Best Practices, Strategies and Benefits for Consolidating Multiple Island SANs (SAN Consolidation Project)

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Introduction

The benefit of having multiple Island SAN's is vastly fading. Many companies are beginning to realize the enormous expense involved in maintaining multiple Islands SAN's. This has heightened the need to consolidate the Storage Area Network (SAN). SAN Consolidation brings to the storage world a good number of benefits, both economically and with the ease of management. There are several ways to approach this project. Each comes with its' stress and complexity. The intent of this article is to outline and provide a clear, precise strategy to approach SAN consolidation. It also highlights the Best practices and more imperatively, its benefits.

The entire SAN can be divided into three main parts: Host/Server, Connectivity devices and Storage arrays. The single purpose reason for consolidating every SAN is to get all servers involved able to see or have the means to access storage from all storage arrays involved. In light of this, it is obvious the implicit importance of Connectivity devices to a consolidation project. As a matter of fact, it is going to be the main focus point of this article: *merging the fabric*. This article will not touch server consolidation or lun consolidation since it's beyond the scope of this topic.

Regardless of increasing new technologies that promises, decreasing storage needs. These needs keep escalating. Whether it's x-ray data, email archives, personal data, databases etc. Disk space keeps filling up! The trend towards consolidation is glaring and growing stronger!

Strategies and Step-by-Step Approach to SAN Consolidation

Every SAN consolidation project needs to commence with a detail research of the existing inventory of storage arrays, switches, servers and applications. Identify what you have, and how many islands need consolidated.

To be able to design and architect a detail storage solution you will first need to identify our need for consolidation.

Determining Need

Why should you consolidate? What is the business need? The first step in storage consolidation is a storage evaluation. Have a thorough evaluation of the cost of maintaining the existing storage, considering its architecture, floor space, cooling power supply etc. Compare this to the cost of running a consolidated SAN. Once this is complete and a firm decision is made, a core storage configuration can be determined.

Factors To Note Before Commencing

Organize your thoughts and structure pattern throughout the entire process. Draw charts and tables to illustrate your ideas if necessary. This will help you identify your steps should you need to execute a back out plan. Below is a list of some of the most important things to note before commencing.

Per each server consider the storage capacity needed, this will help you have an idea of how much throughput to expect for the server. Run EMC performance Manager or any performance analysis tool to determine your current performance structure.

Check and Double-Check the masking configuration for all LUNs. Ensure they have dual access from FA-ports to servers. Also verify dual path is not on the same fabric. This is to prevent the loss of access to a lun if it only had one path active. Prevent a downtime!

Consider the need for dynamic Multi-Pathing and backup requirements to help you make a good decision on how many ISL to use between specific switches.
Verify code levels on all SAN switches. It is always a good idea to have all your switches run the same code level. This will ensure bug fixes are uniform across all switches.

For the sake of better performance, ports you select for ISL's should not be close to each other. This is because most switches have their bandwidth shared among usually every four close ports. ISL's will be carrying load and traffic between switches so to have your ISL's sharing bandwidth with each other is a very bad idea and will throw a very loud performance hit in Response time.

Ensure Fabric binding is not enabled. Otherwise check the member list before proceeding. Disable fabric binding if set. It will make your life easy. You can always enable it back after the process.

Plan and determine how many ISLs to use. Use two or more for redundancy. The more ISLs the better but too many will be a waste.

Most likely than not, zone sets on the separate SAN will not have the same names or any two zones between SAN's have the same name if zoning best practices was enforced, but verify to make sure anyways. If this happens, there will be a conflict when the fabrics merge. This will cause the zones to collide. A total disaster! Also make sure all your zoning is configured using WWN instead of port numbers.

A Domain ID is an identification given to every switch on the SAN. Make sure that every switch has a unique Domain ID. Thus, there should be no Domain IDs that are common between the two SAN. If this exits, change it! This can be done by going to the ***Operating parameters*** option and simply assigning unique IDs. (Domain ID: 1-31)

Set and define a Principal switch in each SAN fabric. With EMC Connectrix Manager the options will always be (Always=1; Default=254; Never=255). Run analysis to identify which switch to make Principal and define it as 1 (Always). Then set all others to 254 (default). Repeat same for the other SAN fabric. Note that if two or more switches are set to the same value the one with the lowest WWN becomes the Principal. Now it is important to also note that if all the switches are set to NEVER (255), the switches will still merge and the one with the lowest WWN again still becomes Principal, but you stand almost a 70% chance of having your zones corrupted. Prevent downtimes!

Set the fabric to the appropriate operational mode. Thus if all switches involved are of the same make i.e. All Mcdata per say, then set ***inter-op mode*** to **FABRIC**. Otherwise set to **OPEN.**

Backup your zoning database. It is very important to back up the zoning library to a CD preferably. Do not backup to the switch's NVRAM! That will do you no good should the switch break. Print out a switch dump (data collection) of all the switches as a back up for your switch configuration data. Also ensure your Connectrix Manager server has at least 128MB of RAM.

Merging The Fabric

Once all of the above is successfully planned and designed, the actual implementation is quiet simple. This section of the article will use a case study to detail and outline the step-by-step process to successfully complete a SAN consolidation project. It will illustrate the need for a consolidation project and the steps taken for its solution. This case study provides a very rigor and precise approach to guarantee a zero percent downtime.

Case Study

The management of *Atinga Frafra Inc*, a cable company has advised they need to cut cost on the free email service they provide to it customers. A performance analysis was run. The result showed storage is been wasted on Central SAN while East SAN is running out of space. Note that both East and Central SAN are within the same data center, Duke. Management is not willing to buy additional space neither are they willing to loss any data. Both SAN have only Mcdata switches. East has two Mcdata 64M2 and Central four ED64M2 and two DS24M2. To have servers connected to East able to utilize the *not needed* (waste) space on Central, you are asked to design, architect and implement a solution for this issue. How will you go by it?

The Solution

Our objective will be to merge Duke's Island SAN fabrics into one heterogeneous SAN. From above there are currently two SANs at Duke: East and Central. Below are the details of each.

East SAN has 2 switches total and of these, 2 fabrics

EAST Fabric A

{EASTCNSW01 (ED64M2) (IP: 10.1.8.5) (Domain ID: 3)}

EAST Fabric B

{EASTCNSW02 (ED64M2) (IP: 10.1.8.6) (Domain ID: 4)}

Central SAN has 6 switches and in 2 fabrics

Central Fabric A

{

CENTCNSW01 (ED64M2) (IP: 10.1.8.9) (Domain ID: 7)

CENTCNSW03 (DS24M2) (IP: 10.1.8.11) (Domain ID: 9)

CENTCNSW05 (ED64M2) (IP: 10.1.8.7) (Domain ID: 5)

}

Central Fabric B

{

CENTCNSW02 (ED64M2) (IP: 10.1.8.10) (Domain ID: 8)

CENTCNSW04 (DS24M2) (IP: 10.1.8.13) (Domain ID: 10)

CENTCNSW06 (ED64M2) (IP: 10.1.8.8) (Domain ID: 6)

}

The goal is to merge East with Central and have two fabrics within the new SAN. Since there are eight switches total, it will be fair for the resultant SAN to have four switches per each fabric.

Checked that:

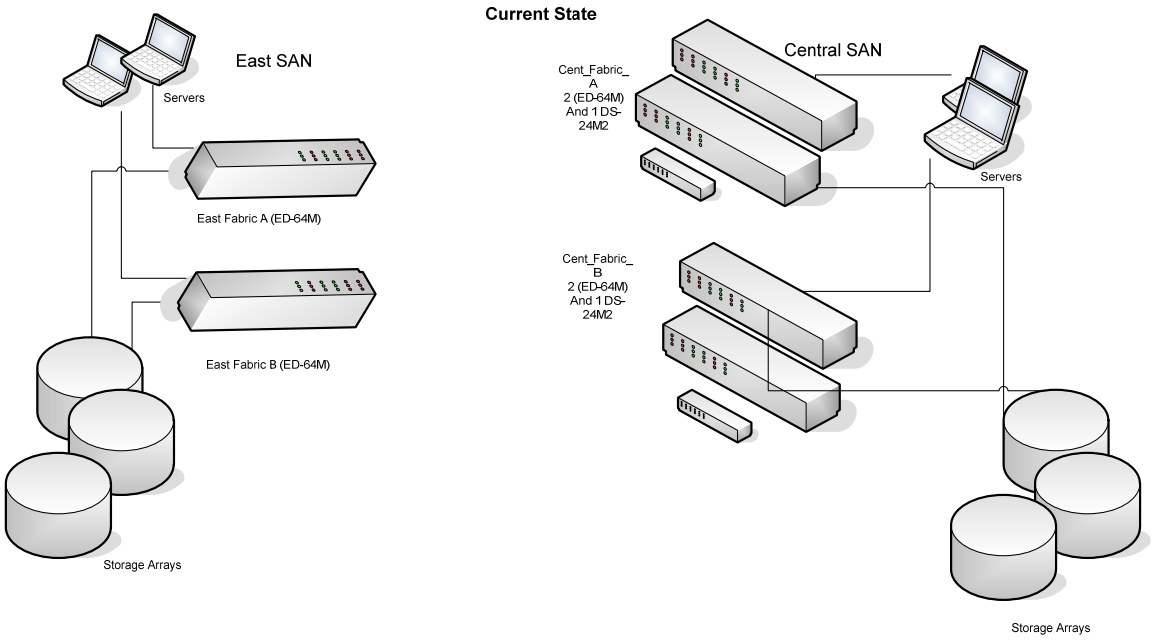
- All switches are running the same microcode: 09.01.00.50
- Domain IDs of each switch is unique.
- Inter-Op mode for all switches is the same: Mcdata fabric 1.1
- There is currently no defined Principal switch in either fabric.
- Operating Parameters show all switches are set at Default=254
- There are 16 pairs of FC ports available for ISL's between SAN fabrics.
- RA_TOV and ED_TOV are set to equal values on all the switches.
- Verified dual path to all connected servers.
- Verified dual paths are in separate fabrics.
- Verified masking relation to LUNs are "properly" redundant.

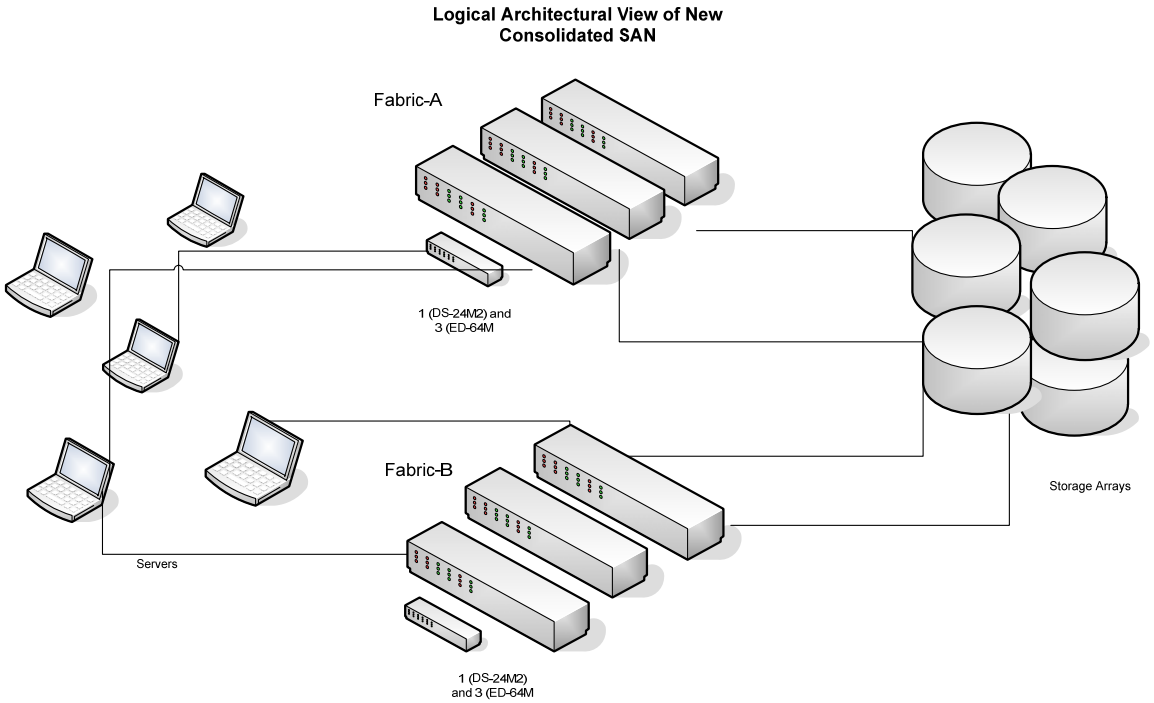
Since we adding EAST to CENTRAL, have your Network team assign 4 ports on your management Network switch on which the Central Connectrix manager belongs. Then add these ports to the appropriate VLAN (Central Connectrix Manager (CM) Service Processor belongs). The idea here is to simplify manageability of your will-be heterogeneous SAN. You will need to cable your EAST switches CTP Ethernet ports to these assigned VLAN.

East Connectrix Manager SP will then become an extra and could be repurposed. The new SAN will be managed on one Connectrix Manager.

EAST CM should only be repurposed after merging both fabrics.

Architectural Overview





Backup the Zoning database of both SAN and print switch dumps of all switches. Have your Fiber cables run between two Islands but don't cable yet! Merge one fabric at a time.

All Fabric _A switches in both SAN should be brought offline. Set **CENTCNSW01** as **Principal** switch. (Element Mgr➔Configure➔Operational Parameters)
Set all other switches to **Default** and confirm interoperation mode for all switches.

One at a time block all E Ports being used for ISL on all switches in A-fabric for both SANs, and connect ISL's each time. This order is very important. Please adhere religiously. Below is a list of available selected ports.

Switches	E Ports	Total
EASTSW1	52, 49,50,57,58,61,62,63	8
CENTCNSW1	18,19,38	3
CENTCNSW3	15,13	2
CENTCNSW5	37,39,45	3

At this point check the host access to storage on all connected servers to make sure data is still accessible via the other live path. Merge A-fabrics between both SAN (single path). Then merge B-Fabric after. Best practice will be to merge evens with evens and odds with odds.

Since there is only one switch per fabric in EAST do below:

Link 3 ISL from A Fabric East to all ED-64M2 in A fabric CENTRAL
Link 2 ISL from A-fabric East to DS-24M2 in A Fabric CENTRAL.

We are using only 2 ISLs in this case because servers connected to DS24M2 are only been used for backup. No production servers are connected to them.

Connect ISL To Respective Ports Per Order Below

From EAST			**To CENTRAL**
(EASTCNSW01)	Connect To		CENTCNSW1 (ED-64M2)

E-Ports	49	18	E-Ports
	50	19	
	52	38	

(EASTCNSW01)	Connect To		CENTCNSW3 (DS-24M2)

E-Ports	57	13	E-Ports
	58	15	

(EASTCNSW01)	Connect To		CENTCNSW5 (ED-64M2)

E-Ports	61	37	E-Ports
	62	39	
	63	45	

Things To Watch For After Merging Fabrics

There will be several RSCN sent, don't panic! Its normal, RSCN is just a state change notification that registers with a switch. Which is exactly what you doing.

After ISL's are connected bring switches in Fabric A back online, one at a time. (Element Mgr➔Maintenance➔Set online State) and verify that LED lights are on otherwise troubleshoot

Unblock all E-ports after ISLs are connected again one at a time. And make sure to Un-Persist fabric.

Check fabric state to ensure new fabric is up and no segmentations are present. If all above its adhered you should not see any segmentations.

Check zoning library. Your Zones from both SAN should add up nicely. Restore if needed. Check active zone set and save new zoning library accordingly.
Amend switch-naming convention to correspond to new consolidated fabric.
Repeat step for all switches in A- fabric. That is it! You have successfully merged the A Fabric.

Repeat the same steps to merge the B Fabric making sure you use the same port numbers on B Fabric switches. This is to enforce consistency.

Back Out Plan

You should always have a back out plan for every project should things not go as expected. In our case disconnect all new ISL cables and restore to old Zoning database. This will bring you back to your original architecture.

Best Practices

There are several best practices that need to be considered and carefully monitored to ensure an accurate and error-free consolidation. This section will detail the common practices to avoid and those to enforce in the consolidation process.

Institute a proper SAN design to accommodate the Consolidated Islands. A good effective consolidated SAN is a result of an excellent planning. The importance of planning increases with the size of your primary SAN and the number of smaller SANs that needs to be consolidated. While barely any planning is required for building small, island SANs, thorough planning is important when there are multiple islands competing for the same resource. A good plan should reveal that the *buy new storage* mindset could be countered with gaining space with *architected storage*.

Redundancy checks needs to be a required level of your consolidation plan. Ensure redundant access at all times during the process. Better still have a Server Admin continuously check path access to data every time you set a fabric offline. This way you guaranteed no downtime. Also ensure to implement at least two ISLs between switches. Determine your cumulative ISL count based on the applications running, your total bandwidth requirements etc.

Take into account applications running on the connecting servers. Provision to these servers, storage from arrays while considering the cache page size and the I/O size of your application. This will prevent wasted cache. Thus do not provision to a server running a 2K I/O size application, storage from an array with 8K-cache page size. A performance hit!

Know what kind of switch-fabric topology you have and what impact it brings? This is an important level to note when connecting ISLs. Plan before hand the topology to implement. Know your primary topology and design accordingly. The above case study illustrated a *partial* meshed switch topology.

Make sure the appropriate storage management tools are in place to analyze performance analysis and availability.

It is best to move towards larger switches and directors when consolidating storage. This reduces their cumulative number in the SAN. Thus simplifies switch management and decreases the incapacitating impact of ISL bottlenecks. Note that if large port-count switches are deployed, this decreases ISL count, and fewer components get migrated while high availability and pliability is attained.

Benefits

The benefit of Island SAN's vanishes rapidly as more are added to the storage infrastructure. With the emerging concept of centralized SAN, the single-purpose reason of Island SAN is quickly diminishing. Below are some benefits in consolidating SAN.

Consolidation enables the idea of tiered storage. It provides the ability to provision storage based on performance requirements. It also simplifies disaster recovery processes and increases the degree of storage resource utilization.

A sound SAN design that allows the reduction of SAN islands strengthens the primary SAN and improves the ease of storage management while providing more data protection.

Consolidation reduces cost around tiered storage. Every IT managers' concern is cost. The impetus of consolidation doesn't only gain us a reduction in cost to purchase new hardware but also the more obvious is the significant savings gained from managing the new SAN with one software package and one person as to several people. The consolidated SAN becomes a much easier environment to manage.

It is ideal for managing different classes of applications if the appropriate SAN technology is used for specific application. Thus a company's most mission critical applications that need high bandwidth can utilize the high availability of Fiber Chanel while those like backups or tier 2 storage implement low cost SCSI or SATA technologies.

Conclusion

In lieu to the different approaches to SAN consolidation, it is imperative to note that all lead you to achieve the same goal. This article' demonstrated approach with a real life case study, outlines the best ways to approach consolidation to reduce and nullify any down-time possible. Hence make you more efficient and effective. If all above is followed diligently the end results will be worth achieving.

The knack to provide new storage where needed in a moments notice, a more resilient and automatic failure recovery, enhanced performance; cost savings from efficient power usage are rewards that await those who consolidate successfully.

Biography

I have seven years experience in the IT industry. During this period, I worked as an IT Admin and eventually delved into Storage Administration. During this time I have done several SAN Consulting positions for EMC under EMC's Residency Program and Professional Services. I was part of EMC's SMS team, a Sr. Storage Consultant resident at GE Corporate. I later took a Lead Senior Storage Admin position at Cox Communications. I am currently working at the NASA Michoud Assembly Facility USDA| NFC as a Sr. Solutions Architect. I have done extensive work with EMC and 3PAR SAN as well as IBM Storage Virtualization Controller (SVC). I hold a Bachelor of Arts degree in Mathematics and Computer Science from Concordia College Moorhead MN and am also a Certified EMC SAN Specialist.