Using EMC Storage Array Technologies for Efficient Data Migrations of VMware ESX Server Environments

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Agenda

- Introduction
- Why data migrations are performed
- Types of data migrations
- Migrations using service console
- Open Replicator for data migrations
  - Considerations in VMware ESX Server 2.5.x environments
  - Migrations in VMware ESX Server 3.0 environments
- SAN Copy for data migrations
  - Considerations in VMware ESX Server 2.5.x environments
  - Migrations in VMware ESX Server 3.0 environments
Why are data migrations performed

- Technology refresh
- Storage consolidation and upgrade
- Performance tuning
- To enable tiered storage (ILM)
Migration Challenges Facing Today’s Businesses

- 24 x 7 x 365 application availability
  - No downtime windows
  - No data exposure
- Performance optimization
  - Load balancing and volume resizing
- Storage utilization
- Complexity and cost
  - Disparate systems
  - Manual processes
  - Long planning cycles
  - Risks
Type of data migrations

- Backup and restore
- Host based data migration
  - ESX Server level migration
  - Virtual Machine migration
- Migrations using SAN or IP
  - Storage virtualization (Invista, SVC etc.)
  - Migrations across heterogeneous storage arrays
    - Open Replicator
    - SAN Copy
  - Migration between homogeneous storage arrays
    - CLARiiON to CLARiiON (MirrorView)
    - Symmetrix to Symmetrix (SRDF)
    - Celerra to Celerra (Celerra Replicator)
Host Based Migration

- Service Console can be used to perform migrations
  - Copy each virtual machines disks from source to target volume
  - Can be done using the “cp” command
    - Not practical for ESX 3.x environments
  - “vmkfstools” in ESX 3.x environment provides an option to copy data
    - Not practical for ESX 2.x environments
- Migrations using Virtual Center
  - “Cold” migrate can be used to move data
- Migrations inside the Virtual Machines
  - Host based replication software
    - Open Migrator/LM for Windows and Linux
    - Replistor for Windows
  - Logical Volume Managers can “move” data
Using “cp” on ESX 2.5 Service Console

- Steps needed to perform migration
  - Present “source” and “target” disk(s) to ESX Server
  - Create VMFS on “target” disk(s) and assign an appropriate label
  - Power virtual machines off
  - Use “cp” to copy virtual disks from source VMFS to target VMFS
  - Remove access to “source” disk(s)
  - Rescan the SAN fabric
  - Re-label the VMFS on “target” disk(s) to the original label
  - Power on virtual machines

- If “source” VMFS does not have labels, configuration files will need to be changed

- Migration of individual VMs on the “source” VMFS can be performed
  - Will need changes to the configuration files
Listing of Source and Target VMFS
Determining the Location and Name of Virtual Disks

```
[root@82ap104 root]# grep scsi0 /home/vmware/OR VM 1/OR VM 1.vmx
scsi0.present = "TRUE"
scsi0.virtualDev = "vmxlsilologic"
scsi0:0.present = "TRUE"
scsi0:0.name = "Boot_VMFS:OR VM 1.vmdk"
scsi0:0.deviceType = "plainDisk"
scsi0:1.present = "TRUE"
scsi0:1.name = "Data_VMFS:OR VM 1.vmdk"
scsi0:1.deviceType = "plainDisk"
[root@82ap104 root]# ls /vmfs/Boot_VMFS/OR VM 1.vmdk
/vmfs/Boot_VMFS/OR VM 1.vmdk
[root@82ap104 root]# ls -l /vmfs/Boot_VMFS/OR VM 1.vmdk
-rw------- 1 root root 12884902400 Sep 11 12:31 /vmfs/Boot_VMFS/OR VM 1.vmdk
[root@82ap104 root]# ls -l /vmfs/Data_VMFS/OR VM 1.vmdk
-rw------- 1 root root 4294967808 Sep 11 09:38 /vmfs/Data_VMFS/OR VM 1.vmdk
```

Identify disks to be migrated

Note the size of the disks
Performing Migration using “cp” on Service Console

```
[root@l82ap104 root]# cp /vmfs/Boot_VMFS/OR VM 1.vmdk /vmfs/Target_Boot_VMFS/OR VM 1.vmdk
cp: cannot open ‘/vmfs/Boot_VMFS/OR VM 1.vmdk’ for reading: Device or resource busy
[root@l82ap104 root]# cp /vmfs/Data_VMFS/OR VM 1.vmdk /vmfs/Target_Data_VMFS/OR VM 1.vmdk
cp: cannot open ‘/vmfs/Data_VMFS/OR VM 1.vmdk’ for reading: Device or resource busy
[root@l82ap104 root]# vmware-cmd /home/vmware/OR VM 1/OR VM 1/vmx getstate
gestate() = on
[root@l82ap104 root]# vmware-cmd /home/vmware/OR VM 1/OR VM 1/vmx stop
stop() = 1
[root@l82ap104 root]# vmware-cmd /home/vmware/OR VM 1/OR VM 1/vmx getstate
gestate() = off
[root@l82ap104 root]# time cp /vmfs/Boot_VMFS/OR VM 1.vmdk /vmfs/Target_Boot_VMFS/OR VM 1.vmdk
real 10m12.137s
user 0m12.850s/sys 1m4.790s
[root@l82ap104 root]# time cp /vmfs/Data_VMFS/OR VM 1.vmdk /vmfs/Target_Data_VMFS/OR VM 1.vmdk
real 0m29.825s
user 0m6.530s/sys 0m14.760s
[root@l82ap104 root]#
```

- Copy cannot be done when VM is active.
- Time for “cp” depends on amount of data on disk and not the size.
Completing the Swap of Source and Target VMFS

```
[root@l82ap104 root]# cos-rescan.sh vmhba2 & & cos-rescan.sh vmhba3
Re-scanning vmhba2...done.
On scsi2, removing: 0:1 0:175 0:245 0:246 0:247 0:248 0:249 0:250 0:50 0:51 0:52
0:71 0:72 0:73 0:74 0:75 0:76 0:77 0:78 0:79 0:80 0:82 0:83 0:84 0:85 0:86 0:87
1: 1:1 1:2 1:3 2:1.
On scsi2, adding:
0:1 0:175 0:245 0:246 0:247 0:248 0:249 0:250 0:50 0:51 0:52 0:71 0:72 0:73 0:74 0:75 0:76 0:77 0:78 0:79 0:80 0:82 0:83 0:84 0:85 0:86 0:87 1
0 1:3 2:
Re-scanning vmhba3...done.
On scsi3, removing:
On scsi3, adding:
[root@l82ap104 root]# ls -1 /vmfs/Boot_VMFS /vmfs/Data_VMFS
ls: /vmfs/Boot_VMFS: No such file or directory
ls: /vmfs/Data_VMFS: No such file or directory
[root@l82ap104 root]# vmkfstools -S Boot_VMFS /vmfs/Target_Boot_VMFS
[root@l82ap104 root]# vmkfstools -S Data_VMFS /vmfs/Target_Data_VMFS
[root@l82ap104 root]# ls -1 /vmfs/Boot_VMFS /vmfs/Target_Boot_VMFS
lrwxrwxrwx 1 root root 64 Sep 11 20:55 /vmfs/Boot_VMFS -> vmhba2: 0:0:73:1
lrwxrwxrwx 1 root root 64 Sep 11 20:55 /vmfs/Data_VMFS -> vmhba2: 0:0:74:1
[root@l82ap104 root]# vmware-cmd /home/vmware/OR\ VM 1/OR\ VM 1.vmx start
start() = 1
[root@l82ap104 root]# vmware-cmd /home/vmware/OR\ VM 1/OR\ VM 1.vmx getstate
gestate() = on
[root@l82ap104 root]#]
```

"Source" disks have been removed

Relabel VMFS
Migrations for ESX 3.x Using Service Console

- Data migration in ESX 3.x environment is more complex than ESX 2.x environment
- VC is tightly integrated
  - Difficult to perform data migration just using service console
  - VC maintains significant information that is not deleted without manual intervention
- dMotion can be used
  - Currently supported for live upgrades from ESX 2.5 to ESX 3.0.1
- Large data migrations in ESX 3.x environments can get complex
  - If provided the choice:
    - First perform data migration in ESX 2.x environment
    - Then upgrade ESX 2.x to ESX 3.0 environment
Using “vmkfstools” on ESX 3.x Service Console

Steps needed to perform migration:

- Present “source” and “target” disk(s) to ESX Server
- Create VMFS on “target” disk(s) and assign an appropriate label
  - Use VC to create VMFS since it automatically aligns VMFS volumes
- Create directories on “target” VMFS to match “source” VMFS
- Copy configuration files from “source” VMFS to “target” VMFS
- Power virtual machines off
- Copy virtual disks using “vmkfstools”
- Remove access to “source” disk(s) and rescan the SAN fabric
- Un-register virtual machines from VC
- Delete “source” VMFS information from VC database
- Re-label “target” VMFS to original “source” VMFS label name
- Re-register VMs and power them on
Presenting Target Volumes to ESX 3.x
Migrating Data from Source to Target for ESX 3.x

```
[root@pase152 Test VM1]# ls -1 /vmfs/volumes/Boot_Volume/Test \ VM1/
total 17676608
-rw------- 1 root root 18099732480 Sep 12 22:17 Test VM1-flat.vmdk
-rw------- 1 root root 8664 Sep 12 22:17 Test VM1.nvram
-rw------- 1 root root 340 Sep 12 22:10 Test VM1.vmdk
-rw------- 1 root root 0 Sep 12 21:53 Test VM1.vmsd
-rwxr-xr-x 1 root root 1566 Sep 12 22:10 Test VM1.vmx
-rw------- 1 root root 252 Sep 12 22:04 Test VM1.vmxf
-rw-r--r-- 1 root root 23642 Sep 12 22:18 vmware.log
[root@pase152 Test VM1]# mkdir /vmfs/volumes/Target_Boot_Volume/Test \ VM1
[root@pase152 Test VM1]# cp /vmfs/volumes/Boot_Volume/Test \ VM1/Test \ VM1.vmx /vmfs/volumes/Target_Boot_Volume/Test \ VM1/
[root@pase152 Test VM1]# vmkfstools -i Test \ VM1.vmdk ../../Target_Boot_Volume/Test \ VM1/Test \ VM1.vmdk
Destination disk format: VMFS thick
Cloning disk 'Test VM1.vmdk'...
Clone: 100% done.
[root@pase152 Test VM1]#
```

Command can be used to thin provision a disk
Un-registering VMs using VC 2.x
Removing Access to Source VMFS

LUN removed from the ESX Server
Removing Source VMFS Information on ESX 3.x

ESX 3.x will not automatically clean up

Use this to clean up /vmfs/volumes directory
Removing Source VMFS from VC 2.x Database

Note there are no virtual machines or ESX hosts associated with this.

Removal of information from VC DB is manual.
Rename Target VMFS to Original VMFS Name
Register and Power on VM from New Disks

[root@pasel152 /proc/scsi/gla2300]

```bash
# vmware-cmd -s register /vmfs/volumes/Boot_Volume/Test\ VM1/Test\ VM1.vmx
register (/vmfs/volumes/Boot_Volume/Test VM1/Test VM1.vmx) = 1

[root@pasel152 gla2300]

# vmware-cmd -l
/lvmfs/volumes/44dc4ede-8a3b2b48-0c70-000423b757fe/ESX Server Domain Controller 1/ESX Server Domain Controller 1.vmx
/lvmfs/volumes/435f9078-2acef974-6f87-000f1f6ebf3f/ESX Server Domain Controller 2/ESX Server Domain Controller 2.vmx
```

```
[root@pasel152 gla2300]

# vmware-cmd /vmfs/volumes/45076661-5d11ce38-c914-000423b757fe/Test/ VM1/Test\ VM1.vmx start
start () = 1
[root@pasel152 gla2300]

# vmware-cmd /vmfs/volumes/45076661-5d11ce38-c914-000423b757fe/Test/ VM1/Test\ VM1.vmx getstate
getstate () = on
[root@pasel152 gla2300]
```
Advantages and Disadvantages of Using COS

**Advantages**
- Simple to use
- Flexible—migration can be performed at individual virtual disk level
- Storage Agnostic—“source” disks could be internal disks!

**Disadvantages**
- Protracted outages
- Slow, cumbersome process
- Can use only processor 0 for migrating the data
  - No parallelism even on a large multi-processor server
Migration between homogeneous storage arrays

- Host based replication is an option (either at VM or ESX Server layer)
  - Storage agnostic
- Can be used for migration to the same type of array
  - Symmetrix to Symmetrix
  - CLARiiON to CLARiiON
  - Celerra to Celerra
- SRDF for Symmetrix
- MirrorView for CLARiiON
- Celerra Replicator for Celerra
  - Celerra Replicator is used for replicating NAS datastores on Celerra Network File Server
## Advantages & Disadvantages

### Advantages:
- Highly scalable and fast
- Does not consume host resources for migration
- Minimal disruption to production hosts (both ESX Servers and VM)
- Enables incremental updates and testing before cut over
- Same process can be used to migrate other operating system

### Disadvantages:
- Requires same type of array (array dependent)
- Cannot/difficult to change volume configuration when migrating data
- Cannot migrate at individual VM level
Migration between heterogeneous storage arrays

- Host based replication is an option (either at VM or ESX Server layer)
  - Storage agnostic
- Storage Array based software
  - Open Replicator
  - SAN Copy
- Open Replicator and SAN Copy will be the focus for rest of the presentation
EMC Open Replicator for DMX

- Runs entirely within DMX array
  - Existing hardware and network
- Mounts open systems remote volumes
  - Appears as a host to remote storage
  - Shares front-end FC ports
- Performs raw block I/O
  - Read, Write and Incremental Update
- 16 copies per session
- 512 concurrent sessions
EMC Open Replicator Modes of Operation

Point-in-Time BCV Push

Point-in-Time "Live" Push
Start: 6:00 a.m.
End: 6:02 a.m.
Image: 6:00 a.m.

Point-in-Time Volume Pull

"Live" Data Migration Pull
SAN Copy for CLARiiON Arrays

- Fast
  - Copies data between arrays
  - Full and incremental copies
  - Bi-directional
  - Array-based
    - No server or LAN impacts
- Simple
  - Single point of management
  - Scripted automation
  - No additional hardware
- Open
  - Application- and operating system-independent
  - CLARiiON, Symmetrix, and third-party systems
SAN Copy for CLARiiON Arrays

- CLARiiON arrays capable of hosting SAN Copy:
  - CX3-80, CX3-40, CX3-20, CX700, CX500, CX600, and CX400
- Full or incremental copies of data residing on a SAN Copy-hosted array can be “pushed”
  - To any EMC or supported third-party array
- Full copies of data residing on any supported array can be “pulled” to a SAN Copy-hosted array
Using Open Replicator with ESX 2.x

- Open Replicator is managed via CLI or GUI
  - Management can be performed from any supported platform
- Open Replicator can be used to migrate RDM volumes
- Open Replicator can be used to migrate VMFS volumes
  - All members of a spanned VMFS needs to migrated together
- All virtual machines on a VMFS needs to be migrated at the same time
  - Incremental push capability of Open Replicator reduces downtime dramatically
- If VMFS labels are used no reconfiguration of virtual machines is needed
- Open Replicator is highly scalable
  - The whole environment can be migrated in one small outage window
- Steps involved when migrating data from or to DMX
  - Zone the DMX ports to provide access to the third party storage array ports
  - Use LUN masking software to provide DMX ports access to the appropriate LUNs
When migrating from DMX to supported third party storage

1. Create session that defines relationship between DMX LUNs and third party storage LUN
   - If needed set it up for incremental refreshes
2. Activate the session to obtain a point in time image of the data
3. To minimize impact control the rate at which the data is copied
4. Recreate the session to perform incremental push
5. Activate the recreated session to obtain new point in time image
6. Repeat the steps above until the amount of data to be migrated is small
7. Shutdown the virtual machines and start the final push
8. Change LUN masking so the ESX Servers have access to new LUNs
   - Remove access to the original LUNs
9. Rescan for new LUNs
10. Restart the virtual machines as soon the Open Replicator session completes
Identifying the Devices to be Migrated

```
[root@l82ap104 root]# ls /vmfs/OR_Boot_VMFS /vmfs/OR_Data_VMFS
/vmfs/OR_Boot_VMFS:
VM1.vmdk VM2.vmdk VM3.vmdk

/vmfs/OR_Data_VMFS:
OR_VM1.vmdk OR_VM2.vmdk OR_VM3.vmdk VM3.vmdk VM4.vmdk VM5.vmdk
[root@l82ap104 root]# ls -l /vmfs/OR_Boot_VMFS /vmfs/OR_Data_VMFS
lrwxrwxrwx 1 root  root  64 Sep 15 15:21 /vmfs/OR_Boot_VMFS -> vm
hba2:0:50:1
lrwxrwxrwx 1 root  root  64 Sep 15 15:21 /vmfs/OR_Data_VMFS -> vm
hba2:0:52:1
[root@l82ap104 root]# vmkfstools -Ph /vmfs/vmhba2:0:50:1
/vmfs/vmhba2:0:50:1 is a VMFS-2.11 volume spanning 2 physical extents.
Volume label (if any): OR_Boot_VMFS
UUID (if any): 4503716d-118d6144-c2d1-00114336e625
Physical Extents:
  vmhba2:0:50:1
  vmhba2:0:51:1

[root@l82ap104 root]# vmkfstools -Ph /vmfs/vmhba2:0:52:1
/vmfs/vmhba2:0:52:1 is a VMFS-2.11 volume spanning 1 physical extents.
Volume label (if any): OR_Data_VMFS
UUID (if any): 45037236-786a539c-293c-00114336e625
Physical Extents:
  vmhba2:0:52:1
```

Be careful of spanned VMFS
Determining Storage Array Volumes to be Migrated

Source DMX devices

We will use both ports to push data

Target devices

Source FAs need to be zoned to this FA
Providing DMX Access to Remote Storage Devices

```cmd
C:\Documents and Settings\ganesb> symcfg -sid 54 -FA all list
FA-1C 0 5006048acc8d480 Yes No Yes
FA-1C 1 5006048acc8d4a0 Yes No Yes
FA-2C 0 5006048acc8d481 Yes No Yes
FA-2C 1 5006048acc8d4a1 Yes No Yes

C:\Documents and Settings\ganesb> symmask -sid 71 -wwn 5006048acc8d480 add dev E B,F3,FB -dir 16c -p 0
The following devices are already assigned in at least one entry:
00EB 00F3 00FB
Would you like to continue <y/[n]>? y

C:\Documents and Settings\ganesb> symmask -sid 71 -wwn 5006048acc8d481 add dev E B,F3,FB -dir 16c -p 0
The following devices are already assigned in at least one entry:
00EB 00F3 00FB
Would you like to continue <y/[n]>? y

C:\Documents and Settings\ganesb>
```

Source DMX FA WWPN

Providing source FA access to target volumes
Creating and Activating Open Replicator Session

```
C:\Documents and Settings\ganesh\Desktop>type vmfs_hot
symdev=54:12B symdev=71:EB
symdev=54:133 symdev=71:F3
symdev=54:0FB wwn=60060480000018790067153594D304642
C:\Documents and Settings\ganesh\Desktop>symrcopy -sid 54 -file vmfs_hot.txt -name vmfs_hot_push -hot push -differential -push -copy -pace 0 -nop create
'Create' operation execution is in progress for the device list in device file 'vmfs_hot.txt'. Please wait...
'Create' operation successfully executed for the device list in device file 'vmfs_hot.txt'.

C:\Documents and Settings\ganesh\Desktop>symrcopy -sid 54 -session_name vmfs_hot_push -consistent -nop activate
'Activate' operation execution is in progress for the device list with session name 'vmfs_hot_push'. Please wait...
'Activate' operation successfully executed for the device list with session name 'vmfs_hot_push'.
```

Activate starts the data movement. With -consistent flag, OR will ensure the remote copy has a consistent point in time copy at the time the command is executed.

This creates the metadata. No data movement occurs at this point.

Defines the mapping. WWN can be used.
Tuning Open Replicator Sessions

Symmetrix ID: 000187900754

Symmetrix Remote Copy Bandwidth Ceiling

<table>
<thead>
<tr>
<th>Dir:</th>
<th>Max &lt;MB&gt;</th>
<th>Set &lt;%&gt;</th>
<th>Actual &lt;MB&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>01C:0</td>
<td>80</td>
<td>100</td>
<td>56</td>
</tr>
<tr>
<td>01C:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02C:0</td>
<td>80</td>
<td>100</td>
<td>56</td>
</tr>
<tr>
<td>02C:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15C:0</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15C:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01D:0</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>01D:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02D:0</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>02D:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15D:0</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15D:1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OR can push a LOT of data fast. With just a few devices and 1 Gb/s infrastructure we are pushing at approximately 100 MB/s.

C:\Documents and Settings\ganesb\Desktop>symrcopy -sid 54 set ceiling 18 -nop -dir 1c -p 0

'Set Ceiling' operation execution is in progress
'Set Ceiling' operation successfully executed

C:\Documents and Settings\ganesb\Desktop>
**Effect of Setting Ceiling on Migration**

```
C:\Documents and Settings\ganesb\Desktop>symrcopy -sid 54 list ceiling
Symmetrix ID: 000187900754

Symmetrix Remote Copy Bandwidth Ceiling

<table>
<thead>
<tr>
<th>Dir: P</th>
<th>Max &lt;MB&gt;</th>
<th>Set &lt;%&gt;</th>
<th>Actual &lt;MB&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>01C:0</td>
<td>80</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>01C:1</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>02C:0</td>
<td>80</td>
<td>100</td>
<td>81</td>
</tr>
<tr>
<td>02C:1</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15C:0</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15C:1</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>01D:0</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>01D:1</td>
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<tr>
<td>15D:0</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15D:1</td>
<td>80</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>
```

Notice the effect of setting the ceiling, OR uses alternate paths to its full capacity.
## Querying Status of Sessions

<table>
<thead>
<tr>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>SID:symdev</td>
<td>Protected Tracks Identification</td>
<td>RI CDSHU</td>
<td>CTLS REM</td>
<td></td>
</tr>
<tr>
<td>000187900754:0133</td>
<td>875270 000187900671:00F3</td>
<td>SD XXXX</td>
<td>CopyInProg</td>
<td>20</td>
</tr>
<tr>
<td>000187900754:012B</td>
<td>889536 000187900671:00EB</td>
<td>SD XXXX</td>
<td>CopyInProg</td>
<td>19</td>
</tr>
<tr>
<td>000187900754:00FB</td>
<td>894098 000187900671:00FB</td>
<td>SD XXXX</td>
<td>CopyInProg</td>
<td>19</td>
</tr>
</tbody>
</table>

Total: 
- Track(s): 2658904
- MB(s): 83090.8

Legend: 
- **R**: Remote Device Vendor Identification
- **S**: Symmetrix, **C**: Clariion, **.**: Unknown.

### Flags: 
- **<C>**: The background copy setting is active for this pair.
- **<D>**: The background copy setting is not active for this pair.
- **<S>**: The session is a differential copy session.
- **<H>**: The session is a hot copy session.
- **<U>**: The session is a cold copy session.
- **<X>**: The session has donor update enabled.
Differential Push of Data

```
C:\Documents and Settings\ganesh\Desktop>symrcopy verify -sid 54 -session_name vmfs_hot_push
Not All session(s) with the given name are in 'Copied' state.

C:\Documents and Settings\ganesh\Desktop>symrcopy verify -sid 54 -session_name vmfs_hot_push
All session(s) with the given name are in 'Copied' state.

C:\Documents and Settings\ganesh\Desktop>symrcopy -sid 54 -session_name vmfs_hot_push -pace 0 -nop recreate
'Recreate' operation execution is in progress for the device list with session name 'vmfs_hot_push'. Please wait...
'Recreate' operation successfully executed for the device list with session name 'vmfs_hot_push'.

C:\Documents and Settings\ganesh\Desktop>symrcopy -sid 54 -session_name vmfs_hot_push activate
Execute 'Activate' operation for the 3 specified devices with session name 'vmfs_hot_push' (y/[n])? y
'Activate' operation execution is in progress for the device list with session name 'vmfs_hot_push'. Please wait...
'Activate' operation successfully executed for the device list with session name 'vmfs_hot_push'.
```

Point in time copy has been migrated
Incremental push to send changed data to target volumes
Benefits of Using Incremental Push
Changing ESX Server Access to Volumes

```
C: \Documents and Settings \ ganesh \ Desktop > symmask -sid 54 -wwn 10000000c940a060 remove dev 12B,133,0FB -dir 1c -p 0

C: \Documents and Settings \ ganesh \ Desktop > symmask -sid 54 -wwn 10000000c940a061 remove dev 12B,133,0FB -dir 2c -p 0

Device not assigned to host HBA. Use force option to remove the device

C: \Documents and Settings \ ganesh \ Desktop > symmask -sid 54 -wwn 10000000c940a060 remove dev 12B,133,0FB -dir 1c -p 0

C: \Documents and Settings \ ganesh \ Desktop > symmask -sid 54 -wwn 10000000c940a061 remove dev 12B,133,0FB -dir 2c -p 0

Device not assigned to host HBA. Use force option to remove the device

C: \Documents and Settings \ ganesh \ Desktop > symmask -sid 71 -wwn 10000000c940a060 add dev EB,F3,FB -dir 1c -p 0

The following devices are already assigned in at least one entry:

00ED 00F3 00FB

Would you like to continue <y/n>? y

C: \Documents and Settings \ ganesh \ Desktop > symmask -sid 71 -wwn 10000000c940a061 add dev EB,F3,FB -dir 1c -p 0 -nop

C: \Documents and Settings \ ganesh \ Desktop > symmask -sid 71 -nop refresh

Symmetric FA directors updated with contents of SymMask Database 006187900671

C: \Documents and Settings \ ganesh \ Desktop >
```
Finishing the Migration

The migrated devices are only seen

Notice, OR_Boot_VMFS now points to the migrated devices
Starting Virtual Machines on Migrated Volumes

ESX automatically recognizes spanned VMFS if all elements are presented

Virtual Machines start on migrated volume
Migrating Data to DMX in ESX 2.x Environment

- When migrating to DMX from supported third party storage
  1. Create session that defines relationship between DMX LUNs and third party storage LUN
     a. If available, ensure donor update is turned on
  2. Shutdown the virtual machines
  3. Activate the session to start migration of the data
  4. Change LUN masking so the ESX Servers have access to new LUNs
     a. Remove access to the original LUNs
  5. Rescan for new LUNs
  6. Restart the virtual machines as soon as possible
     a. Data migration continues in the background
- The outage time is approximately the time required for step 2—5 listed above
Additional Steps When Migrating ESX 3.x Data

- When migrating from DMX to supported third party storage
  > Create session that defines relationship between DMX LUNs and third party storage LUN
    - If needed set it up for incremental refreshes
  > Activate the session to obtain a point in time image of the data
  > To minimize impact control the rate at which the data is copied
  > Recreate the session to perform incremental push
  > Activate the recreated session to obtain new point in time image
  > Repeat the steps above until the amount of data to be migrated is small
  > Shutdown the virtual machines and start the final push
  > Change LUN masking so the ESX Servers have access to new LUNs
    - Remove access to the original LUNs
  > Rescan for new LUNs
  > Un-register virtual machines using VC
  > Restart the virtual machines as soon the Open Replicator session completes
Additional Steps When Migrating ESX 3.x Data

- When migrating from DMX to supported third party storage
  - Create session that defines relationship between DMX LUNs and third party storage LUN
    - If needed set it up for incremental refreshes
  - Activate the session to obtain a point in time image of the data
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  - Activate the recreated session to obtain new point in time image
  - Repeat the steps above until the amount of data to be migrated is small
  - Shutdown the virtual machines and start the final push
  - Change LUN masking so the ESX Servers have access to new LUNs
    - Remove access to the original LUNs
  - Rescan for new LUNs
  - Restart the virtual machines as soon the Open Replicator session completes

Turn resignaturing on
Additional Steps When Migrating ESX 3.x Data

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    - If needed set it up for incremental refreshes
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  > Recreate the session to perform incremental push
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  - Rescan for new LUNs
  - Restart the virtual machines as soon the Open Replicator session completes

Relabel migrated volume to use old datastore name. Register VM using VC
SAN Copy for Migrating ESX Server Environments

- SAN Copy is managed via CLI or GUI
- SAN Copy is very similar to Open Replicator except for
  - Cannot support as many concurrent migrations as Open Replicator
  - Initial push cannot provide a consistent point in time copy of the data
  - One has to wait for pull to complete before accessing data
  - Does not have donor update feature
- All virtual machines on a VMFS needs to be migrated at the same time
  - Incremental push capability of SAN Copy reduces downtime dramatically
- SAN Copy can provide much faster migration than what can be obtained with host based software
- Steps involved when migrating data from or to CLARiiON is the same as listed for Open Replicator
Advantages & Disadvantages

- Advantages of using storage array based SAN migration software
  - Scalable and fast migration rates
  - Amount of downtime
  - Incremental refresh capabilities
  - Test before you actually swap (leveraging storage array based snaps)
  - No host cycles involved

- Disadvantages of using storage array based SAN migration software
  - Cannot migrate a subset of virtual disks
  - Can be more complex than using host based utilities
  - Requires both source and target storage on the SAN
When to use what technologies for migration

- Open Replicator and SAN Copy are ideal when:
  - Large amount of data (100+ GB) needs to be migrated
  - Migration involves 10 or more virtual machines
  - Environments that do not have a large maintenance window
  - Migration is between dissimilar arrays (one of them is DMX or CLARiiON)

- Use Open Replicator
  - When migrating data from DMX to supported third party arrays
  - When migrating data to DMX from other supported arrays (except CLARiiON)

- Use SAN Copy
  - When migrating data from CLARiiON to supported third party arrays
  - Can be used for migrating data to CLARiiON but outage windows would be larger

- Use host based utilities when migrating small amount of data or VM
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- Mike McGhee, Symmetrix Engineering
- Susan Young, VMware Instructor
- Sheetal Kochavara, CLARiiON Engineering
- Jeff Bernard, Alliance Manager
References

- “Best Practices for deploying VMware ESX 3.x and 2.5.x server with EMC Storage products” at VMworld 2006
- [VMware ESX Server Using EMC Symmetrix Storage Systems](#)
- [VMware ESX Server Using EMC CLARiiON Storage Systems](#)
- [CLARiiON Integration with VMware ESX Server](#)
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