

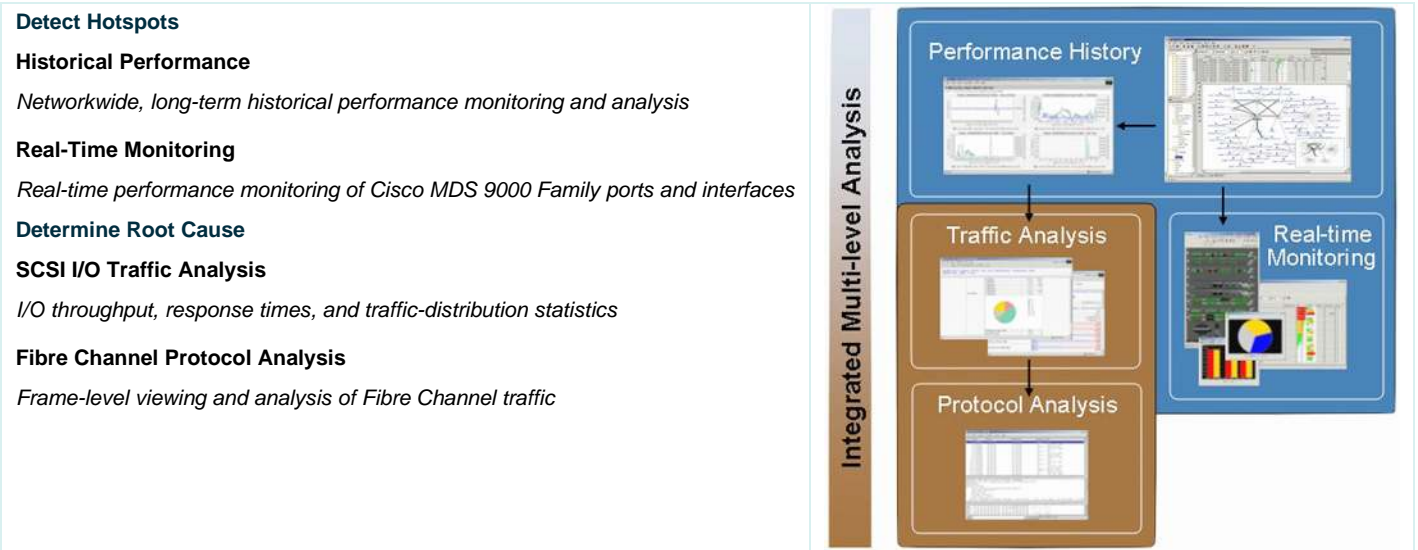
CISCO MDS 9000 FAMILY PERFORMANCE MANAGEMENT

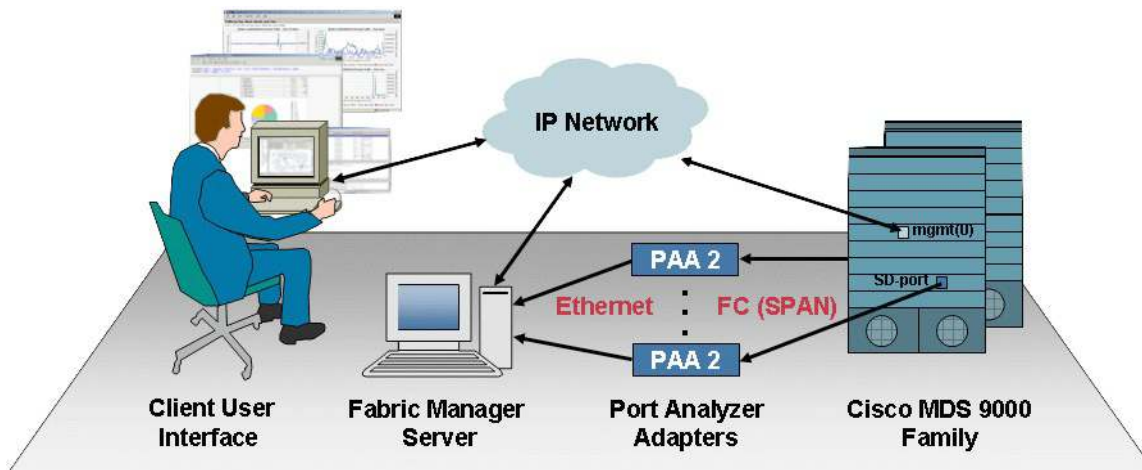
As storage area networks (SANs) grow, so do the challenges for monitoring and resolving performance issues. Summary views of networkwide historical statistics are needed to identify hotspots quickly. Probing deeper into Small Computer System Interface (SCSI) I/O statistics is required to identify affected hosts and storage devices. Additional capabilities such as real-time performance monitoring and analysis of Fibre Channel operations at the frame level are needed to find root causes for the most challenging problems.

INTEGRATED SOLUTION

An integrated, multilevel SAN performance-analysis solution is available for the Cisco® MDS 9000 Family. This nonintrusive, nondisruptive solution uses Cisco MDS performance management features and provides capabilities not available in other SAN switches and third-party software products (Figure 1).

Figure 1. Cisco MDS 9000 Family Performance Management Solution





HISTORICAL PERFORMANCE MONITORING

Cisco Fabric Manager Server (FMS) provides networkwide historical performance monitoring and analysis. Throughput on all host and storage-device connections, Inter-Switch Links (ISLs), and between specific Fibre Channel sources and destinations (flows) can be monitored. A one-year history of performance statistics is maintained for trend analysis (Figure 2).

Up to two different event thresholds may be set for each throughput statistic monitored by Cisco FMS. Threshold values may be set with user-specified levels or with baseline values automatically calculated from performance history.

HOTSPOT AND TREND ANALYSIS

A view of the entire SAN's performance is provided, helping you quickly identify hotspots that require more in-depth monitoring and examination. The Top 10 Summary lists average and peak throughput values for host and storage connections, ISLs, and flows all in one compact report. Links are provided for access to Traffic by Day, Week, Month, or Year reports with graphs that show performance trends. In-depth capabilities help you analyze detailed SCSI I/O and Fibre Channel traffic statistics. Additional text and graphical reports are available to study all other interconnections and flows.

Cisco FMS provides a Web client for an operational view of storage networks. Through this standard Web-browser interface you can view essential information needed for day-to-day management: fabric events, SAN performance, and inventory reports.

Simple Setup and Management

Setup and maintenance of Cisco FMS historical performance monitoring is effortless. Wizards help define flows and data collections in minutes. The lightweight, integrated Java database requires only 76 KB per performance statistic and requires no maintenance, because its usage of disk storage space remains constant. To further simplify operation, statistics are associated with end devices, allowing physical connections to switches to be changed without losing historical statistics.

Figure 2. Historical Performance Monitoring

Long-Term, Networkwide Statistics

Collects one-year history for host and storage connections, ISLs, and flows

Hotspot and Trend Analysis

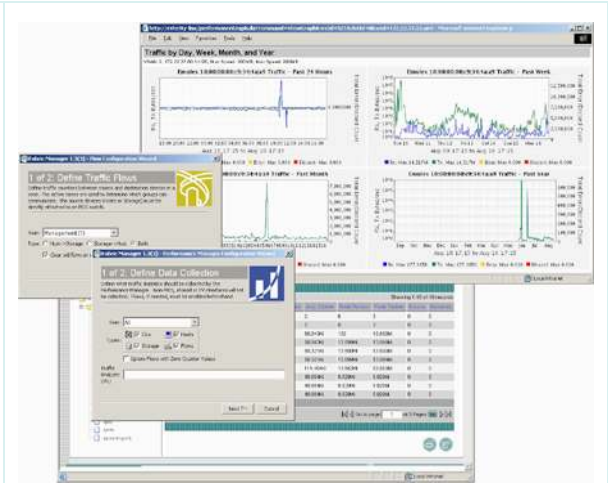
Shows connections with highest traffic, and daily, weekly, monthly, and yearly trends

Detail-Oriented Capabilities

Provides interlinked reports and comprehensive SCSI traffic analysis

Simple Setup and Management

Includes wizards and no maintenance database to simplify setup and use



REAL-TIME PERFORMANCE MONITORING

Historical performance analysis tools provide excellent trend information, but capture statistics only several times per hour, so they lack the capability to show what is happening in real time on the network. Real-time performance monitoring is necessary to get a more accurate picture. The Cisco MDS 9000 Family performance management solution includes real-time monitoring for Fibre Channel, Gigabit Ethernet, and IBM Fiber Connection (FICON) ports and interfaces. You can view and graph more than 60 Cisco MDS 9000 Family statistics, including byte and frame counts by class, specific error counts, and all other protocol statistics (Figure 3).

Flexibility

The flexible real-time performance-analysis capabilities allow you to select the sampling rate, view summary statistics, save samples to a log file, and graph specific statistics. You can select sampling rates as low as two seconds, which provides over 100x finer resolution than historical monitoring tools. A summary view shows important statistics for the active supervisor engine module and switch interfaces. Real-time statistics are presented in both tabular and graphical formats, with bar, line, area, and pie-chart options.

Figure 3. Real-Time Performance Monitoring

Real-Time Performance Monitoring
Provides summary view and access to more than 60 port and interface statistics

Rapid Sampling Rates
Allows user-selected sampling rates as low as two seconds

Graphing Statistics
Generates bar, line, area, and pie charts for any monitored statistics

Tabular View of Related Statistics
Shows cumulative, average, minimum, maximum, and last values

SCSI I/O TRAFFIC ANALYSIS

Access to SCSI I/O statistics at the logical unit number (LUN) level is necessary to analyze the effects and study the I/O patterns related to hotspot conditions. Characteristics such as distribution of read and write commands, I/O response times, and SCSI session or management task statistics help you pinpoint root causes. Statistics on Fibre Channel control traffic and distribution of frame sizes also provide valuable clues for resolving performance issues.

SCSI I/O and Fibre Channel statistics analysis are important elements of the comprehensive, multilevel performance analysis solution for the Cisco MDS 9000 Family. All this information can be analyzed using Cisco developed and enhanced software in conjunction with the Cisco Port Analyzer Adapter (PAA).

Switched Port Analyzer and PAA

The Cisco SAN-OS Switched Port Analyzer (SPAN) feature allows you to nonintrusively analyze Fibre Channel control and data-plane traffic. Traffic through Fibre Channel interfaces can be replicated to any port configured as a SPAN destination (SD-port) in the fabric. Available SPAN traffic sources include Fibre Channel ports, Small Computer System Interface over IP (iSCSI), and Fibre Channel Interface Protocol (FCIP) virtual interfaces for IP services. Commercial protocol analyzers and Cisco PAA both can use SPAN.

The Cisco PAA encapsulates Fibre Channel traffic from a SPAN destination port in Ethernet headers for transport to a computer for capture and analysis. Information from multiple Cisco PAAs can be aggregated and analyzed concurrently by a single computer.

Traffic Analysis

Fibre Channel traffic is processed in real time or from capture files. Through a Web-browser interface you can quickly determine the throughput between specific Fibre Channel sources and destinations, all traffic in a particular virtual SAN (VSAN), or all SPAN traffic. Round-trip response times, SCSI I/Os per second, SCSI read vs. write traffic throughput and frame counts, SCSI session status, and management task information are provided. Additional statistics are also available on Fibre Channel frame sizes and control traffic (Figure 4).

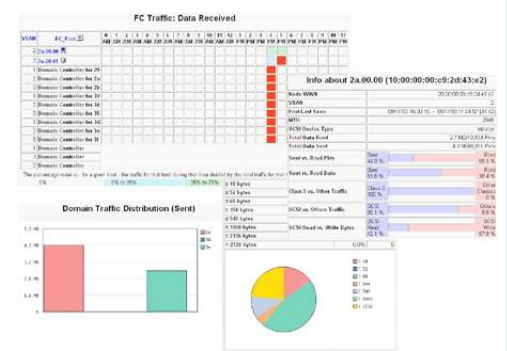
Figure 4. SCSI I/O Traffic Analysis

Fibre Channel Traffic Analysis
Analyzes captured and real-time traffic aggregated from multiple Cisco PAAs

Network Summary Statistics
Categorizes traffic by VSAN, protocols, frame sizes, and time

LUN-level I/O Statistics
Displays byte and frame counts, SCSI reads and writes, I/Os per second, and response times

SCSI Status and Management Statistics
Provides counts for target or LUN resets, check conditions, and failed commands



The screenshot displays the 'FC Traffic: Data Received' window. It features a table with columns for 'VSAN', 'FC_Protocol', and 'FC_Frame Size'. To the right, there is a summary section titled 'Info about 2a.00.00 (10:00:00:00:09:20:43:e2)' with fields for 'Host Name', 'Device Name', 'Device Path', 'Device Type', 'Device Status', 'Device ID', 'Device LUN', 'Device Size', 'Device Type', 'Device Status', 'Device ID', 'Device LUN', and 'Device Size'. Below this, there is a 'Domain Traffic Distribution (Sort)' section with a bar chart and a pie chart. The bar chart shows traffic distribution across different domains, and the pie chart shows the percentage of traffic for each domain.

FIBRE CHANNEL PROTOCOL ANALYSIS

During routine daily operation of SANs, networkwide historical performance and I/O statistics are sufficient to assess the current state of the network and plan changes for expansion and optimization. When a difficult problem arises, in-depth information is often needed to quickly and accurately determine the cause. Switch commands such as the Cisco MDS 9000 Family show tech-support provide much information, but not the insights derived from viewing the Fibre Channel frames.

Protocol Analysis

The Cisco MDS 9000 Family multilevel performance analysis solution also allows you to analyze Fibre Channel traffic at the frame level in real time or from capture files through a GUI. Data-capture filtering allows the exclusion of unwanted frames to reduce file sizes. A display filter is provided to remove additional information, so you can view only the frames of greatest interest. The unique ability to match Fibre Channel requests and responses greatly simplifies locating relevant information, including response times (Figure 5).

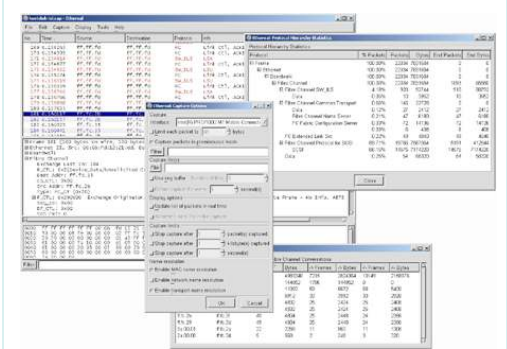
Figure 5. Fibre Channel Protocol Analysis

View Fibre Channel Frames
Filters and color-codes Fibre Channel frames captured or viewed in real time

Decode Fibre Channel and SCSI
Supports Cisco MDS 9000 Family enhanced ISLs

Capture Traffic
Filters and captures SPAN traffic to files for later protocol or traffic analysis

Match Fibre Channel Frames
Matches requests and responses



The screenshot shows the 'View Fibre Channel Frames' interface. It displays a table of frames with columns for 'Time', 'Source', 'Destination', 'Protocol', 'Status', and 'Size'. The table is filtered to show only frames of interest. To the right, there is a detailed view of a selected frame, showing the 'Fibre Channel Protocol' and 'SCSI' information. The detailed view includes fields for 'Protocol', 'Status', 'Size', 'Time', 'Source', and 'Destination'. The 'Fibre Channel Protocol' section shows the 'Protocol' and 'Status' of the frame, and the 'SCSI' section shows the 'SCSI' information, including the 'SCSI ID', 'SCSI LUN', and 'SCSI Type'.

CONCLUSION

A comprehensive, multilevel performance analysis solution is available for the Cisco MDS 9000 Family. Combining Cisco Fabric Manager Server networkwide historical monitoring and real-time monitoring with traffic and protocol analysis provides superior capabilities for Fibre Channel performance monitoring and troubleshooting. You can examine performance trends and identify network hotspots quickly, view SCSI I/O and Fibre Channel statistics, monitor device interfaces, and view Fibre Channel frames in real time. These integrated capabilities greatly simplify monitoring, planning, and troubleshooting your storage networks.

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