



HOST INTEGRATION WITH EMC STORAGE ARRAYS



EMC Proven Professional Knowledge Sharing 2011

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Abstract

“Do you have any documents which can help me configure my host with EMC array?”

The usual answers given to this frequently asked question include, “Check Powerlink”, “Register for EMC array training”, or “I will help you”. The same question is asked every time a new engineer joins the team, as they typically need to develop or test their software with EMC storage arrays or need some larger storage space. Even if someone finds a document to configure, for instance, Microsoft Windows, the next request will be about Solaris or other operating systems, which bring their own nuances. Perhaps you have configured an array with a physical host and now you have a couple of virtual machines which need EMC array configuration. The engineer ends up going through multiple trainings or piles of lengthy documents or other members spend significant time to help them repeatedly. Many times engineers do not go through the complete documents, instead opting to browse the text to help them quickly satisfy their needs.

In larger organizations such as EMC, there are dedicated storage administrators who provide storage infrastructure, storage provisioning, and host integration. But often, it takes a very long time for them to fulfill the request due to the large number of people they have to serve. For example, EMC India has 4 or 5 storage administrators serving more than 1500 development and QA engineers. Development, QA, and Support engineering also needs hands-on experience with EMC storage arrays for quality development, testing, and customer support.

We have used EMC arrays for our software development for the past 8 years and have gone through several trainings, have hands-on experience with EMC CLARiiON[®], EMC Symmetrix[®], multiple of operating systems, and physical to virtual machines. But sometimes we still need to search information on Powerlink or review self-prepared notes. Having a single document that provides an introduction to Storage Area Network (SAN) components and a step-by-step procedure on host integration will be very useful and will bring an engineer (development, QA, Support) to speed quickly and make him/her productive in a timely fashion.

This Knowledge Sharing article will provide an introduction on:

- ➔ SAN hardware components
- ➔ SAN software components
- ➔ Configuring third-party hardware, e.g. Host Bus Adapter (HBA) and its software
- ➔ Different types of EMC array and their use in a customer environment

- Step-by-step guide on host integration using EMC array GUI and command line interfaces used for storage provisioning
- Configuring EMC array replication technologies
- Configuring Windows or non-Windows host with EMC arrays
- Configuring physical and virtual machines or VMware ESX servers and much more

Note **: This article will not cover SAN theory, SAN topology, storage array details or Fiber Channel switches.

Benefit of this document

- Single point of reference to configure the host with EMC storage
- Quick turnaround time and smooth transition
- Self-learning with very minimal effort and time required from others
- Document is expandable, any new learning will be consolidated here, no need for everybody to change/modify/update/recreate their own documents
- Document can easily be integrated into the Procedure Generator Tools and can be made available via the web

Engineering personnel are the intended audience for this Knowledge Sharing article but it is not limited to publish for end users as a “Quick user guide” for quick host configuration with EMC arrays.

SAN Hardware Components

SAN Hardware: Typical SAN hardware requirement is:

- Storage Array – EMC CLARiiON, EMC Symmetrix
- Fiber Channel Switch – Brocade McData, Centrix
- Fiber Channel cables – LC-LC, SC-LC, SC-SC
 - LC-LC – The usual FC cables in use now.
 - SC-LC – One end of the cable is bigger than the other, normally, the smaller one goes to the storage array port and bigger one to the fiber switch or HBA.
 - SC-SC – Older cables; both ends of the cables are the same size (larger) and normally go from a 1GB switch to a HBA card.
- Host Bus Adapters (HBA) cards – Emulex, Qlogic
- Servers – Dell, Sun, IBM

SAN Software: Typical SAN software requirement is:

- Storage array management software:
 - EMC CLARiiON
 - FLARE® Operating System
 - Navisphere® Management GUI
 - Unified Storage Management GUI with latest EMC CLARiiON array
 - EMC Symmetrix
 - Enginuity™
- Fiber Channel Switch management – Managed by their web interface or CLIs via telnet.
- HBA drivers supplied by HBA vendor for different Host Operating System types.
- HBA management software:
 - SANSurfer for Qlogic
 - HBAnywhere for Emulex
- Software to manage storage array via host:
 - Solutions Enabler for EMC Symmetrix
 - Navisphere agent and NaviCLI for EMC CLARiiON
- Multipathing Software – EMC PowerPath®

EMC Storage Array Type

EMC Symmetrix and EMC CLARiiON are industry-proven storage arrays that maintain a high degree of robustness and availability. An organization can centralize and simplify its data protection strategies with local continuous data protection or remote replication, which protect an organization from data loss due to server failures, data corruption, software errors, viruses, end-user errors, and catastrophic events.

EMC CLARiiON

EMC CLARiiON is a mid-range SAN disk array manufactured and sold by EMC Corporation. Occupying the entry-level and mid-range of EMC's SAN disk array product palette, it is complemented by the high-end EMC Symmetrix. It is now in its fourth generation (denoted by model numbers beginning AX4/CX4).

EMC CLARiiON supports fibre channel and iSCSI front-end connectivity, with a fibre channel back end. Storage is currently FC-SCSI at 2 or 4Gb/s or SATAII at 3Gb/s arbitrated to 2 or 4.

EMC CLARiiON storage processor also underpins the EMC Celerra[®] NAS device, which is based on the same X-blade architecture as the EMC CLARiiON storage processor.

EMC Symmetrix

EMC Symmetrix system is EMC Corporation's flagship Enterprise storage array. There have been many generations of Symmetrix hardware, with the first appearing in 1990 and the latest, the Symmetrix VMAX™ Series, introduced in April 2009. Developments of Symmetrix' new features and huge internal software base, while simultaneously increasing its capacity and performance by orders of magnitude, have been an on-going process since its introduction.

EMC Symmetrix VMAX

EMC Symmetrix VMAX is the high-end, scalable storage array with a system bay and separate roll-up storage bays. The system scales from a single Symmetrix VMAX Engine system with one storage bay to a large eight engine system and a maximum of ten storage bays. Online system upgrades are achieved by adding single or multiple VMAX Engines or additional storage bays. Each VMAX Engine contains two Symmetrix VMAX directors with extensive CPU processing power, physical memory, front-end ports, and back-end ports. Drive capacity is increased by installing 4 Gb/s disk array enclosures to the storage bay.

EMC Symmetrix DMX Series

EMC Symmetrix DMX line of arrays replaced the old direct connect line of Symmetrix with an array whose components were interconnected. This release delivered the first modular Symmetrix, the DMX800, as well as the monolithic DMX1000. Later revisions were named DMX2, DMX3, and DMX4.

Setting up Storage Area Network (SAN)

To set up a SAN, basic knowledge of few storage terms are required, such as

- What is a LUN (Logical Unit Number)?
- What is a HBA port?
- Zoning
- LUN Masking

This section will cover step-by-step procedures on SAN setup.

Install HBA cards

Physically install the HBA card in the server machine. Checkpoints for HBA card installation include:

- Note the HBA vendor name and HBA model number.
- Check EMC Storage Array hardware compatibility guides to determine if the HBA in hand is supported by your EMC array.
- Check the HBA vendor's web site for the latest drivers of the HBA in hand.

Install Operating System

Install the desired operating system and apply all the latest Service Packs and patches. This applies to Windows, Linux, Solaris, and other operating systems.

Configure HBA card driver and application

HBA card drivers

For Windows 2008 and Windows 2008R2, HBA drivers are installed by default and supported by all EMC Storage Arrays.

Windows 2003 also installs the HBA miniport drivers, but it is highly recommended to install EMC recommended storport driver supplied by HBA vendors.

Latest firmware and driver updates can be found on HBA vendor web sites, e.g.

Emulex: <http://www.emulex.com/downloads/emc.html>

Qlogic:

http://driverdownloads.qlogic.com/QLogicDriverDownloads_UI/OEM_Product_List_New.aspx?oemid=65

To install HBA driver on Windows 2003: Emulex LP800

- Download the HBA driver from vendor website.
- Open “Computer Management” UI.
- Expand “SCSI And RAID Controllers”.
- Right click on HBA card and select “Update driver” from floating menu.
- Follow the instructions on the Wizard; provide the location of the driver files. This will install *storport* driver.

To install HBA driver on Solaris: Emulex LP8000

1. Unzip (or untar) the driver kit, e.g.
tar -xvf lpfc601f.tar
2. Use “pkgadd -d <full path to driver kit>” to install the driver. For example:
pkgadd -d /export/home/emulex/driver
3. Follow the instructions on the screen and reboot the machine if asked to do so.

To install HBA driver on Linux: Qlogic QLA2342

1. Unzip the driver kit.
2. Qlogic documents three methods to install driver on Linux.
 - Method # 1 – Build the driver in the directory created for it and install it.
 - Method # 2 – Use the Dell-generated DKMS RPM to compile and install the modular driver for Dell servers running RHEL 2.1 and 3.0 attached to CLARiiON storage arrays.
 - Method # 3 - Use the QLogic RPM to compile and install the modular driver for RHEL 2.1, RHEL 3.0, and SLES 8 systems attached to EMC arrays.

For the setup in Table 1, Method # 1, e.g.

make all install

HBA applications

To manage the HBA card, you may be required to have HBA management software on the host. Download the HBA management software from the vendor's web site or use the vendor-supplied CD with HBA card. Use the latest HBA management software; they are usually compatible with all models of HBA cards.

To install HBA adapter application on Windows: HBAnyware

1. Get the Application kit.
2. Run "setup.exe" and follow the instructions on the screen.

To install HBA adapter application on Solaris: HBAnyware

1. Get the Application kit.
2. Unzip and untar the application kit.
3. Use pkgadd -d to install application kit, e.g.

```
pkgadd -d /export/home/emulex/app
```

To install HBA adapter application on Linux: SANSurfer

1. Get the HBA application kit e.g. SANSurfer FC HBA Manager for Linux 2.0.30 Build 32
2. Unzip and untar it.
3. SANSurfer application kit (emc_sansurferxxx_linux_install.bin) is in binary form. Check its permission; if it is not executable, change its permission to execute, e.g.

```
# chmod 755 emc_sansurferxxx_linux_install.bin
```

4. Now execute the binary file, e.g

```
# ./emc_sansurferxxx_linux_install.bin
```

Note: Most HBA card drivers complied with SNIA (Storage Networking Industry Association, www.snia.org) guidelines. Please refer to manufacturer's web site for additional library/package installation to get SNIA-supported HBA APIs

Fiber Channel Switch setup

A Fiber Channel Switch is a device that routes data between HBA on a host and Fiber adapters on storage arrays. To set up a Fiber channel switch, follow these steps:

1. Connect FC switch to LAN.
2. Connect FC cables from storage array adapter to any of the switch ports.
3. Power on FC Switch. When powered on, the switch runs a POST (Power on Self Test); wait until it completes.
4. Assign an IP address and subnet mask to the FC switch using its front panel buttons.
5. To learn more on initial settings and using switch, refer to its Hardware Manual which can be found at the FC switch vendor web site or partner's web site, e.g. <http://support.dell.com/support/edocs/stor-sys/switch/>
6. Once you are done with initial switch settings, you can use the switch through a web browser using its IP, e.g. <http://10.5.221.xxx>; or connecting the switch through telnet, e.g. **telnet 10.5.221.xxx**. Web browser provides a graphical user interface (GUI) and telnet provides a Command Line Interface (CLI).
7. Set up user name and passwords on the switch. Default user name and password could be *login = admin; password = password*.

Host connection to Storage Array

There are two methods to connect to the storage array:

1. Point to Point: Connect storage adapter directly to host HBA.
2. Fiber Channel SAN: Create a fabric connecting the Fiber Channel switch with the storage array adapters and HBA on the hosts.

This document will focus on method # 2 as this document is describing setting up a Fiber Channel SAN.

Set up hosts to use storage array:

To set up hosts to use storage array, create a fabric by connecting the host HBA to any of the free ports on the FC switch, "Zoning" and "LUN Masking", to assign the LUNs to a host.

Steps to connect host to FC switch and Zoning:

1. Connect HBA to any of the free ports on the FC Switch using Fiber Channel cable.
2. Open HBA management application on the host, e.g. HBAnyware for Emulex HBA and SANSurfer for Qlogic HBA
3. Note the WWN (World Wide Name) of the HBA adapter, e.g. 10:00:00:00:C9:26:94:66 is the WWN in Figure 1.

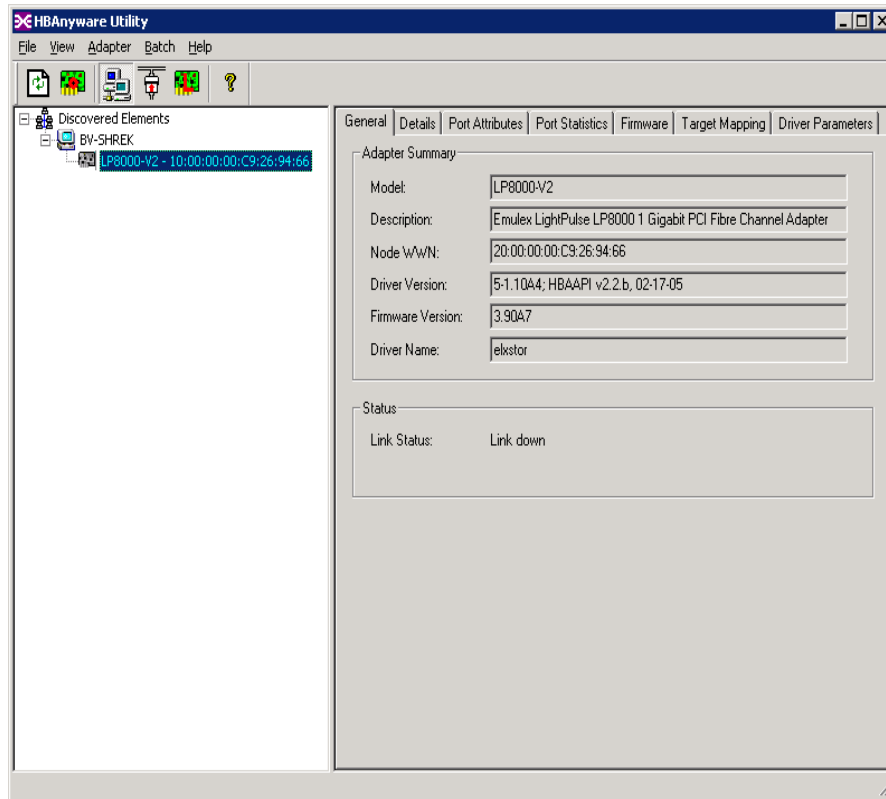


Figure 1 – HBA Application

4. Bring up the FC Switch management application using your web browser, e.g. <http://10.5.221.xxx>

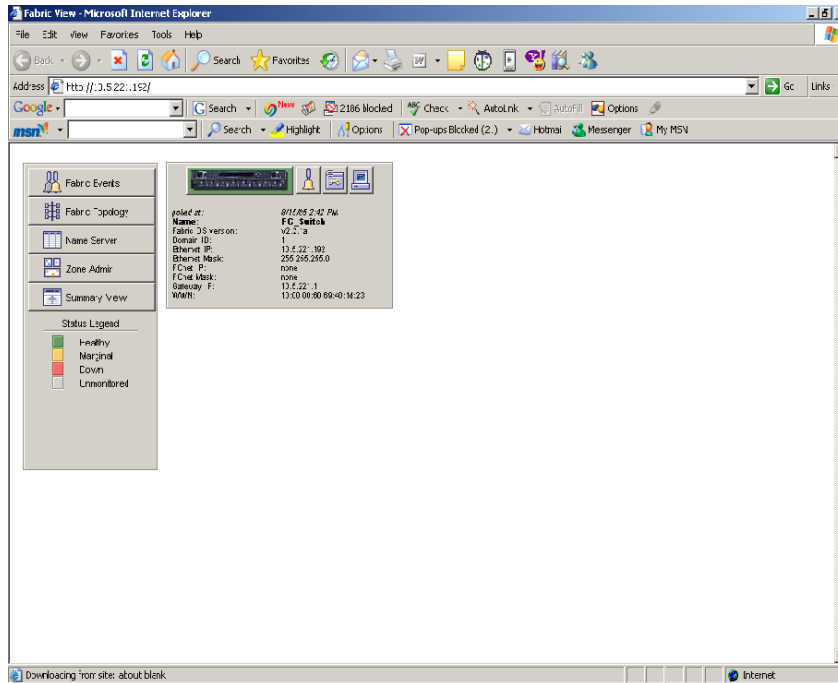


Figure 2 – Switch Configuration - I

- Click on the “Zone Admin” button to bring up the Zone administrator screen. This will prompt for user name and password. Enter user name and password and click on “Zone Settings” tab to create a fabric using WWN of host HBA and Storage Array, as shown in Figure 3.

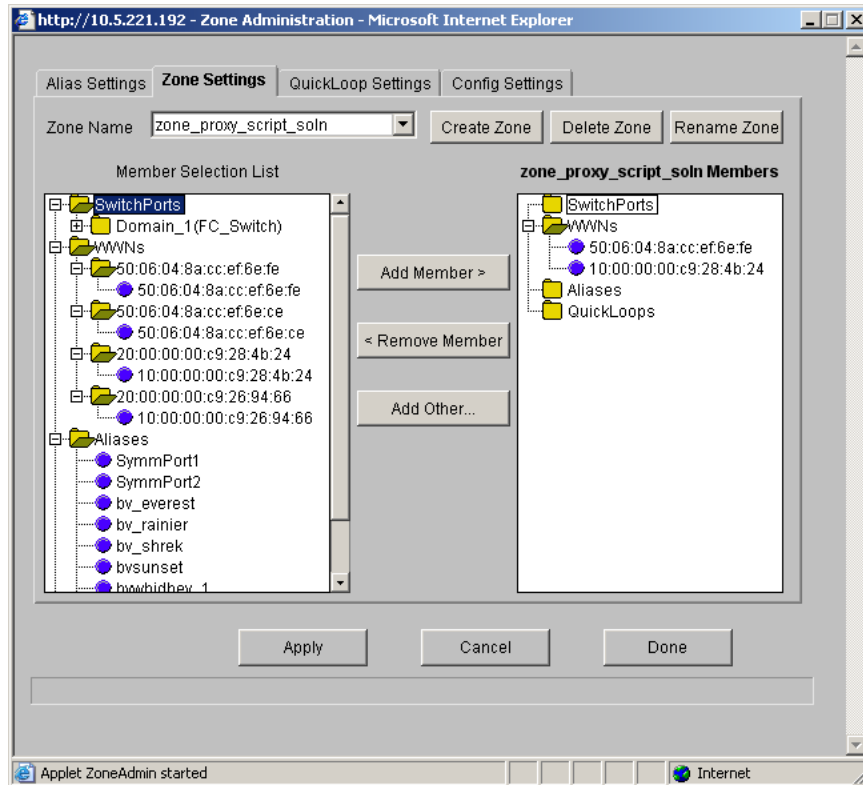


Figure 3 – Switch Configuration - II

6. Click the “Create Zone” button and enter a name for the zone, e.g. “any_test_zone” and click OK.
7. Now assign the WWNs of storage array and host HBA to the new zone. For example, “Add Member” storage array WWN “50:06:04:8a:cc:ef:6e:f,” and “10:00:00:00:c9:26:94:66” to the “any_test_zone”, you can add other hosts to the same zone as well. In this case, all hosts belonging to “any_test_zone” will see all the LUNs exposed to “50:06:04:8a:cc:ef:6e:fe” storage array WWN.
8. Once you are done with adding hosts to a zone, click “Apply” to commit changes to the Fibre Channel switch.
9. Click on “Config Settings” to bring online the zone created in the steps above.
10. Click “Create cfg” button as shown in Figure 4 and enter a name to the configuration, e.g. “any_config”.
11. Add zones to the newly created configuration and click “Apply” to commit your changes to the Fibre Channel switch as shown in Figure 4.

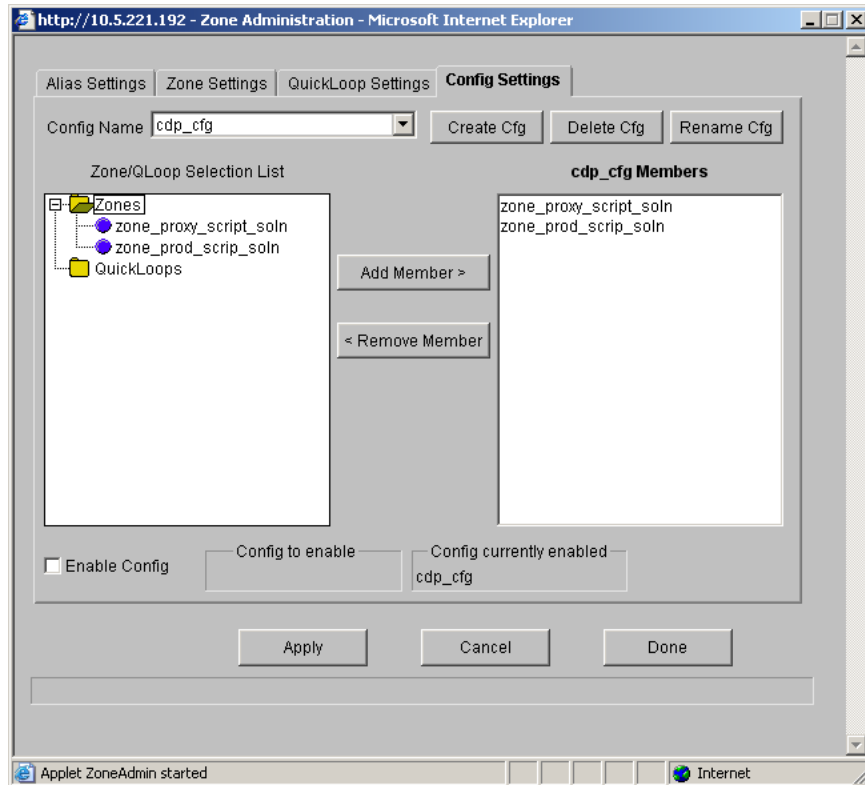


Figure 4 – Switch Configuration – III

12. Click “Done” to complete zoning.

To verify host connectivity with the storage array, open the HBA management application on a host and you will see EMC Symmetrix WWN and a LUN as shown in Figure 5. (This LUN cannot be used as a disk as this will store configuration information and will not be accessible).

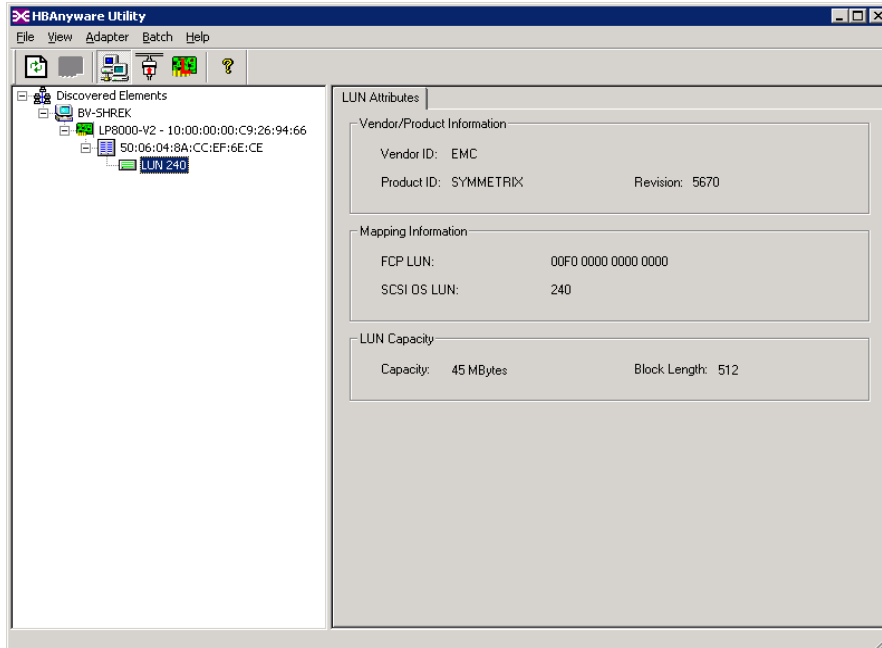


Figure 5 – HBA Configuration

Note: Above example is for creating a fabric with EMC Symmetrix. There is a difference between EMC Symmetrix and EMC CLARiiON concerning their WWNs.

EMC Symmetrix: WWNs of EMC Symmetrix contain a number of disks. Storage administrators assign required number of disks to a “Fiber Adapter” and expose them as a WWN.

Figure 3 has two Fiber Adapters of EMC Symmetrix with WWN 50:06:04:8a:cc:ef:6e:fe and 50:06:04:8a:cc:ef:6e:ce; each WWN contains six disks with BCVs. So, while configuring with Symmetrix, storage administrators will provide WWN of the Fiber adapter port, director e.g. FA15, fiber port number e.g. D1 or D0, disk numbers e.g. 1C3, 1C4, and so on, and number of disks.

EMC CLARiiON: EMC CLARiiON contains two storage processors, SP-A and SP-B. Each storage processor represents a WWN. The storage administrator creates LUNs as per the requirements and makes them available to use in a storage group with a host, as shown in Figure 6; 50:06:01:60:30:20:58:b3 & 50:06:01:68:30:20:58:b3 are the WWNs of SPA and SPB of CLARiiON.

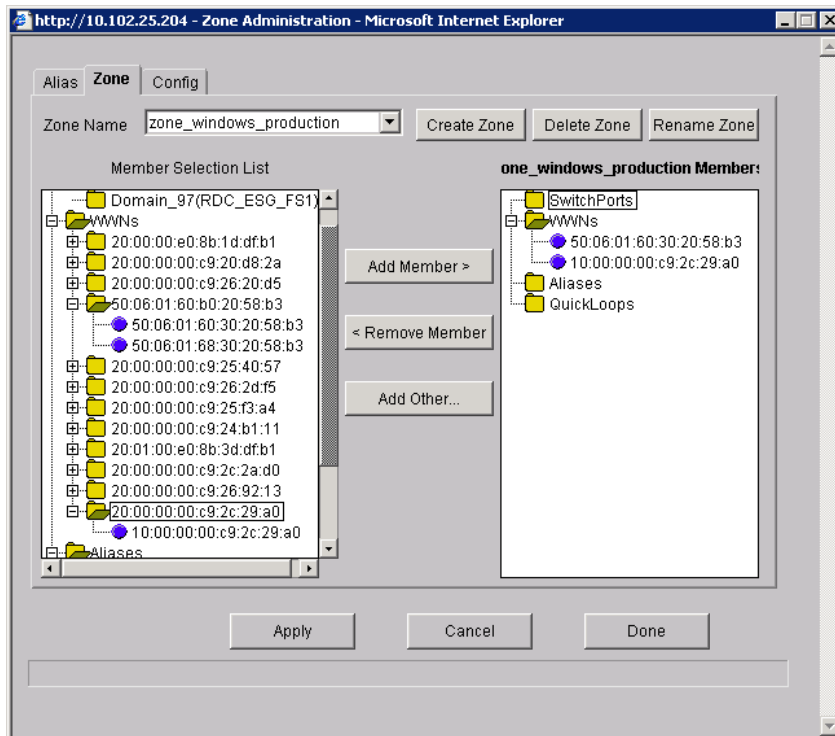


Figure 6 – Zone Configuration

Steps for LUN Masking: Configure LUNs to a Host

This section discusses exposing LUNs to hosts. There are multiple LUNs in a Storage Array which can be used by different hosts. Unique LUNs are assigned to each host unless there are specific needs like Cluster Application where the same LUNs are shared across multiple cluster nodes. There are two ways to assign LUNs to hosts:

1. Your storage administrator for EMC CLARiiON or EMC Symmetrix assigns the LUNs using SYMCLI for Symmetrix and NaviCLI/Navisphere UI for EMC CLARiiON as per your storage requirements.
2. Your storage administrator lets you know the LUN numbers as per your storage requirement for EMC CLARiiON or EMC Symmetrix and you use SYMCLI for Symmetrix and NaviCLI/Navisphere UI for CLARiiON to expose LUNs to the hosts.

This document will cover the second method.

Configuring Symmetrix LUNs:

- Apply the SYMCLI licensed using **symImf <license key>** command.
There are different licenses for each command.

- Install EMC Solution Enabler on the host; v7.2 is the latest GA version.
- Use ***symcfg discover*** SYMCLI to discover the Symmetrix array attached to your host. This should be done every time you are going to establish a session with Symmetrix.
- Use ***symmaskdb -sid <symmetrix id> init -file <anyname>*** to initialize the VCM database on Symmetrix. Note that, Symmetrix id is the last three digits of the Symmetrix you are using. The full number can be found on the back of the Symmetrix array rack. **This command should be used only once. You should not use this command on all the hosts, otherwise the VCM database will be re-initialized and you will not see any Symmetrix disk on the host you configured earlier.**

e.g. ***symmaskdb -sid 283 init -file foo1***

- Use ***symmask -sid <symmetrix id> list hba*** to list the configured HBAs and their WWN. You can also see the HBA WWN by using the HBA Manager tool.
- Use ***symmask -sid <symmetrix id> -wwn <HBA wwn> -dir <Symm director> -p <Symm port number> add devs start:enc | dev 1, dev2, ...***
 - wwn needs to be followed by the port WWN of the host you want to give LUNs to on a particular channel.
 - -dir is the director number assigned by the storage administrator.
 - -p is the port number where 0=port "A" and 1=port "B", assigned by the storage administrator.
 - The device is specified by their Symmetrix ID or device number. The IDs can be given as a contiguous range, "start:end"; or just a single LUN; or a comma separated list of discontiguous IDs.

e.g. ***symmask -sid 283 -wwn 10:00:00:00:C9:2C:29:A0 -dir 15A -p 0 add devs 1C3:1C7***

To remove devices, use ***remove devs*** instead of ***add devs***.

- Finally, use ***symmask -sid <symmetrix id> refresh*** to force the Symmetrix to write out the VCM DB.
- You can use ***symmaskdb -list database*** to see what's in VCM DB.

- Once you are done, open your Disk Manager on Windows and you will see n+1 disks; +1 is the VCM disk which you cannot initialize.

To configure Symmetrix LUNs with Solaris or Linux:

- Add LUNs in /kernel/drv/sd.conf so that Solaris or Linux recognize new disks; e.g.

```
# Start lpfc auto-generated configuration -- do NOT alter or delete this line
# WARNING: anything you put within this auto-generated section will
# be DELETED if you execute pkgmgr to remove the lpfc driver package.
# You may need to add additional lines to probe for additional LUNs
# or targets. You SHOULD delete any lines that represent lpfc targets
# or LUNs that are not used.
# You should add any new entries between this line
# and the End lpfc auto generated configuration line
# name="sd" parent="lpfc" target=16 lun=0;
# name="sd" parent="lpfc" target=17 lun=0;
# A small number of LUNs for a RAID array
# name="sd" parent="lpfc" target=17 lun=1;
name="sd" parent="lpfc" target=0 lun=0;
name="sd" parent="lpfc" target=0 lun=1;
name="sd" parent="lpfc" target=0 lun=2;
.....
.....
```

- Use the **format** command to initialize the disks and then you can use Solaris Management UI to partition them. Use the fdisk command on Linux for the same. If Volume Managers are used for managing LUNs, use the command reference guides for volume managers for scanning, labeling, and creating volumes on LUNs.

Configuring EMC CLARiiON LUNs: Navisphere UI

1. Using your web browser, open the EMC CLARiiON storage array management GUI using the IP address of the Storage Processor.
2. Create a storage group - A Storage Group is a container which holds information about host name, LUNs, Snapshots attached to the host, and so forth. This is also used for security to protect LUNs from being used by another host.
3. Add the host name to the storage group.
4. Select LUNs to be assigned to the hosts.

- a. Once you are done, open your Disk Manager on Windows, rescan disk, and you will see n+1 disks; +1 is the VCM disk you cannot initialize.

To configure CLARiiON LUNs with Solaris or Linux:

- Add LUNs in /kernel/drv/sd.conf so that Solaris or Linux recognize new disks; e.g.

```
# Start lpfc auto-generated configuration -- do NOT alter or delete this line
# WARNING: anything you put within this auto-generated section will
# be DELETED if you execute pkgmgr to remove the lpfc driver package.
# You may need to add additional lines to probe for additional LUNs
# or targets. You SHOULD delete any lines that represent lpfc targets
# or LUNs that are not used.
# You should add any new entries between this line
# and the End lpfc auto generated configuration line
# name="sd" parent="lpfc" target=16 lun=0;
# name="sd" parent="lpfc" target=17 lun=0;
# A small number of LUNs for a RAID array
# name="sd" parent="lpfc" target=17 lun=1;
name="sd" parent="lpfc" target=0 lun=0;
name="sd" parent="lpfc" target=0 lun=1;
name="sd" parent="lpfc" target=0 lun=2;
.....
.....
```

- Use the **format** command to initialize the disks and then you can use Solaris Management UI to partition them. Use fdisk command on Linux for the same. If Volume Managers are used for managing LUNs, use the command reference guides for volume managers for scanning, labeling, and creating volumes on LUNs.

Now you should be able to access the disks on Symmetrix/CLARiiON storage arrays. Open the Device Manager on Windows hosts. Below is a snapshot of a Windows host configured with EMC CLARiiON LUNs:

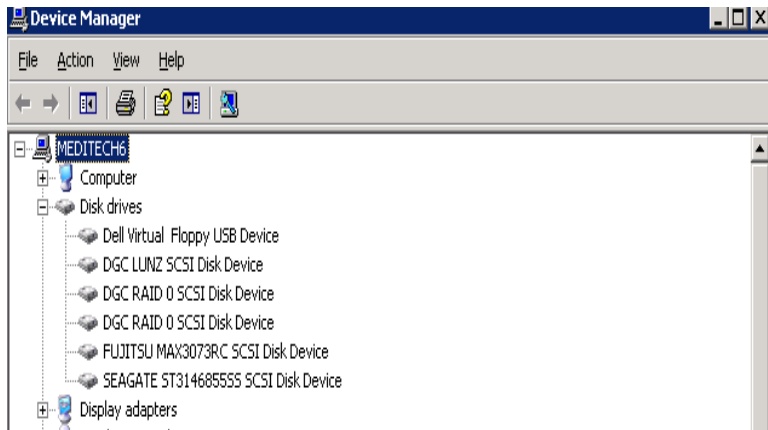


Figure 7 – Device Manager

A typical SAN setup looks like:

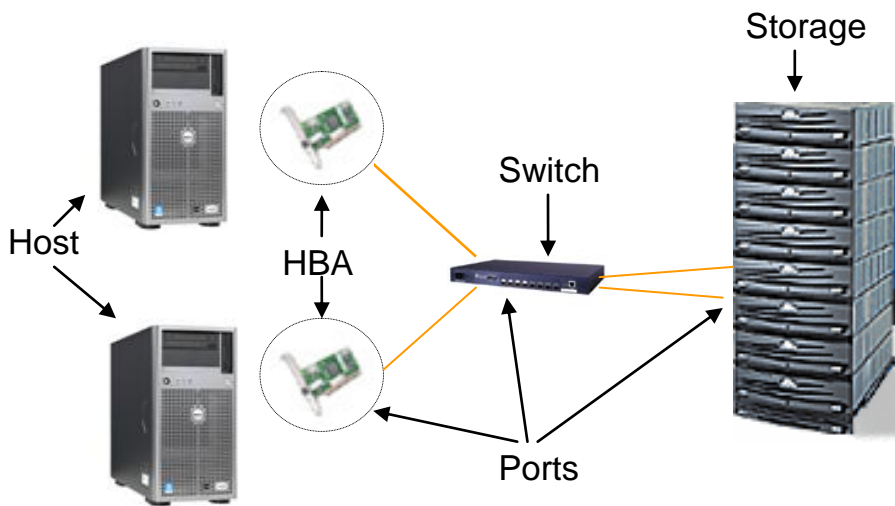


Figure 8 – SAN Topology

Configuring VMware ESX server and virtual machines with EMC storage array

All EMC arrays are supported with VMware ESX server via FC or iSCSI.

Configuring VMware ESX Server with EMC Storage Array

To configure EMC storage array with VMware ESX server is the same as configuring a host with Storage Array. Follow the steps in Section 2 for EMC Storage Array and VM for ESX server configuration.

VMware ESX Server is a Linux-based server; hence follow the steps for Linux storage array configuration.

All the LUNs will be assigned to ESX server; virtual machines will not be able to see the LUNs immediately. Follow the steps in the next section to make LUNs visible to virtual machines.

Enable SSH on ESX server for secure login required by Storage array host software running on virtual machine. Follow the link to enable SSH on ESX server:

http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=8375637

Configuring Virtual Machines hosted on VMware ESX server with EMC Storage Array

Use VMware vCenter to assign the LUNs to virtual machines. LUNs can be assigned to the virtual machine without shutting it down. Below are the steps and visual examples:

1. Open VMware vCenter and log in to the ESX server.
2. Make sure that ESX server is able to see all the assigned LUNs, as shown in Figure 9.

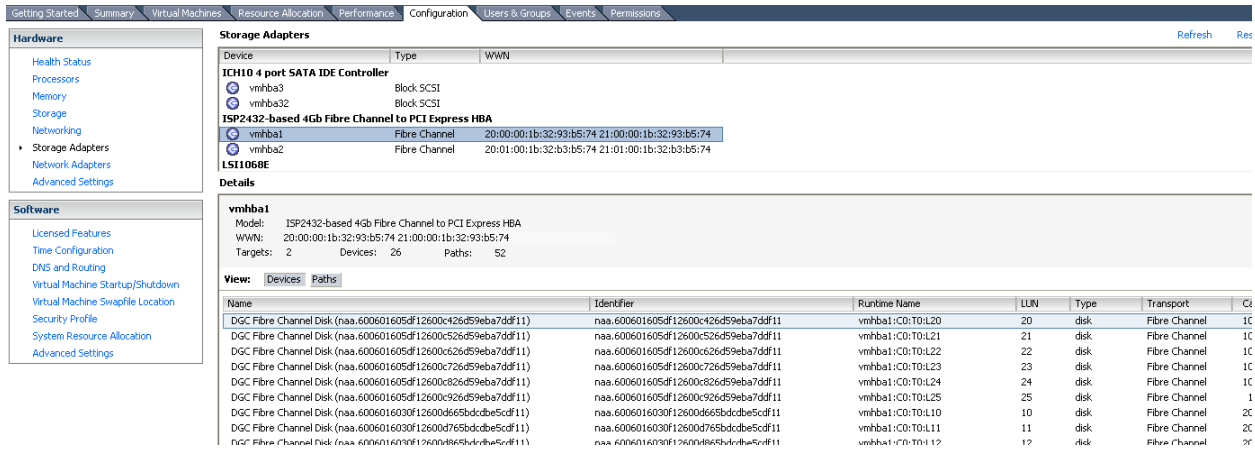


Figure 9 – ESX Management - I

3. Select the virtual machine for LUN provisioning.
4. Install the VMware tools on the virtual machine before LUN provisioning.
 - a. Assign VMware tools as CD driver to virtual machine, Figure 10.

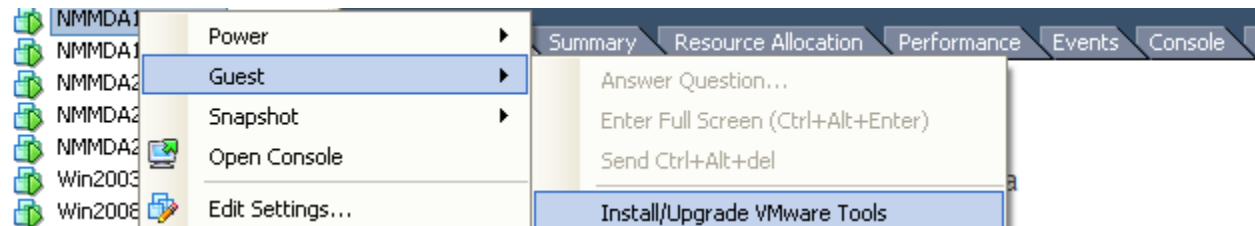


Figure 10 – ESX Management - II

- b. Go to the virtual machine and install the VMware tools; they are mounted as CD Drive.
5. Select Edit Settings for the virtual machine.
6. Click on “Add Devices” in the dialog box.
7. Select “Hard disk” and click Next.
8. Select “Raw Device Mapping” and click next; see Figure 11.

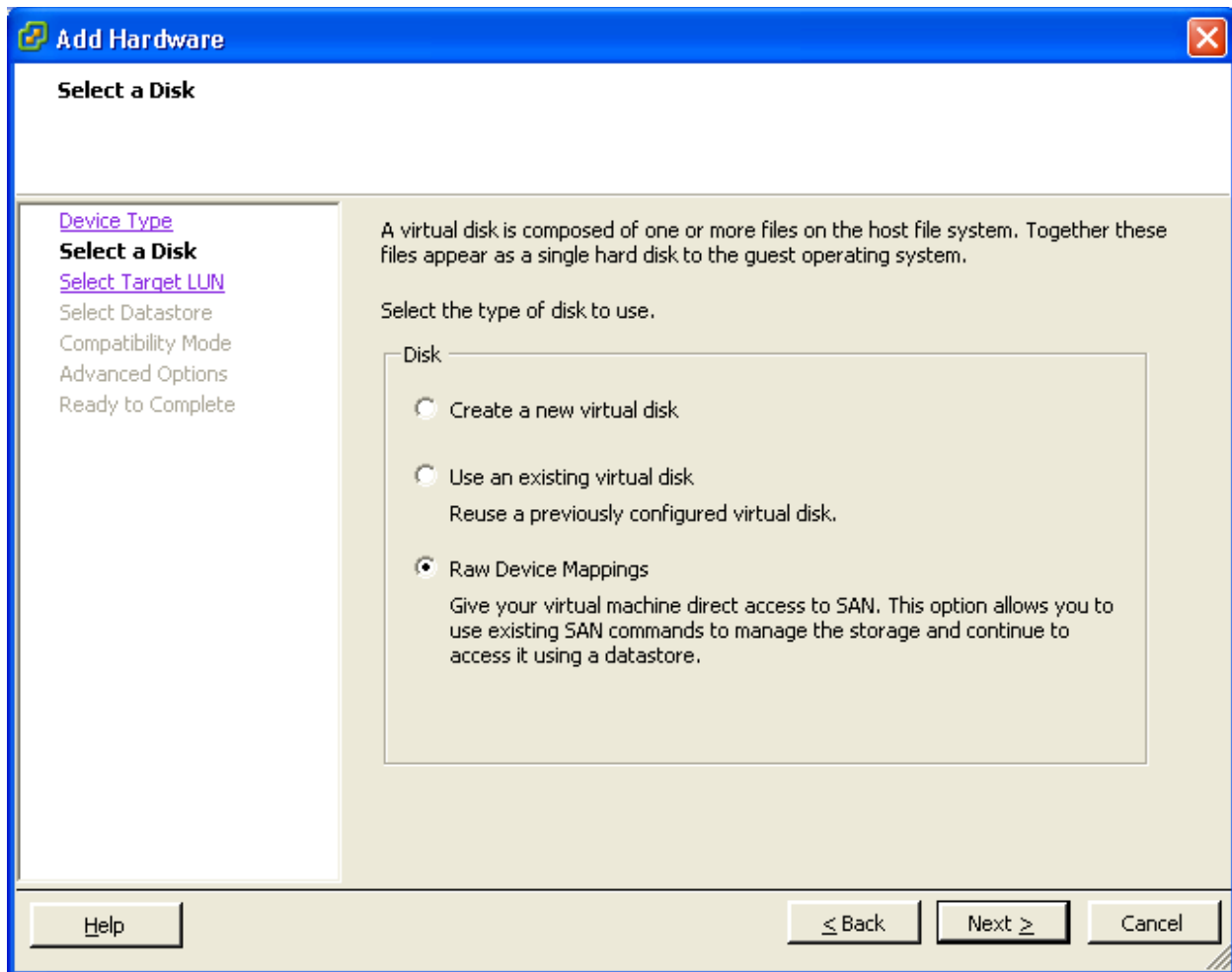


Figure 11 – Guest OS Configuration

9. Select the LUN for the virtual machine (you can select one LUN at a time).
10. Select the default options in the following screen and click Finish.
11. Log in to the virtual machine and open the Disk Manager.
12. New disks should be visible in Disk Manager; if not, do a rescan of devices.
13. Install the following software on the virtual machine to manage the LUNs from host:
 - a. EMC CLARiiON
 - i. Navisphere Agent – Provide the IP address of both storage processors on the prompt for system info.
 - ii. Navisphere CLI – Provide the array credentials for secure login to storage array from the host.
 - iii. Solutions Enabler kit
 - b. EMC Symmetrix
 - i. Solutions Enabler kit

- ii. Apply the symcli licenses to the virtual machine using symcli command.

Note: VMware ESX server assigns a virtual HBA to the virtual machine and performs its own multi-pathing, hence no need to install HBA driver and PowerPath multi-pathing software.

14. Set VICLIENT_DISABLE_CACHE=1 environment variable on the virtual machine.
15. Run the following commands on virtual machine for secure login to VMware ESX server.
 - a. Host connected with EMC CLARiiON
 - i. Naviseccli –user admin –Scope 0 –address <CLARiiON SP-A IP address> -AddUserSecurity
 - ii. Naviseccli –user admin –Scope 0 –address <CLARiiON SP-B IP address> -AddUserSecurity
 - iii. Symcfg authorization add –host <CLARiiON SP-A IP address> –username <user> –password <password>
 - iv. Symcfg authorization add –host <CLARiiON SP-B IP address> –username <user> –password <password>
 - v. C:\Program Files\EMC\Symcli\shlib\Vicfg setup –u <ESX server user name> -p <ESX Server password> -s <ESX Server IP address> -force
 - b. Host connected with EMC Symmetrix
 - i. C:\Program Files\EMC\Symcli\shlib\Vicfg setup –u <ESX server user name> -p <ESX Server password> -s <ESX server IP address> -force

Note: Above steps are required for non-Windows virtual machine as well.

Configuration of EMC Array replication technologies

Replication is the process of creating an exact copy of data. Creating one or more replicas of the production data is one of the ways to provide Business Continuity (BC). These replicas can be used for recovery and restart operations in the event of data loss. The primary purpose of replication is to enable users to have a point in time copy of data at the right place, in a state appropriate to the recovery need. The replica should provide recoverability and re-startability.

Recoverability enables restoration of data from the replicas to the production volumes in the event of data loss or data corruption. It must provide minimal RPO and RTO for resuming

business operations on the production volumes, while re-startability must ensure consistency of data on the replica. This enables restarting business operations using the replicas.

There are two types of replication; Local Replication and Remote Replication.

Local replication refers to replicating data within the same array or the same data center.

Remote replication refers to replicating data from one array to another array; both arrays are located at different data centers.

EMC storage arrays provides a number of techniques for making a copy of a LUN, but two main technologies are pointer-based copy (Snapshot) and fully byte-by-byte copy (Mirror/Clones). An EMC storage array also provides the capability to create the copies on remote storage arrays as well. Below is the list of replication techniques provided by EMC arrays:

- EMC CLARiiON
 - SnapView™ Snapshot – Pointer-based copy
 - SnapView Clones – Full byte-by-byte copy
 - SAN Copy™ – Remote replication or local replication
 - MirrorView™ – Remote replication

- EMC Symmetrix
 - TimeFinder® Mirror – Full byte-by-byte copy
 - TimeFinder Clone – Full byte-by-byte copy
 - TimeFinder Snap – Pointer-based copy
 - SRDF™ (Symmetrix Remote Data Facility) – Remote replication

The remainder of this section will cover configuring EMC CLARiiON clones and EMC Symmetrix TimeFinder/Clones.

Configuring EMC CLARiiON SnapView clones

A SnapView Clone is a full byte-by-byte copy of a source LUN within the same storage system. Clone LUNs are exactly the same size as a Source LUN. To configure a clone LUN for a source LUN, follow these steps:

1. Open the EMC CLARiiON Management GUI, e.g. Navisphere Management GUI in a Web browser using IP address of EMC CLARiiON storage processor. You can use IP address of any of the storage processors.
2. Provide the credentials to manage EMC CLARiiON.
3. Make sure you have the following software/license installed on your array (Figure 12)

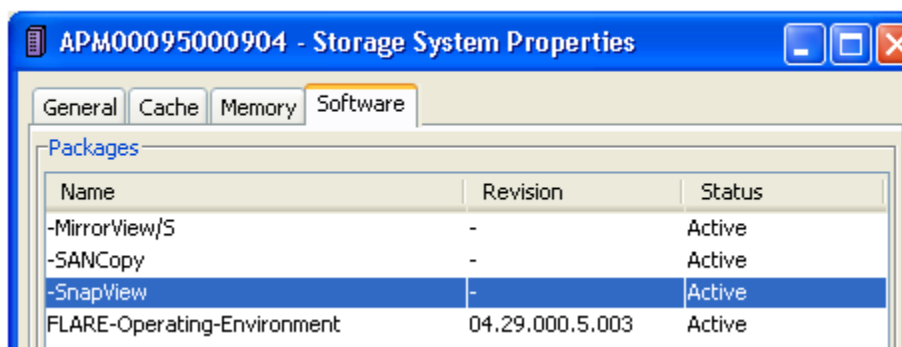


Figure 12 – SnapView Configuration

4. Locate the source LUN you plan to use to create the Clone.
5. Right click on the source LUN and select “Create Clone Group”, as shown in Figure 13.

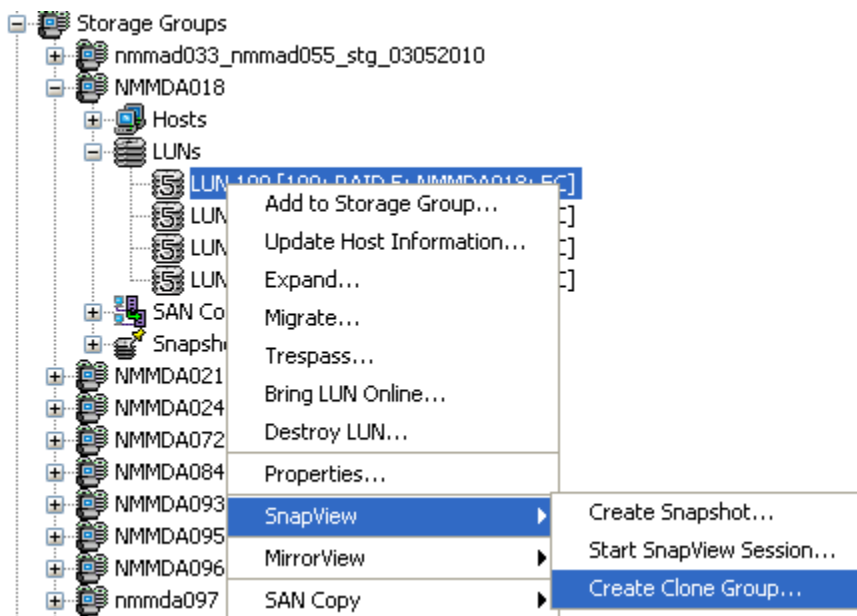


Figure 13 – Clone Configuration

6. Provide the name for the clone group, select the LUN id you plan to clone, click OK and then Yes; see Figure 14.

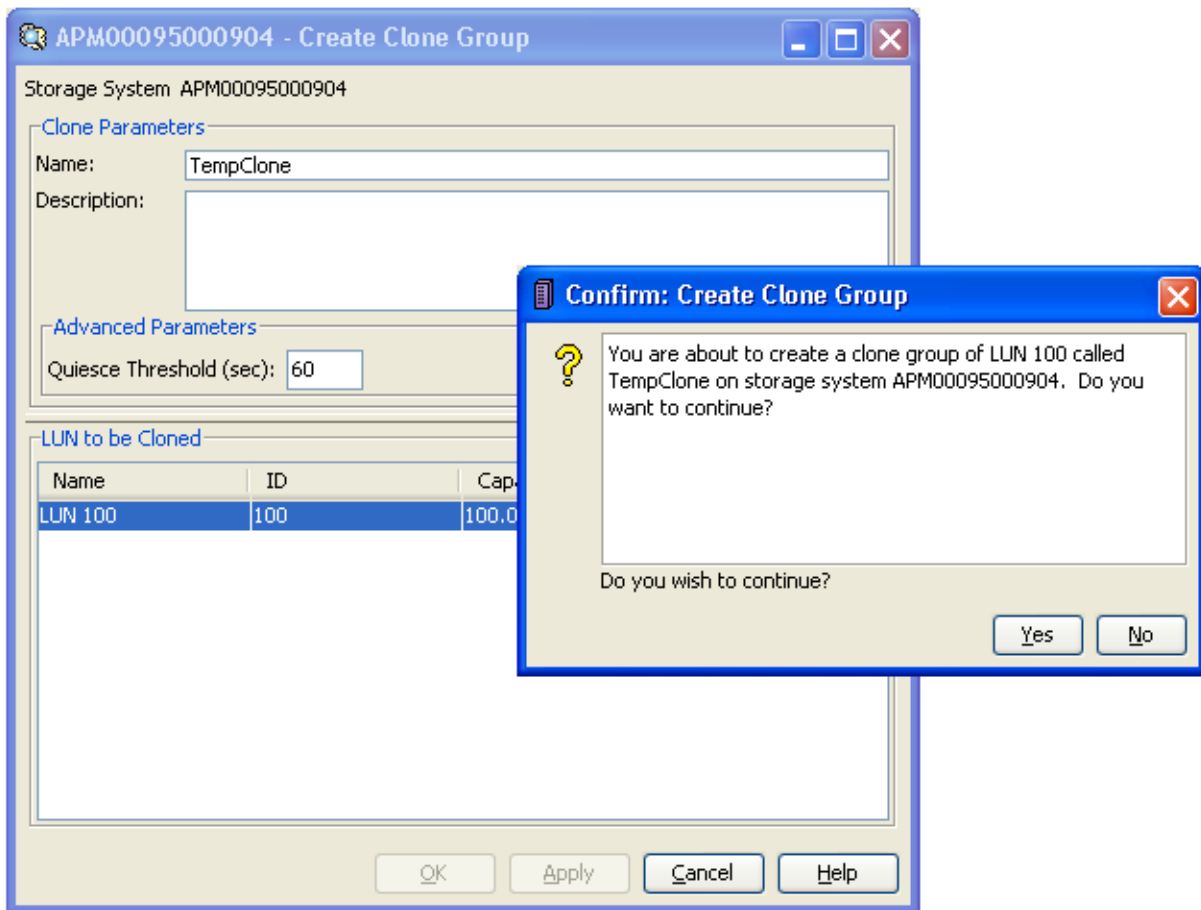


Figure 14 – Clone Configuration

7. Go to the “SnapView” section in Navisphere Management GUI and right click on “Add Clone” option from the floating menu; see Figure 15.

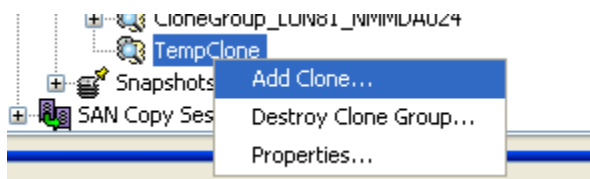


Figure 15 – Clone Selection

8. Select the available LUN from a storage processor and click Apply; see Figure 16.
 - a. If no LUN is displayed for selection, create a LUN on the array using LUN bind options.
9. Once you complete the clone configuration, source and LUNs will start syncing. Sync time depends on the size of the LUN; see Figure 17.

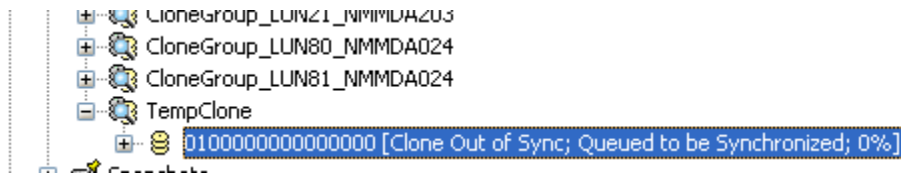


Figure 17 – Clone Synchronization

10. Once source and clone LUNs are in 100% copied state, all the writes coming to source LUN will be copied to clone LUN.
 - a. Copy activity on the source LUN will not impact host performance.

Please note that Clone LUNs will not be accessible to the host unless they are in fracture or split state. To make clone LUN available to a host:

1. Right click on the Clone Group and select fracture; see Figure 18.

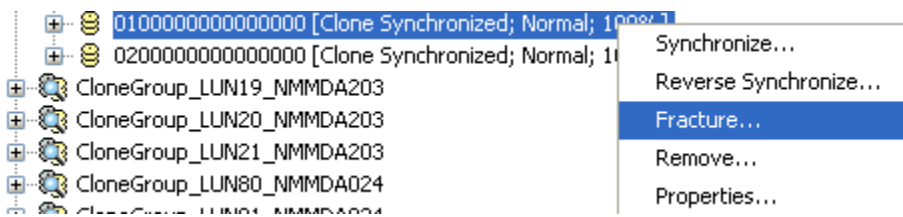


Figure 18 – Clone Fracture

2. Click Yes to fracture the relationship.
3. Add the clone LUN to the same host or to another host via storage group.

Configuring EMC Symmetrix TimeFinder/Clone

TimeFinder/Clone allows you to create *Clone* copies of a source device on multiple target devices. The source and target devices can be either standard devices or BCV devices as long as they are all of the same size. Once activated, the copy can be instantly accessed by a target's host, even before the data is fully copied to the target device.

TimeFinder/Clone copies are appropriate in situations where multiple copies of production data are needed for testing, backups, or report generation. Clone copies can also be used to reduce disk contention and improve data access speed by assigning users to copies of data rather than accessing the one production copy.

Follow the steps given below to configure the TimeFinder Clones using SYMCLI. Production LUNs and Clone LUN relationship can be created in multiple ways using **symclone** SYMCLI. It could be done by using device group, through an input file containing source and clone device pair, or defining the pair on the command line. The example below is with device group.

1. Install Solutions Enabler kit (v7.2 latest) on a host configured with Symmetrix.
2. Procure the following licenses from EMC licensing and apply them to SYMMCLI:
 - SYMAPI Feature: BASE / Symmetrix
 - SYMAPI Feature: SRDF / Symmetrix
 - SYMAPI Feature: SRDFA / Symmetrix
 - SYMAPI Feature: SRDF/AR / Symmetrix
 - SYMAPI Feature: SRDF/CG / Symmetrix
 - SYMAPI Feature: TimeFinder / Symmetrix
 - SYMAPI Feature: Snap / Symmetrix
 - SYMAPI Feature: TF/CG / Symmetrix
 - SYMAPI Feature: SERVER / Symmetrix
 - SYMAPI Feature: DevMasking / Symmetrix
 - SYMAPI Feature: SOLUTION_4 / Symmetrix
 - SYMAPI Feature: TF-Clone / Symmetrix

3. Open the command prompt on Windows and change directory to \Program Files\EMC\SYMCLI\bin
4. Run **symcfg discover** command to sync the local configuration database.
5. Run **sympd list** command to list all the Symmetrix devices configured with the host.

Figure 19 shows the list of devices. The first two devices are the physical devices visible to the host. These devices, called STD volumes, are used as production volumes for data.

```
C:\>sympd list
Symmetrix ID: 000190300880
```

Device Name	Directors			Device				
Physical	Sym	SA	:P DA	:IT	Config	Attribute	Sts	Cap (MB)
\\.\PHYSICALDRIVE1	0057	01D:0	16A:D2		Unprotected	N/Grp'd	RW	20480
\\.\PHYSICALDRIVE2	0058	01D:0	02A:D2		Unprotected	N/Grp'd	RW	20480
\\.\PHYSICALDRIVE3	0070	01D:0	N0-N0		UDEF	N/Grp'd	NR	2048

Figure 19 – SYMCLI Command Output - I

6. Create a normal type device group – ***symdg create CloneGrp1***
7. Add a source device to newly created device group - ***symld -g CloneGrp1 add dev 057***
8. Add a BCV device to the device group. This BCV device will work as a clone device – ***symbcv -g CloneGrp1 add dev 05F***
 - a. Usually BCV devices are not masked to the host. You should know the BCV device ID assigned to you by a storage administrator.
9. Query the state of STD and BCV device in the device group and get their logical device names, as shown in Figure 20; DEV001 for STD and BCV001 for BCV – ***symdg show CloneGrp1 query***

```
Standard <STD> Devices <1>:
<
-----
LdevName          PdevName          Sym  Device  Att.  Sts    Cap
Dev               Config            Dev  Config  Sts   Sts     <MB>
-----
DEV001            N/A               0059 Unprotected  RW    20480
>
```

```
BCU Devices Locally-associated <1>:
<
-----
LdevName          PdevName          Sym  Device  Att.  Sts    Cap
Dev               Config            Dev  Config  Sts   Sts     <MB>
-----
BCV001            N/A               0063 BCU      NR    20480
>
```

Figure 20 – SYMCLI Command Output - II

10. Create a clone copy session – ***symclone -g CloneGrp1 create -precopy -differential DEV001 sym ld BCV001***
 - a. “*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.
 - b. “*-precopy*” options is used with the “*create*” argument to start copying tracks in the background before the clone session is activated. A point-in-time copy cannot be established until the session is activated.
 - c. *-differential* option is used with *-precopy* or *-copy* option to create the session for maintaining the changed track information.
11. Run the query to see the state of the clone session; Figure 21.

```

C:\>symdg show CloneGrp3 -multi
'-multi': Illegal option.

C:\>symclone -g CloneGrp1 query -multi

Device Group (DG) Name: CloneGrp1
DG's Type           : REGULAR
DG's Symmetrix ID   : 000190300880

```

Source Device				Target Device			State	Copy	
Logical	Sym	Protected Tracks	Modified Tracks	Logical	Sym	Modified Tracks	CGDP	SRC <=> TGT	< % >
DEV001	0057	0	0	BCV002	0061	0	XXX.	Copied	100
		0	0	BCV001	005F	0	XXXX	PreCopy	100
Total		-----				-----			
Track(s)		0				0			
MB(s)		0.0				0.0			

Figure 21 – SYMCLI Command Output - III

12. To get the point-in-time copy of the source LUN, you need to activate the session – ***symclone -g CloneGrp1 activate DEV001 sym Id BCV001***

In case you need to terminate the clone session, use, ***symclone -g CloneGrp1 terminate***

You can add multiple clone devices for the single source LUN. Use step # 9 to add more devices and step # 11 to establish session - ***symclone -g CloneGrp1 create -precopy -differential DEV001 sym Id BCV002***

To remove any device from the clone session, you first need to terminate the session and use ***symld -g CloneGrp1 remove DEV001 or symld -g CloneGrp1 BCV001***

Some of the other symcli commands and their examples for configuring and verifying IDR setup are:

- **symdg list** — Lists all the device groups
- **sympd list** — Lists all STD devices
- **symbcv list** — Lists all BCV devices
- **symdg show <device group name>** — Displays information about device group

Conclusion

This document is based on the theme of “Knowledge Sharing” where anybody can gain from/contribute to the document anytime. Configuring SAN/Datazone is a complex task and often require users to refer to different documentation guides for different SAN components. Each component has its own set of prerequisites, recommendations, and limitations.

This document can be used as a quick cheat sheet for anybody dealing with SAN and shall be able to reduce the turnaround time, cut down the learning time and, most importantly, improve TCE (Total Customer Experience). The document is the first step to simplify/consolidate and reduce the start-up time to configure/troubleshoot or modify any SAN configuration.

Going forward, we can request the subject matter experts for each of the software components discussed to review and update the document to its most current state. Again, the document is not owned by an individual or group but by EMC in general and anybody can add value to it by contributing content, thereby helping millions of people using EMC products.

We also have an idea to host this document on a web server backed up with an efficient search mechanism; it would be accessible to anybody. Also, converting this document to an EMC_SAN_CONFIG_CHECKER software utility can also be considered as a next step.