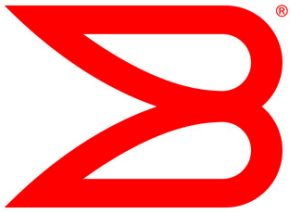

DATA CENTER

Operational Simplicity: Automating and Simplifying SAN Provisioning

BROCADE

CONTENTS

INTRODUCTION

As customers look to Fibre Channel (FC) storage area networks (SANs) for building private storage cloud services for their enterprise data centers, some of the key attributes are:

- Consolidated and highly virtualized pools of compute, storage and network resources
- Secure and efficient use of inter-fabric connectivity
- Lower capital and operational costs, higher asset utilization
- On-demand and efficient provisioning of application resources through automated management

Brocade has developed solutions to address these key attributes leveraging its seventh-generation "Condor3" ASIC features in the 16-Gbps platform, Fabric Operating System (FOS) v7.0, Brocade Network Advisor, Brocade HBA and CNA technology, and are working with transceiver vendors to address these key requirements. In order to enable customers to achieve these goals, Brocade is delivering key technologies (see Figure 1) that would allow customers to:

- Scale up/out based on business growth
- Secure data and optimize inter-data center bandwidth utilization
- Reduce CapEx and OpEx cost with build in diagnostics and SAN management tools
- Optimize both bandwidth and IOPS while being energy efficient

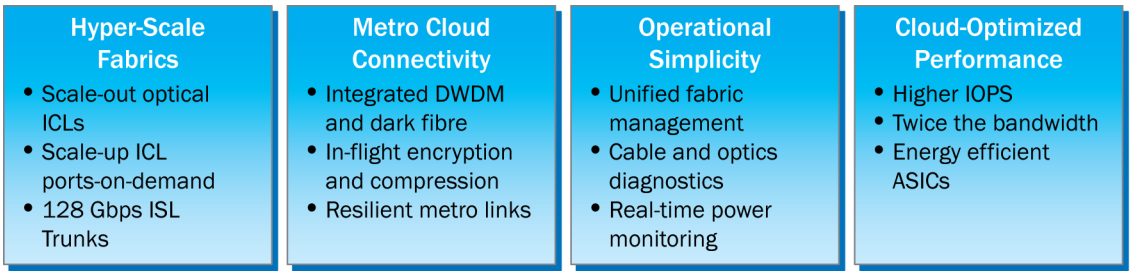

Figure 1. Enabling Private Storage Clouds

OPERATIONAL SIMPLICITY

Brocade SAN fabrics provide a secure, low-latency, and high-performance infrastructure for mission-critical applications on which Fortune 1000 companies depend. However, this requires additional zone management as well as clean and reliable cable connectivity to support higher speed grades like 16-Gbps Fibre Channel. As network speeds increase, tolerance levels for optics and cables become even more critical to link integrity. The added security that zone management provides increases the administration and operational burden for the SAN administrator. In the current business environment of having to do more with less, technology can be used to reduce manually intensive and error-prone tasks like testing cable links and optics on a live network or zone management for device communication.

This is one of four technical briefs that address Brocade solutions for helping customers in their transition to private storage clouds. In this article, we will describe tools that are available on the Brocade platform for infrastructure diagnostics and zone management, and the benefits that they can provide in your SAN infrastructure.

Based on customer need for automated capabilities that are related to diagnostics and provisioning, Brocade has developed innovative solutions in these two areas:

- Automated validation of the connectivity of the physical infrastructure
- Automated provisioning and administration of zone management

Physical Infrastructure Validation and Diagnostics

Whether building a new SAN or connecting to an existing SAN, pre-staging and validating a fabric prior to putting it into production ensures that there are baseline metrics in terms of rated throughput, latency, decibel loss through patch panels, and quality of optic cables as a measure of cyclic redundancy checks (CRCs). Currently, customers have these two options for validating the physical infrastructure:

- Use SAN test equipment
- Deploy actual devices like servers, storage, and tape libraries that will be supported in production

While the best practice is to use actual devices to validate the infrastructure, equipment may not be available at the time of staging. Purchasing or leasing SAN test equipment to validate connectivity is an added cost that could easily be addressed by providing the test support in the fabric as part of the SAN core functionality. Once a SAN is in production, most data centers have restricted access or may be remotely managed. Having to physically place SAN test equipment in-line to test optics and cables is not only intrusive and error-prone, but it can be critically disruptive if the wrong link is removed for diagnosis.

Optics and Cables

The digital diagnostics capabilities that are available with most current transceivers provide generalized warnings and alert levels that are defined across transceivers from multiple vendors. With the 16-Gbps short wavelength (SWL) and long wavelength (LWL) transceivers, Brocade provides granular vendor-specific thresholds and flags critical alarms as listed below with Brocade Fabric Watch and Brocade Network Advisor. By proactively monitoring critical transceivers, customers can quickly address any physical layer issues without the need for special optical testers.

As network speeds increase, media and cable tolerance become critical for avoiding degraded performance and avoiding CRC errors over time. Brocade designed intelligence into their FC switching ASICs and worked with major transceiver vendors so that the new 16-Gbps small form-factor pluggables (SFPs) provide link-level validation, which is commonly provided by SAN test equipment.

Fabric-based physical layer validation testing provides the following benefits to customers:

Table 1. Infrastructure Diagnostics

Test	Benefit
Local and long-distance measurements	Check for cable reroutes within a data center or path reroute over dense wavelength-division multiplexing (DWDM) to a distance granularity of 16.4 feet (5 meters)
Latency measurements	Measure latency between links within or across data centers for latency-sensitive applications like virtual machine (VM) motion and replication, or for monitoring service level agreements (SLAs)
Link performance	Generate traffic patterns that are similar to the projected traffic patterns over links of the new fabric to ensure that it meets the performance requirements and detects potential congestion points
Transceiver health check	Validate that all the electrical and optical components of the transceiver are working as designed and that the decibel budget between the links is within tolerance
Transceiver uptime	Proactively monitor and trend for the integrity of the optics during its operational life cycle with the power on hours or years

This testing and analysis is enabled through a new port operational mode called the Diagnostics Port or "D_Port," which is a Brocade patent-pending technology that is used to simplify and automate SAN physical layer diagnostics.

The D_Port is a new port type that is statically configured by the user to run diagnostics during pre-deployment or when there are susceptible physical layer issues. It is an offline diagnostics tool that allows users to automate a battery of tests to measure and validate latency and distance across the switch links as well as verify the integrity of all the 16-Gbps transceivers in the fabric. In addition, a D_Port only requires the individual ports that are attached to the link being tested to go offline, while leaving the rest of the ports to operate online, in isolation from the link being tested.

How Does D_Port Work?

Brocade Network Advisor or Brocade FOS command-line interface (CLI) commands can be used to initiate the diagnostic tests to validate the cables and the transceivers.

Figure 2 is an example of two 16-Gbps switches that are connected via Inter-Switch Links (ISLs), either local or over distance. When the ports are set in the D_Port mode, the tests are automatically initiated on both ends of the link. In this mode, it is possible to validate the following:

- The electrical components of the local transceiver
- The optical and electrical components of the remote transceiver
- The link distance (in meters) and latency (in nanoseconds) between the ports

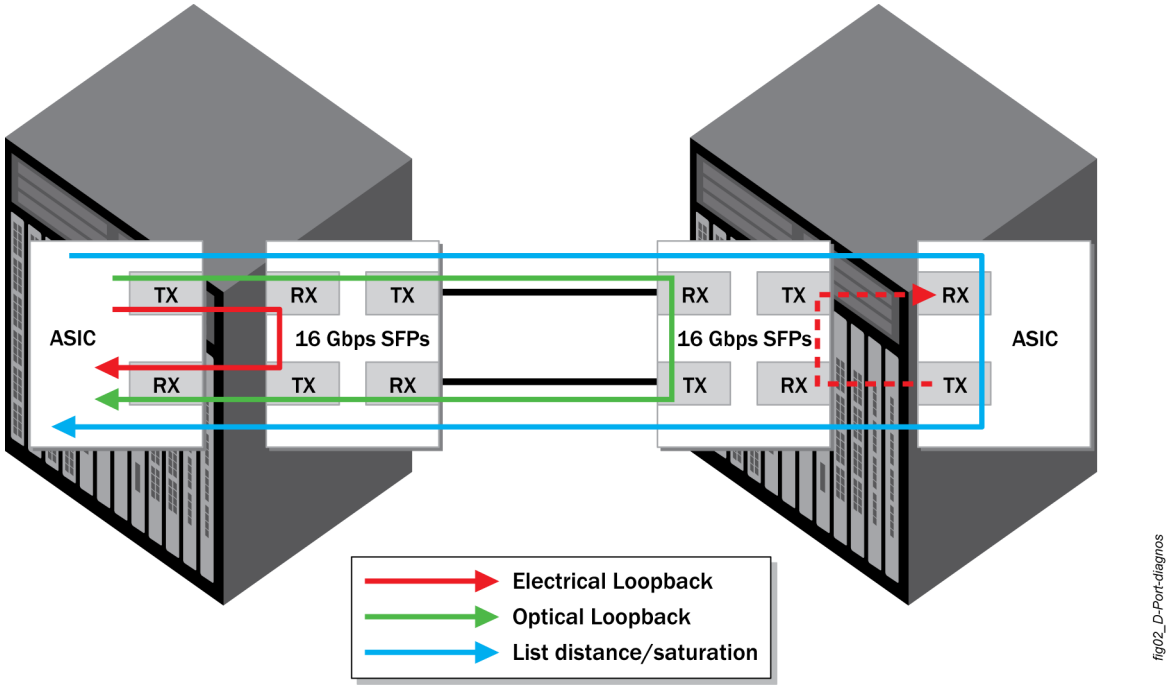

Figure 2. D_Port to D_Port Diagnostics

In Figure 3, Brocade Network Advisor displays D_Port test results for six ISLs where two ports succeeded, two ports failed the optical component of the test, and two ports are still in progress.

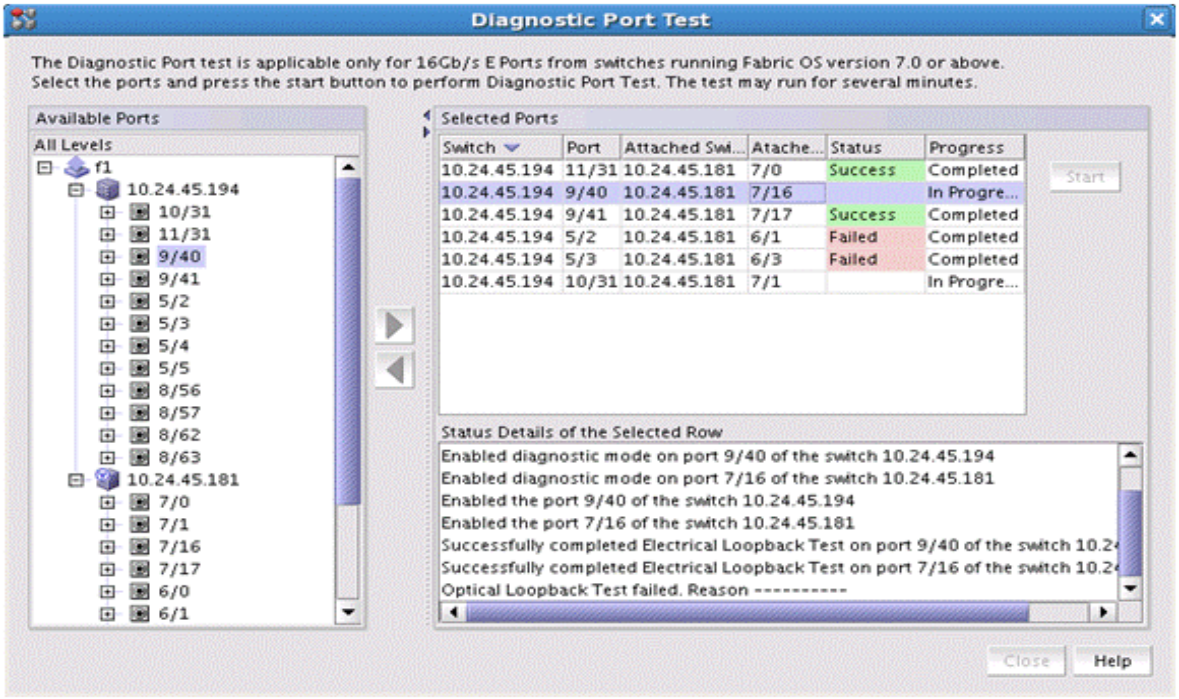

Figure 3. Brocade Network Advisor: D_Port Test Results

Zone Management: Dynamic Fabric Provisioning (DFP)

Zoning is a security mechanism that is used to specify the devices in the fabric that should be allowed to communicate with each other. It is based on either port world wide name (pWWN) or Domain,Port (D,P). Refer to *Secure SAN Zoning Best Practices White Paper* for details. When using pWWN, the SAN administrators cannot pre-provision zone assignments until the servers are connected and the WWN name of the HBAs is known.

As data centers consolidate and increase fabric device density, providing an automatic provisioning tool for SAN administrators to plan ahead and pre-provision device connectivity becomes more imperative. Solutions are necessary that can simplify customer migrations to truly secure, automated private cloud storage services. The Brocade next-generation 16-Gbps SAN platforms provide an integrated switch and HBA solution that enables customers to dynamically provision switch-generated virtual WWNs and create a fabric-wide zone database prior to acquiring and connecting any Brocade HBAs to the switch.

The Brocade fabric-based implementation supports a scalable solution for environments with blade and rack servers.

What Do Customers Do Now?

Defining, adding, or changing a zone database for device connectivity is currently a very manual process and, in cases where the HBAs fail or servers come off lease, the zone database must be updated to accurately reflect the changes in the fabric. To deploy a server in an FC SAN, it requires multiple administrative teams, such as server, SAN, and storage teams, to coordinate with each other and perform configuration tasks like creating zoning at the fabric and logical unit number (LUN) mapping and masking at the storage device before deploying a server. To configure WWN zoning and LUN masking, administrators need to know the physical pWWN of the server. That means that administrative teams cannot start their configuration tasks until the physical server arrives and its physical pWWN is known. Additionally, due to the sequential and interdependent nature of tasks across various administrative teams, it may take several days or weeks before a server gets deployed in an FC SAN.

Zoning becomes more complicated in an Access Gateway environment where the port that is connected to the switch is virtualized, allowing up to 255 virtualized connections from a single switch port. DFP reduces the zone management overhead as devices move between Access Gateway ports.

In order to simplify and accelerate server deployment and improve operational efficiency, DFP enables SAN administrators to pre-provision services like zoning, quality of service (QoS), device connection control (DCC), or any services that require port-level authentication prior to servers arriving in the fabric.

How Does Dynamic Fabric Provisioning Work?

A list of fabric-assigned port worldwide names (FA-WWNs) are automatically generated and can be provisioned to current and future servers in the fabric. During the initial login, the switch provides a virtual WWN to the Brocade HBA.

These are a few simple steps for setting up the DFP:

1. Select a switch port.
2. Configure an auto-assigned or user-assigned fabric WWN.
3. Create a zone with the fabric-assigned WWN and target device.
4. Enable zoning.
5. Connect a Brocade FC HBA to the switch port.
6. HBA automatically acquires the fabric-assigned WWN and the server is ready for operation.

In the future, as devices are replaced or moved, no additional changes are needed for zone management.

USE CASE: PRE-DEPLOYMENT OF PRIVATE CLOUD INFRASTRUCTURE

Infrastructure Validation

In a pre-deployment scenario where all the 16-Gbps switches are interconnected (see figure 4), all the ports can be placed in the diagnostic mode. They are automatically run through the link performance, latency, and distance measurement tests as well as the optical health checks prior to connecting servers and storage to the SAN, without having to use expensive SAN testers to individually test each port or link.

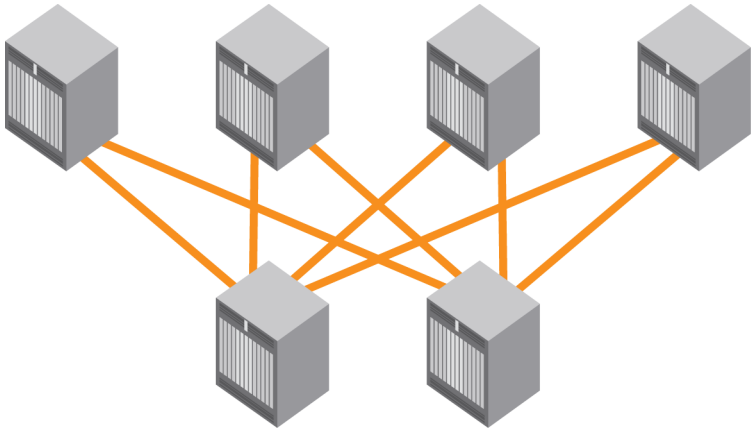

Figure 4. Infrastructure Validation

If the data centers are interconnected over dark fiber for workload migration and replication, assessing the distance and latency tolerance becomes critical for maintaining application uptime. SAN administrators can now measure the latency and cable distance to a granularity of 16.4 feet (5 meters), without having to contact network engineers. This reduces unnecessary organizational delays in identifying any application performance impacts due to cable or path rerouting issues over a metro DWDM link.

Pre-Provisioning of Zones

Customers can plan ahead and pre-provision servers before they are connected to the switch ports in the SAN. This is a one-time procedure. Servers can be moved or replaced in the fabric without having to modify the zone database or make any changes to fabric services like booting over SAN, QoS, or DCC policies that uses WWN.

By pre-provisioning the servers to storage, SAN administrators can reduce the time to bring resources online from an error-prone manual process to a plug-and-play model. The SAN administrators do not need to know the pWWNs of the servers while they configure the server in the fabric. When the actual server is connected to the switch, or moved or replaced, there are no changes to zone administration. For example, in the private cloud architecture, a VM needs to be created on-demand in a self-service manner for the internal customers. With DFP, multiple 2-TB LUNs can be pre-provisioned to physical servers to automate the storage provisioning. This removes the interaction between server and storage administrators in order to ultimately support a self-service model. When a new workload needs to be created in the physical server, a chunk of the 2 TB can be assigned per VM.

USE CASE: POST-DEPLOYMENT OF PRIVATE CLOUD INFRASTRUCTURE

Verify Disruptive Links

After a SAN has been deployed into production, during the operational life cycle of the fabric, links may begin to exhibit CRC errors or increased latency due to misconfigurations or other problems (see figure 5). The relevant ports can be taken offline (red link) and put into D_Port mode without disrupting the fabric if there are additional connections between the switches to route traffic.

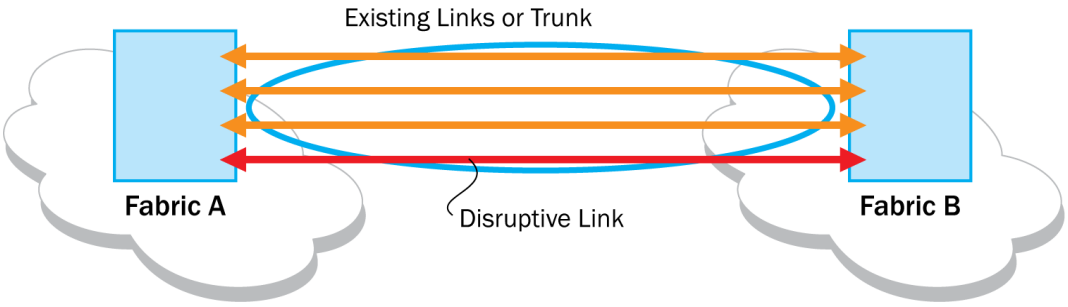

Figure 5. Test a Disruptive Link

The automated D_Port tests can be used to verify if it is a cable issue or an optics issue. Then it can be serviced accordingly to minimize downtime.

Verify Integrity of New Link

As more switches are added to the fabric or as additional ISLs are required for reducing congestion, it is a good practice to verify the integrity of the new connections. Prior to connecting the new link, the two end ports can be placed in D_Port mode and run through the diagnostic tests without disrupting the existing fabric. Once the tests are completed and the integrity of the link is confirmed, the two end ports can be connected to form an additional ISL or a trunk member without disrupting the traffic on an existing trunk.

Server Migration or Replacement

When servers come off lease, HBAs are replaced due to failure or are upgraded to handle increased workloads. The SAN administrator needs to manually update the zone database to reflect these changes. If DFP was used during the pre-deployment stage, the SAN administrator does not have to interact with server administrators to make any changes. For example (Figure 6), if a new server that requires more CPU and memory is needed and the existing server is re-purposed, all that needs to be done is to move the fabric-assigned WWN from one port to another without changing the zone database.

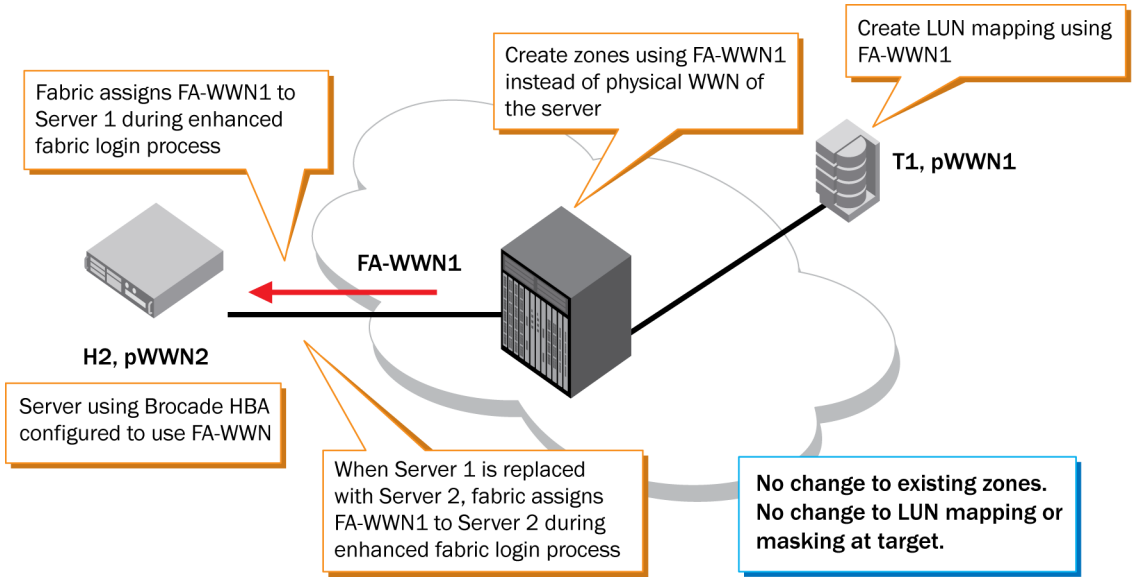

Figure 5. Post-Provision Zones

SUMMARY

Aside from delivering the highest-performing SAN platforms in the industry with the 16-Gbps product line, Brocade has simplified and automated the deployment and management of Brocade fabrics. As customers move to create a private storage cloud infrastructure for their virtualized environment, the ability to ensure the integrity of the underlying infrastructure and dynamically provision and bring resources online is important to a successful deployment of storage clouds.

By leveraging our 7th-generation Condor ASIC features in the 16-Gbps platform, Brocade FOS Brocade Network Advisor, and Brocade HBAs with 3.0 drivers, customers can save on both OpEx and CapEx of maintaining SANs with the following features:

- Automation of validation of the integrity of optics and cables without the need for external test equipment
- Measuring latency and distance between switches and fabrics to ensure it is within application tolerance and meets the SLA
- Automation of zone management by dynamically pre-provisioning servers to the fabric, which virtually eliminates the need for zone management as servers are connected, repurposed, or removed from the fabric

To learn more about the Brocade DCX® 8510 Product Family, Brocade DCX 6510 Product Family, Brocade FOS, and Brocade Network Advisor, contact your sales representative or visit http://www.brocade.com/products-solutions/products/dcx-backbone/index.page.