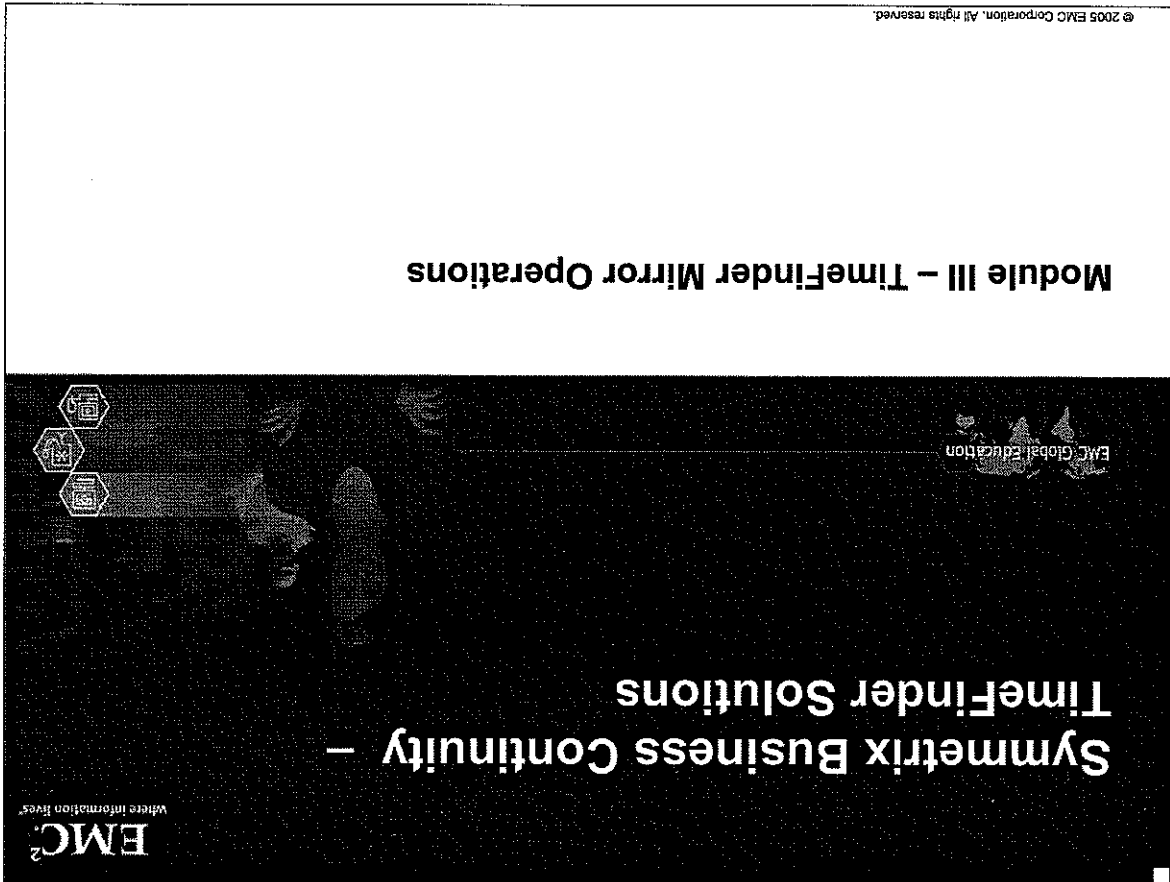




These materials may not be copied without EMC's written consent.

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED "AS IS." EMC CORPORATION MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WITH RESPECT TO THE INFORMATION IN THIS PUBLICATION, AND SPECIFICALLY DISCLAIMS IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC and TimeFinder are trademarks of EMC Corporation.

All other trademarks used herein are the property of their respective owners




Copyright © 2005 EMC Corporation. Do not Copy - All Rights Reserved.

Revision History

Symmetrix Business Continuity – TimeFinder Solutions

Module III – TimeFinder Mirror Operations

Rev #	File Name	Date	Revision Number	Activity - Notes
1.0a	BCL_Mod3_V10a.Ppt	04-Apr-2005		First Pass – 04-Apr-2005
1.2a	BCL_Mod3_V12a.Ppt	26-Jun-2005		Second Pass – Sym-6.0 01-Jun-2005
2.1a	BCL_Mod3_V21.Ppt	12-Sep-2005		Name Change
			Module #	Module Name
		1		TimeFinder Introduction
		2		TimeFinder Mirror Overview
	***	3		TimeFinder Mirror Operations
		4		TimeFinder Clone / Operations
		5		TimeFinder Snap / Operations
		6		TimeFinder Labs

Mod 3 – Page 2

© 2005 EMC Corporation. All rights reserved.

EMC Global Education

EMC

Copyright © 2005 EMC Corporation. All rights reserved.

These materials may not be copied without EMC's written consent.

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED "AS IS." EMC CORPORATION MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WITH RESPECT TO THE INFORMATION IN THIS PUBLICATION, AND SPECIFICALLY DISCLAIMS IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC, and TimeFinder are trademarks of EMC Corporation.

All other trademarks used herein are the property of their respective owners.



Module Objectives – TimeFinder Operations Symmetrix Business Continuity – TimeFinder Solutions

At the completion of this module, the student will be able to

- Describe and use most of the TimeFinder – Solutions Enabler 6.0 command set.
- Create and implement TimeFinder device groups using the Solutions Enabler 6.0 command set.
- Perform TimeFinder Establish, Split and Restore functions.
- Describe a business application for Multi-BCV functionality
- Perform a TimeFinder query to check the states of a TimeFinder device group.

© 2005 EMC Corporation. All rights reserved.

Mod 3 – Page 3

The above objectives are covered in this module

Program – Symmetrix Business Continuity – TimeFinder Solutions.

Module Name – TimeFinder Commands)

Module Number - III

symbov list dev

To list all the BCV devices, regardless of whether they are visible to your host, enter:

symbov list pd

To list all the BCV devices that are visible to your host, enter:

Configuration and status information is stored in the Symmetrix configuration database file for each device on every Symmetrix array, including BCV devices.

You can find all BCV devices on a Symmetrix array and view their physical and Symmetrix device names. In addition, you can display details about the BCV devices, including the BCV device name, the Symmetrix device name of the paired standard device, the number of invalid tracks for both the BCV device and the standard device, and the BCV pair state.

Identify BCV Volumes																																							
■ symbcv list pd displays summary information about all BCV volumes accessible to your host ■ symbcv list dev displays summary information about all BCV volumes in attached Symmetrix ■ A host does not need access to a BCV in order to perform TimeFinder operations on it																																							
# symbcv list pd Symmetrix ID: 000182503423																																							
<table> <tr> <th colspan="2"></th><th colspan="2">BCV Device</th><th colspan="2">Standard Device</th><th colspan="2">Status</th><th colspan="2"></th></tr> <tr> <th colspan="2"></th><th colspan="2">Inv.</th><th colspan="2">Inv.</th><th colspan="2"></th><th colspan="2"></th></tr> <tr> <th>Physical</th><th>Sym</th><th>RDF</th><th>Att.</th><th>Tracks</th><th>Physical</th><th>Sym</th><th>Tracks</th><th>BCV</th><th><=> STD</th></tr> </table>												BCV Device		Standard Device		Status						Inv.		Inv.						Physical	Sym	RDF	Att.	Tracks	Physical	Sym	Tracks	BCV	<=> STD
		BCV Device		Standard Device		Status																																	
		Inv.		Inv.																																			
Physical	Sym	RDF	Att.	Tracks	Physical	Sym	Tracks	BCV	<=> STD																														
c0t10d0	00B0	+	+	0	c1t0d1	0	0021	0	Synchronized																														
c0t10d1	00B1	+	+	0	c1t0d0	0	0020	0	Synchronized																														
c0t10d2	00B2	+	+	0	c1t0d2	0	0022	0	Split																														
c0t10d3	00B3			0	N/A	0	N/A	0	NeverEstab																														
c0t10d4	00B4			0	N/A	0	N/A	0	NeverEstab																														
c0t10d5	00B5			0	N/A	0	N/A	0	NeverEstab																														
c0t10d6	00B6			0	N/A	0	N/A	0	NeverEstab																														
Total																																							
Track(s)																																							
MB (s)																																							
0.0									0.0																														

EMC Global Education

Mod 3 - Page 4

© 2005 EMC Corporation. All rights reserved.



Identify Accessible BCV Volumes

- Syminq - Displays volume type and can also be used to identify accessible BCV volumes

syminq

Device		Product		Device	
Name	Type	Vendor	ID	Rev	Ser Num Cap (KB)
/dev/rds/c0t0d0	EMC	SYMMETRIX	5671 23020170	1070400	
/dev/rds/c0t0d1	EMC	SYMMETRIX	5671 23021170	1070400	
/dev/rds/c0t0d2	EMC	SYMMETRIX	5671 23022170	1070400	
/dev/rds/c0t0d3	EMC	SYMMETRIX	5671 23023170	1070400	
/dev/rds/c0t0d4	EMC	SYMMETRIX	5671 23024170	1070400	
/dev/rds/c0t0d5	EMC	SYMMETRIX	5671 23025170	1070400	
/dev/rds/c0t0d6	EMC	SYMMETRIX	5671 23026170	1070400	
/dev/rds/c0t0d7	EMC	SYMMETRIX	5671 23027170	1070400	
/dev/rds/c0t10d0	BCV	EMC	SYMMETRIX	5671 230B0170	1070400
/dev/rds/c0t10d1	BCV	EMC	SYMMETRIX	5671 230B1170	1070400
/dev/rds/c0t10d2	BCV	EMC	SYMMETRIX	5671 230B2170	1070400
/dev/rds/c0t1d1	R2	EMC	SYMMETRIX	5671 2300A170	1070400
/dev/rds/c0t1d2	R2	EMC	SYMMETRIX	5671 2300B170	1070400
/dev/rds/c0t15d0	EMC	SYMMETRIX	5671 2310B170	5760	
/dev/rds/c0t15d1	EMC	SYMMETRIX	5671 2310F170	5760	



Displaying SYMCLI Device Groups

- **symdg** show displays detailed information about a device group
- Group membership
- Associated BCV devices

```
# symdg show databasedg
```

```
Standard (STD) Devices (3):
```

LdevName	PdevName	Sym	Dev	Att.	Sts	Cap
DEV001	/dev/rdsk/clt0d0	0020	RW			1045
DEV002	/dev/rdsk/clt0d1	0021	RW			1045
DEV003	/dev/rdsk/clt0d2	0022	RW			1045

```
Associated BCV Devices (3):
```

LdevName	PdevName	Sym	Dev	Att.	Sts	Cap
BCV001	/dev/rdsk/c0t10d0	00B0	RW			1045
BCV002	/dev/rdsk/c0t10d1	00B1	RW			1045
BCV003	/dev/rdsk/c0t10d2	00B2	RW			1045




symmir establish - All Devices

- Establishes a BCV mirror to each volume in a device group
- Default is to perform incremental establish
- -full must be specified the first time a BCV is established to a volume
- -exact assigns BCVs in order associated with DG

```
# symmir -g databasedg -full -opt establish
```

```
Execute 'Full Establish' operation for device group
'databasedg' (y/[n]) ? y
'Full Establish' operation execution is in progress for device
group
'databasedg'. Please wait...
'Full Establish' operation successfully initiated for device group
'databasedg'.
```

Mod 3 - Page 8

© 2005 EMC Corporation. All rights reserved.

After configuration and initialization of a Symmetrix array, BCV devices contain no data. The BCV devices, like the standard devices, have unique host addresses and are online and ready to the hosts to which they are connected. The full establish must be used the first time the standard devices are paired with BCV devices.

Optionally, you can target devices in a device group, composite group, or device file:

- symmir -g DgName -full establish
- symmir -g CgName -full establish
- symmir -[file] FileName -full establish

To initiate a full establish on all the BCV pairs in the prod device group, enter:

```
symmir -g prod -full establish
```

To initiate a full establish on one BCV pair, DEV001, in the prod device group, enter:

```
symmir -g prod -full establish DEV001
```

To initiate a full establish on more than one BCV pair (list) in the prod device group with one command, enter:

```
symmir -g prod -full establish DEV001 BCV ID BCV005 DEV002 BCV ID
BCV007 DEV003 BCV ID BCV008
```

symmir establish - Selected Devices

- Allows you to override existing device pairing
- Default is to perform incremental establish
- -full must be specified the first time a BCV is established to a volume

```
#SYMCLI DG=databasedg; export SYMCLI DG
```

```
#symmir -full establish DEV003 BCV dev 0b2
```

```
Execute 'Full Establish' operation for device 'DEV003'
in device group 'databasedg' (y/[n]) ? y
```

```
'Full Establish' operation execution is in progress for device 'DEV003'
in group 'databasedg'. Please wait...
```

```
'Full Establish' operation successfully initiated for device 'DEV003'
in group 'databasedg'.
```

When a full establish is initiated for each specified BCV pair in a device group:

- Command validity is checked. For example, the Symmetrix array makes sure that both the standard device and the BCV device are the same size, the device specified as the BCV has the BCV attribute, the standard device does not already have a BCV device assigned to it.
- If the standard device is a meta head device, then the BCV must also share the same meta device properties. All meta members will be implicitly established along with the meta head device.
- The BCV device is set as Not Ready to the host.
- The BCV device is assigned as the next available mirror of the standard device.
- The contents of the standard device are copied to the BCV.

symmir query

- Setting the SYMCLI_DG variable eliminates having to specify the Device Group using -g flag
- The [-i interval] option displays the synchronization rate and estimated time to completion

```
# SYMCLI DG=databasedg; export SYMCLI_DG
# symmir query -i 10 -c 10
```

```
Device Group (DG) Name: databasedg
DG's Type : REGULAR
DG's Symmetrix ID : 000182503423
Standard Device : BCV Device
Status
```

```
Inv. Logical Sym Tracks Logical Inv.
-----
```

```
DEV001 0020 0 BCV002 00B1 * 22206 SyncInProg
DEV002 0021 0 BCV001 00B0 * 21738 SyncInProg
DEV003 0022 0 BCV003 00B2 * 24208 SyncInProg
```

```
Total
Track(s) 0
MB(s) 68152
Synchronization rate 2129.8
Estimated time to completion : 00:02:49
```

```
Legend:
(*) : The paired BCV device is associated with this group.
```

© 2005 EMC Corporation. All rights reserved. Mod 3 - Page 10

You can perform a query to determine the state of a BCV pair for all BCV pairs in a device group. The query is sent via the gatekeeper device to the Symmetrix array, returning with information about the state of the BCV pair(s).

Optionally, you can target devices in a device group, composite group, or device file:

- symmir -g DgName query
- symmir -cg CgName query
- symmir -file] Filename query





symmir split

- All devices in a device group or specific devices can be split in a single operation.

```
# symmir split
```

```
Execute 'Split' operation for device group
'databasedg' (y/[n]) ? y
'Split' operation execution is in progress for device group
'databasedg'. Please wait...
'Split' operation successfully executed for device group
'databasedg'.
```

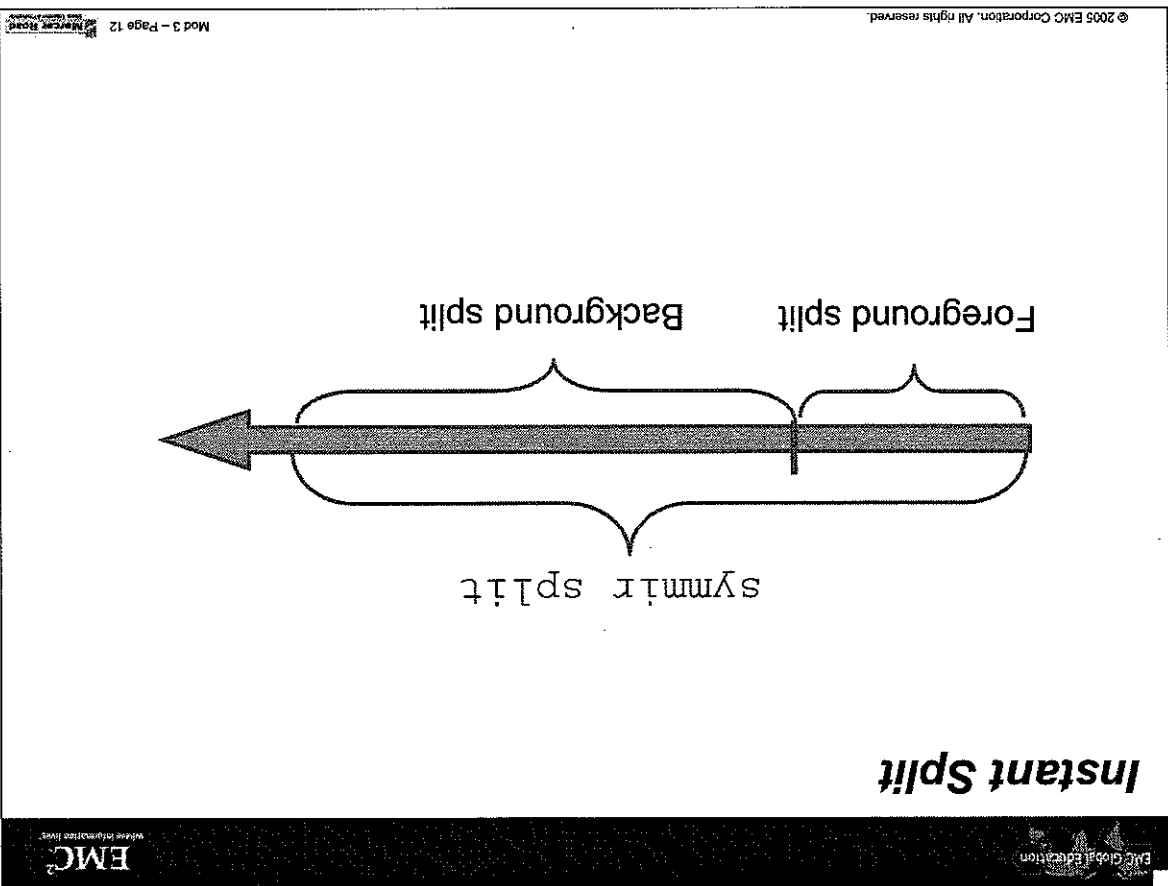
After an establish operation and the standard device and BCV mirrors are synchronized, the BCV device becomes a mirror copy of the standard device. You can split the paired devices to where each holds separate valid copies of the data, but will no longer remain synchronized to changes when they occur. SYMCLI processes can then be executed with the BCV device once the split completes.

When a *split* is initiated for each specified BCV pair in a device group, the following occurs:

- Command validity is checked. For example, the Symmetrix array makes sure that the standard device has an active BCV mirror and that the standard and BCV devices comprise a BCV pair.
- I/O is suspended to the standard device until the split operation completes.
- Any pending write transactions to the standard device and the BCV device are destaged.
- The BCV device is split from the BCV pair.
- The BCV device state is changed to Ready, enabling host access through its separate address (BCV001).

- Operation with the standard device is resumed and any tracks changed from write operations to the standard device are marked. (This is necessary for updating the BCV device if it is reestablished with the same standard device at a later time.)

- If the BCV device has any of its own mirrors, the mirrors are synchronized.



The instant split improves the performance of a typical split operation by performing a quick foreground BCV split. It

returns a more immediate successful status back to the host, allowing applications to continue. The instant split option is supported for Enginuity Versions 5x66 and 5x67. Since Version 5x68, this option is no longer required because instant split mode is the default behavior.

The following immediate post operations are illegal and can fail, or are improper if the split is not fully complete in the background.

- You cannot restore any BCV to the standard when the standard has not yet completed the background split.

- You cannot establish (full or increment) the STD with another BCV device.

- If you incrementally reestablish the splitting pair (while still in background), any tracks that are still splitting in the background will become Invalid on the BCV device and need to be copied.

The wait-for-background-split option, SYMAPI_WAIT_FOR_BCV_BG_SPLIT, in the options file can be used to force symmir split command to wait for the entire (background) split operation to complete before returning the prompt to users. The default path for the options file on UNIX host is at /var/symapi/config/options and C:\Program

Files\EMC\symapi\config\options on Windows.

EMC

EMC Corporation

symmir restore

- Data is restored from BCV to Standard Volume
- Previous BCV pairing is used unless overridden with -exact option or specifying new pairing
- Default is incremental restore. Specify -full if required

symmir restore -full -noprompt

'Full Restore' operation execution is in progress for device group

'Full Restore' operation successfully initiated for device group

'databasedg'. Please wait...

'databasedg'.

symmir query

Device Group (DG) Name: databasedg.

DG's Type : REGULAR

DG's Symmetric ID : 0001822600534

Standard Device	BCV Device	Status
Inv.	Inv.	
Logical	Sym Tracks Logical	
DEV001	002D 17841 BCV002	
DEV002	002E 22205 BCV001	
Total		
Track(s)	40046	0
MB(s)	1251.4	0.0

Mod 3 - Page 13

EMC Corporation

The incremental restore process accomplishes the same thing as the restore with a major time-saving exception. The BCV device copies only new data that was updated on the BCV device while the BCV pair was split. Any changed tracks on the standard device are also overwritten by the data on the corresponding tracks on the BCV device. This maximizes the efficiency of the synchronization process. This process is useful if the results from running a new application on the BCV device were desirable, and the user wants to port the data and the new application to the standard device.

Optionally, you can target devices in a device group, composite group, or device file:

- symmir -g DgName restore
- symmir -cg CgName restore
- symmir -f[ile] FileName restore
- symmir -g prod restore

To initiate an incremental restore on all the BCV pairs in the prod device group, enter:



Multi-BCV Example

- 1) Identify two Regular Volumes and four BCVs for use
- 2) Create two SYMCLI Device Groups of type Regular - AMdg and PMdg
- 3) Add the two Regular Volumes to AMdg. Associate the first two BCVs in set one, with AMdg
- 4) Associate the next two BCVs in set two with PMdg (as yet does not have any Regular Volumes added to it)
- 5) Create a Volume Group, Logical Volume, File System, using the Regular Volumes. Add some files to the filesystem
- 6) Full establish AMdg, verify synchronization, freeze I/O then split AMdg
- 7) Move the Regular Volumes to PMdg, full establish, verify synchronization
- 8) Add/delete some files from the filesystem. Split PMdg, Move Regular Volumes to AMdg, stop I/O, restore to recover "lost" files

© 2005 EMC Corporation. All rights reserved. Mod 3 - Page 14

By default, relationships of one STD device with up to eight BCV devices can be maintained. Maximum number of BCV devices that can be paired with the same STD device can be increased up to sixteen: SYMCLI_MAX_BCV_PAIRS variable.




Multi-BCV's Example

- Step 1 - Identify two regular volume and four BCV's for use
- Steps 2 - 4
- Step 5 - Create a Volume Group, Logical Volume, File System
- Step 6 -

```

#symdg -type regular create Amdg
#symdg -type regular create Pmdg
#symld -g Amdg addall dev -range 092:093
#symbcv -g Amdg associateall dev -range 056:057
#symbcv -g Pmdg associateall dev -range 058:059

Create a Volume Group, Logical Volume, File System

#symmir -g Amdg establish -full -exact
#symmir -g Amdg verify -synched

All devices in group 'Amdg' are in the 'Synchronized' state.

#umount /data
#symmir -g Amdg split -instant -noprompt

#mount /data
#ls /data/ (List of Amdata-files)
        
```

Mod 3 - Page 15

EMC Corporation
Global Education & Production

© 2005 EMC Corporation. All rights reserved.

The following is an example of a script for a multi-BCV environment: You are tasked with testing your business applications with incoming database data from certain anticipated peak periods in the day. It is decided that three snaps of your database may be needed. To establish a multi-BCV environment, you must initially perform a full establish to each BCV device in the set.

For example, you plan to have BCV001 through BCV003 in the set to pair with DEV001 that is the source of your test data:

- symmir -g MultigrpA -full establish DEV001 BCV id BCV001
- symmir -g MultigrpA split DEV001 #split at 3:10pm
- symmir -g MultigrpA -full establish DEV001 BCV id BCV002
- symmir -g MultigrpA split DEV001 #split at 3:10pm
- symmir -g MultigrpA -full establish DEV001 BCV id BCV003
- symmir -g MultigrpA split DEV001 #split at 3:20pm
- symmir -g MultigrpA -full establish DEV001 BCV id BCV003

2. It's now 4:00 p.m. and BCV003 is still currently established with DEV001. At this point, you are testing your business applications and want to reset your database back to the business activity that was current up till 3:10 p.m. To incrementally restore DEV001 to the 3:10 p.m. business data:

- symmir -g MultigrpA split DEV001 # split at 4:00pm
- symmir -g MultigrpA restore DEV001 BCV id BCV001

Multi-BCV's Example

■ Step 7 Move the Regular Volumes to Pmdg, full establish, verify synchronization

```
#symld -g Amdg moveall Pmdg
#symmir -g Pmdg est -full -exact
#ls /datafs/ (List of Amdata-files / Pmdata-files)
```

■ Step 8 Add/delete some files from the filesystem. Split Pmdg, Move Regular Volumes to Amdg, stop I/O, restore to recover "lost" files

```
#umount /datafs
#symmir -g Pmdg split -instant -noprompt
#symld -g Pmdg moveall Amdg
#umount /datafs
#symmir -g Amdg restore
#symmir -g Amdg split -noprompt
#mount /datafs
#ls /datafs (List of Amdata-files)
```

The data "lost" from the morning run (Amdata5-Amdata10) is recovered by the restore operation. Also note that the data added in the evening run (Pmdata1-Pmdata5) is overwritten. Restore operation discards any changes made to the STD device and replaces it with the BCV data.

3. You are now working successfully with the 3:10 p.m. data and want to continue test operations with this data and remove the second split BCV that occurred at 3:20 p.m. as this data won't be needed.

- symmir -g MultigrpA cancel DEV001 BCV id BCV002

4. You decide to call it a day, keeping the remaining two multi-BCVs and need to reestablish (incrementally establish) BCV003 to the current standard data:

- symmir -g MultigrpA split DEV001 #split at 4:50pm
- symmir -g MultigrpA establish DEV001 BCV id BCV003

EMC
Global Edition

EMC²
Where Information Lives

Multi-BCV Query

symdg list

DE V I C E G R O U P S

Name	Type	Symmetrix ID	Num of Devices	Num of Gatekeepers	Num of BCV's
Amdg	REGULAR	000184501805	2	0	2
Pmdg	REGULAR	000184501805	0	0	2

symmir -g Amdg query -multi

Standard Device	BCV Device	State
Logical	Inv.	Logical
Sym Tracks	Sym	Tracks STD <=> BCV

DEV001	0092	0 BCV001	0056 *	0 Split
		0 N/A	0058	0 Split
DEV002	0093	0 BCV002	0057 *	0 Split
		0 N/A	0059	0 Split

Mod 3 - Page 17

© 2005 EMC Corporation. All rights reserved.

You can perform a query to determine the state of a BCV pair or all BCV pairs in a device group. The query is sent via the gatekeeper device to the Symmetrix array, returning with information about the state of the BCV pair(s).

Optionally, you can target devices in a device group, composite group, or device file:

- symmir -g DgName query
- symmir -cg CgName query
- symmir -f[file] FileName query

Module Summary

Key points covered in this Module :

- Described and used most of the TimeFinder – SymCll Ver 6.0 command set
- Created and implemented TimeFinder device groups using the SymCll Ver 6.0 command set
- Performed full TimeFinder Establish, Split and Restore functions to create mirror replica
- Described a business application for Multi-BCV functionality
- Performed a TimeFinder query to check the states of a TimeFinder device group

The following Module Summary / Key Point for TimeFinder Operations where presented.



where information lives

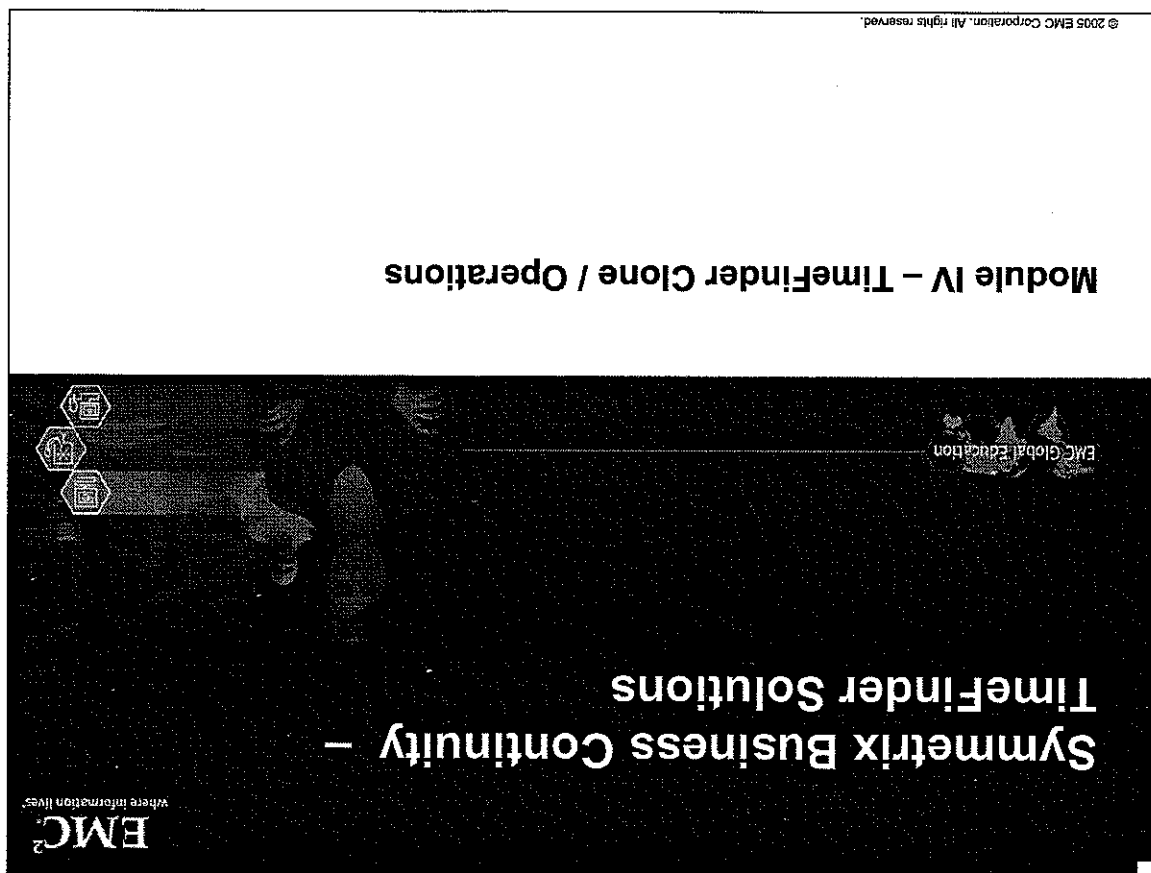


EMC



EMC

This concludes, Module III “TimeFinder Local Operations” for Symmetrix Business Continuity – TimeFinder Solutions.



© 2005 EMC Corporation. All rights reserved.

These materials may not be copied without EMC's written consent.

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED "AS IS." EMC CORPORATION MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WITH RESPECT TO THE INFORMATION IN THIS PUBLICATION, AND SPECIFICALLY DISCLAIMS IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC and TimeFinder are trademarks of EMC Corporation.

All other trademarks used herein are the property of their respective owners



Module Objectives – TimeFinder Clone / Operations
Symmetrix Business Continuity –
TimeFinder Solutions

At the completion of this module, the student will be able to:

- Describe TimeFinder / Clone and possible uses within a business environment.
- Describe the TimeFinder / Clone Operations.
- Describe TimeFinder / Clone emulation mode.
- Describe when to use TimeFinder / Clone vs. TimeFinder / Mirror.
- Use the Sym CLI symclone command set to Create, Activate, Query and Terminate TimeFinder Clone sessions.
- Use the Sym CLI symclone command set to Recreate, Establish and Restore TimeFinder Clone copies.

Mod 4 – Page 3

© 2005 EMC Corporation. All rights reserved.

The above objectives are covered in this module

Program – Symmetrix Business Continuity – TimeFinder Solutions.

Module Name – TimeFinder Clone)

Module Number - IV

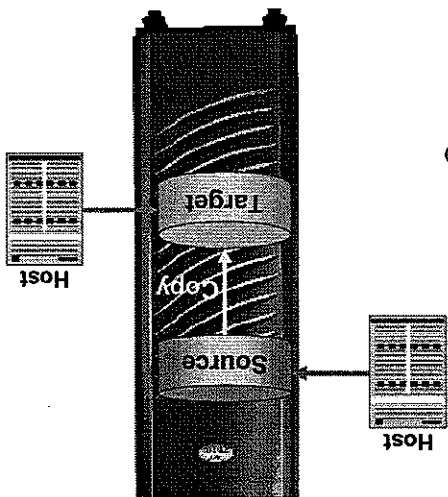
Clones are full volume copies of a source device in open systems which are pointer-based. When creating a clone image, it is not necessary to first perform a full establish operation as you would with traditional TimeFinder BCVs. Upon activation of the cloned image, it is fully read/write enabled; data is copied in the background as it is accessed.

The Symmetrix array is currently limited to sixteen sessions per source device, which can be used for TimeFinder Mirror, Clone or Snap operations. This limits the number of available clone copies that can be created. A total of sixteen concurrent CopyOnAccess copy sessions can be created from a standard device.

TimeFinder Clones

A *TimeFinder clone* is an instant point-in-time copy of a Symmetrix standard device or TimeFinder BCV:

- Copying can be immediate or deferred (copy on access)
- Copying can be controlled by *copy sessions*
- Copy sessions are maintained on the Symmetrix unit
- Copy sessions can be - Created, Recreated, Restored, Activated, Queried, Listed, and Terminated using the **symclone** command.
- Data can be copied from a single source device to as many as sixteen target devices, with automatic background copying of up to four target devices simultaneously
- Does not take up a "Mirror" position
- Remote clone is supported with -rdt

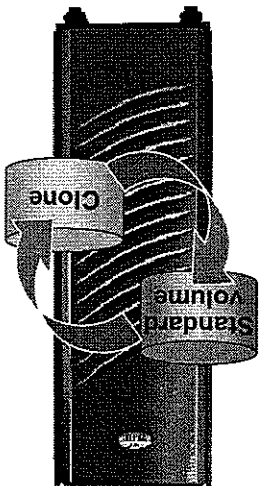




Clone Operations

EMC Clone Education

- Create
 - Create relationship between standard and Clone
- Activate
 - Clone is now active and available immediately for read/write access
 - Production I/O is processed against standard
- Re-Create
 - Clone is re-attached to Standard for new point-in-time copy (incremental/differential)
- Establish
 - Create and activate
- Restore
 - Re-attached to Standard and incremental or full restore is performed
- Terminate



Mod 4 - Page 5

© 2005 EMC Corporation. All rights reserved.

EMC Road

The create action defines the copy session requirements and sets the track protection bitmap on the source device to detect which tracks are being accessed by the target host or written to by the source host. The target device is made Not Ready to its host and placed on hold status for copy session activity.

This prevents other control operations from using the device. The activate action makes the clone ready to the host. It also starts the one of background copying processes. The process, Copy-On-Access or Full Copy, depends on the argument used when the clone session was created.

The "recreate" command allows you to incrementally copy all subsequent changes made to the source device. In another word, it allows you to refresh the contents of the clone with new contents of the source since the clone session has been activated. The restore action restores contents of the clone volume to a restore target. The restore operation with clone is always a protected restore..

The establish operation creates and then immediately activates a clone session with a single command. This operation in a clone environment is always a protected establish.

The terminate action terminates a source – clone relationship

EMC²

EMC Global Education

Options with Clone Creation

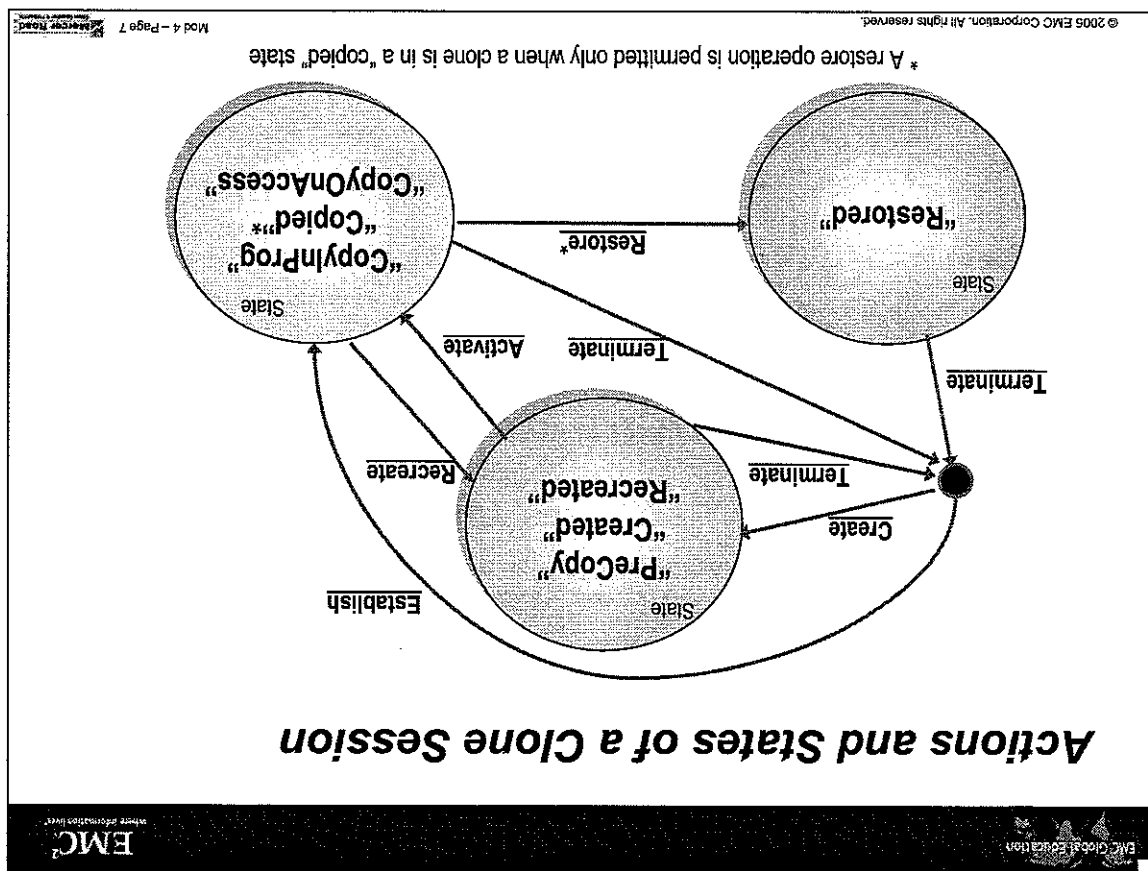
- CopyOnAccess
 - Default
 - Only modified tracks are copied to clone volume after **activation**
- Full Device Copy
 - Full copy in the background starts after **activation**
- Precopy
 - Full copy in the background starts after **creation**
- Differential
 - Used with Full Copy or Precopy (implied Full Copy by default)
 - Required if **recreate** clone session is planned
 - Required if **incremental restore** is planned

CopyOnAccess By default, when a copy session is finally activated, the device pair state will be CopyOnAccess. This means that after activating the copy session, only those tracks that have been written to the source or written/read from the target will be copied to the target device. A full data copy to the target device will *not* occur unless all of the device tracks are accessed or written to while participating in the active session. When Engenuity detects that a source-protected track was written, it copies the track to the target device and unprotected the track before accepting the new write. Data from the source then becomes available to a target-connected host during the active session.

Full Device Copy Option When the copy session is eventually activated, data begins background copying so that a full copy of the data will become available on the target device. The full copy option (-copy) is only applicable when the target is a regular device and not a virtual device.

Precopy Option The -precopy option can be used with the create argument to start copying tracks in the background, before the clone session is activated. When using this option, a point-in-time copy cannot be established because the session is not activated. Before an activation, the pre-copy process never actually completes. Instead, the process keeps checking for new writes to be pre-copied to the target device until the session is activated. Once activated, the normal background copy mechanism takes over and the pre-copy operation ceases.

Differential Option This option creates an SDPF (Symmetric Data Differential Facility) session for maintaining changed track information. Creating a differential clone session automatically implies a Full Device Copy.



The diagram depicts flow of actions and states of clone session.



Creating a Copy Session

To create a CopyOnAccess session:

`symclone ... create`

- To create a "CopyOnAccess" Clone session – when activated tracks that have been written to the source or written/read from the target will be copied to the target device.

To create a Full Copy session:

`symclone ... create ... -copy`

- To create a full "copy" – when activated will invoke a background track for track copy of the source to the target clong device

To create a Precopy session:

`symclone ... create ... -precopy`

- To create a –precopy which enable track for track copy from the source to the clone device before the clone session is activated.

To create a differential clone session:

`symclone ... create ... -differential`

- Creating a differential clone session automatically implies a Full Device Copy.



Mod 4 – Page 8

© 2005 EMC Corporation. All rights reserved.

The `symclone create` command:

- Makes the target not ready (NR) to its host
- Creates a copy session
- Sets up the track protection bitmap to provide user access to data on the target as soon as the clone pair is activated
- Puts a hold on the target to prevent other control operations (for example, TimeFinder operations) or a copy over previously copied data
- The `-copy` option will make an immediate copy of the entire source to the target. Copying begins upon issuing the `symclone activate` command
- -precopy starts the copy immediately after the session has been created
- -differential allows a clone session to be recreated and incremental restore to be performed.



Changing Copy Mode of a Session

```
symclone -g Proddb set mode <nocopy|copy|precopy>
```

- Should be done before activation
- Used when state is Created or Recreated.



Mod 4 - Page 9

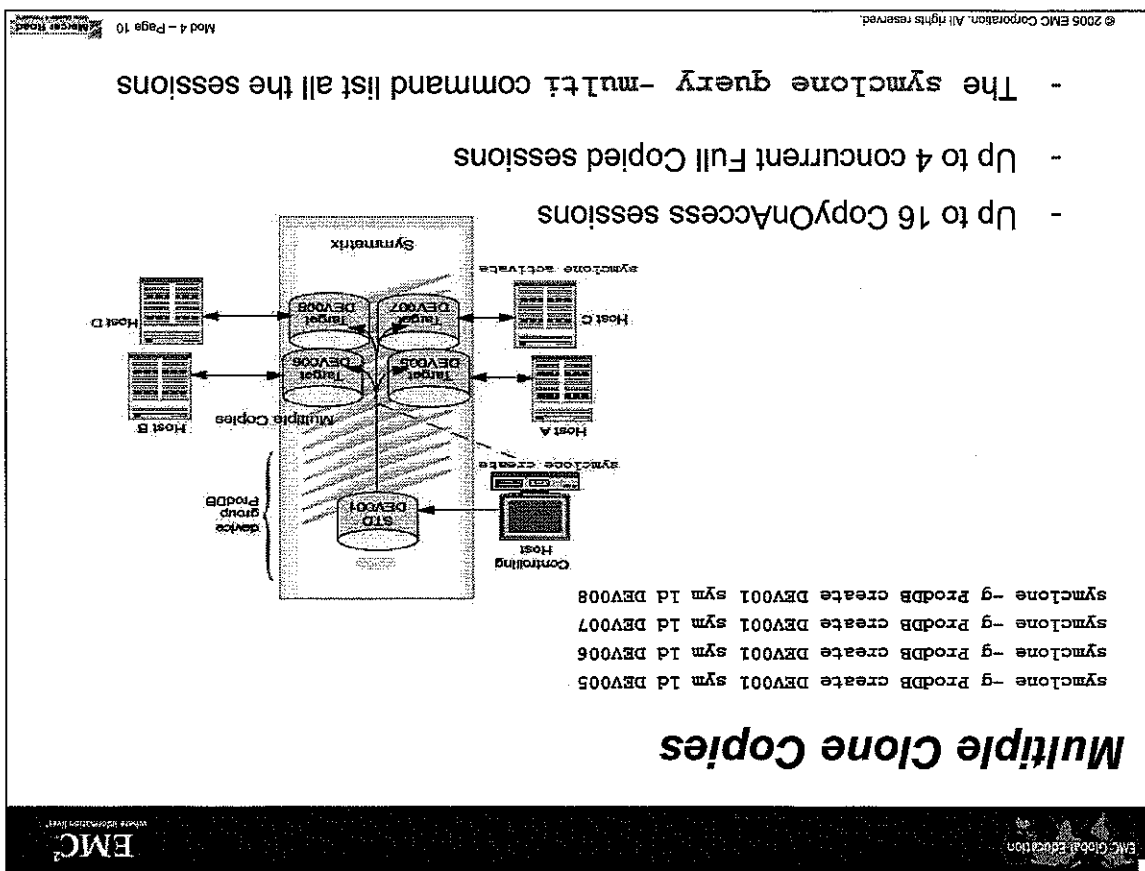
© 2005 EMC Corporation. All rights reserved.

You can use the set mode argument to modify the mode in which a copy session is operating after creation or recreation. However, you must use this argument before activating the session. Possible values are:

Copy — If the session was created without the -copy option, setting the mode to copy changes the session to Copy mode. That is, a copy will initiate once the session is activated.

Nocopy — If a session was created with the -copy option, setting the mode to nocopy changes the session to No-Copy mode. That is, the session will become CopyOnAccess once the session is activated and no full device copy will initiate.

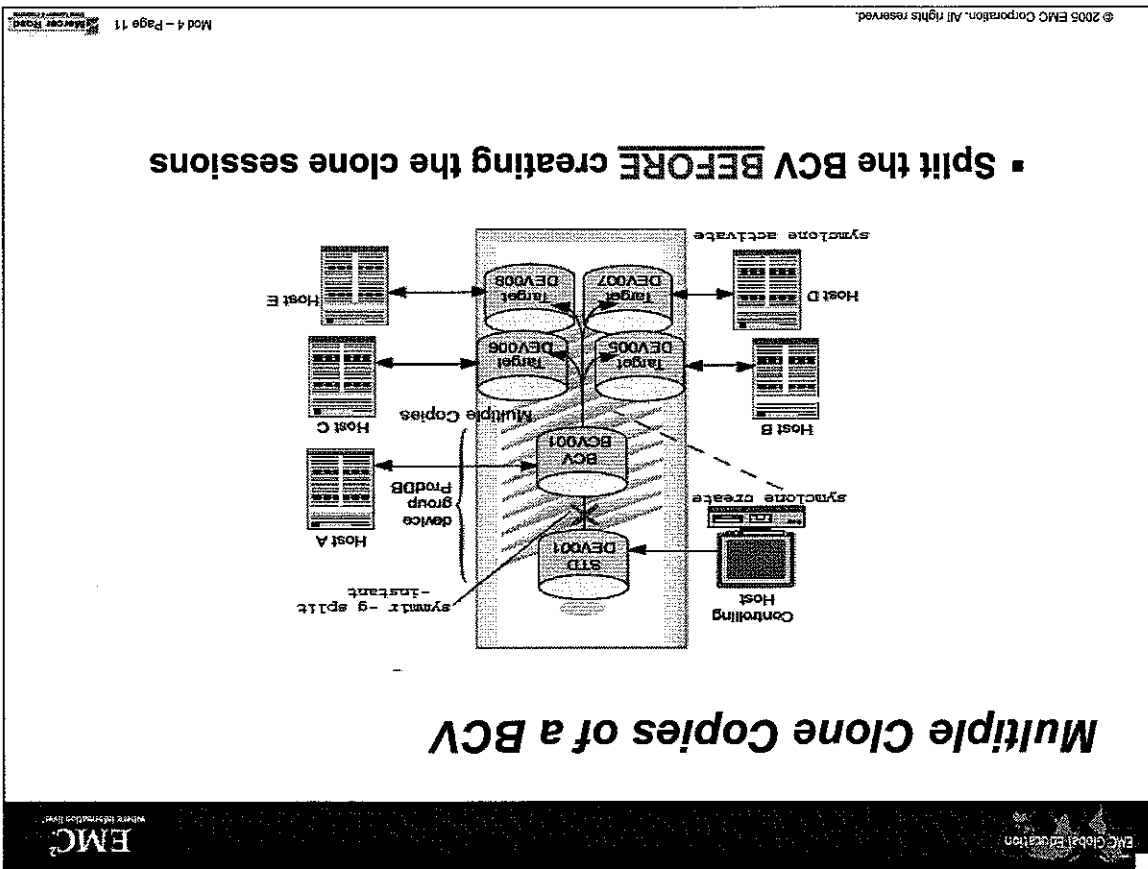
Precopy — If a session was created without the -precopy option, setting the mode to precopy will cause a Pre-Copy to take effect. Once you are in Pre-Copy mode, you cannot change to No-Copy mode.



Up to 16 clone copies of a standard source device can be created. Each session must be separately created and activated. The Symmetrix array is currently limited to 16 sessions per source device, which can be used for TimeFinder Mirror, Clone, Snap, or

SDDF (Symmetrix Differential Data Facility) operations. This limits the number of available Clone copies that can be created. A total of 16 concurrent CopyOnAccess copy sessions can be created from a standard device (sessions created without using the -copy option). However, this number is decremented for each current TimeFinder Mirror, Clone, Snap, and SDDF session. For example, if you have a standard device with two paired BCV devices, you can only create up to 14 copy sessions for that standard device.

Copy sessions created using the -copy option to create full data copies are limited to four concurrent sessions, with up to an additional 12 CopyOnAccess sessions, for a total of 16 sessions.



Clone sessions can use BCV as a source volume. This helps isolate production volumes from clone I/O during the copy sessions. The BCV background split must be completed before a clone session creation.



Activating a Copy Session

`symclone -g clonegrp activate SRC001 sym 1d TGT002`

The symclone activate command:

- Places the target in the Read/Write (RW) state
- Initiates copying if the -copy option has been specified in the symclone create command
- Omitting the -copy option in the symclone create command *defers* data copying until either tracks on the source are written to or tracks on the target are read or written to

A user on the target's host can access data on the target, even while copying is in progress.

When you issue the symclone activate command, the target is made ready again. A user on the target's host can then access data on the target immediately:

If the target's host attempts to read from or write to the target device tracks that have not been copied yet, the system finds those tracks on the source device and copies them immediately to the target, then services the I/O request.

If the source's host attempts to write to the source device tracks that are not copied yet, the system finds those tracks on the source and copies them immediately to the target, before those writes to the source can occur on the source.



TimeFinder/Clone: Consistent Activation

- Three methods to execute Consistent Activation
 - By specifying **-ppath** and PowerPath STD devices that hold the database
 - Specific devices – supply the device name
 - All devices using keyword **SRCDEVS**
 - Use **-rdb** for automatic mapping of DB devices
 - By specifying **–consistent**
 - By specifying **–vxfs** for VxFS filesystem (Solaris and HP only)



Mod 4 – Page 13

© 2005 EMC Corporation. All rights reserved.

There are three types of consistent activation available, each offers a restartable copy on the clone devices:

- PowerPath
- ECA
- Veritas File System




Major Activation Options

- Not Ready
 - The clone volume is placed in NR state
 - symclone -g clonegrp activate SRC001 sym
 - Id TGT002 -not_ready
- Consistent
 - Create a consistent image of a heterogeneous database environment
 - symclone -g clonegrp activate -consistent

EMC
© 2005 EMC Corporation. All rights reserved.

Mod 4 - Page 14
Mercer Road

Not Ready Option The -not_ready option can be used with the activate action to cause the target device to remain not ready to its host. The copy session will be activated and the target device will be placed in the Not Ready state. The Clone copy can later be read/write enabled to the host using the symld ready command.

Consistent Option The symclone activate command can be used with the -consistent option to invoke the Enginuity Consistency Assist (ECA) feature. This feature can be used to create Clone copies that are consistent with the database up to the point in time that the activation occurs. The feature suspends writes to the source devices during the activation. When the activation has completed, writes are resumed and the target device contains a consistent production database copy of the source device at the time of activation. Details of ECA technology will be discussed in the Consistency Technology module.

Refer to EMC Solutions Enabler Symmetrix CLI Version 6.0 COMMAND REFERENCE, P/N 300-002-181, REV A01 for the complete option list.



Establishing a Copy Session

- The establish command combines create/recreate and activate into a single command.
 - Makes behavior more similar to TimeFinder/Mirror
- Execute recreate followed by activate.
 - symclone establish
- Execute create followed by activate.
 - symclone -full establish
- Activate options (-consistent, -preaction, etc.) are performed at activate (not create) time
 - symclone -full establish -consistent



Mod 4 - Page 15

© 2005 EMC Corporation. All rights reserved.

The symclone establish command sets the target device to Not Ready for a short time. Therefore, you may want to unmount the target volume before issuing the command. An establish operation will create and then activate a new clone session. The clone session created by the establish operation is by default equivalent to a session created with -copy and -differential options. The establish operation can also be performed on an existing differential clone session. In which case, the operation will perform recreate and activate operations on the clone session.

Terminating a copy session deletes the pairing information in the Symmetrix array and removes any hold on the target device.

Terminating a session while the device pairs are in the CopyOnAccess or CopyInProgress state will cause the session to end. If the application has not finished accessing all of the data, the target copy is not a full copy. The symclone terminate command is allowed for all TimeFinder pair states.

A created and activated copy session may be terminated, but the data on the target device will become invalid (whether or not data was actually copied to the target. If the state is CopyInProgress, then the -symforce option must be applied to terminate the session. But, this will also leave the target copy as an “incomplete copy”.

Terminating a Copy Session

The symclone terminate command:

- Stops a copy session
 - Removes any hold on the target
 - Deletes copy session information from the Symmetrix unit
- Normal termination is possible whenever a copy pair is in the Created, Copied, CopyOnAccess, or Restore state

The syntax is:

symclone -g clonegrp terminate SRC001 sym id TGT002



Restoring from a TimeFinder/Clone

`symclone -g clonegrp restore SRC001 sym 1d TGT002`

- Restore can be done to other standards or the source volume
- Session must be created with `-copy` or `-precopy`
- Session must be activated
- Wait until the clone is in a “Copied” state
- Issue a `symclone restore` command

Mod 4 – Page 17© 2005 EMC Corporation. All rights reserved.

You can use the `symclone restore` command to copy target data to another device (full restore), or back to the original source device (incremental restore).

In the case of a full restore (-full), the original session will terminate and a copy session to the target of the restore will start.

In the case of an incremental restore, the original session will terminate and an incremental copy session back to the original source device will start.

To support this operation, the session must have been created with the -differential option and the device must be in a fully copied state.

The diagram illustrates the process of cloning a standard volume. A large vertical rectangle labeled 'Standard Volume' is shown. Two arrows point from it to a smaller cylinder labeled 'Clone'. The first arrow is labeled 'symmtr commands' and the second is labeled 'symclone commands'.

TimeFinder/Mirror Emulation Mode

- Emulation mode allows customers to leverage existing TimeFinder/Mirror scripts
 - symmtr commands are converted to symclone commands
- Enables
 - Faster introduction of TimeFinder/Clone into existing TimeFinder/Mirror environments
 - Simplified conversion to RAID 5 protected BCVs
 - Support for all current TimeFinder/Clone capabilities
 - Symmetrix mirror position not required
 - Immediately read and write accessible
 - Up to 16 copies of a source
 - NOCOPY option
 - TimeFinder/Consistency Group support

© 2005 EMC Corporation. All rights reserved.

Mod 4 - Page 18

Starting with Enginuity™ Version 5671, TimeFinder supports the ability to map TimeFinder commands to Clone operations. With this feature, TimeFinder commands will execute Clone operations. This feature is enabled by setting the environment variable

`SYMCLEEMULATION` to `ENABLED`, or if a RAID 5 BCV is encountered.

SE 6.0 Added capabilities to match the missing TimeFinder/Mirror functionality

- recreate and -differential to match the incremental capabilities
- establish to remove the separation of activate and create
- copy mode -precopy to with the -cycled verify state to simulate the TimeFinder synchronization before split
- restore to explicitly match restore support including incremental restore
- remote RDF operations for DGS, CGs and the Device File

• Only Clones

- Can be protected using any type of supported protection scheme including RAID5
- Can be put into a NOCOPY mode fully suspending "synchronization" I/Os



Operations Mappings – TimeFinder Mirror to TimeFinder Clone

TimeFinder/Mirror Commands	TimeFinder/Clone Commands
FULL ESTABLISH	CREATE with Pre-copy
SPLIT	ACTIVATE
INCREMENTAL ESTABLISH	RECREATE
FULL RESTORE	FULL RESTORE
INCREMENTAL RESTORE	INCREMENTAL RESTORE
CANCEL	TERMINATE

© 2005 EMC Corporation. All rights reserved.

Mod 4 – Page 19

EMC Corporation

The following limitations apply to this feature:

- The TimeFinder reverse split feature is not allowed.
- Restores will always be protected restores.
- Incremental Restore (Reverse Re-Snap) will only be accepted if all tracks were originally copied from the source prior to the restore taking place.
- The SYMAPI_DEFAULT_BCV_SPLIT_TYPE, SYMAPI_DEFAULT_BCV_RESTORE_TYPE, SYMAPI_DEFAULT_BCV_ESTABLISH_TYPE option file settings will be ignored.
- Any Snap or Clone operations to an emulated device will be rejected.
- The maximum number of BCVs that can be incrementally established with a Standard device will be 8 instead of the 16 allowed by TimeFinder.
- The SYMCLI_MAX_BCV_PAIRS can at most be eight.
- The BCV states Split-Before-Restore and Split-Before-Sync are not valid states for an emulation device. In both cases, a forced Split will complete the operation.

EMC Global Edition

EMC²

Clone Emulation in Action

sun-55:/ >symdev show 21B
(TRUNCATED) ..

BCV Pair Information

Standard (STD)	Device Symmetrix Name	: 020B
Standard (STD)	Device Serial ID	: Not Visible
Standard (STD)	Device Group Name	: cloned
Standard (STD)	Composite Group Name	: Not/Grouped

BCV Device Symmetrix Name	: 021B
BCV Device Serial ID	: Not Visible
BCV Device Associated Group Name	: cloned
BCV Device Associated CG Name	: Not/Associated

BCV Device Status

State of Pair (STD ==> BCV)	: Synchronized
Percent Initiated	: 100%
Time of Last BCV Action	: Tue May 31 14:45:00 2005

State of BCV Mirrors

State of BCV Mirrors	: Detached
----------------------	------------

BCV State Flags

BCV State Flags	: (CanRevSpt1) (Emulation)
-----------------	----------------------------

Number of Inv. Tracks for STD Device : 0
Number of Inv. Tracks for BCV Device : 0

Mod 4 -- Page 20

© 2005 EMC Corporation. All rights reserved.

The device 21B is a RAID-5 BCV which would automatically trigger a TF/clone emulation. The device is paired with a standard as follows:

symmlr -g clonedg est SRC001 BCV dev 21B -full -nop

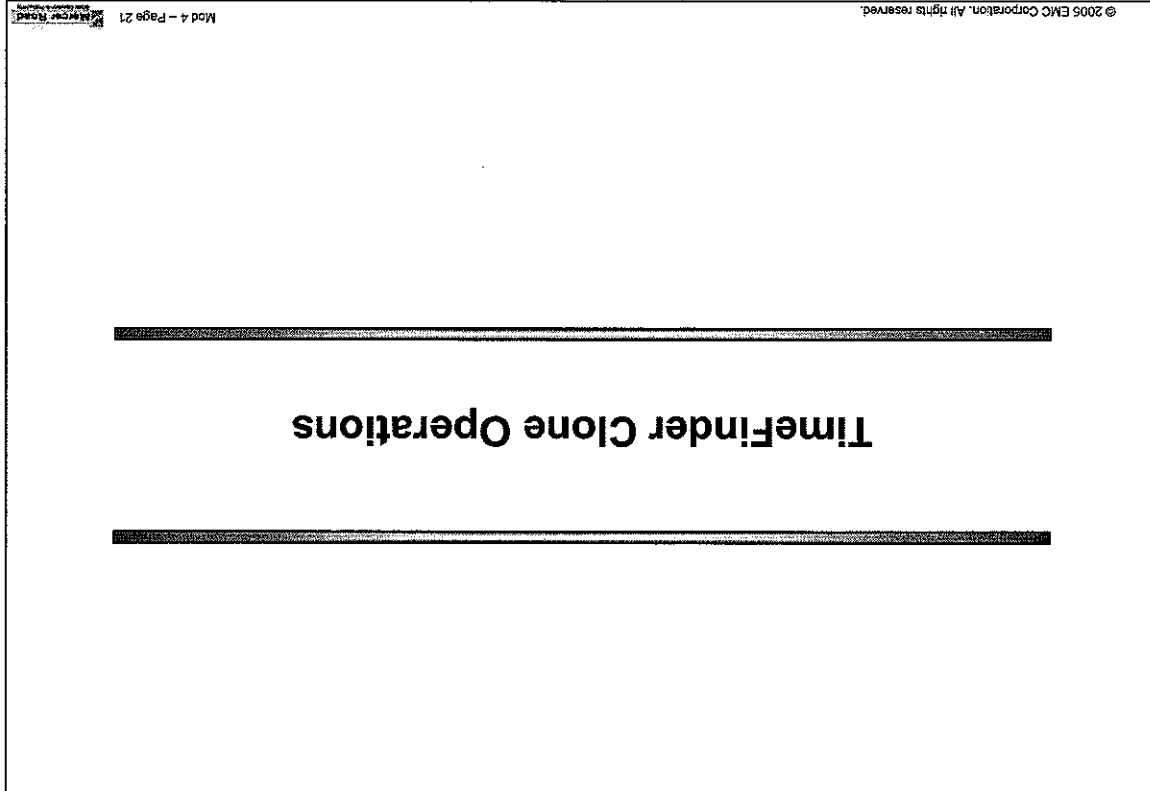
'Full Establish' operation execution is in progress for device 'SRC001' paired with BCV device '21B' in device group 'clonedg'. Please wait...

'Full Establish' operation successfully initiated for device 'SRC001' in group 'clonedg' paired with BCV device '21B'.

The translation of TimeFinder / Mirror to TimeFinder / Clone command is done by the Symmetrix. The only way that users will know that the emulation is in effect is to perform a symdev show on the RAID-5 BCV device as shown.



TimeFinder Clone Operations





The symclone list / query command

symclone list

Symmetrix ID: 000187940398

No Copy sessions found

symclone query

Device group 'clonedg' does not have any devices that are
Clone source devices



Creating the symclone session

```
# symclone create SRC001 sym Id TGT001 -nop
```

```
'Create' operation execution is in progress for  
device 'SRC001' paired with target device 'TGT001'  
in device group 'clonedg'. Please wait...
```

```
'Create' operation successfully executed for device  
'SRC001' in group 'clonedg' paired with target  
device 'TGT001'.
```



Checking the symclone create Session

symclone query

Device Group (Dg) Name: clonedg

Dg's Type : REGULAR

Dg's Symmetrix ID : 000187940398

Source Device	Target Device	State	Copy
---------------	---------------	-------	------

Protected Modified	Modified
--------------------	----------

Logical	Sym Tracks	Tracks	Logical	Sym tracks	CGDP SRC	TGT (%)
---------	------------	--------	---------	------------	----------	---------

SRC001	020B	14370	0 TGT001	01FC	0 .X..	Created
--------	------	-------	----------	------	--------	---------

Total	449.1
-------	-------

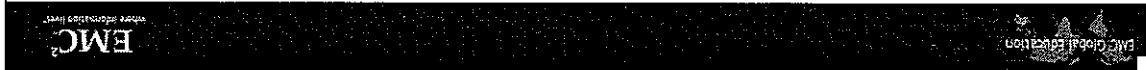
© 2005 EMC Corporation. All rights reserved.

Mod 4 - Page 24

EMC
Global Education

Legend:

- (C) : X = The background copy setting is active for this pair.
- = The background copy setting is not active for this pair.
- (G) : X = The Target device is associated with this group.
- = The Target device is not associated with this group.
- (D) : X = The Clone session is a differential copy session.
- = The Clone session is not a differential copy session.
- (P) : X = The pre-copy operation has completed one cycle
- = The pre-copy operation has not completed one cycle



Activating the symclone session

```
# symclone activate SRC001 sym Id TGT001 -nop
```

```
'Activate' operation execution is in progress for device group  
'SRC001' paired with target device 'TGT001' in device group  
'clonedg'. Please wait...
```

```
'Activate' operation successfully executed for device 'SRC001'  
in group 'clonedg' paired with target device 'TGT001'.
```



Querying the state of the clone session

symclone query

Device Group (DG) Name: clonedg

DG's Type : REGULAR

DG's Symmetrix ID : 000187940398

Source Device		Target Device		State		Copy	
Protected Modified		Logical		Sym Tracks		Tracks	
Logical		Sym Tracks		CGDP SRC		=> TGT	
MB (s)		Total		MB (s)		Total	
449.1		-----		0		0	
SRC001		020B		14370		0 TGT001	
01FC		0 .X..		CopyOnAccess		0	





Terminating the symclone session

symclone terminate SRC001 sym Id TGT001 -nop

'Terminate' operation execution is in progress for device
'SRC001' paired with target device 'TGT001' in device
group 'clonedg'. Please wait...

'Terminate' operation successfully executed for device
'SRC001' in group 'clonedg' paired with target device
'TGT001'.

Mod 4 -- Page 27

© 2005 EMC Corporation. All rights reserved.



The symclone create-differential flag

```
# symclone create SRC001 sym Id TGT001 -copy -differential -nop
```

```
'Create' operation execution is in progress for device 'SRC001'  
paired with target device 'TGT001' in device group 'clonedg'.  
Please wait...
```

```
'Create' operation successfully executed for device 'SRC001' in  
group 'clonedg' paired with target device 'TGT001'.
```

Legend:

(C) : X = The background copy setting is active for this pair.
 . = The background copy setting is not active for this pair.

(G) : X = The Target device is associated with this group.
 . = The Target device is not associated with this group.

(D) : X = The Clone session is a differential copy session.
 . = The Clone session is not a differential copy session.

(P) : X = The pre-copy operation has completed one cycle
 . = The pre-copy operation has not completed one cycle

EMC Global Education

EMC

where information lives

Query after Creation (-differential)

symclone query

Device Group (DG) Name: clonedg
 DG's Type : REGULAR
 DG's Symmetrix ID : 000187940398

Source Device	Target Device	State	Copy

Protected Modified	Logical	Sym Tracks	CGDP SRC <=> TGT (%)

SRSC001	020B	14370	0 TGT001 01FC 0 XXX. Created 0
Total			
MB(s)			449.1

Mod 4 - Page 29

© 2005 EMC Corporation. All rights reserved.



The symclone activate-consistent

```
# symclone activate SRC001 sym Id TGT001 -consistent -nop
```

```
'Activate' operation execution is in progress for device 'SRC001'.  
paired with target device 'TGT001' in device group 'clonedg'.  
Please wait...
```

```
'Activate' operation successfully executed for device 'SRC001' in  
group 'clonedg' paired with target device 'TGT001'.
```



Query after Activation (–consistent)

symclone query

Device Group (DG) Name: clonedg

DG's Type : REGULAR

DG's Symmetrix ID : 000187940398

Source Device	Target Device	State	Copy
---------------	---------------	-------	------

Protected	Modified	Modified
-----------	----------	----------

Logical	Sym	Tracks	Tracks	Logical	Sym	tracks	CGDP	SRC	<=>	TGT	(%)
---------	-----	--------	--------	---------	-----	--------	------	-----	-----	-----	-----

SRC001	020B	7030	0 TGT001	01FC	0 XXX	CopyInProg	51				
--------	------	------	----------	------	-------	------------	----	--	--	--	--

Total

MB(s) 219.7





The symclone recreate

```
# symclone recreate SRC001 sym Id TGT001 -nop
```

```
'Recreate' operation execution is in progress for device group  
'SRC001' paired with target device 'TGT001' in device group  
'clonedg'. Please wait...  
'Recreate' operation successfully initiated for device 'SRC001'  
in group 'clonedg' paired with target device 'TGT001'.
```



Query after Recreating

symclone query

Device Group (DG) Name: clonedg

DG's Type : REGULAR

DG's Symmetrix ID : 000187940398

Source Device	Target Device	State	Copy
---------------	---------------	-------	------

Logical	Sym	Tracks	Protected Modified	Logical	Sym	tracks	CGDP SRC	<=>	TGT	(%)
---------	-----	--------	--------------------	---------	-----	--------	----------	-----	-----	-----

SRC001	020B	0	0	TGT001	01FC	0	xxx. Recreated			100
--------	------	---	---	--------	------	---	----------------	--	--	-----

Total

MB (s)

0.0



The symclone establish

```
# symclone establish SRC001 sym id TGT002 -full -nop
```

```
'Clone Full Establish' operation execution is in progress for  
device 'SRC001' paired with target device 'TGT002' in  
device group 'clonedg'. Please wait...
```

```
'Clone Full Establish' operation successfully executed for  
device 'SRC001' in group 'clonedg' paired with target  
device 'TGT002'.
```





Query after Establishing

symclone query

Device Group (Dg) Name: clonedg

Dg's Type : REGULAR

Dg's Symmetrix ID : 000187940398

Source Device	Target Device	State	Copy
---------------	---------------	-------	------

Protected Modified			
--------------------	--	--	--

Logical	Sym Tracks	Tracks	Logical	Sym tracks	CGDP SRC	<=> TGT (%)
---------	------------	--------	---------	------------	----------	-------------

SRC001	020B	0	0 TGT002	01FB	0	xxx. copied
--------	------	---	----------	------	---	-------------

Total

MB (s)

Implicit Full Copy and Differential session



Query of Multi Clone

symclone query -multi

Required to query multiple clone sessions

Device Group (DG) Name: clonedg

DG's Type : REGULAR

DG's Symmetrix ID : 000187940398

Source Device	Target Device	State	Copy
---------------	---------------	-------	------

Logical	Sym	Tracks	Tracks	Logical	Sym	tracks	CGDP	SRC	<=>	TGT	(%)
---------	-----	--------	--------	---------	-----	--------	------	-----	-----	-----	-----

Protected Modified				Modified							
--------------------	--	--	--	----------	--	--	--	--	--	--	--

SRC001	020B	0	0	TGT002	01FB	0	XXX	Copied	100
--------	------	---	---	--------	------	---	-----	--------	-----

Total	-----	0	0	TGT001	01FC	0	XXX	Copied	100
-------	-------	---	---	--------	------	---	-----	--------	-----

Track(s)	0
----------	---

MB(s)	0.0
-------	-----



symclone restore

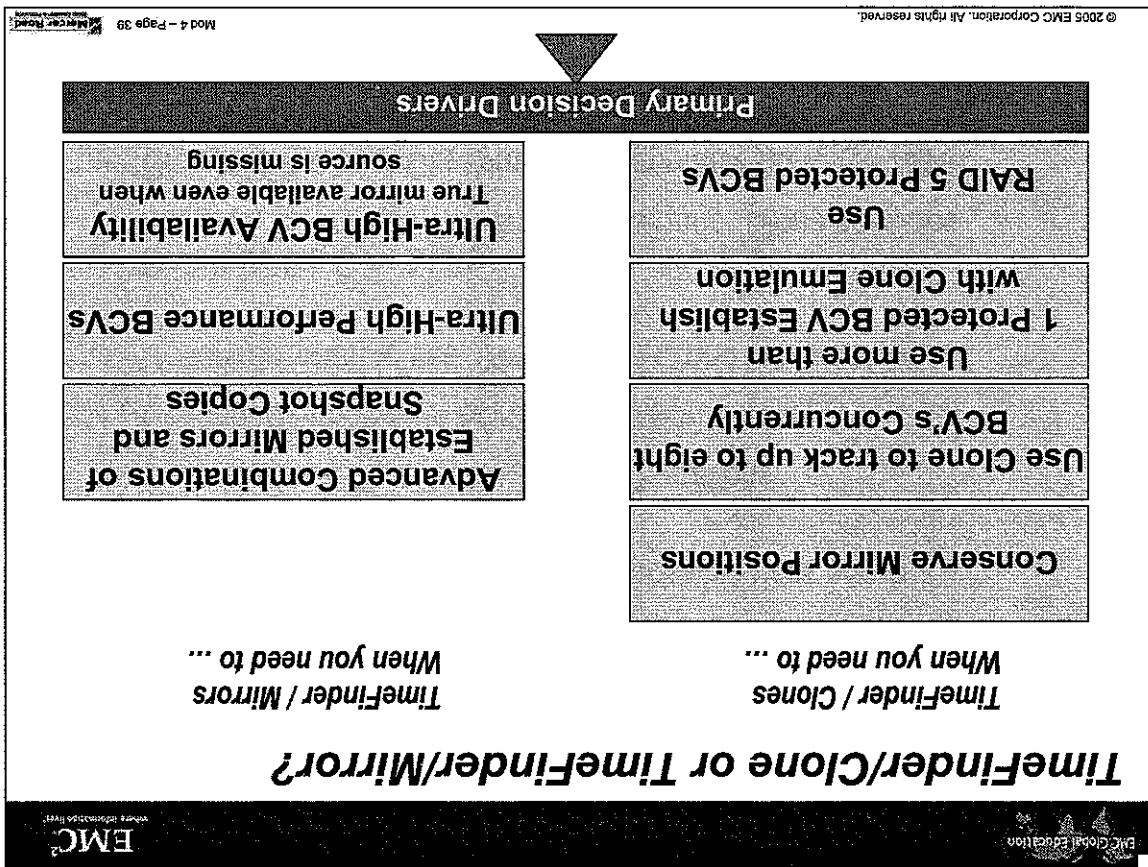
```
# symclone restore SRC001 sym 1d TGT001 -nop
```

```
'Incremental Restore' operation execution is in progress  
for device 'SRC001' paired with target device 'TGT001'  
in device group 'clonedg'. Please wait...
```

```
'Incremental Restore' operation successfully initiated  
for device 'SRC001' in group 'clonedg' paired with  
target device 'TGT001'.
```

#symc1one query

Copy	Source Device	Target Device	State
--	Logical Sym Protected Modified Logical Sym tracks Modified CGDP SRC <=> TGT (%)	--	--
SRC001	020B	0 TGT001	01FC
100			0 XXX. Restored
Total MB(s)	-----		
0.0			



Clone advantages include:

- Relieving the four-mirror limit on the STD device (since clones do not require mirror positions). Since no positions will be taken up by BCVs, more are free for SRDF configurations including SRDF/Star and Concurrent SRDF.
- Using more than two Clone Copies Concurrently . Today we are limited by the mirror positions available and the number of dynamic mirrors a device can have. Using clone emulation mode, we will allow up to eight concurrent BCV devices to be established to the STD.
- Using more than one protected BCV establish. Today, a protected BCV establish (for BCV devices that are mirrored) moves both mirrors of the BCV device to the STD. This uses up the mirror positions in a way that only a single BCV device can be "protected established" to the STD. Using clone emulation mode, the mirror restrictions are removed and you can perform a protected BCV establish with more BCV devices.
- For the sole purpose of using RAID-5 BCVs.

TimeFinder/Mirrors strengths are higher performance and higher availability needs



Module Summary

Key points covered in this Module :

- Described TimeFinder / Clone and possible uses within a business environment.
- Described the TimeFinder / Clone Operations.
- Described TimeFinder / Clone emulation mode.
- Described when to use TimeFinder / Clone vs. TimeFinder / Mirror.
- Described the Sym CLI symclone command set to Create, Activate, Query and Terminate TimeFinder Clone sessions.
- Described the Sym CLI symclone command set to Recreate, Establish and Restore TimeFinder Clone copies.

© 2005 EMC Corporation. All rights reserved.

Mod 4 - Page 40



The following Module Summary / Key Point for TimeFinder Clone” where presented.



EMC
Global Education



EMC
where information lives

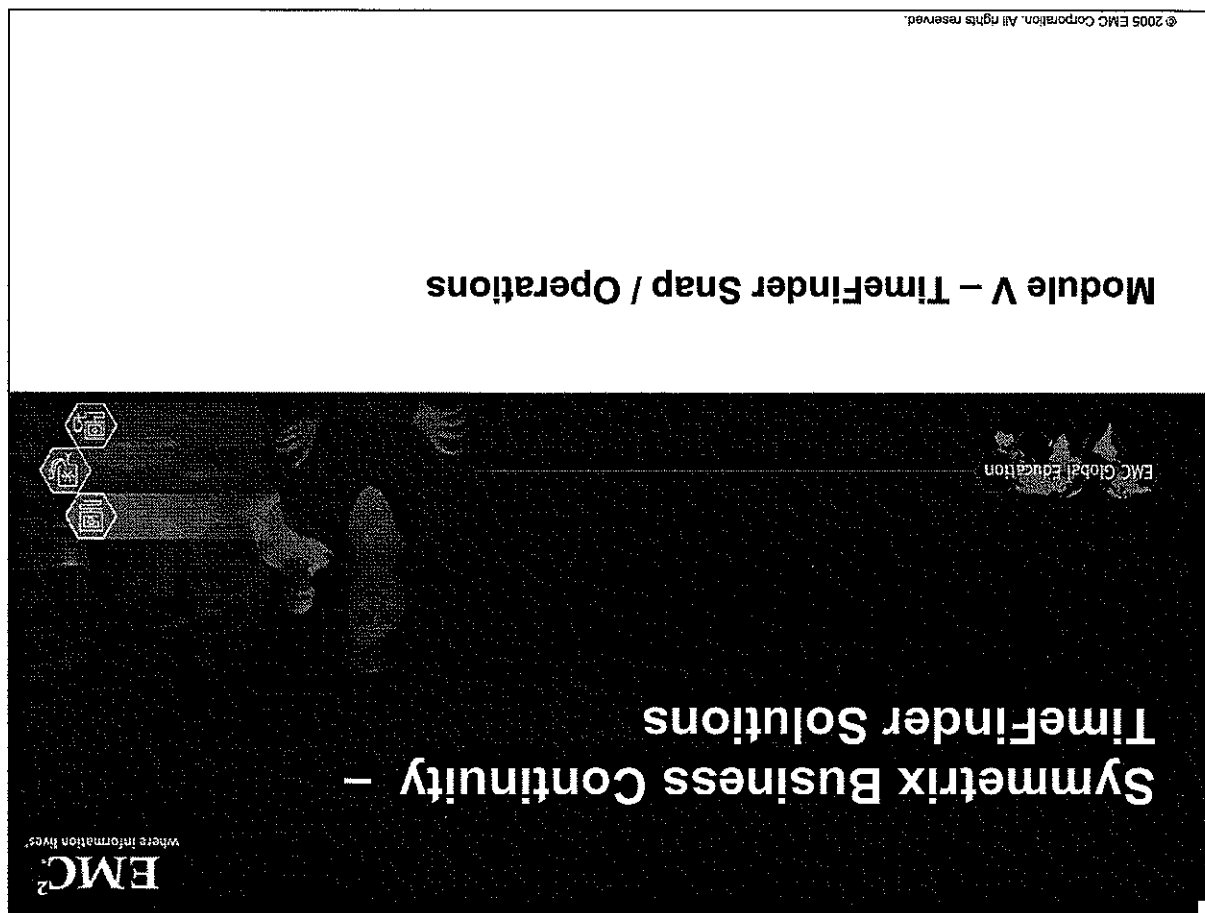
EMC²

where information lives

© 2005 EMC Corporation. All rights reserved.

Mod 4 - Page 41

This concludes, Module IV “TimeFinder Clone” for Symmetrix Business Continuity –
TimeFinder Solutions.



EMC² where information lives

Symmetrix Business Continuity -

TimeFinder Solutions

Module V - TimeFinder Snap / Operations

EMC Global Education

© 2005 EMC Corporation. All rights reserved.

These materials may not be copied without EMC's written consent.

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED "AS IS." EMC CORPORATION MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WITH RESPECT TO THE INFORMATION IN THIS PUBLICATION, AND SPECIFICALLY DISCLAIMS IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC and TimeFinder are trademarks of EMC Corporation.

All other trademarks used herein are the property of their respective owners

Revision History

Symmetrix Business Continuity – TimeFinder Solutions

Module V – TimeFinder Snap / Operations

Rev #	File Name	Date	Revision Number	Activity - Notes
1.0a	BCL_Mods_V10a.Ppt	30-Mar-2005		First Pass – 30-Mar-2005
1.2a	BCL_Mods_V12a.Ppt	26-Jul-2005		Second Pass – After T3 - 01-Jun-2005
2.1a	BCL_Mods_V21.Ppt	12-Sep-2005		Name Change
			Module #	Module Name
			1	TimeFinder Introduction
			2	TimeFinder Mirror Overview
			3	TimeFinder Mirror Operations
			4	TimeFinder Clone / Operations
			5	TimeFinder Snap / Operations
			6	TimeFinder Labs

© 2005 EMC Corporation. All rights reserved.

Mod 5 – Page 2

EMC Global Education
EMC
where information lives

Copyright © 2005 EMC Corporation. All rights reserved.

These materials may not be copied without EMC's written consent.

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED "AS IS." EMC CORPORATION MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WITH RESPECT TO THE INFORMATION IN THIS PUBLICATION, AND SPECIFICALLY DISCLAIMS IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC, and TimeFinder are trademarks of EMC Corporation.

All other trademarks used herein are the property of their respective owners.

Module Objectives – Module – V

Symmetrix Business Continuity –

TimeFinder Solutions

At the completion of this module, the student will be able to

- Describe the advantages of a TimeFinder Snap environment
- Describe a TimeFinder Snap "Copy on First Write" process within a created Snap session
- Describe Create, Activate, Terminate and Restore TimeFinder Snap operations
- Identify and describe "Virtual Devices" within a TimeFinder Snap environment
- Using the Sym CLI symsnap command set, to Monitor, Create, Activate, and Query TimeFinder Snap sessions

© 2005 EMC Corporation. All rights reserved.

Mod 5 – Page 3

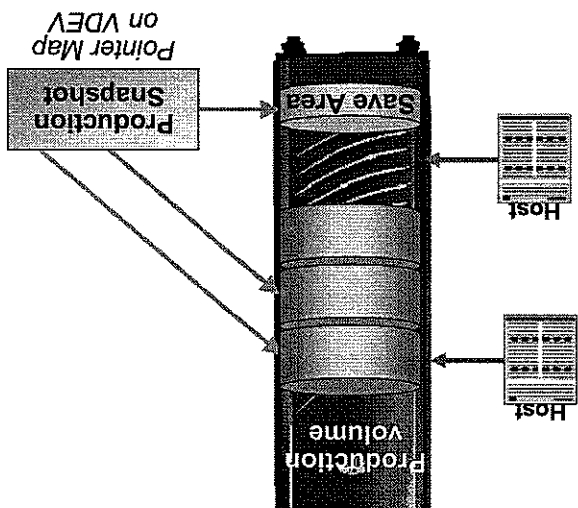
The above objectives are covered in this module

Program – Symmetrix Business Continuity – TimeFinder Solutions
Module Name – Symmetrix TimeFinder Snap Overview Module

Module Number - V

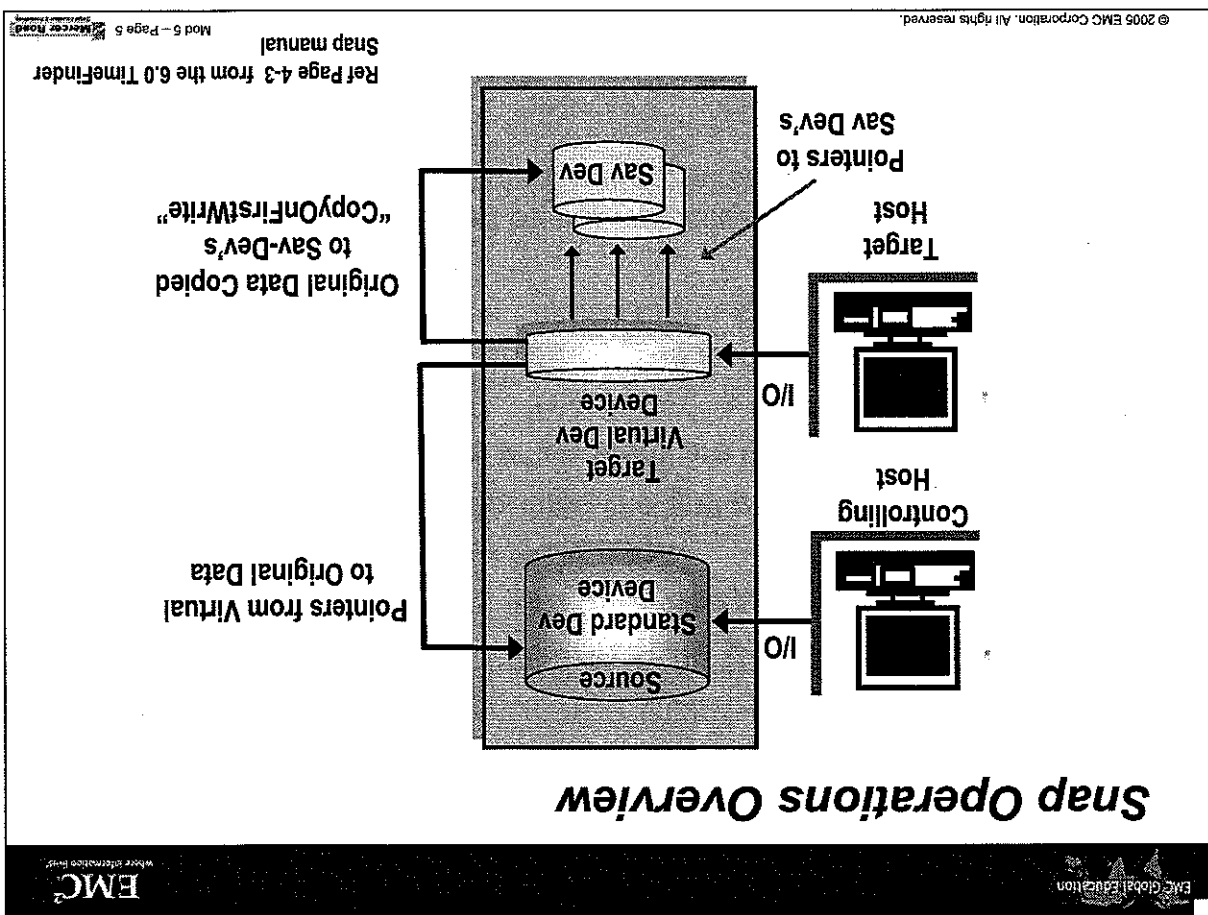
TimeFinder Snap for Symmetrix DMX

- Snapshots create logical point-in-time images of a source volume
- Requires only a fraction of the source volume's capacity
- Up to fifteen (15) snapshots can be created from a source volume and are available immediately
- Complements TimeFinder and provides unmatched replication flexibility



TimeFinder Snap creates space-saving, logical point-in-time images or "snapshots." The snapshots are not a full copies of data; they are logical images of the original information based on the time the snapshot was created. It's simply a view into the data.

A set of pointers to the source volume data tracks is instantly created upon activation of the snapshot. This set of pointers is addressed as a logical volume and is made accessible to a secondary host that uses the point-in-time image of the underlying data. Some documents may indicate that the maximum copy session is sixteen. The fact is that users can create up to fifteen copy sessions and the Symmetrix reserves one session for restoring purpose.



The above illustrates a virtual copy session where the controlling host creates a set of pointers to reference where the original data resides. The pointers reside on the "Virtual Device". TimeFinder/Snap functionality is managed via copy sessions, which pair the source and target devices. Sessions are maintained on the Symmetrix array and can be queried to verify the current state of the devices.

A copy session must first be "Created" that defines the Snap devices in the copy operation. Once the session is subsequently activated, the target virtual devices then become accessible to its host. When the information is no longer needed, the session can be terminated.

Snap operations are controlled from the host by using the symsnap command to create, activate, terminate, and restore the Snap copy sessions.

TimeFinder Snap allows you to make copies of data simultaneously on multiple target devices from a single source device. The data is available to a target host instantly. However, you can copy data from a single source device to as many as fifteen (15) target devices. This source device can be a Standard or a BCV device.

A target device is a virtual device that consumes negligible physical storage through the use of pointers to track data.



EMC
Global Education

Copyright © 2005 EMC Corporation. All Rights Reserved.

TimeFinder Snap

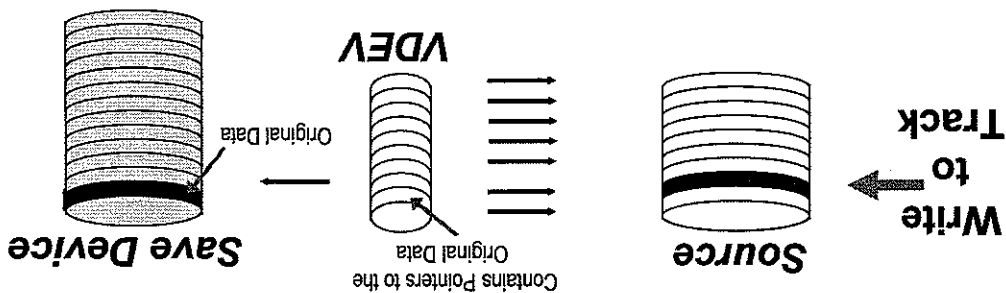
TimeFinder Snap captures a point-in-time view of a source volume by duplicating only the *changed* data:

- The target is a “slim” *virtual device* that contains pointers to the original source data
- The target can be mounted like any other volume
- Copying only occurs when there are writes to the source or target
- The pre-image of data that has changed is copied to a **save device**, consuming a fraction of the space required to copy the entire source
- Copying is controlled by *copy sessions*, which are created, activated, queried, listed, and terminated using the **symSnap** command

Mod 5 - Page 6

© 2005 EMC Corporation. All rights reserved.

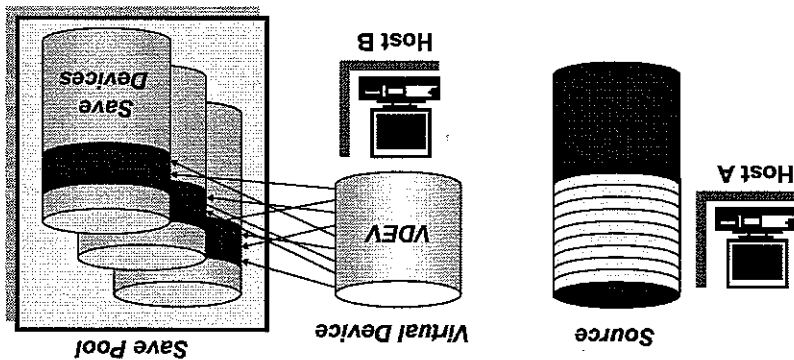
TimeFinder Snap: Copying Data



- Once the TimeFinder Snap session is activated:
 - The first time a track on the source is written to, the original data on the source is copied to the save device.
 - The VDEV pointer is changed to point to the save device, then the source is changed.

TimeFinder Snap uses a process called "Copy on First Write" when handling writes to the production data when a snapshot is running. When a host attempts to write to the data on the production volume, the original track is first copied to the "Save Area", then the write is processed against the production volume. This process of pointers maintains the consistent, **point-in-time copy** of the data for the ongoing snapshot.

TimeFinder Snap: Striping the Save Device

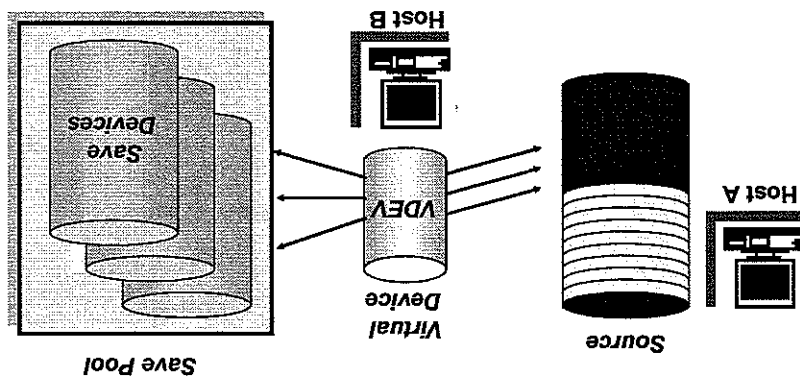


- The copy on write is repeated every time a different track on the source is first written to
- Tracks are "striped" in a round-robin manner to the "Save Devices" to improve performance

The save pool device are not host accessible but accessed only through the virtual devices that points to it.

Save devices provide a pool of physical space to store snap-copy data to which virtual devices point. "Tracks are "striped" by the microcode in a round-robin manner to the save devices to improve performance. When save devs are configured across the backend they are separated first by director, then channel, and then by disk

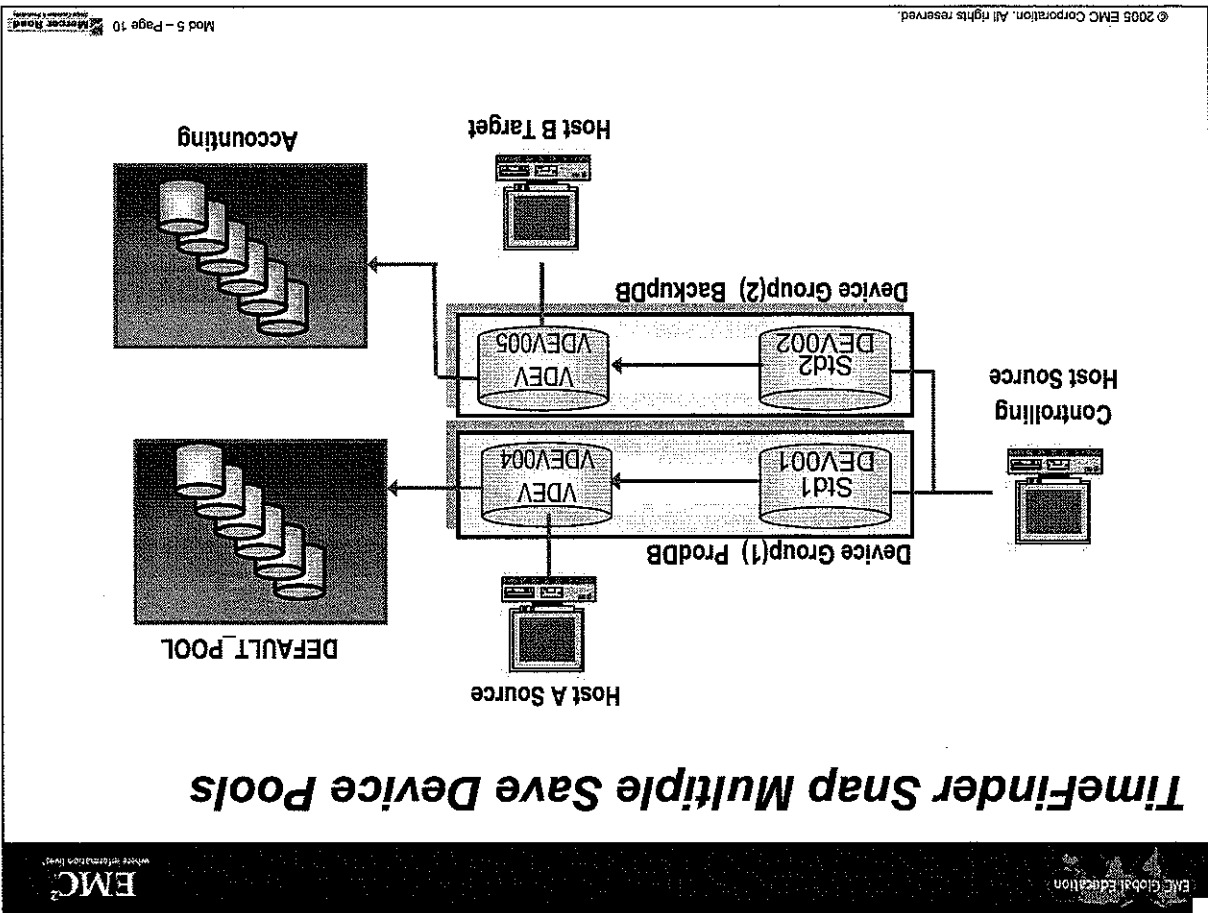
TimeFinder Snap: Terminating a Copy Session



When a copy session is terminated

- The virtual device is made not ready
- Tracks on the save device(s) are reclaimed if they are not referenced by any other copy session
- The copy session structures are freed up

As sessions are terminated, the space in the Save Area is released and available for re-use by other snap sessions.



Symmetrix SAVE devices are specially configured devices (not mapped to the host) that provide pooled physical storage space used to store pre-update images or changed tracks during a virtual copy session. Devices within a SAVE device pool act as a group to store data in striped form. Symmetrix supports the creation of multiple named SAVE device pools, allowing symsnap commands to use a particular pool.

Save Area capacity can also be allocated based on application requirements, for example

- Allocate more space for Write-intensive applications.
- Allocate more space for long duration snapshots.

The -svp option can be used with the create action to specify which SAVE device pool to use for an operation. For example, to instruct the copy session to use the SAVE device pool Accounting,

use the following symsnap command:

```
smsnap -g BackupDB create DEV002 vdev 1d VDEV005 -svp Accounting
```