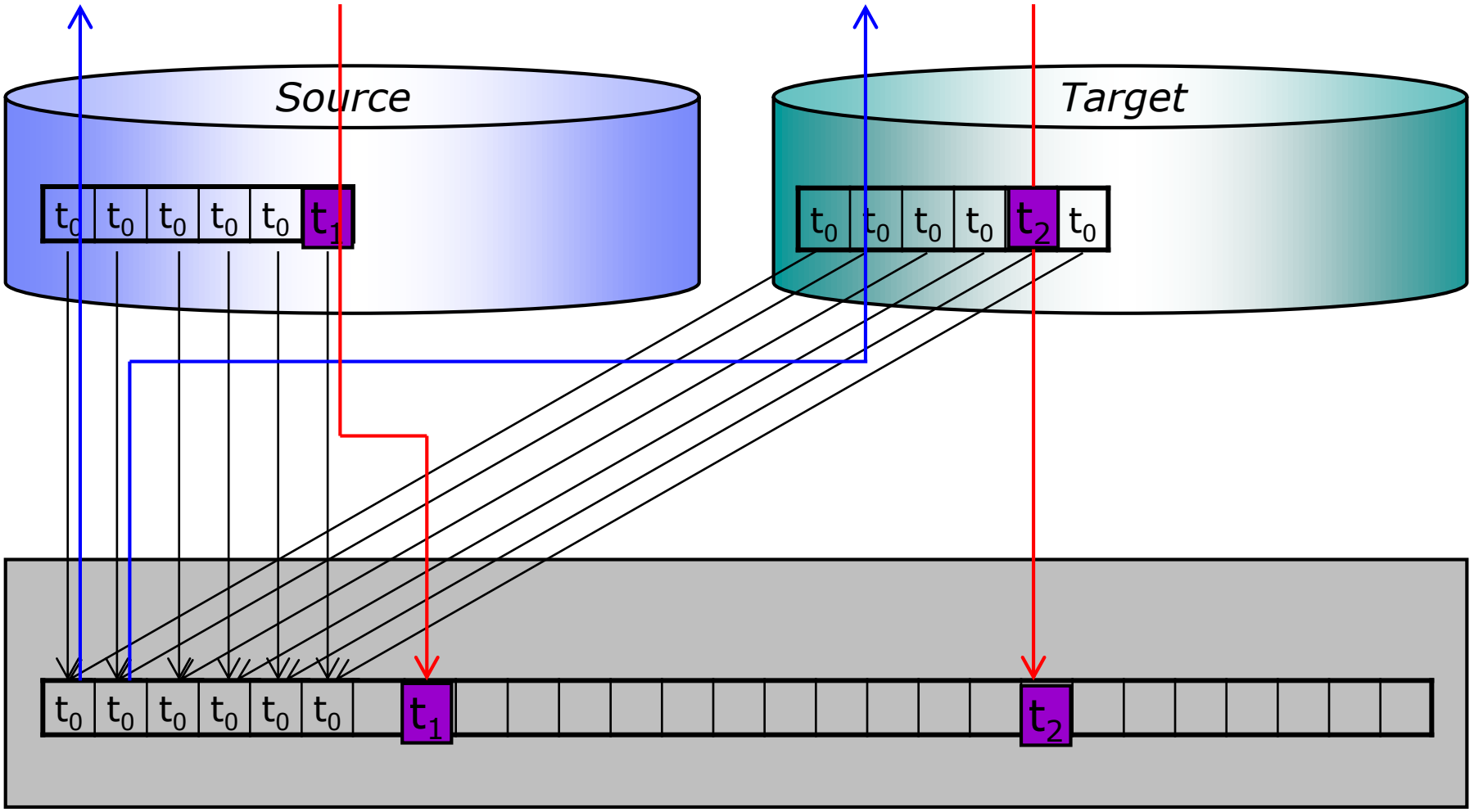
- "Instant t_0" copy
  - Target volume is "frozen" image of the source volume
  - Source and target immediately available for read and write access
- In contrast to:
  - Continuous copy (local or remote mirroring) — target volume receives updates
  - Volume copy (cloning) — no instant copy, source writes and target reads+writes have to be quiesced
- Copy services combinations depending on architecture

Copy on write: Design



Before physical write to the source, copy t_0 data from source to target.

Copy versus redirect on write: Design at volume layer



Copy versus redirect on write: Characteristics

Copy on write (SVC, DS8k, DS5k)	Redirect on write (XIV, N Series)
Snapshot requires original data (until optional background copy completes).	Snapshot requires always original data.
Space efficient possible.	Always space-efficient.
CPU and I/O overhead: Establish with very low overhead. Later write overhead medium…low (depending on rate of change to source). High overhead of cloning operations.	CPU and I/O overhead: Establish with very low overhead. Later write without overhead, but internal fragmentation possible.
Protection against logical data errors. Reverse: differential copy (valid original must exist only without background copy)	Protection against logical data errors. Reverse: differential copy (valid original must always exist)
Protection against physical failures with optional background copy (cloning).	No protection against physical failures.
Image mode source/target possible (on SVC).	Image mode source/target not possible.

Supported storage details

Storage Architecture		Unix
DS8000, SVC 4.3.x	FULL FlashCopy	Yes
	INCR FlashCopy	At most one incremental target set per LVM mirror
SVC >= 5.1, Storwize V7000	FULL FlashCopy	Yes
	INCR FlashCopy	Yes
	Space-efficent FlashCopy	Yes
XIV	Space-efficient snapshot	Yes
N series/NetApp	Space-efficient snapshot	Yes

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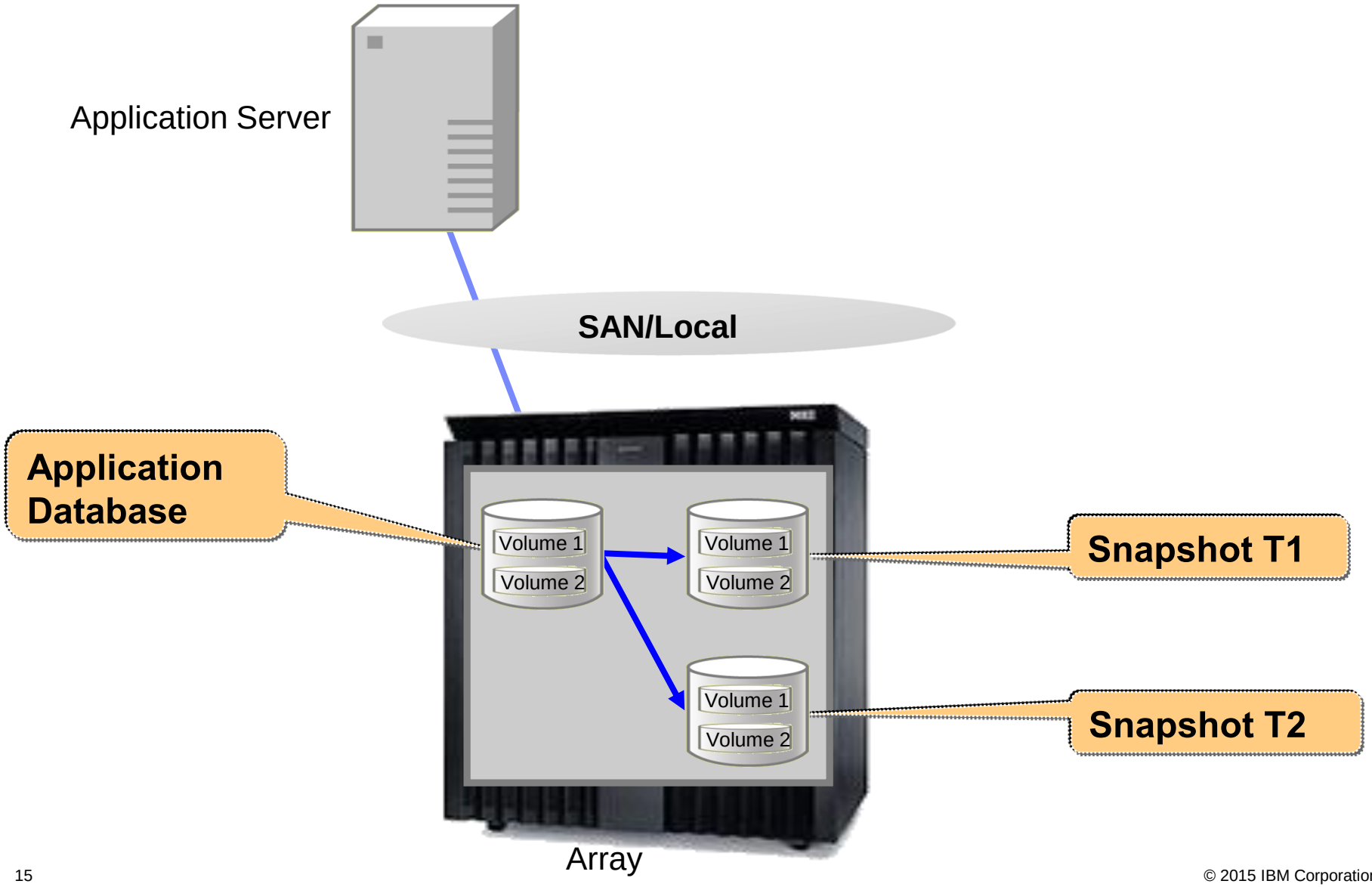
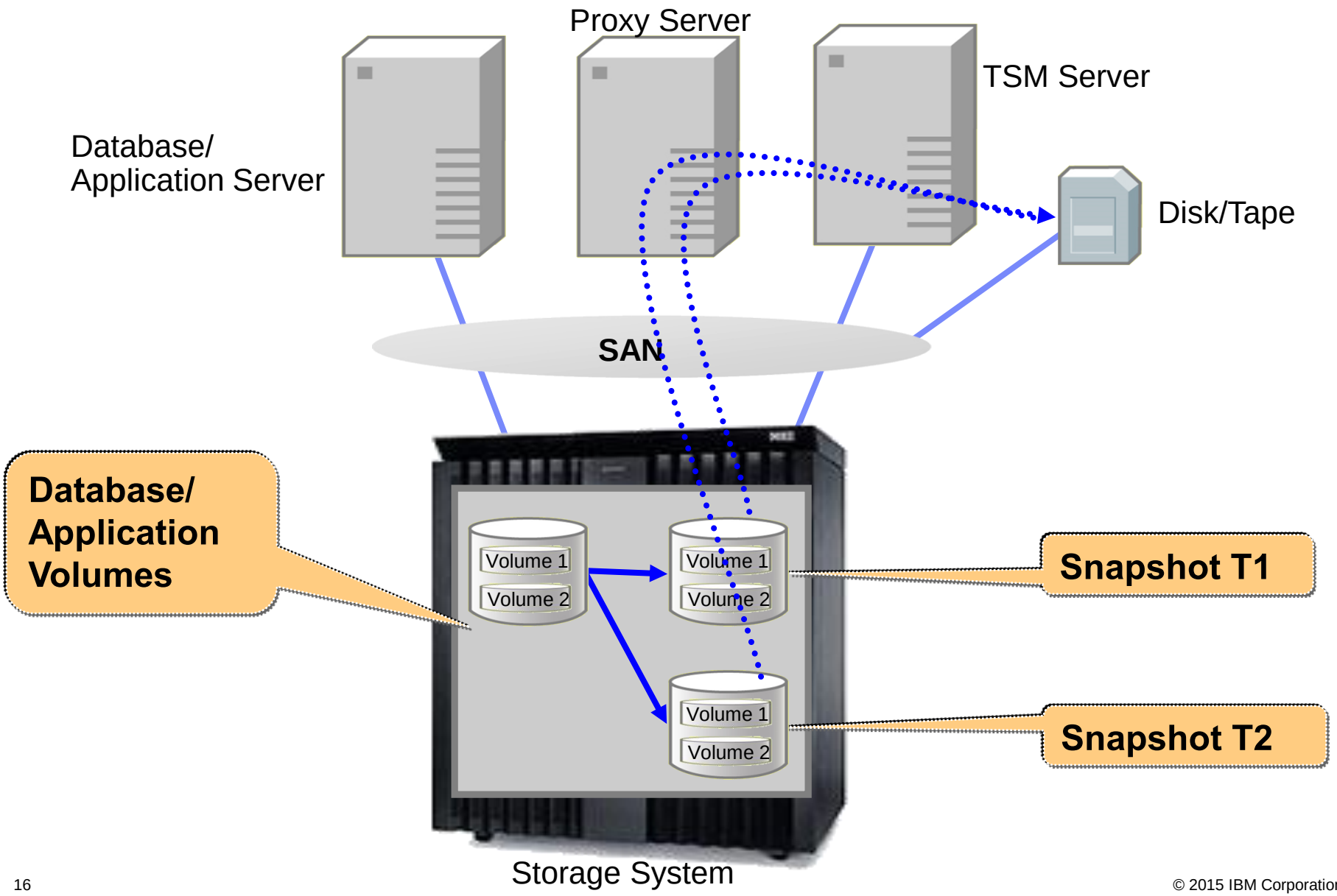
FCM Disk-only Backup



FCM Integration with a backup/restore system (e.g. TSM)



FlashCopy Manager database cloning

1 1.1 Start Cloning process
- Check DB mode and configuration

1.2 Establish relation logical to physical volumes

1.3 Suspend DB

1.4 Generate copy
- **perform FlashCopy**

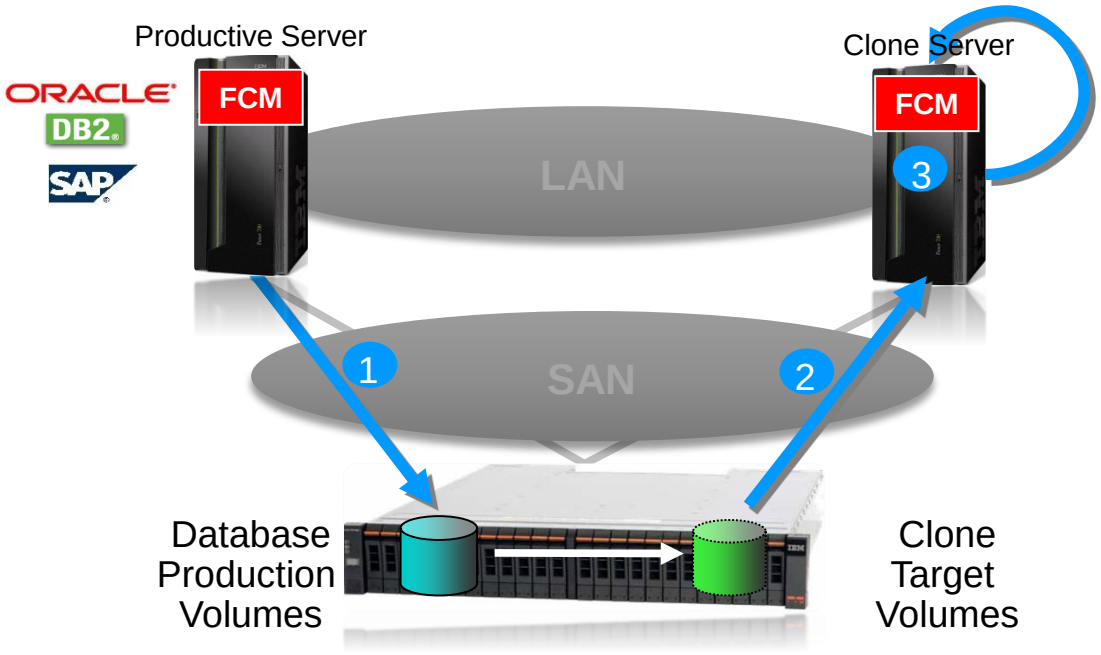
1.5 Resume DB

2 2.1 Prepare Cloning Server
- import/vary on volume groups
- mount file systems / disk groups

2.2 Recover Clone DB

2.3 Rename and start Clone DB

3 3.1 Post process Clone DB



FlashCopy Manager operation is application-aware

FlashCopy Manager process flow in database environments on UNIX and Linux:

- Set database into backup mode / quiesce database I/O
- Perform file system sync
- Optionally perform a file system freeze operation *
- Create a FlashCopy / Snapshot on the storage system
- Optionally perform a file system thaw (unfreeze) operation
- Set database to backup complete / resume database I/O
- For database cloning:
  - Import volume groups and mount file systems / disk groups on the FlashCopy target volumes at secondary server
  - Recover and rename database
- For offload to TSM server / third party backup system:
  - Import volume groups and mount file systems / disk groups on the FlashCopy target volumes at secondary server
  - Transfer data to TSM server / third party backup system

* If the file system freezes are omitted, file system checks will be required before mounting the file systems on the FlashCopy target volumes.

FlashCopy Manager restore and database recovery on UNIX and Linux

1) Cleanup production system resources
   - unmount file systems / disk groups
   - export Volume Groups

2) Perform reverse FlashCopy / restore Snapshot

3) Import production system resources
   - Import Volume Groups and mount file systems / disk groups

4) Recover database depending of backup type (additional step outside FCM)

Use the same utilities as for the backup:

- DB2: db2 backup / db2 restore ...
- SAP BR*Tools: brbackup / brrestore ...
- Oracle: RMAN, acsora ...

FlashCopy Manager Prerequisites

- Volume Manager / File System and Oracle ASM support
- Oracle RAC is supported in combination with Oracle ASM.

- Seperate volumes sets are required for the database (or database partitions) files and database log files.

- Schedule preliminary work early enough before starting the software installation.

All prerequisites in the FCM pre-installation checklist (current version 4.1.1):

http://www-01.ibm.com/support/docview.wss?uid=swg21684506

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Flashcopy Manager backups on UNIX and Linux

Configuration	Snapshot Backup Only	Backup to TSM		
		From Production DB	Integrated with Snapshot	From Existing Snapshot
DB2 (native)	db2 backup…use snapshot	db2 backup…use tsm	db2 backup…use snapshot[1]	fcmcli –f tape_backup[2]
DB2 (SAP)	db2 backup…use snapshot	db2 backup…load <library> or backom	db2 backup…use snapshot[1]	fcmcli –f tape_backup[2]
Oracle (native)	ascora –f backup	RMAN using Data Protection for Oracle	ascora –f backup [1]	fcmcli –f tape_backup[2]
Oracle (SAP)	brbackup –d util_vol	brbackup –d util_file	brbackup –d util_vol[1]	fcmcli –f tape_backup[2]

1 The profile parameter TSM_BACKUP is set to YES and the Offload Agent (tsm4acs) is running in daemon mode on the production server.
2 The profile parameter TSM_BACKUP is set to YES and the Offload Agent (tsm4acs) is not running in daemon mode.

CLI command overview / Easy handling

All commands are initiated on the original system. The System ID of the clone system is O1C.

- **Run pre-processing scripts (i.e. Stop SAP and database system):**

```
./fcmcli -f preproc_clone -u orao1c -C O1C
         -X /oracle/O1C/acs/SQL-scripts/PreProcessing.ini
```

- **Delete a clone:**

```
./fcmcli -f delete_clone -C O1C -u orao1c
```

- **Create a clone:**

```
./fcmcli -f create_clone -C O1C -u orao1c
```

- **Run post-processing scripts:**

```
./fcmcli -f postproc_clone -u orao1c -C O1C
         -Y  /oracle/O1C/acs/SQL-scripts/PostProcessing.ini
```

- **Refresh a cloned SAP system and run pre- and post-processing scripts before/after the refresh:**

```
./fcmcli -f refresh_clone -C O1C -u orao1c
         -X /oracle/O1C/acs/SQL-scripts/PreProcessing.ini
         -Y  /oracle/O1C/acs/SQL-scripts/PostProcessing.ini
```

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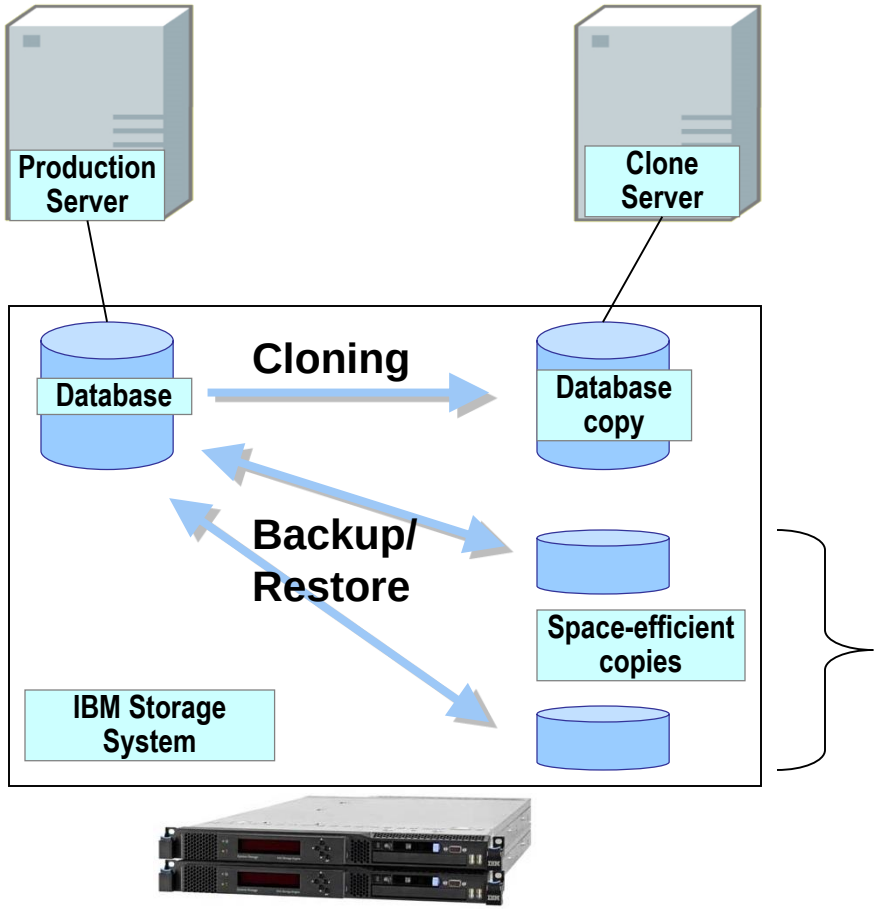
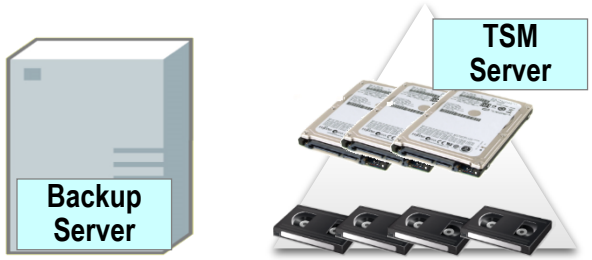
FlashCopy Manager 4.1 live demonstration setup

SAP system name: O1O
Database SID: O1O
Hostname: sapo1o

SAP system name: O1C
Database SID: O1C
Hostname: sapo1c



We are running:
- SAP NetWeaver 7.4
- Oracle 11.2 database
- IBM AIX 7.1 OS
- IBM Storwize V7000



Volumes can be attached to secondary server and the database contents offloaded to a backup/restore system (such as Tivoli Storage Manager).

Agenda

- Tivoli Storage FlashCopy Manager Positioning
- Product Overview
- Basics
  - Protection levels
  - Database backup and restore
  - FlashCopy Manager prerequisites
- Performing backups, restores, and cloning
- Live demonstration
  - Performing backups, restores, and cloning
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Summary

- Use FlashCopy Manager to create FlashCopy/snapshot backups of applications on Windows, AIX, Linux and Solaris and eliminate or reduce the effect of backups on applications.
- Use FlashCopy Manager to create FlashCopy clones of DB2, Oracle, and SAP databases for test, development or education purposes.
- Exploit hardware FlashCopy/snapshot techniques on IBM and non-IBM storage systems to improve restore times for Microsoft SQL Server, Exchange, IBM DB2, Oracle, and SAP applications.

Tivoli Storage Flashcopy Manager

...and other operating systems!

For more information on:

- IBM Tivoli Storage FlashCopy Manager:
  http://www.ibm.com/software/tivoli/products/storage-flashcopy-mgr/
- FlashCopy Manager for SAP quick start guides (FCM release 2.2):
  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101627
  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101703
- IBM Tivoli Storage Manager:
  http://www.ibm.com/software/tivoli/products/storage-mgr/
- IBM Tivoli Storage Manager for ERP Systems:
  http://www.ibm.com/software/tivoli/products/storage-mgr-erp/
- IBM System Storage Disk:
  http://www.ibm.com/systems/storage/disk/
- IBM System Storage SAN Volume Controller:
  http://www.ibm.com/systems/storage/software/virtualization/svc/index.html
- IBM XIV Storage System:
  http://www-03.ibm.com/systems/storage/disk/xiv/index.html

Supported environments

- IBM Storage FlashCopy Manager 4.1 system requirements:
  http://www-01.ibm.com/support/docview.wss?uid=swg21650875 version 4.1
  http://www-01.ibm.com/support/docview.wss?uid=swg21684506 version 4.1.1

- FlashCopy Manager virtualization support:
  https://www.ibm.com/support/docview.wss?uid=swg21433737

- FlashCopy Manager Information Centers:
  https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Tivoli%20Documentation%20Central/page/Tivoli%20Storage%20FlashCopy%20Manager

- Rocket Device Adapter Pack for IBM FlashCopy Manager:
  http://www.rocketsoftware.com/products/device-adapters-for-ibm-tivoli-flashcopy-manager

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