

Technical Review

Modern SAN Management with Brocade SANnav

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Abstract

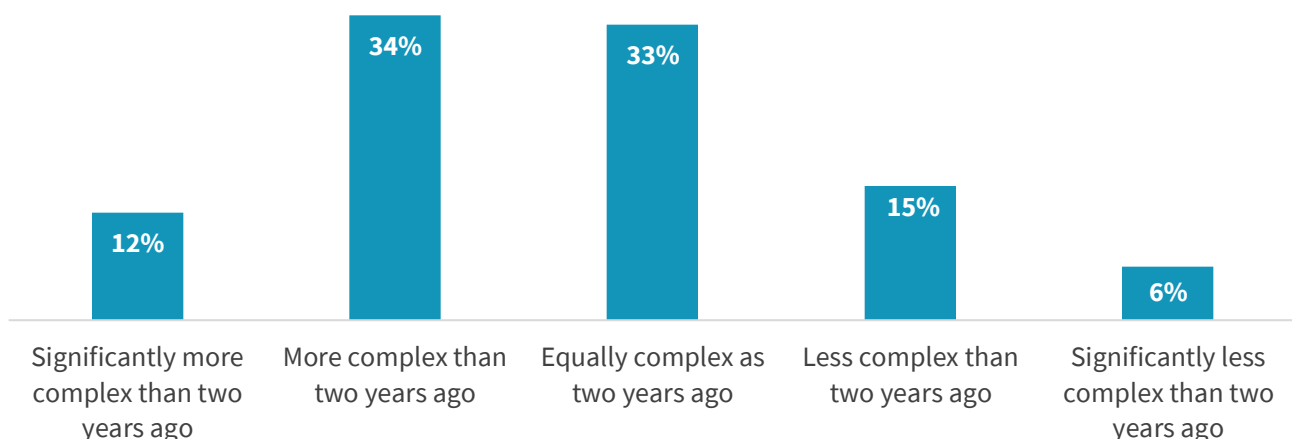
This ESG Technical Review documents hands-on testing of Brocade SANnav Management Portal and SANnav Global View to validate their ability to present the big-picture view of all SANs being managed as well as simplify daily management tasks to improve operational efficiencies. We focused on how Brocade SANnav provides both global visibility across multiple SANs and individual entity state and statistics, as well as time savings in daily operations with simplified task management, problem identification, and remediation.

The Challenges

Digital transformation and data center modernization have increased the complexity of data center architectures. Indeed, according to ESG's annual spending intentions survey, 46% of organizations said that their IT environment has gotten more complex in the last two years (see Figure 1). These organizations indicated that some of the biggest reasons for this increased complexity are higher data volumes (35% of respondents), the need to incorporate emerging technologies like AI/ML, advanced analytics, etc. (34% of respondents), and the increase in the number and type of applications used by employees (33% of respondents).¹ In addition, 91% of organizations identified that they must operate at a faster pace than they did three years prior, with 41% reporting that they need to accelerate operations by 50% or more.²

Figure 1. Change in Level of IT Complexity

In general, how complex is your organization's IT environment relative to two years ago?
(Percent of respondents, N=706)



Source: Enterprise Strategy Group

Fibre Channel SANs have not escaped this trend—SANs have gotten more complex to accommodate modern data center infrastructures including multi-tiered storage, multi-tenant architectures, massive virtualization deployments, and global

¹ Source: ESG Complete Survey Results, [2022 Technology Spending Intentions Survey](#), November 2021.

² Source: ESG Research Report, [Data Infrastructure Trends](#), November 2021.

operations. With more entities, deployment, and growth dictated by the speed of business, administrators have difficulty obtaining the global view of SAN status, health, and performance while still maintaining the ability to identify and fix specific component-level issues. Thus, it's no surprise that organizations are seeking to identify the best management solution for their SAN operations.

The Solution: SANnav

As IT environments have become more complex, administrators have struggled with both response time and the ability to focus on the most likely trouble spot in the environment. Can the human operator be fast enough? Can they quickly identify the likely cause of the issue or outage and do they have an immediate grasp of potential solutions?

Brocade designed SANnav Management Portal and SANnav Global View to address these and other IT issues, increasing the efficiency and productivity of IT administrators when managing their SAN environments. Architected with a modern GUI (Graphical User Interface) designed to be more intuitive, Brocade SANnav streamlines common workflows such as configuration, zoning, deployment, troubleshooting, and reporting.



Brocade SANnav provides comprehensive visibility into the SAN environment, transforming SAN behavioral information into actionable insights. Using Brocade SANnav, administrators can quickly identify, isolate, and correct problems before they impact operations. SANnav simplifies workflows and automates redundant steps, accelerating administrative tasks.

Administrators can navigate directly from SANnav Global View down to SANnav Management Portal in local environments to investigate points of interest. SANnav Global View has immediate visibility into important events from all local environments and SANnav Management Portals. SANnav analyzes data from Brocade Fibre Channel hardware, providing at-a-glance actionable intelligence regarding the overall health of fabrics, switches, servers, and storage.

SANnav features include:

- **Topology view**—Contextual-based topology views, contextual searches, and filters accelerate locating objects of interest from many thousands of entities.
- **Flows and flow collections**—Monitor flows (i.e., end-to-end aggregated traffic from the host port to the storage port) and flow collections, which can represent aggregate application traffic.
- **Policy-based configuration management**—Provides consistent switch and monitoring configuration services across environments.
- **Dashboards**—Provide at-a-glance views and summary health statistics for fabrics, switches, hosts, and targets that may be experiencing operational or performance degradation.
- **Health summary**—SANnav analyzes and aggregates health and performance metrics into a single score, helping administrators understand current state and identify potential issues in seconds.
- **Network port traffic conditions**—Enables administrators to quickly identify and isolate currently congested or oversubscribed SAN ports, and quickly analyze how related ports may be affected.
- **Investigation mode**—Enables administrators to identify and isolate SAN objects of interest in as little as 30 seconds, accelerating troubleshooting and problem resolution.

The benefits of deploying Brocade SANnav include:

- **Accelerated deployment**—Streamlined workflows for the deployment of new applications, switches, hosts, and targets.
- **Actionable insights**—Advanced analysis of key metrics provides insights to quickly identify and isolate problems.

- **Contextual visualization**—Contextual searching and filtering isolate points of interest in simple-to-understand topology views.
- **Automation**—Manual processes are reduced through automated data collection, reporting, and identification and reconfiguration of out-of-compliance fabrics and switches.
- **Northbound streaming**—Enables Brocade OEM systems and customers to receive SAN statistics and telemetry data through a secure Kafka streaming interface.
- **Best practices**—Single-click deployment of more than 20 years of storage networking monitoring best practices.
- **Increased operational stability**—Non-intrusive real-time monitoring and alerting of key performance metrics, development of baseline I/O performance, and identification of anomalies help avoid common network problems and accelerate problem identification and resolution.

ESG Validated

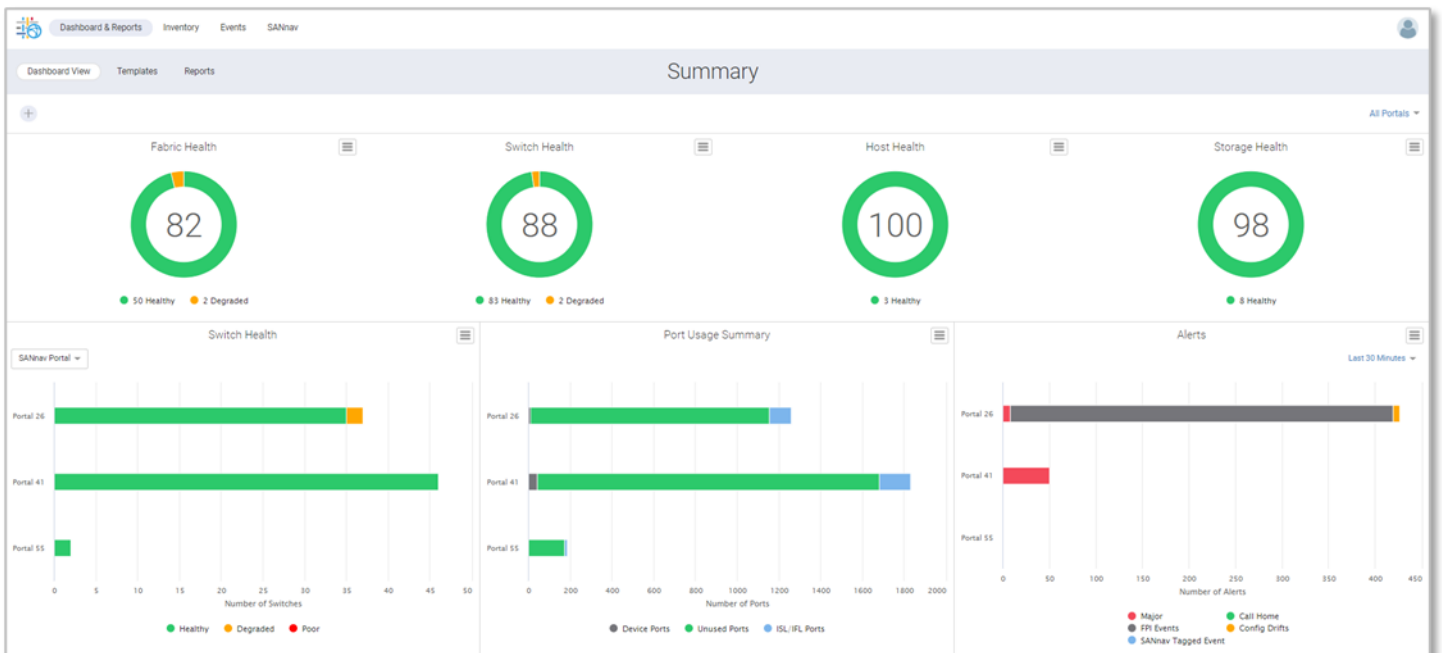
First, ESG used the SANnav Global View dashboard. Shown in Figure 2, the top of the dashboard provides an at-a-glance summary of the health of all fabrics, switches, hosts, and storage in the environment. Health data is collected from all SANnav Management Portals, which in turn collect data from all SAN objects.

SANnav analyzes key statistics to develop a health summary score that represents the overall health of the SANs from various perspectives. Health is scored from 1 to 100, with a score above 90 indicating healthy operation, 71 to 90 indicating degraded operation, and below 70 indicating poor health and limited operational capability.

SANnav provides instantaneous access to additional contextual information. For example, hovering the mouse over areas of the health ring shows a pop-over with counts of items in each category. In this case, three SANnav Management Portals are shown, one of which has seven items in poor health.

Below the health scores are three panels that provide bar graphs of switch health, port usage, and alerts for each SANnav Management Portal instance. The switch health information includes a pulldown to show health categorized by portal, firmware version, product category, or model.

Figure 2. SANnav Global View Dashboard



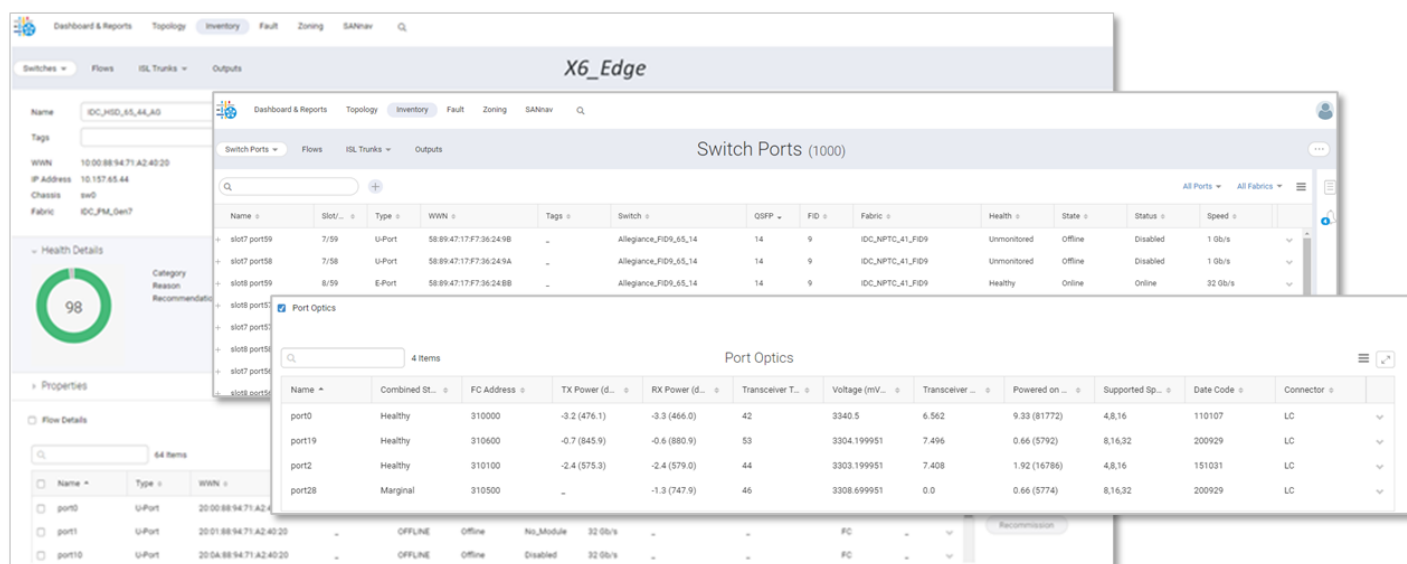
Source: Enterprise Strategy Group

Next, ESG used the health scores to identify that there was an issue with some switches in the environment. Using intuitive context-sensitive menus, we drilled down to obtain more data and quickly identified the switch in question. From SANnav Global View, we launched SANnav Management Portal to investigate the switch.

The SANnav Management Portal provides a summary view like SANnav Global View. However, by launching the management portal directly from the Global View of the problem switch, we were brought directly to the summary data for that switch, eliminating the time, effort, and distraction of navigating through the hierarchy.

The management portal view of switch *X6_Edge* is shown in Figure 3, and provided a section with basic switch information such as WWN, IP address, firmware revision, state, health, and more. Alongside the switch information is a graphical representation of the switch health score, uptime, and resource utilization. Below the health information, the management portal provided a table with switch port data, including port type, WWN, tags, status, state, speed, and attached nodes. We also chose to display the port optics data, including type, health, TX and RX power, voltage, and power consumption. All tables were sortable by clicking on a column header.

Figure 3. SANnav Management Portal View of Switch Data



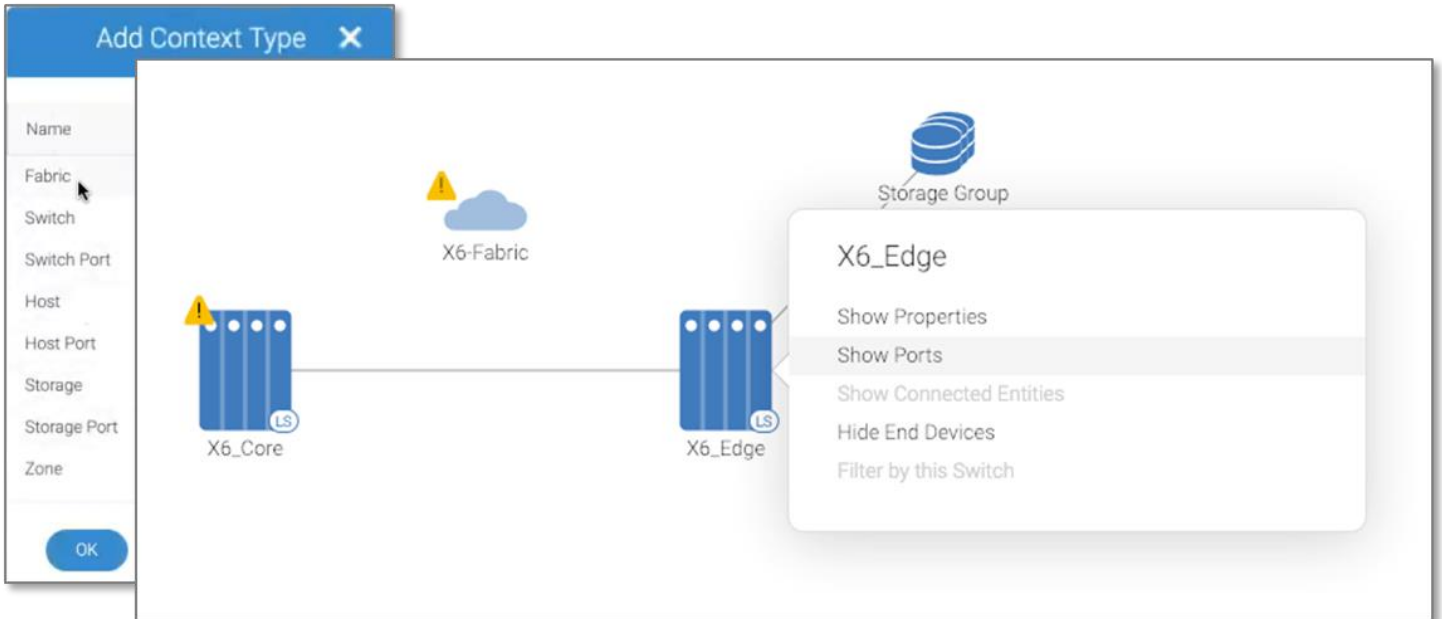
Source: Enterprise Strategy Group

As storage and SAN speeds increase, proactive monitoring is crucial for non-disruptive application performance. For example, identifying degrading optics before any impact is noticeable becomes critical and having ready access to optics data will become a key part of the problem identification and resolution process. The switch and switch port data provided the information necessary for us to identify and resolve this issue.

Using SANnav, we were able to identify and resolve issues through multiple different workflows. Next, we navigated to the management portal inventory table and selected switch *X6_Edge*, and then, using the pulldown menu, were provided options to obtain details and properties, enter investigation mode, view inventory details, manage the switch, and show the switch in the topology map.

The topology map, shown in Figure 4, graphically displayed the switch in the overall topology, and provided context-sensitive menu options for showing or hiding information and adding objects to the view.

Figure 4. SANnav Management Portal Topology View

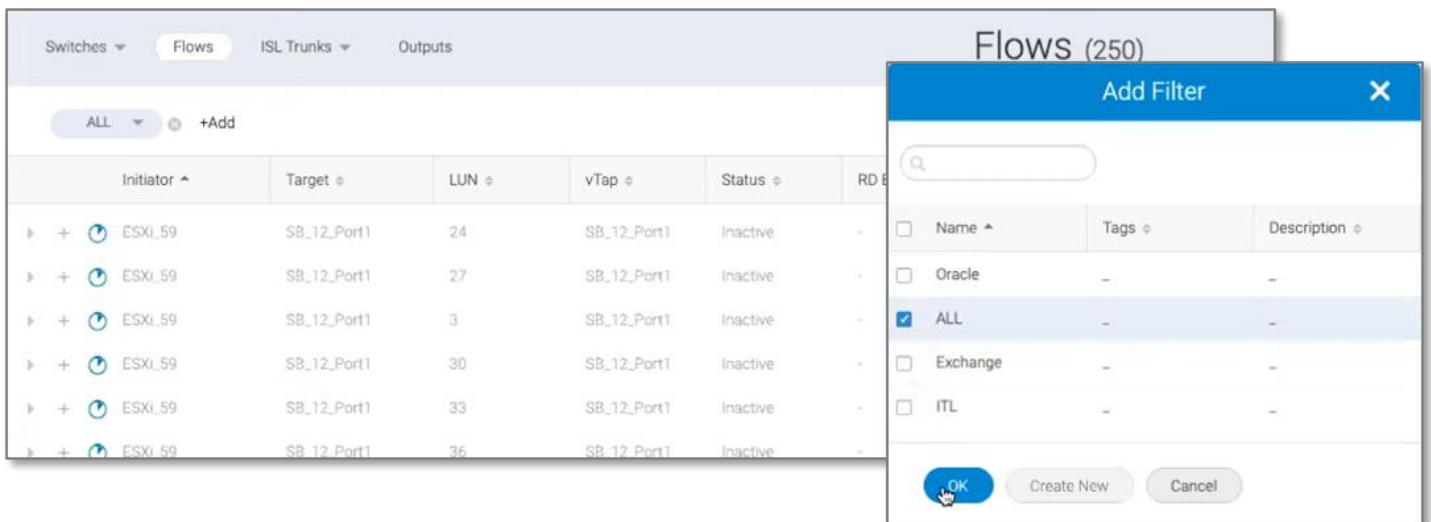


Source: Enterprise Strategy Group

SANnav defines a flow as a conversation between a host port and a storage port. SANnav enables the administrator to define a collection of flows, which helps administrators measure and monitor the aggregate traffic of an application. ESG selected Flows from the menu to display the inventory of flows automatically detected by SANnav. As SANnav can support hundreds of thousands of flows, we added a search filter to limit the display to flows from a specific set of hosts. Figure 5 shows the SANnav flow inventory, which lists the initiator, target, LUN, vTap, status, and critical Tx and Rx metrics.

Clicking on a flow enabled us to drill down for more details, including comprehensive metrics. SANnav supports collecting metrics for up to 100 ports with two-second granularity for the last three days, enabling administrators to troubleshoot performance and connectivity issues.

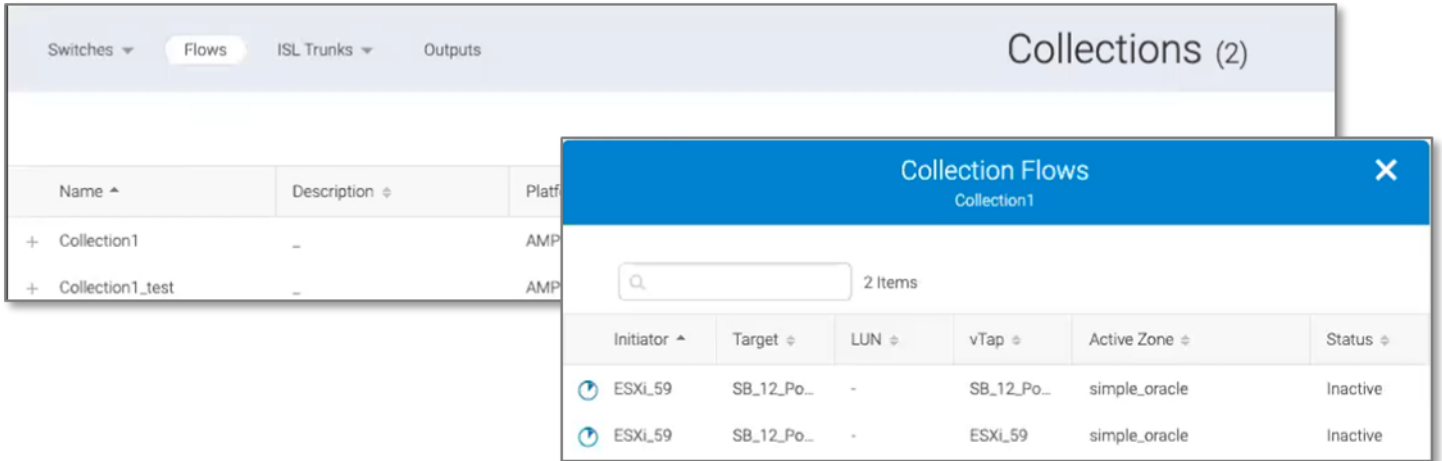
Figure 5. Flow Inventory



Source: Enterprise Strategy Group

Using the menu, we chose Collections to display the flow collection inventory, as shown in Figure 6. We clicked on a flow collection and using the pulldown menu, selected to display the flow members in the collection. The display included the aggregate metrics for the flow collection, as well as custom metrics defined by an administrator.

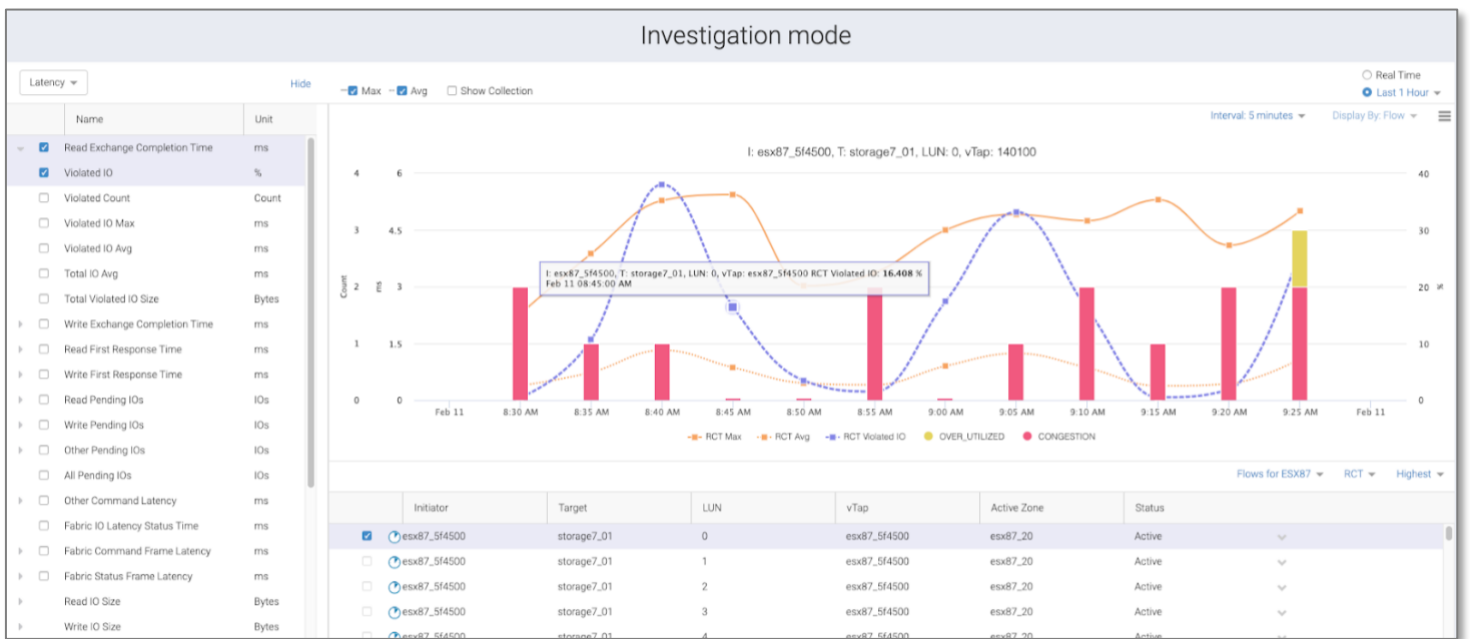
Figure 6. Flow Collection Inventory



Source: Enterprise Strategy Group

We selected a flow from the collection and clicked on investigate to enter investigation mode. The investigation mode, shown in Figure 7, enabled us to view critical flow metrics in real time or to graph historical data for any time scale. We chose to graph critical I/O metrics such as RCT Max, RCS Avg, and RCT Violated I/O, which were displayed as lines on a time graph at the top of the screen. We also chose to display violations, selecting congestion and over-utilization. These violations were displayed as bars on the graph and enabled us to correlate I/O performance with violations, accelerating the troubleshooting process.

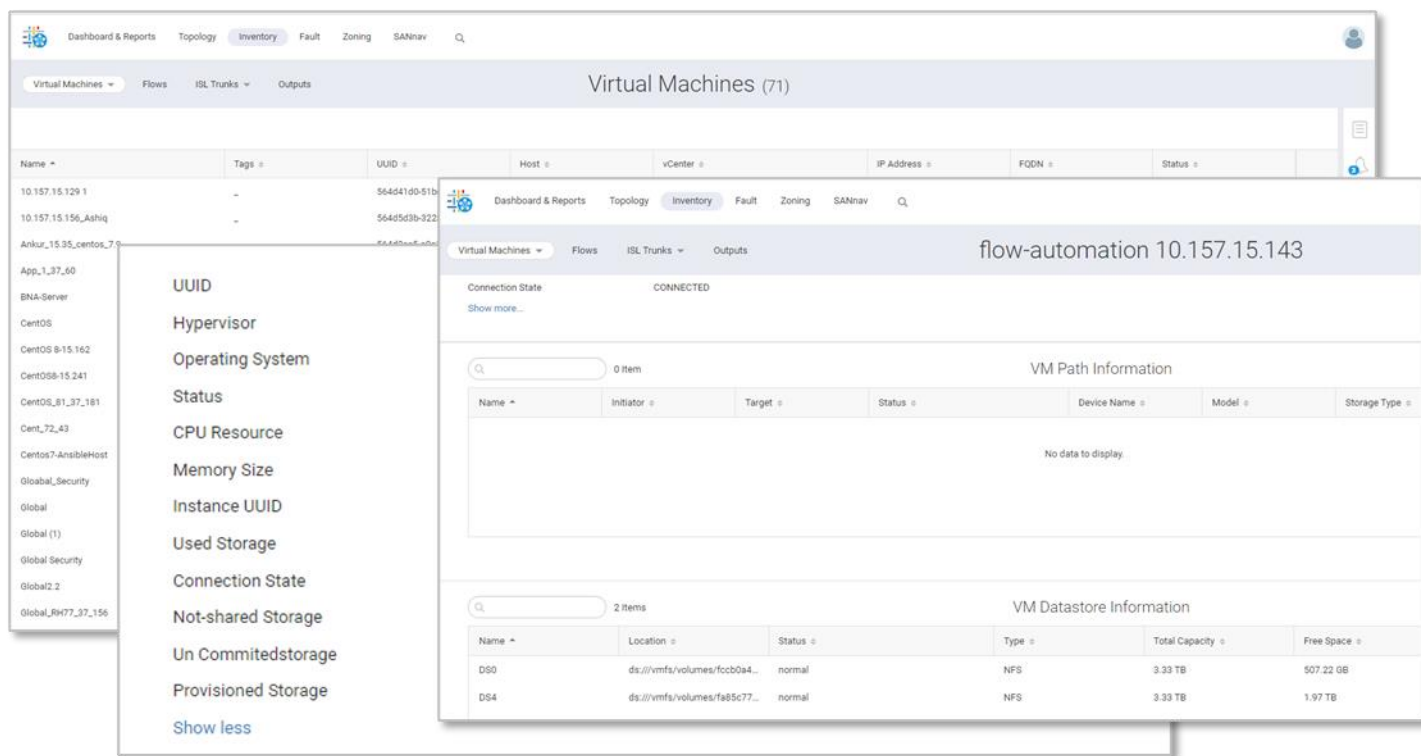
Figure 7. Graphing Flow Metrics in Investigation Mode



Source: Enterprise Strategy Group

From the management portal’s main menu, we selected to view the entire SANnav inventory. SANnav provides a rich set of searching and filtering tools, including the ability to save filters for repeated use, enabling administrators to save time with shortcuts. From the filtering menu, we could select switches, switch ports, hosts, host ports, virtual machines, storage, storage ports, and fabrics, and we filtered on virtual machines, as shown in Figure 8.

Figure 8. Virtual Machine Data



Source: Enterprise Strategy Group

SANnav Management Portal incorporates data automatically obtained from VMware vSphere, visualizing the relationship from the VM infrastructure through the host to the SAN. Using context-sensitive right-click menu options, we drilled down to get more information on a specific VM. The management portal displayed generic VM information as well as VM datastore, storage path information, and cross-correlation of VM and SAN data, providing a single point of investigation into multi-pathing and path failover issues.

We then used the main menu to view events and alerts.

SANnav displays events in a sortable and filterable table, and we filtered on MAPS (Brocade Monitoring, Alerts, Policy Suite) Violations, as shown in Figure 9. We clicked on the arrow symbol to expand an alert, and SANnav displayed additional information inline in the table, saving us time and effort. The display provided all relevant information and included Brocade’s recommended remediation action.

In the modern infrastructure, virtually no application owner knows where in the infrastructure their application is running, nor should they. Consequently, when an application owner complains about performance, how is the SAN admin to know where to begin looking or even what portion of the infrastructure is supporting the application? Integration of SANnav and vSphere enables diagnostics to be targeted at the portion of the infrastructure in use by the application having the issue.

Figure 9. Events and Alerts

Source Name	Description	Source Address	Category	Count	Last Occurred(Server Time)
X6_Edge	slot3 port6, F-Port 3/6, Condition=ALL_F_PORTS(DEV_LOGIN_DIST...	10.155.2.204 [128]	Product Event	2	Jan 22, 2019 16:30:31 PST
Brocade_X6-8	Node Port: logout Port: 10:00:00:10:9b:34				
X6_Core	Switch, Condition=SWITCH(EPORT_DOW...				
X6_Edge	Switch, Condition=SWITCH(EPORT_DOW...				
X6_Edge	Switch, Condition=SWITCH(FLOGI/min>...				
X6_Edge	Port slot12 port8 changed its operation				
X6_Edge	Port slot12 port15 changed its operation				
X6_Core	Port slot12 port15 changed its operation				
X6_Edge	Port slot12 port15 changed its operation				
X6_Core					
X6_Edge					
X6_Core					
X6_Edge					
X6_Core					

Rule Name	Category	Rule C...	Measure Value	Product	Object Name	Last Occurred(Server T...
defALL_PORTS_IO_LATENCY_CLEAR	Fabric Performance Impact	ALL_POR...	IO_LATENCY_CLEAR	10.155.2.217 [128]	slot3 port23	Jan 22, 2019 16:35:32 PST
defALL_PORTS_IO_PERF_IMPACT	Fabric Performance Impact	ALL_POR...	IO_PERF_IMPACT	10.155.2.204 [128]	slot6 port2	Jan 22, 2019 16:35:31 PST
defALL_PORTS_IO_PERF_IMPACT	Fabric Performance Impact	ALL_POR...	IO_PERF_IMPACT	10.155.2.217 [128]	slot12 port7	Jan 22, 2019 16:34:32 PST

Rule Name	Category	Rule C...	Measure Value	Product	Object Name	Last Occurred(Server T...
defALL_PORTS_IO_LATENCY_CLEAR	Fabric Performance Impact	ALL_POR...	IO_LATENCY_CLEAR	10.155.2.217 [128]	slot3 port23	Jan 22, 2019 16:35:32 PST
Rule Name	defALL_PORTS_IO_LATENCY_CLEAR	Port Type	E-Port			
Rule Condition	ALL_PORTS(DEV_LATENCY_IMPACT==IO_LATENCY_CLE AR)	Product Address	10.155.2.217 [128]			
Severity	Info	Fabric	X6-Fabric			
Measure Value	IO_LATENCY_CLEAR	Recommended Action	Isolate the devices causing the latency impact and disable the impacted switch ports.			
Actions	RasLog					

Source: Enterprise Strategy Group

Northbound Streaming

In contemporary data center environments, storage arrays and switches may possess a lot of data that could provide insights into the environment and alleviate management complexity; however, historically IT has not had a quick and efficient mechanism to extract, integrate, and act on that data. Correlating that data into a single narrative takes significant effort, slowing operations and impacting revenue opportunities.

Broadcom has taken a major step to address these challenges with SANnav Management Portal northbound streaming. SANnav uses Kafka technology to push data out to a consumer that is configured to receive it. Clients receive a secure binary stream of telemetry data pushed periodically. Clients can subscribe to any or all streams and receive all the data for all those elements. It’s important to note that unlike with SNMP, the historical order of the sent information is guaranteed.

Kafka decouples the producer of the streams from the consumer, which enables it to efficiently scale. Data streamed from SANnav includes Fibre Channel and Ethernet port statistics, Switch/Chassis statistics, Tunnel/Circuit statistics, and flow telemetry data.

This “push” approach represents an important move from the old-fashioned way of receiving, reusing, and acting on infrastructure behavioral data. The old method was centered on extracting health-polling data on demand using a non-real-time REST API interface.

Use Case: Data Retention

The streaming approach ensures proper data retention, critical to ensuring audit compliance and accurate billing. An organization under audit may be asked to show the performance of a specific device or port from a specific point in time that could be months or years in the past, or an e-commerce company may need to investigate a complaint where a customer was incorrectly billed six months ago based on a missed SLA. In either case, they’ll need to look at the past performance of the appropriate entity in the SAN environment to be able to make their case. This is a common requirement in all verticals: healthcare, finance, government, etc.

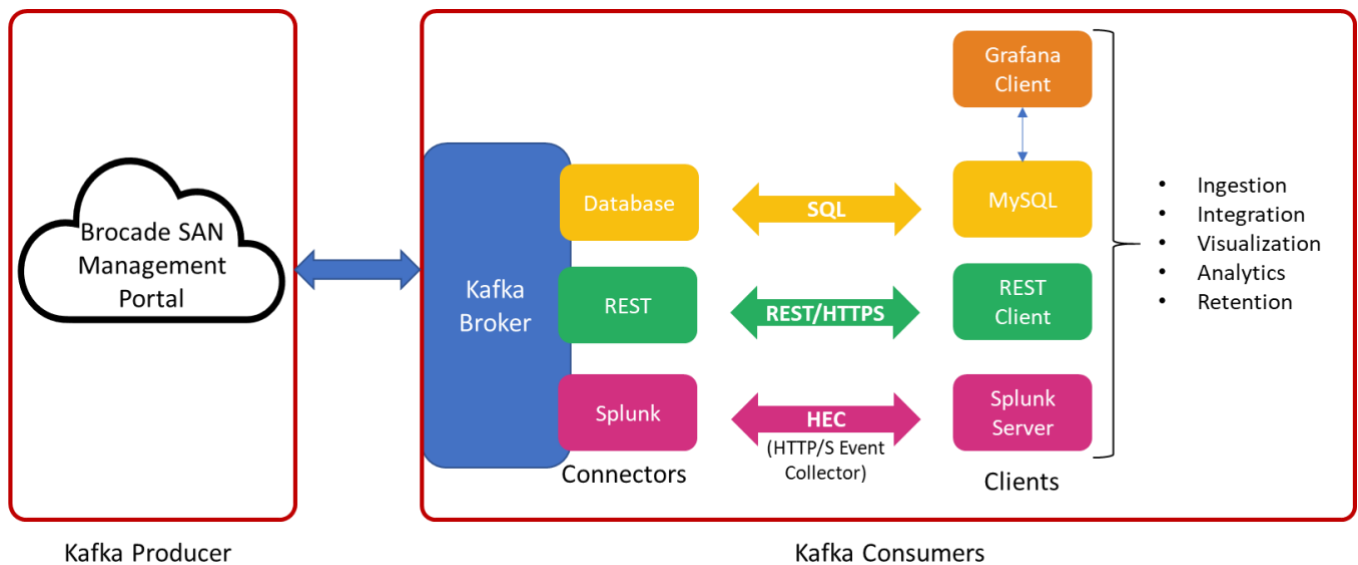
Use Case: Data Integration

Obtaining performance metrics from ports, circuits, tunnels, flows, and switches, then integrating them into operations systems can be a challenge. Every storage OEM uses an operating system that can integrate with SANnav to receive this data—without performance problems thanks to the push model. Because of the sheer volume of this type of data, the push model is a more effective way of delivering such insights to organizations when they are ready for them. With SANnav, organizations can acquire a deeper level of insight from their networked storage.

Use Case: Network-related Data Analytics

Organizations can aggregate data from multiple SANnav systems and other systems in order to create a data lake to support advanced analytics activities, such as network-traffic analysis over a long period of time, anomaly detection, or seasonal traffic behavioral analysis.

Figure 10. Northbound Streaming Ingestion—Use Cases



Source: Enterprise Strategy Group

SANnav streams data to clients using application-specific connectors. The data can be retained for long-term storage in a system of record and used to populate a data lake for advanced analytics and visualization, as shown in Figure 10.



Why This Matters

IT organizations are being challenged to improve their agility and move faster even as their environments are getting more complex. In order to make smart decisions, organizations need to be able to get the data they need out of their infrastructure and into their analytics/visualization engines quickly and efficiently.

The push approach leveraged by SANnav northbound streaming does just that. SANnav streams data from throughout the ecosystem to a system of record for retention, integration, and analytics.

This technology represents a way to move beyond CLI and SNMP traps. The effort involved in leveraging CLI- and SNMP-based approaches to glean information is significant and increases the risk of negative impact to the business. Infrastructure components need to be allowed to focus on running the business and not waste cycles supporting secondary polling inquiries. Broadcom's SANnav Management Portal focuses on both collecting the right insights and ensuring those insights can be shared easily with the right entities and organizations.

SANnav changes the way in which organizations collect insights and information about what's happening across the network in a way that is aligned with the needs of a modern IT environment. Essentially, Broadcom is making infrastructure insight as consumable as possible.

The Bigger Truth

IT organizations face numerous challenges when managing increasingly complex IT infrastructures. Complexity makes it harder for staff to visualize and understand dataflows, network connectivity, and failures. This increases troubleshooting time and effort, limiting IT's ability to meet the business needs of the organization. According to recent ESG research, increased employee productivity (32%), business process improvement (28%), OpEx reduction (25%), and improved return on investment (25%) were among the top ten most frequently cited considerations when IT professionals justify their IT investments to business management teams.³

ESG validated that Brocade SANnav simplifies SAN management and accelerates problem resolution through a modern GUI that gathers, aggregates, and correlates relevant SAN metrics and inventory data and generates a unique health score for SAN fabrics, switches, hosts, and storage. Broadcom's SANnav Management Portal focuses on both collecting the right insights and ensuring those insights can be shared easily with the right people using northbound streaming.

We observed that SANnav enables top-down management—SANnav Global View aggregates all data, providing a global view of the health and performance of all SANs in the environment, and SANnav Management Portal provides an object-level view of the health and performance, enabling administrators to rapidly drill from the global view all the way down to a single port or optical transceiver.

SANnav's abilities to identify end-to-end host-port to target-port traffic flows and to aggregate collections of flows enabled us to measure, tune, and troubleshoot performance at the application level.

When compared with traditional SAN management tools, Brocade SANnav provided greater visibility of inventory, state, health, and performance; provided at-a-glance global health scores; cross-correlated SAN and virtual machine paths and metrics; simplified SAN management processes through drill-downs from the global to the individual level; and reduced troubleshooting time. Using SANnav enabled us to look at what was going on in the SAN environment, understand what was changing and why, and gauge the impact of changes. SANnav drastically reduced troubleshooting time from the typical hours or days to just a few minutes.

Complex storage, server, VM, and SAN deployments are becoming the norm to support modern data centers and digital transformation initiatives. In this environment, SAN performance is a critical component of IT operations, and configuration must take a backseat to troubleshooting. Modern SAN management systems must focus on accelerating and simplifying arduous day-to-day management and problem solving. Using modern management systems shrinks the time, effort, and personnel devoted to problem resolution, and enables IT to focus on provisioning and optimizing the environment to meet current and future business needs. Organizations looking to increase employee productivity, improve IT processes, and increase return on investment should investigate Brocade SANnav and its ability to help administrators optimize their SANs before performance or operational issues become visible to the business.

³ Source: ESG Research Report, [2022 Technology Spending Intentions Survey](#), November 2021.

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