

Best Practices in SAN Migration

QLogic 9000 Series

Key Findings

When planning a SAN migration, there are several important factors to consider and actions to take that will ensure a smooth transition and future scalability. Some of the key steps, which are covered in this white paper, include the following:

- Assess the current SAN environment
- Examine the current power and management infrastructure
- Analyze any existing SAN issues
- Identify new additions to the fabric
- Plan the migration path

Executive Summary

Not too long ago, storage administrators were managing the growth of their Storage Area Networks (SANs) on the fly – probably not the degree of management they would have liked, but they were nevertheless getting the job done. However, with the exponential growth of data over the last five to seven years, this task has started to become overwhelming, to say the least. And with the additional stress of data retention due to federal regulations, the ability to grow and manage at the same time has become crucial – not only to keeping your job, but also to becoming a valuable player in the organization.

This growth has led many data center managers to a position of migrating from old, legacy equipment to newer, more robust and scalable equipment. When the older Fibre Channel Switches just can't scale any further, it may be that the older design and architecture the environment is based on is simply unable to keep pace with the data rates in demand today. Hence the reason for migrating from smaller, less scalable legacy switches and SANs to state-of-the-art, scalable and robust switches and SAN designs.

Objective. The purpose of this paper is to give the Storage Administrator or Storage Architect a general purpose, “best practices” guideline to help him/her through a migration from one SAN to another in the least intrusive manner.

This paper will contain the information needed to document assessment results, blank forms for recording these results, procedures and suggestions to help implement a migration. The idea is to give the user a base to start from and to invoke the thought process when taking on such a challenge, though not to provide a step-by-step procedure that answers all questions. There are too many aspects and considerations that are involved in this type of project, as well as various configurations/environments, to assume that one procedure fits all. Instead, the intent here is to provide an informative, general purpose document to make the user's experience less frustrating.

Assumption. This paper assumes that the SAN is operating in a production environment with servers and storage connected through a Fibre Channel Switch with remote management capabilities. It also assumes that the reader of this paper is familiar with SAN terms as well as general operations terms.

Assessment of Current SAN Environment

Inventory all server and storage ports connected in the current fabric.

To get started, you would need to document every device on the existing fabric – whether it's a server, a storage array or a tape library; it all needs to be documented. You also will need to make a note of how many ports on the SAN each device takes, for example, a server with dual paths to its storage will take up 2 ports in the fabric, but be careful here...if this is a redundant configuration and there are redundant fabrics, then this server will only take 1 port on each fabric. Refer to the example assessment sheet in appendix one to help you record your devices on the SAN.

While we are here, this is probably the best spot to make sure that all your cables are labeled, as well as all the existing SAN devices. This will make your life much easier throughout the migration.

Identify critical servers for High Availability configurations. Simply stated, you need to identify those servers that cannot go down nor have any interruption to data flow. High-profile applications such as SAP that need 100% availability to the customer base run on these types of servers. They are probably the ones that already have 2 Host Bus Adapters in them with dual or redundant connections or “paths” to its storage. These servers could also be in a clustered environment where there is more than one server supporting the application, so if one does go down the other picks up and keeps the application running – this way, if any type of interruption were to occur, it would be completely transparent to the end user or customer.

TIP: Always check both ends of the cable to make sure where it starts and terminates and label the cable at both ends.

Once these servers are identified, you can plan accordingly on how to migrate them over to the new SAN. We will cover this in section 6 later in this paper. Again, record them in the assessment sheet and label the cables and the devices where needed.

Identify critical storage ports for High Availability configurations. This too is an important part of the assessment procedure. Sometimes we tend to forget that at the other end of the server cable is the storage which also takes up ports on the SAN, and which can also be configured with dual or redundant connections or “paths” to its servers for high availability. Use caution when locating the connections into the fabric just as above. If you have redundant fabrics, then one port would be used in each fabric from a dual-path configuration. If you have a single fabric, then two ports might be used.

TIP: Always check both ends of the cable to make sure where it starts and terminates and label the cable at both ends.

You can use the assessment sheet for this type of device, as well as marking the type as “storage port.” Again, please label the cables and the devices as well to help make the migration a smooth transition.

Identify the remaining devices attached to the SAN. This is where you would record the remaining devices attached to the fabric, other servers, storage ports, and tape devices whether tape libraries, standalone tape drives, or VTLs (virtual tape libraries). Included on this list or on one of the lists above would also be any type of appliance, i.e. FalconStor’s IPStor appliance for data replication, virtualization, continuous data protection, or disaster recovery. If it connects to a port or ports on the SAN then you will need to document that connectivity and the cables.

While we are on this subject...if you have any type of disaster recovery implementation for your fabric, i.e. data replication to another site or data center via the SAN infrastructure, make sure you include that connectivity in your assessment documentation.

Identify the priority of these devices. In other words, can these devices be taken off line? Will their applications be missed? If so, how long can they be down? You will need to plan accordingly, making special notes on your assessment sheet for these types of devices. Arrange with any control change management board or committee you might have to interface with to get time on these devices.

Identify current backup environment. You will need to identify your backup environment from backup servers to the tape devices. In section 2.4, you recorded your tape devices, which may be anything from tape libraries or VTLs to standalone tape drives. Some backup SANs are separate from production disk SANs and need to be maintained as a single fabric. If you are planning on incorporating your backup SAN into your new SAN, you will need to carefully document all the pieces that make up the infrastructure of your tape SAN. This will include switch ports from the disk SAN and all the zoning information. See Figure 1 to get an idea of what to look for.

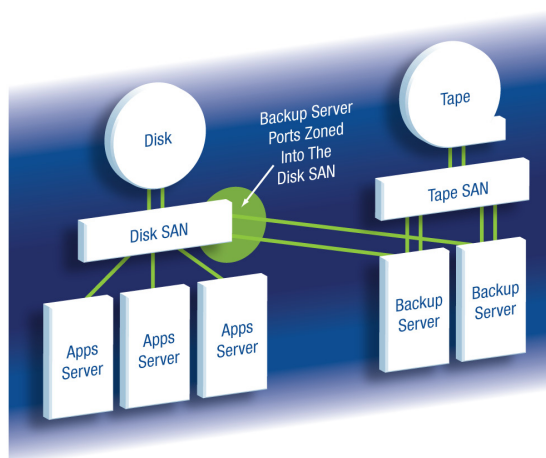


Figure 1. Zoning for Backup

Assessment of Current Power and Management Infrastructure

Define the current power used for the existing SAN. Is there sufficient power currently feeding the existing SAN infrastructure? If so, that is good news. Are there redundant power feeds into your data center for high availability environments? Redundant means whether power is coming from two different sources. In other words, does source “A” come from one power grid and source “B” from a completely different power grid? Is there additional power already installed and not being used? If so, that is great news! Someone was thinking ahead and planned for future growth. Now, is it possible to use this additional power for the new SAN infrastructure and is it redundant?

Make note of all of your power feeds that are currently being used for the existing fabric and label all the feeds. Also, make a special note of those that are feeding the same switch and if they are redundant or not. For true high availability installations, you will want your power feed from two separate sources, so in case one source experiences an outage, the other source will not be affected.

TIP: Another point to power is battery backup (whether high-end or a UPS in the bottom of a cabinet) in case you do lose power to your data center.
How valuable is your data?

Identify if additional power will be required. After you have identified all of your current power for your existing SAN infrastructure and have labeled all power feeds (both in use and not in use), you can determine how much power you will need for your new hardware. This is simply done by asking your switch manufacturer for the power requirements of the particular hardware you are going to be using. This is also a good place to determine if your environment calls for high availability and, if so, plan accordingly.

with a second source of power and possibly some form of battery backup depending on the size of your operation.

Define the current management workstation. Most data centers have some type of management workstation for their fabrics where they manage the switches on the SAN as well as the storage, and in some cases the server Host Bus Adapters. Check to see how this is done, whether in-band or out-of-band...meaning through the fabric via a Fibre Channel connection, which will take up another port on the fabric, or through an Ethernet connection. In either case, ensure that this workstation can connect and communicate with all the devices it manages before the migration takes place.

Will this same workstation be used to manage the new SAN hardware you are getting ready to install? If so, it is recommended that you install the new management software and use this workstation to connect to the new hardware and test its capabilities before you start the migration, ensuring that it is all compatible with your new hardware and software.

Current SAN Issues

Ensure that the current SAN is working properly. First things first...you need to make sure that what is running today is actually working properly. Check all your logs and look for any indicators that something might be wrong. Check that all your ports are running clean...a few “SYNC LOSS” messages isn’t anything to get alarmed about but a few hundred might prove to be a problem somewhere in the fabric. Look into it and find out why.

Also, you should talk to your administrators to see if they have noticed anything funny in the last few weeks or so. Most times, admins will call you before you even think of calling them, but this time you want to cover all your bases. Find out if they have been experiencing any performance issues. If so, you will need to do some digging...get into the logs, right down to the port level of those particular server/storage connections on the switch. You need to identify any bottlenecks in the existing infrastructure and resolve them before moving on to migrating to the new infrastructure, unless of course the new infrastructure is the answer to these bottlenecks and/or performance issues.

Identify and understand causes for performance issues. Understand the particular applications that are suffering in their performance and how they transfer data across the wire. Do they transfer large blocks of data a little at a time or thousands of small blocks of data constantly? Once you understand the issues, you might be able to tune your SAN to work with the particular application whether on the host side or the storage side.

Generate a plan to resolve the performance issues. Once you understand the root cause of your performance problems or bottlenecks, the next step is to put together a plan of attack on how you will resolve these issues and make that a priority. Once your plan is outlined and ready...test it! You

need to make sure your plan will work and that all the issues you uncovered are resolved before you start the migration.

Identify New Additions to the Fabric

Hardware and Applications. Now that you have an understanding of what you are migrating from the existing or legacy SAN infrastructure, you will need to also identify any new or unused hardware that might eventually be connected to your SAN. Are there servers that have been in existence but have not had SAN connectivity, and are now to be included in the new infrastructure? Is there new hardware coming that needs to be included? Storage, servers, or tape? What are the applications they are tied to? What are the requirements for these applications? Performance requirements, block size, etc. and do they need to be highly available?

For example, if you have a new Oracle database application being added to your fabric, you will need to discuss these questions with the database administrator and the architect of the hardware. From this discussion you surmise that there will be two servers in a cluster each with redundant Fibre Channel ports to the fabric or fabrics. In the case of redundant fabrics, that’s a total of four ports that will be connected from the host side, two to each fabric. You also find out that they have been assigned two of their own storage ports which will translate to one port on each fabric. So you will need to add this to your assessment sheet and be prepared to allocate these ports, as well as the others that have been added above, to the existing environment.

Backups. Once you are finished adding the new applications and hardware to your list and you know how many ports they will be utilizing on your new infrastructure, you would now need to determine if they need to be tied into your existing backup strategy, plus you would need to understand their requirements for backups. How often does the application need to be backed up? Determine how critical the data is and if there needs to be replication and some type of retention plan. This will add to your overall design and in some cases create some complexity that may warrant expert advice or consulting beyond the scope of this paper. The general idea is to keep these things out in the open...it’s better to have extra ports than too few.

Future growth. An important part of the assessment is planning for the future. Talk with your administrators and find out the growth rate you have experienced over the last year. Verify the number of additional storage and server ports that were added to your existing environment and determine your growth percentage rate as far as ports are concerned. For example, you started out the year with 100 ports in your SAN. Throughout the year you added 16 server ports and 4 storage ports for a total of 20 new ports... that’s a 20% increase in your port count. So now you can determine from there that you have a potential growth rate of 20% roughly, and perhaps add a little onto that just in case – having extra ports is a better place to be.

So using our example from above, with a potential growth rate of 20% and using that same formula, we can figure out what we should be building this port count to – $120 \text{ ports} \times 20\% = 24 \text{ ports}$, $120 + 24 = 144 \text{ ports}$. Add on another 10% as a cushion (just in case) and you would get $144 + 12 = 156 \text{ ports}$. Also, don't forget to include the new hardware that you are adding to the infrastructure that has not yet been SAN attached.

With this done, you would then need to develop a data growth plan that would serve you well over the next couple to three years. Not rocket science, but a good idea to do before you decide on what hardware you are going to purchase and how many ports. . .the ability to scale without interruption to the fabric is an important capability that should be considered when researching switch vendors. (See Table 1)

What to look for in a switch

1. Ability to load code and activate without impacting running I/O
2. Ability to scale without taking down the fabric
3. Ability to scale without taking any devices or hosts offline
4. Support for fabric and loop
5. Non-blocking architecture
6. Easy to use, manage, and configure
7. Redundant components (power supplies, fans, and CPUs), all hot-swappable
8. Serviceability – customer serviceable
9. High port count in a small space
10. Supports 1/2/4Gb/s and possibly 10Gb/s for inter-switch links (ISLs)
11. Management software package (trunking, fabric extension, fabric monitoring, diagnostics, statistics and logging, and security)
12. Low power consumption
13. Simple zoning
14. Ability to support multiple domains



Table 1

Migration Plan

Switch configurations. One of the more challenging pieces to this project will be getting the zoning information off of the old switch and onto the new switch or switches. If you are using the same vendor for your new infrastructure as before, this should not be too much of an issue, provided the old and new firmware is compatible and supports uploading/downloading the configuration. If you are using different vendors and your zoning is fairly complex, you might want to check into the ability to copy the configuration from one switch to another. Check with your switch vendor to see if they offer any type of conversion package that would take care of this. The size of your fabric will dictate how far you have to go here – if you have less than fifty ports, you could enter the zoning information manually. If you are looking at fifty plus ports, you might consider one of the options previously stated.

Other questions to consider: Will the zoning remain the same? Are you adding new hardware into the fabric? Have you changed zones around for performance issues? Are you going to incorporate a backup SAN into the fabric where it was separate before? These are also some configuration details that will need to be worked out and included in your overall migration plan.

Prioritize devices. Once you have all the pieces together, your new switches in place, powered up, and configured to match the legacy switches you are replacing (or at least configured to accommodate your old and new configurations), you are now ready to start moving the devices over to the new fabric. You will want to schedule the move so that it will have the least impact on the production environment. Typically these types of moves are done over the weekend. Also, depending on the size of your fabric, this might take either a couple or many weekends to complete.

You already know your most critical servers and storage from the assessment exercises you performed in the previous sections. The most critical servers should be moved after you have already moved over a few of the less critical servers. This way, you already have a pretty good idea of how the migration will go and what to watch out for. . .it is always best to work with the least important servers and storage first in case there is a problem and it doesn't work. Once you've established that the migrated devices are working properly and everything worked according to your plan, then start to move the more critical servers and storage.

Procedure to move devices. Once you have the order in which you will be moving your devices over to the new fabric, you will need to create a plan on how you will be moving these devices. The size of your shop will influence how you make the move. Larger shops usually purchase new/additional storage for the move and retire the older storage. So if you are using this game plan, then you will need to get the data from the old storage to the new storage first. There are many software packages that are made specifically for migration...check with your storage vendor and see what they would recommend. Most mid-range to enterprise storage array vendors offer some type of software package to accomplish this task. See Figure 2 to get a better understanding of this procedure.

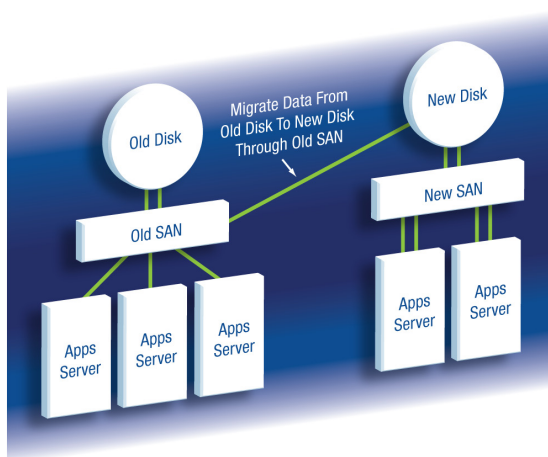


Figure 2. Data Migration from Old Storage to New

There are other ways to make this move as well, depending on the storage array you are currently using in your SAN. If you have a high-end array with support for multiple ports and you have the room to add more ports, you could take advantage of this ability. First you would add the new port(s) to the storage array and then assign the new port(s) access to the LUNs that you will be migrating over to the new SAN. Then you give the host port(s) access to the new storage port(s) so that the host has the ability to talk to the LUNs behind the new port(s) using zoning or LUN masking. Once that configuration is completed, you connect the new storage and host port(s) to the new switch and ensure the zoning on the new switch and the masking on the storage side are correct. Of course this is just describing the basics in migrating data for one server...not considering dual-port configurations for high availability. With this simple procedure, the host will have to be taken down. If you do have redundant paths to the existing storage, then you could make this work without any downtime by moving one path at a time while the other is up and running.

Now, you must realize that this also has a lot to do with where you are migrating from or to. There is a lot less planning involved when everything you are moving is in the same data center. Much more planning is needed when moving from one data center to another or from one city to another...but all the same basics apply. The biggest difference is time and effort. Compare time in transferring terabytes of data within the same data center to the time it would take to transfer that same data over a WAN using Intelligent Storage Routers that support multiple protocols. Or compare the effort it takes to move a piece of equipment over the floor of a data center compared to the effort it would take to move that same piece of equipment across the road.

Test Plan. You already verified in section four that the old SAN was in proper working order, so now you need a plan to ensure that nothing has changed as far as any customers or users are concerned. Everything should be working as it was before your migration. This is standard operating procedure...test what you moved! Test everything...applications and failover with redundant paths or clustering.

Back-out Plan. One of the main parts of the overall plan is a plan to get back to the original configuration of the old SAN – what you knew worked before you made the move. Most operation managers will have a time limit – if you can't get the new fabric up and running and online within a certain amount of time, you need to back out of the migration and put everything back to where it was and make sure that it is all working properly. This includes the total time it will take to get the hardware and applications migrated and tested, and if it doesn't work, to put it back to the original configuration and test it. As part of this plan, include time for troubleshooting as well, which would give you enough time to figure out why something isn't working.

Most organizations have a change control management board or committee that you will need to present your back out plan to. If there is no plan, it's likely that in most instances you will be asked to come back with a back-out plan included in your overall plan.

Troubleshooting problems. There are multiple problems that could happen during the migration. The size of the infrastructure you are migrating would correlate to the number of possible problems you could encounter. If you stuck to the game plan from the start and tested everything before you migrated, then any problems you uncover would more than likely have something to do with the new fabric. Check physical connections and zoning, as well as any LUN masking and binding. Check for typos in configuration files, etc. Use logic and common sense when troubleshooting these problems in order to narrow a problem down to the simplest configuration and work from there.

Conclusion

All in all, the idea is to understand what you have in your current environment and where it will sit in your new environment. Once you have this knowledge, the migration becomes nothing more than a procedure you follow and the size of the project is of no concern – the basic principles apply no matter what the size of the environment.

The more you understand it, the better you will be able to manage it, as well as troubleshoot any problems that might arise. After you make and document all your connections, test all the applications and hardware connections, and troubleshoot and correct any problems you found, you will then have gained an in-depth knowledge of how your infrastructure is built and a better understanding of how it works and why. You will now know whether it's a performance issue or a connectivity issue, and how to get to the root cause and identify the right solution.

Disclaimer

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