White Paper

The Benefits of Gen 7 Fibre Channel

Data Center Trends and Challenges

Enterprise data centers have entered a period of transformation that offers the opportunity to dramatically increase previous levels of efficiency and productivity. New technologies offer early adopters an opportunity to gain a strategic advantage against their competition while simultaneously threatening to leave laggards behind. The first step in this transitional phase was the deployment of hybrid and first-generation all-flash arrays (AFAs). Deploying these AFAs eliminated bottlenecks that had built up over years as spinning disk media struggled to keep up with IT demands. NVMe-based all-flash arrays (NAFAs) represent the next phase of storage development, optimizing performance by replacing the disk-centric SCSI transfer protocol with one that is purpose-built for memory and adopted for use in flash storage applications.

NVMe-connected devices for storage have become mainstream in production environments, and for adopters of NVMe over Fibre Channel storage, the performance benefits are tremendous. NVMe not only takes advantage of the micro-second latency times afforded by flash storage, but also enables massive parallel processing with support for 64k queues and 64k commands per queue—a total of 4.1B compared to the 256 commands in a single queue supported by SAS.

With these performance gains, however, comes a need to address the challenges in managing the continual growth and increased complexity that arises from adding applications, generating more data, and driving higher throughput to more endpoints in the data center. Managing these challenges, combined with the need for rock-solid reliability and the requirement to maintain high levels of security, can become cumbersome. Growth in Tier 1 applications with expectations of 100% uptime means that storage network performance must stay at peak levels at all times. At the same time, storage networks need to strengthen the level of security to protect applications against threats around the clock. Since greenfield buildouts are very rare, investments often need to span generations of server and storage systems while simultaneously supporting new demanding application workloads. The time required to address developing issues that impact performance across the entire environment must be minimized, and those issues must be automatically remediated, if possible. Congestion management and automated service-level agreements (SLAs) become key. Improved visibility into the health of the storage environment and automated responses to congestion bottlenecks are urgently needed.

Exponential Improvements

While most of the consideration in regards to AFA and NVMe storage is focused on the performance benefits that can be gained today, there is another important aspect of AFA and NVMe storage that dramatically changes technology development cycles. Historically, the Moore's Law prediction that the number of transistors in an integrated circuit (IC) doubles about every two years has applied to servers and networks. With the advent of IC-based all-flash and NVMe storage arrays, Moore's Law now applies to enterprise storage for the first time in history.

Figure 1: Brocade Gen 7 Fibre Channel Offering

This fact means that technology cycle times are shorter on both the storage side and the server and network side—a critical distinction that carries some important implications:

- Storage technology must be able to accommodate the integration of much more rapidly evolving and impactful changes without disruption to the existing environment. Rip-and-replace disruptions every two years is not a business-friendly way of incorporating new technology, but neither is delaying adoption for years until the environment can be completely refreshed. Easy migration to the latest technology while maintaining multiple generations of technologies without downtime will be key to a successful implementation.
- Sustaining the higher performance levels of flash storage means that an increased level of automation is required to monitor application performance and respond to potential disruptions as its storage traffic flows through the network. Throughout the SAN, any potential congestion points must be identified to ensure reliability and non-stop performance, and misbehaving devices must be separated from the rest of the traffic to keep everything moving. But because not all SAN traffic is equal, you must be able to prioritize mission-critical traffic coming from high-performing servers over non-mission-critical traffic to avoid mismatched traffic analysis and response behavior. This "not all traffic is equal" statement also applies to older, yet still mission-critical environments that must be allowed to perform as well as possible without developing "slow drain" congestion or dropped traffic in order to alleviate the problem.
- The exposure to human error while managing the growing complexity in the data center is increased. While making configuration changes required to accommodate changing business needs, there is a risk that an unintentional change to a baseline setting causes an adverse impact on data security, application performance, or management. Therefore, the SAN must address its part and be able to identify when configuration drifts occur and recover as fast as possible.

An on-demand data center requires answers to fundamental questions that have a potentially big impact on the capability of the environment:

- How do you know what is happening in your network?
- Are you able to measure response times and throughput levels to define a performance baseline? If not, then how do you recognize a developing problem?

Gen 7 Innovation

The evolution of the on-demand data center has changed the expectations of storage networks. Reliably passing data between compute and storage is no longer sufficient to meet business demands. Storage connectivity must be able to deliver on rapidly evolving requirements to keep up with new server and storage technologies.

In the ESG white paper *Brocade Gen 7: Enabling a Cyber-resilient Network*, analysts call out Gen 7 Fibre Channel storage networking as a critical element to achieving the full value of infrastructure investments. ESG discusses how the storage network plays a foundational role in IT modernization, often determining the performance and flexibility of the data storage environment while also affecting the security posture of the application ecosystem. To keep pace, modern storage networks must deliver the necessary performance and scale, while also helping to simplify operations and reduce IT and business risk with improved resiliency and cyber resiliency.

Gen 7 is the latest standard for Fibre Channel technology, building on 25 years of progressive development that has served as the archetype for high-performance and reliable storage networking. In addition to increasing throughput at 64G speeds, the Gen 7 standard also includes the following enhancements:

- NVMe over Fibre Channel with error recovery enhancements over Gen 6 NVMe/FC
- Automatic buffer credit recovery to maintain buffer levels between FC ports
- VM latency and performance monitoring through VMID tagging
- FPIN (Fabric Performance Impact Notification) signaling to alert the HBA of fabric issues such as congestion, oversubscription, or link integrity, enabling an automated response
- Automation: Dev Ops to facilitate orchestrated management with support for target-driven zoning and peer zones

Brocade® engineering has built on these standards-based enhancements with hardware, firmware, and system management to create a SAN that is ready for new dimensions of speed, efficiency, reliability, and resiliency—a new level of performance, manageability, and security that enables the autonomous SAN.

Thinking through the answers to the following questions in advance can help administrators plan out their infrastructure management strategy:

- How do you prioritize the traffic you have?
- How do you handle your mission-critical flows in a way that maximizes uptime over all other workload traffic?
- How do you identify issues as they occur?
- Should you encounter problems, can you isolate them to avoid performance issues or intermittent system health issues that can lead to a disruption or outage?
- How do you maintain high levels of security to protect your network against cybersecurity and business-continuity challenges that threaten to disrupt data center operations?

Brocade engineering has designed products to take the pain out of managing and securing your data center. Beyond higher speeds and lower latency, Brocade Gen 7 simplifies operation and ensures reliability by self-learning, self-optimizing, and self-healing without intervention. By automating congestion detection and resolution, you can instantly mitigate impacts on your applications while you free up valuable admin time by resolving issues much faster. Brocade Gen 7 combines unparalleled performance and nearly zero-touch autonomous SAN technology that enable a faster, more intelligent, and more resilient network. At the same time, integrated security technology protects mission-critical operations by validating the integrity of Gen 7 hardware and software. All these capabilities enable Brocade Gen 7 products to act autonomously to protect against security threats while quickly and efficiently maintaining optimal conditions, maximizing the availability of your storage resources, and ensuring the highest levels of resiliency.

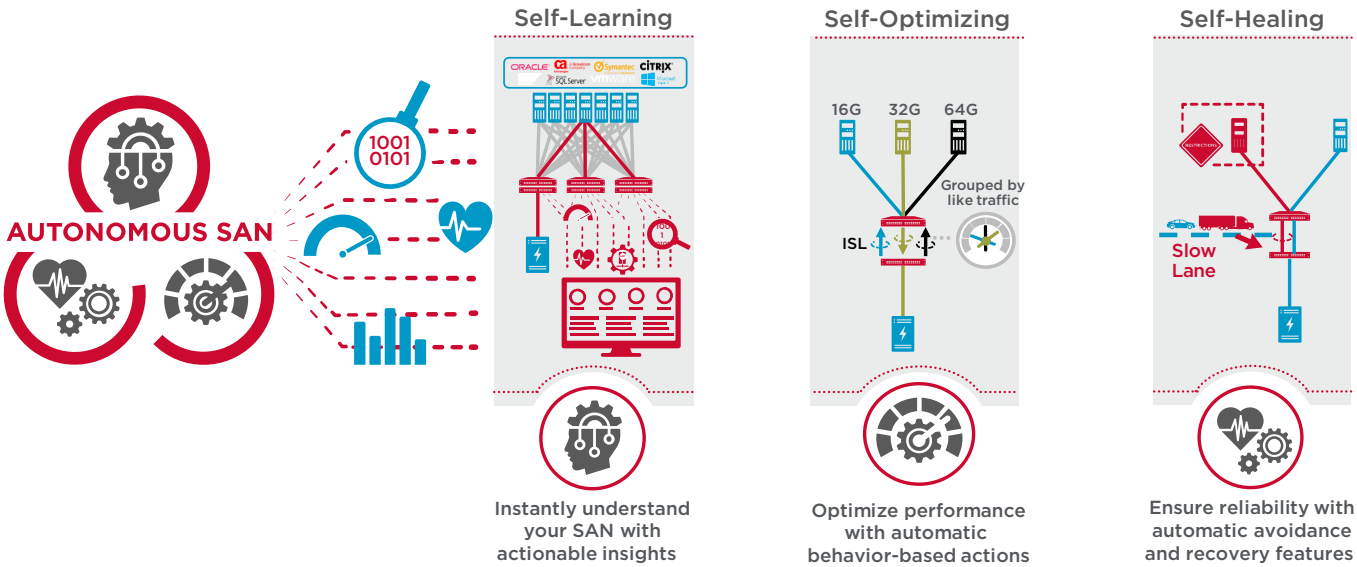
What Is the Autonomous SAN?

IT infrastructure is challenged to not only maintain a continuous level of high performance, but to also enable faster deployment of new services with easier management and monitoring at higher uptimes than ever. The only way to achieve this level of operation is through enabling advanced automation that offloads time-consuming tasks and speeds up response times as potential disruptions develop. The Brocade autonomous SAN provides end-to-end visibility of the entire network, including storage, hosts, and virtual machines.

The autonomous SAN is a collection of powerful analytics and advanced automation capabilities that enable a new level of functionality. These capabilities are based on a combination of line-rate speed, hardware-based data collection integrated into the ASIC, advanced data analytics built into Fabric OS® 9.0 firmware, and intuitive, comprehensive real-time presentation of network status from Brocade SANnav.

Integrated network sensors proactively monitor millions of physical-layer, protocol-layer, and FC-layer data points in real time to gain deep insight into the environment. These telemetry data points provide actionable insights that use powerful analytics capabilities to measure data characteristics against baseline network performance and health metrics. This actionable intelligence helps to provide automated problem mitigation. When more complex solutions are required, it can provide recommended actions to aid in problem resolution. This powerful combination of technologies enables the following capabilities:

Figure 2: Analytics and Automation Capabilities that Eliminate Complexity and Save Money



- **Self-learning:** Instantly understand your SAN with actionable insights by monitoring network performance and behavior throughout the SAN fabric in real time. Network sensors collect data points, Fabric OS translates the data into information, and SANnav displays the information.
- **Self-optimizing:** Information gathered through self-learning is applied to help guarantee performance levels, enforce traffic prioritization, and avoid traffic congestion.
- **Self-healing:** Automated responses to potentially negative conditions allow issue mitigation or resolution without admin intervention. Potential actions include adjustment of traffic flows, path failover, or correction of fabric misconfiguration.

Taken in combination, these capabilities enable the Gen 7 SAN fabric to meet the performance demands of the modern data center and ensure that performance targets are consistently achieved.

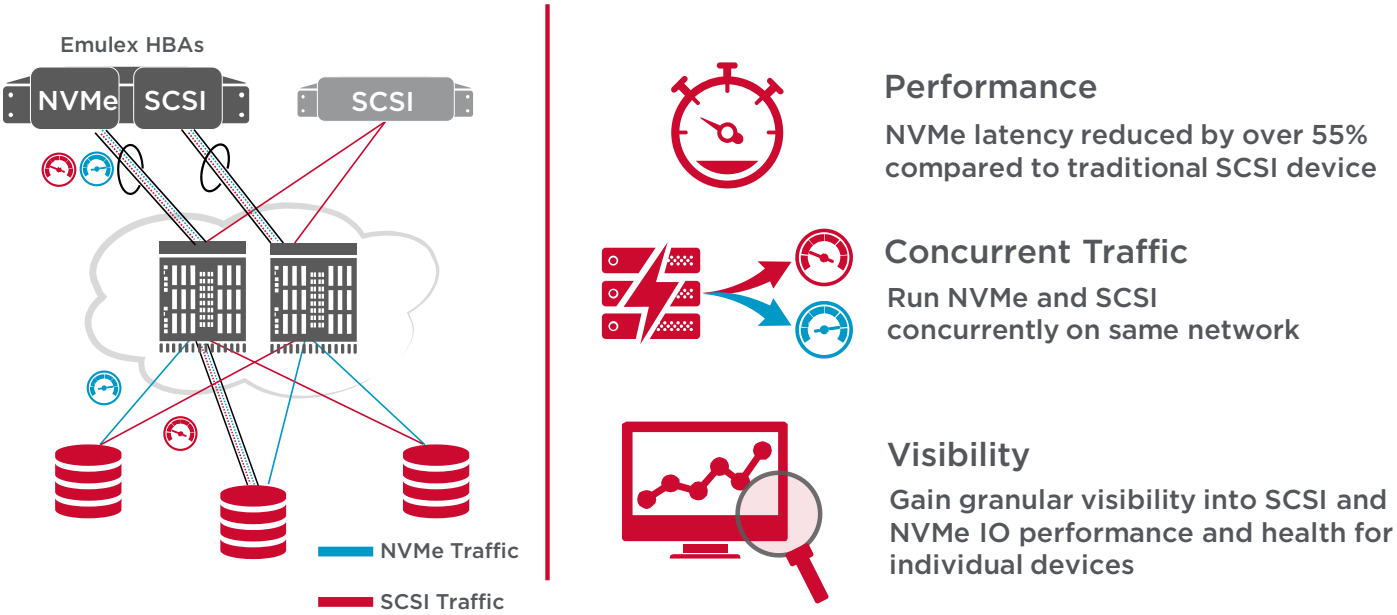
In the ESG Technical Review *Ensuring Application Performance and Reliability with Brocade Gen 7 SAN*, analysts validate how Brocade Gen 7 Autonomous SAN technology proactively optimizes traffic and automatically detects and addresses common congestion and physical-layer issues that can arise in a SAN. They conclude that IT, SAN, and storage administrators should quickly embrace this technology.

What Is in Brocade Gen 7 Fibre Channel?

Brocade engineering has built on the Gen 7 industry standard to further enhance and automate storage networking capabilities. The Brocade Gen 7 product line includes the following additional improvements:

- **50% Lower Latency Compared to Gen 6 Platforms:** Maximizes the performance of NVMe storage and high transaction workloads, eliminating I/O bottlenecks and unleashing the full performance of next-generation storage.
- **Traffic Optimizer:** Guarantees application performance by automatically prioritizing and grouping traffic. With automatic classification of data flows into performance groups by speed, protocol, and dynamic performance, the network eliminates common oversubscription and congestion issues that prevent negative performance impacts to mission-critical applications.
- **Traffic Congestion with Hardware Congestion Signaling:** Identifies the root causes of data traffic congestion with automatic remediation to avoid degrading application performance.
- **Fabric Performance Impact Notification (FPIN):** Notifies end devices through software or hardware signaling of developing congestion situations so they can take action automatically to avoid or mitigate the issue without requiring admin intervention.

Figure 3: Seamless Integration of NVMe with Fibre Channel Connectivity



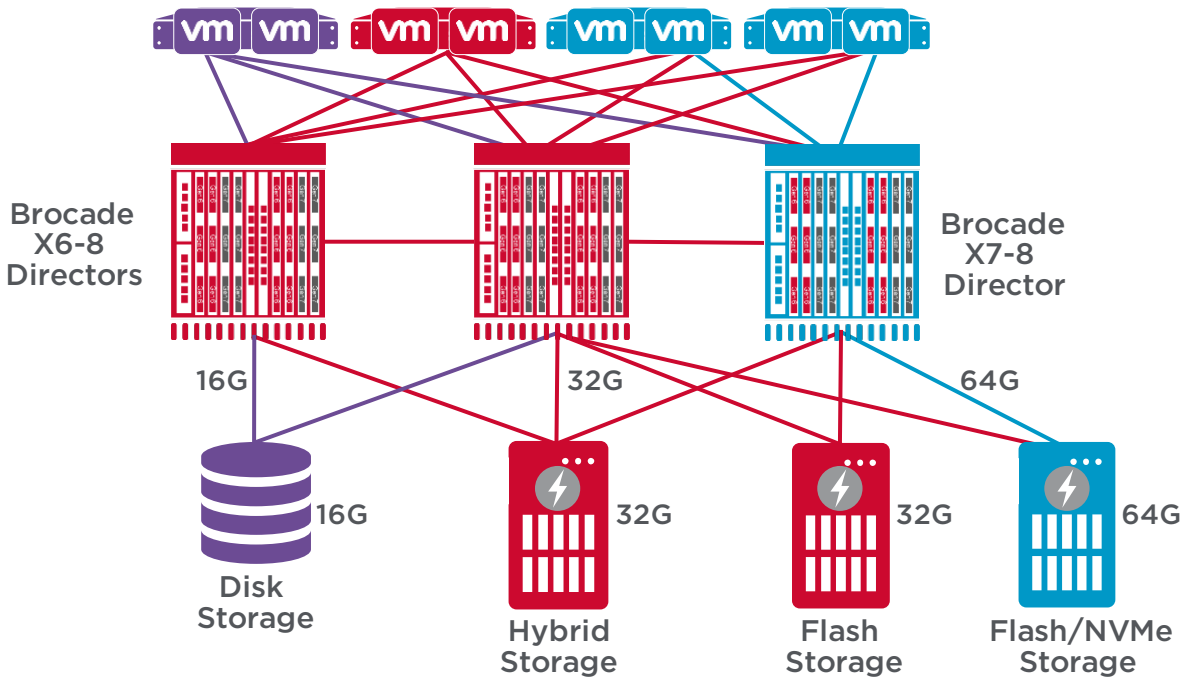
- **Fabric-wide IO Insight:** Monitors and analyzes traffic across the entire fabric, providing a level of visibility and control previously only available with the deployment of expensive external devices.
- **VM Insight Technology:** Provides virtual machine visibility and monitoring of VM flows across the SAN nondisruptively. This results in granular insight into the application health and performance for each VM to allow you to fine-tune your infrastructure or quickly identify abnormal VM behaviors, ensuring performance optimization and quick troubleshooting.
- **VMID+ Technology:** Provides VM Insight for all storage arrays, enabling end-to-end visibility of virtual machine performance.
- **Multipath Topology Discovery:** Alerts HBAs to ensure data delivery by discovering the presence of multipath topologies and applying FPIN failover, enabling a network-based fabric failover response in the event of path congestion.
- **Integrated Security Technology:** Protects mission-critical operations by validating the integrity of Gen 7 hardware and software. In addition, it reduces the vulnerabilities from malware and hijacking attacks by hardening Fabric OS (FOS) and strengthening hardware.

Easy Migration to NVMe Connectivity

As storage admins increasingly replace their legacy disk-based storage arrays with all-flash systems, the decision to adopt low-latency NVMe connectivity is an easy one that maximizes the value of their investment. What is even more appealing is the ability to migrate from all-SCSI environments to NVMe connectivity without incurring any downtime or disruption while gaining immediate performance benefits in the process. By offering verified IOPS increases of 80%, migration to NVMe is the fastest, easiest, and least disruptive way to increase performance for workloads using all-flash storage.

Adoption of NVMe connectivity to all-flash arrays can be easily achieved with Gen 7 Fibre Channel. Note that the data paths to the highest-priority, mission-critical workloads are the first to migrate to NVMe-connected all-flash arrays, while Tier 2/3 apps continue to run on existing SCSI-based FC connections across the same network. As new connections or devices are added, new paths can be created in a nondisruptive manner to bring up new workloads and migrate existing ones to NVMe.

Figure 4: Mixed-Generation Storage Environment



Investment Protection with Flexibility and Upgradeability

Brocade Gen 7 Fibre Channel protects your investments and eases migration to the latest technology. As well as achieving the higher speeds and scalability that your organization needs today, you will be able to fast-track the addition of new technologies as you need them.

Migration should never equate to wasted investment. Brocade Gen 7 makes it easy to run NVMe and SCSI data traffic concurrently on the same network. Traffic Optimizer allows you to seamlessly integrate next-generation hardware with new levels of speed. It isolates traffic according to speed, giving the SAN the unprecedented ability to handle devices with different performance capabilities, without adversely impacting the highest-performing workloads. In addition, the mixed-blade flexibility of the Brocade X7 Director allows you to utilize both Gen 7 and Gen 6 blades within a single chassis, so you can migrate on your terms.

As Gen 6 fabrics grow and integrate with Gen 7 switches, users can extend the life of their existing X6 directors to Gen 7 with an in-place system upgrade. With a firmware update and upgrade to CR64 core blades, X6 directors support all Gen 7 Fibre Channel features and functions. Users can continue to use their existing FC32 port blades to connect devices at 4/8/16/32G and can add FC64 blades with full Gen 7 feature support as their requirements for low latency and high-speed performance grow.

Integrated Security to Protect Operations

A Brocade Gen 7 cyber-resilient network protects against security threats, enables non-stop operations, and automates management functions. Fibre Channel fabrics are secure by design based on controlled access between servers and storage and their isolation within the data center. Brocade Gen 7 technology further reduces the risk of vulnerabilities by continuously validating the integrity of the switch operating system, security settings, and hardware.

Brocade Fabric OS (FOS) software adds enhancements to validate the integrity and security of Brocade hardware and software. Features including Secure Boot, Brocade Trusted FOS (TruFOS) Certificates, and hardening of FOS protect the SAN against malware and hijacking attacks.

Brocade TruFOS Certificates ensure that enterprises with Brocade directors and switches are currently covered by support licenses and securely enabled to perform critical operations, so users no longer have to worry about whether the operating system has been tampered with.

Brocade SANnav™ Management Portal gives enterprise users the ability to automatically distribute SSL certificates across the SAN to ensure authenticity and encryption settings. In addition, security features are built into Brocade SANnav Management Portal to help administrators protect their network. With Brocade SANnav, administrators can set up monitoring and alerting for security configuration changes, customize security thresholds, give proper access control to individual admins, and view switch security events.

Use Case 1: Multigenerational Server and Storage Environments

Over time, IT environments often evolve into a diverse collection of server and storage systems from different generations that must co-exist with a common storage network. This inevitable development can present challenges from the perspective of maintaining optimal performance across the entire environment. Newer systems that support faster throughput speeds naturally outperform the slower legacy systems but must still support critical applications. With a disparity of connected devices, it is common for one misbehaving device to cause congestion across the fabric. The impact of the problem, however, often shows up in a completely different place, such as on a server that is not the root cause, leading you to look in the wrong place for the problem. So how do you identify which devices are misbehaving and mitigate their adverse impact on other healthy traffic flows? And how can you know what optimal performance looks like or whether systems are underperforming? There may not be an outright failure in the environment, but identifying, diagnosing, and resolving developing congestion issues or a borderline failing component leading to underperforming systems can be a real challenge.

Gen 7 Benefit

Gen 7 introduces a combination of features that enables SAN admins not only to allow server and storage systems from different generations connected to the network to perform at optimal levels, but also to create a performance baseline to understand exactly what optimal performance looks like in order to sustain that level over time. Gen 7's automated flow learning self-learns up to 20,000 flows (Initiator-Target, Initiator-Target-LUN, or Initiator-Target-NSID). Brocade Traffic Optimizer capability can take the learned data flows and classify them based on the performance characteristics of the receiving device.

Automatically segregating traffic by speed types optimizes application throughput performance and eliminates the oversubscription and congestion issues caused by mismatched speeds. Once defined, prioritized, and monitored, traffic flows are automatically streamed to an analytics presentation that allows easy identification of data center traffic by generation and application so all can be assured of operating at peak performance. Self-healing capabilities make your network work more intelligently with end devices, resolving issues without human intervention to avoid network disruptions and outages.

Not only can Brocade Gen 7 detect and identify the root cause of congestion issues at the earliest stages, but it can also take action to mitigate the issues before they impact operations. Brocade Fabric Performance Impact (FPI) and Fabric Notifications technologies provide full-time monitoring of data flows across the fabric with automatic remediation of any developing or persistently intermittent issues. By sending signals to fabric-attached devices, Brocade Gen 7 alerts them to these issues and allows for remedial actions to mitigate the behavior.

Fabric Notification signals sent through in-band software messaging are also supported on Gen 6 platforms running FOS 9.x. Gen 7 platforms have the added enhancement of hardware-based Fabric Notification that communicates to devices via primitives, allowing for communication even when the path is in a congestive state. Gen 7 ensures that alerts reach the misbehaving devices to correct behavior as quickly as possible, providing the storage team with an extremely granular view.

Use Case 2: Seasonal and Event-Driven Performance Management

Traffic patterns in a storage network are generally not constant—fluctuation of activity cycles means that they spike during peak periods, often dramatically, which may occur daily, weekly, or seasonally. Systems must be designed to operate with consistency not just at average levels, but also during peak demand. But do you know what normal data flows look like throughout these days, weeks, and months as demand surges and shifts between workloads?

The threat of I/O-related performance problems at peak demand, such as slow response, timeouts, or even a crash, means that administrators are under great pressure to mitigate the likelihood of issues by addressing developing situations quickly. Because there are many components in a storage network that can impact performance, the administrator must first try to identify and isolate the source of the problem, whether it is within the fabric, a storage device, or a slow-drain host or target.

Gen 7 Benefit

Gen 7 self-learning flow discovery and data flow monitoring empower administrators to attain a level of visibility into network activity that was previously only possible with very expensive network monitoring devices. Self-learning allows for performance baselining during different activity levels and monitoring of all critical parameters that may be impacted during peak demand periods. Unlike some other technologies, however, where monitoring is a "sample rate" (for example, one packet in 8000 nominally or one packet in 2000 for "aggressive" monitoring) that allows for performance modeling, Brocade Gen 7 Fibre Channel platforms see every frame on every port. Gen 7 ensures not only constant visibility into the actual events that are impacting the health of the storage environment, but also the ability to respond immediately as workloads change over time.

Knowing what this baseline performance level is and being able to demonstrate that network performance is meeting the application requirements greatly speed up the ability to pinpoint the actual source of the problem, improving resolution or recovery time, often referred to as "mean time to innocence." It also means that when the storage administrator needs to go into deep troubleshooting mode, all of the measurement data—including latencies, exchange completion times, pending I/Os, and quarantined devices—is already captured. In addition to baselining system performance, IO Insight displays health metrics for every component and application, including NVMe-connected devices, that alert to the development of potentially negative performance impacts to mission-critical applications. These metrics are presented to you through clear and meaningful dashboards to automatically provide you with a baseline for your SAN.

Additional Brocade Gen 7 enhancements that broaden the application of Brocade fabric management capabilities include support for IO Insight monitoring of NVMe flows and SCSI-based Fibre Channel, expanded use of IO Insight across the entire fabric, and tagless VM Insight that enables monitoring of data at the VM level even without storage-side support for VM ID.

If metrics are abnormal, it is likely that the problems are due to the storage device itself, rather than the fabric. If the metrics are within normal range, the problems are more likely within the fabric or coming from the hosts. The I/O and VM performance metrics provided by IO Insight and VM Insight dramatically accelerate troubleshooting performance issues, helping organizations avoid disruption to operations and reducing costs.

Use Case 3: Latency-Sensitive Transactional Applications

Large-scale software applications and workloads considered to be Tier 1 and mission-critical continue to drive growth in the data center. Of these, transactional applications running on databases like Oracle or SQL Server are often the highest priority in an IT organization, sustaining the revenue lifeblood as well as the essential operational backend of an enterprise. These applications must not only stay up and available but must also consistently perform at a level that avoids introducing congestion into the environment. Large and growing databases and dense virtual server environments with mixed workloads can put a strain on legacy infrastructures from the perspective of bandwidth as well as response time.

In addition to the problem of overtaxed infrastructure, failing and underperforming components resulting in sick but not dead links that inhibit workload performance tend to be difficult to diagnose and isolate. These issues, often the result of a physical-layer issue, such as a failing SFP or substandard optical cable, can linger and amplify over time, leading to the risk of becoming a severe impairment.

Gen 7 Benefit

Brocade Gen 7 Fibre Channel adds capabilities to vastly improve network resiliency, maintain uptime for critical workloads, and sustain peak performance in multiple ways:

- Flow learning identifies flows across the fabric based on millions of collected telemetry data points and then baselines flow performance so that deviations from this level can be quickly identified.
- IO Insight monitors I/O performance and behavior through integrated network sensors to pinpoint the source of sick but not dead links that impact fabric performance and frame delivery as the result of physical-layer issues.
- Traffic Optimizer groups and prioritizes high-bandwidth traffic for the most critical workloads to eliminate oversubscription and congestion issues caused by mismatched speeds.
- Fabric Performance Impact (FPI) monitoring identifies high link utilization, link latency, and frame loss and sends alerts to administrators to solve these issues before they affect application performance and availability. FPI monitoring also integrates with the Fabric Performance Impact Notification (FPIN) feature to automatically interact with devices to identify and resolve lost credit issues.
- Fabric Performance Impact provides automatic failover responses to avoid impacted links and ensures that application performance can be sustained over time.
- Fabric Performance Impact Notification (FPIN) takes notifications generated by FPI monitoring or via link-signal and uses them to automatically notify devices in the SAN about issues that could affect them to autonomously fix credit-loss issues and mitigate sick links. FPIN also interacts directly with multipath input/output (MPIO) drivers, so it is a vendor-agnostic feature that can work across all operating systems, servers, and storage.

Taken together, these innovative features combine to ensure optimal application performance, making Brocade Gen 7 the best connectivity choice for critical and performance-demanding workloads.

Use Case 4: eCommerce

Creating an optimal online shopping experience for potential customers that makes them want to come back relies on immediate response times. The online transaction processing (OLTP) that takes place behind eCommerce platforms is foremost about optimizing speed. High-performance OLTP transactions require high IOPS and low latency to accelerate application response time and complete workloads faster in order to generate more revenue. The infrastructure must also be highly scalable to meet requirements during peak periods and support application growth.

Gen 7 Benefit

Gen 7 Fibre Channel offers a 50% reduction in latency and faster application response times for demanding application workloads. Speeding up data-intensive application response times allows more transactions to be completed in less time and improves service levels while providing a highly scalable infrastructure to support peak loads. Revenue-producing OLTP workloads will benefit by generating more revenue for the business and ensuring that customer service SLAs are met.

Use Case 5: Database Analytics

Increasingly, organizations are looking to perform deeper analysis on their large data stores to help them optimize their revenue potential and discover new opportunities. Low-latency, high-performance Gen 7 Fibre Channel provides fast connectivity to stored data, enabling faster response times that allow businesses to apply insights to transactions in real time and with maximum reliability and uptime.

Gen 7 Benefit

Gen 7 low-latency response and high-bandwidth throughput allow powerful servers to access data at the speed of direct-attached storage and process it for immediate response. Rather than taking minutes or hours to calculate, data analytics can be done with large data stores at significantly faster response times and can even allow for real-time responses that turn inquiries into closed sales.

Summary

Data centers are becoming increasingly complex, supporting a multitude of systems and workloads. At the same time, expectations for resiliency and 100% uptime are increasing. Gen 7 Fibre Channel not only delivers double the performance with twice the data throughput and half the switching latency, but also addresses the challenges of managing demanding environments with advanced self-learning, self-optimizing, and self-healing capabilities that vastly improve the reliability and resiliency of the entire storage environment. In addition, Brocade Gen 7 is designed with security in mind and implements many security measures to protect an organization against vulnerabilities. It hardens your SAN against cybersecurity and other business-continuity challenges that threaten to disrupt data center operations. Gen 7 Fibre Channel enables SAN admins to support storage connectivity demands today and migrate to higher levels of functionality, performance, and resiliency as needed to meet the requirements of the future.

Additional Information

- Brocade Gen 7 ESG Showcase - Enabling a Cyber-resilient Network: ESG reviews how Brocade Gen 7 solutions deliver an autonomous SAN with next-level performance, integrated intelligence, and improved cyber resilience, helping to provide the accelerated, reliable, and secure foundation that modern data centers need.
- Brocade Gen 7 ESG Hands-on Review: ESG puts Brocade Gen 7 self-healing capabilities to the test. Learn why ESG believes that IT, SAN, and storage administrators should quickly embrace these autonomous capabilities.
- Top Reasons to Upgrade to Gen 7: Gen 7 delivers more than just higher speeds and lower latency; that is to be expected. Explore the benefits of upgrading to Brocade Gen 7 Fibre Channel and learn how it will simplify your operations.
- Gen 7 Prevents Congestion: Nothing should get in the way of application performance. See how Gen 7 protects you against misbehaving devices, mismatched device speeds, and even issues at the physical layer.
- Safeguard your SAN Solution Brief: With hundreds of IT security vulnerabilities uncovered every year, it is important to keep up on the latest technology or risk leaving your infrastructure exposed. Learn how Brocade Gen 7 safeguards your SAN against cybersecurity and business-continuity challenges that threaten to disrupt data center operations.
- Traffic Optimizer Technical Brief: In general, three parameters dictate network quality: latency, throughput, and errors. Learn how Traffic Optimizer optimizes all three.
- Fabric Notifications Technical Brief: Flow control can potentially pose congestion challenges due to traffic characteristics and misbehaving devices if not addressed. Learn how Brocade Gen 7 addresses link integrity, oversubscription, and credit stall issues.
- VM Insight ESG Showcase: Brocade VM Insight and VMID+ technology provide VM awareness through the network without the need for other tools. Learn how VM awareness can speed up infrastructure design and deliver more efficient data center architectures, faster diagnosis, and more timely issue resolution.

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