The Brocade SilkWorm 12000 Director provides a highly reliable and intelligent solution for deploying enterprise-class Storage Area Networks (SANs) in mission-critical environments.

SILKWORM 12000 DIRECTOR

Highlights

- Meets enterprise-class "five-nines" availability requirements with redundant, hot-pluggable components, no single points of failure, and non-disruptive software upgrades
- Simplifies enterprise SAN deployment by combining high port density with exceptional scalability, performance, reliability, and availability
- Leverages Brocade Secure Fabric OS® to provide a comprehensive security platform for the entire SAN fabric
- Supports emerging storage networking technologies with a unique multiprotocol architecture
- Provides 1 and 2 Gbit/sec operation and the capability for seamless extension to 10 Gbit/sec in the future
- Employs Brocade Inter-Switch Link (ISL) Trunking to provide a high-speed data path of up to 8 Gbit/sec between switches
- Delivers up to 128 ports in a single 14U enclosure and up to 384 ports in a single rack, facilitating easily managed SAN fabrics composed of thousands of ports
- Provides FICON support for mainframe environments, including open systems and FICON intermix modes, cascaded FICON fabrics, and both 1 and 2 Gbit/sec FICON speeds

A High-port-density, Multiprotocol Director for "Five-nines" Availability

As the industry's first 2 Gbit/sec director-class switch, the Brocade® SilkWorm® 12000 Director provides unprecedented levels of availability, scalability, manageability, and security for open enterprise storage applications. Possible configurations range from a 32-port switch to dual 64-port switches in a single enclosure that provides "pay-as-you-grow" scalability.

Based on the Brocade Intelligent Fabric Services Architecture, the SilkWorm 12000 provides a reliable foundation for high-performance core-to-edge SANs that leverage proven core backbone networking methodologies. In addition, multiple SilkWorm 12000 directors can be interconnected at the core to form enterprise SAN fabrics capable of supporting thousands of hosts and storage devices in mission-critical environments (see Figure 1).

The SilkWorm 12000 provides higher levels of performance and availability than other director-class switches while supporting a more intelligent and scalable networked storage model. Moreover, the SilkWorm 12000 is designed to integrate with heterogeneous environments that include multiple operating systems such as Windows NT, UNIX, Linux, Solaris, AIX, and others. As a result, organizations have the flexibility to build cost-effective and easy-to-manage enterprise SAN fabrics. These capabilities make the SilkWorm 12000 ideal for mission-critical business continuance applications such as LAN-free back-up, remote mirroring, data replication, and high-availability clustering.

BROCADE

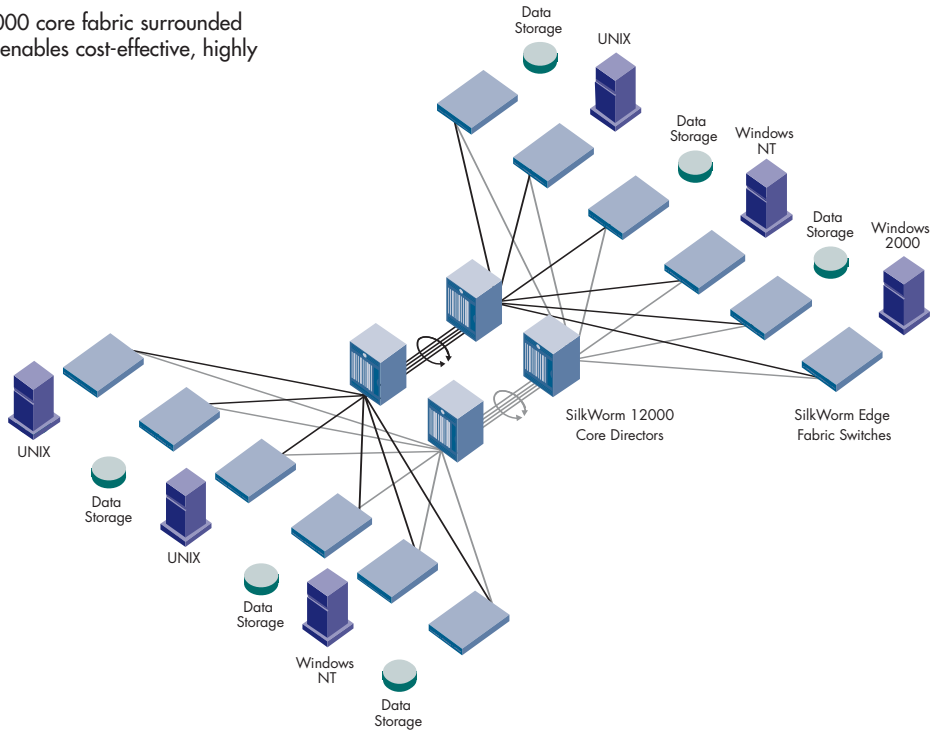

Figure 1. A SilkWorm 12000 core fabric surrounded by SilkWorm edge switches enables cost-effective, highly scalable enterprise SANs.

ULTRA-HIGH AVAILABILITY THROUGHOUT THE FABRIC

The core-to-edge SAN model features redundancy within the director as well as a high-availability network approach for the entire fabric. Combining the proven reliability of the SilkWorm family with enterprise-class availability features, the SilkWorm 12000 provides a SAN fabric with built-in redundancy and no single point of failure. This infrastructure is capable of delivering overall system availability greater than 99.999 percent—the "five nines" of availability. Other key availability features include:

- Non-disruptive software upgrades
- Fabric Shortest Path First (FSPF) traffic rerouting
- Dual-redundant control processors with stateful failover
- Non-disruptive control processor failover
- Redundant, hot-swappable components
- Redundant power and cooling subsystems

INDUSTRY-LEADING PERFORMANCE

The SilkWorm 12000 is designed to provide high-performance switching at the core of large SANs. All external Fibre Channel ports can operate at 1 and 2 Gbit/sec per port (inbound and outbound) at distances up to 40 km. In addition, auto-sensing and speed-matching of data traffic ensures interoperability between 1 and 2 Gbit/sec devices. With Brocade Extended Fabrics software and Dense Wave Division Multiplexing (DWDM) technology, ISLs can span up to 120 km over Metropolitan Area Networks (MANs)—extending SAN connectivity without significantly inhibiting performance. This long-distance capability makes the SilkWorm 12000 ideal for disaster recovery solutions.

To provide even higher performance in the core, Brocade ISL Trunking combines up to four ISLs between a pair of switches into a single, logical high-speed trunk running at up to 8 Gbit/sec. Organizations can provision multiple trunk groups to meet even higher bandwidth requirements.

FICON SUPPORT

The SilkWorm 12000 supports the FICON protocol for mainframe environments, enabling organizations to utilize a single platform for both open systems and mainframe storage networks. The SilkWorm 12000 supports intermix mode, the ability to run both open systems Fibre Channel and FICON traffic on a port-by-port basis within a single switch. The Brocade FICON implementation also supports cascaded FICON fabrics as well as both 1 and 2 Gbit/sec FICON speeds. In addition, industry-leading security features provide the highest levels of protection for mission-critical enterprise data and applications.

INTELLIGENCE WITHIN THE SWITCH

To improve security and manageability, Brocade Frame Filtering intelligence is built directly into the SilkWorm 12000 ASIC technology. This design enables the unique capability of hardware-enforced zoning based on World Wide Name (WWN) for greater security and easier management. Organizations can also use Brocade Advanced Performance Monitoring to improve end-to-end performance analysis on a fabric-wide basis. This optional feature helps reduce storage costs by improving SAN performance tuning, resource optimization, and administrator productivity.

SUPERIOR RELIABILITY, AVAILABILITY, AND SERVICEABILITY

Enterprise-class SilkWorm 12000 reliability features include the following:

- Redundant control processors provide continuous performance during failovers and enable non-disruptive firmware upgrades.
- Continuous monitoring of environmental components improves reliability and availability.
- Redundant, hot-swappable components help ensure continuous operation, even if critical components require servicing.
- Power-On Self-Test (POST), online/offline diagnostics, and

per-port statistics enable organizations to monitor ports and diagnose problems without disrupting switch operations.
- Error detection and fault isolation facilities automatically disable failing ports and restart them when the problem has been resolved.
- Call-home capabilities through Brocade Fabric Manager enable remote notification of system events.

SEAMLESS UPGRADES, COST-EFFECTIVE MIGRATION, AND INVESTMENT PROTECTION

To help protect existing technology investments, the SilkWorm 12000 provides a seamless upgrade path and backward and forward compatibility with SilkWorm entry, midrange, and port aggregation offerings. As SAN technologies evolve, the SilkWorm 12000 architecture is designed to integrate with emerging storage networking protocols such as iSCSI and FC-IP. The current design is extendable to future 10 Gbit/sec technologies.

A NEW LEVEL OF SAN SECURITY

The SilkWorm 12000 supports Brocade Secure Fabric OS, the most comprehensive fabric-based security architecture available. Based on state-of-the-art networking security technology, this architecture addresses a wide variety of vulnerabilities within the SAN fabric. Secure Fabric OS enhances SAN availabilty by safeguarding against downtime due to human error. Fabric-based authentication and access controls deliver the highest levels of configuration integrity. Advanced security features such as Public Key Infrastructure (PKI) authentication and Access Control Lists (ACLs) provide powerful tools for securing SAN access and supporting mission-critical applications. In addition, software- and hardware-enforced Brocade Advanced Zoning helps secure data by preventing unauthorized access.

OPEN SAN MANAGEMENT

The SilkWorm 12000 simplifies management by networking both core and edge switches under Brocade Fabric OS, the embedded operating system. In addition to centralizing management, this approach enables heterogeneous device connectivity, automatic data routing and rerouting, self-healing ISL Trunking capabilities, and scalable connectivity. Moreover, the Brocade Fabric Access API enables software vendors to develop feature-rich management applications that leverage the underlying distributed intelligence of Brocade SANs.

INTELLIGENT SAN MONITORING

To simplify SAN monitoring and maintenance, the SilkWorm 12000 provides the following functions:
- Fabric OS enables value-added Brocade SAN fabric monitoring and an ecosystem of management applications through the industry-leading, open Brocade Fabric Access API.
- Industry-standard Management Information Base (MIB) support enables SNMP-based management platforms to access switch information.
- Network administrators can manage switch configurations through a command line interface for automated scripting or through the GUI-based Brocade WEB TOOLS.

MAXIMIZING SAN INVESTMENTS

Brocade and its partners offer complete SAN solutions to meet a wide range of technology and business requirements. These solutions include education and training, support, service, and professional services to help optimize SAN investments. For more information, contact an authorized Brocade sales partner or visit **www.brocade.com**.

SILKWORM 12000 DIRECTOR SPECIFICATIONS

Systems Architecture

Fibre Channel ports	128 ports, universal (E, F, and FL); up to eight 16-port Fibre Channel modules
Control processor	Redundant (active/standby) control processor modules with automatic failover
Scalability	Full fabric architecture: 239 switches maximum
Performance	1.063 Gbit/sec line speed, full duplex; 2.125 Gbit/sec line speed, full duplex; auto-sensing of 1 Gbit/sec and 2 Gbit/sec port speeds; optionally programmable to fixed port speed; speed matching between 1 Gbit/sec and 2 Gbit/sec ports
ISL Trunking	Up to four 2.125 Gbit/sec ports per ISL trunk; up to 8.5 Gbit/sec per ISL trunk
Aggregate bandwidth	512 Gbit/sec end-to-end
Switch latency	<2.1 µsec any port to any port at 2 Gbit/sec, cut-through routing
Maximum frame size	2112-byte payload
Frame buffers	108 per 4-port group, dynamically allocated
Classes of service	Class 2, Class 3, Class F (inter-switch frames)
Port types	FL_Port, F_Port, and E_Port; self-discovery based on switch type (U_Port); optional port type control
Data traffic types	Fabric switches supporting unicast, multicast (255 groups), and broadcast
Media types	Hot-pluggable, industry-standard Small Form-Factor Pluggable (SFP), LC connector; Short-Wavelength Laser (SWL), up to 500 m (1,640 ft); Long-Wavelength Laser (LWL), up to 10 km (6.2 mi); Extended Long-Wavelength Laser (ELWL), up to 40 km (24.8 mi); distance depends on fiber optic cable and port speed
Fabric services	Simple Name Server; Registered State Change Notification (RSCN); Brocade Advanced Zoning; WEB TOOLS; Fabric Watch; Extended Fabrics; Remote Switch; ISL Trunking; Advanced Performance Monitoring

High Availability

Control processor	Redundant (active/standby) control processor modules; automatic and non-disruptive failover; non-disruptive software upgrades; dual-flash memory on each control processor to store two software images
Modules	Hot-swappable
Backplane	Fully passive
Input power	Dual AC inputs
Chassis power	Four AC-DC power supply modules, 2N redundant
Cooling	Three blower assembly modules (two operational required)

Management

Management	Telnet; SNMP (FE MIB, FC Management MIB); WEB TOOLS; Fabric Watch; Fabric Access layer
Management access	10/100 Ethernet (RJ-45), in-band over Fibre Channel (requires fabric); two serial ports (DB-9) per control processor module
Diagnostics	POST and embedded online/offline diagnostics

Mechanical Specifications

Mounting	Rack mountable in a standard 19 in. EIA rack; Telco-style mid-mounting available
Ports per rack	Up to 384 ports per 42U rack
Enclosure	Rear panel-to-door airflow
Size	43.74 cm (17.22 in.) width 61.24 cm (24.11 in., 14U) height 70.90 cm (27.90 in.) depth without door 74.20 cm (29.20 in.) depth with door
Weight	98 to 113 kg (215 to 250 lb)

Environment

Temperature	Operating: 0°C to 40°C
Humidity	Operating: 20% to 85% non-condensing at 40°C
Altitude	0 to 3 km
Shock	20 g, 6 ms, half sine
Vibration	Operating: 0.5 g p-p, 5 to 500 Hz; Non-operating: 2.0 g, 5 to 500 Hz
Heat dissipation	1960 Watts (6700 BTU/hour) fully loaded

Power

Supported power range	Nominal: 200 to 240 VAC, single phase Operational: 180 to 264 VAC auto-sensing Maximum 2300 Volt-Amps Maximum 12 Amps
In-rush current	40A maximum, < 1/4 AC cycle, per AC input
Frequency	47 to 63 Hz

Fibre Channel Standards

Standard	Revision
FC-AL-2	NCITS 332: 1999
FC-FLA	NCITS TR-20:1998
FC-GS-4	rev 7.6
FC-FS	Rev 1.7
FC-PI	Rev 13
FC-PLDA	NCITS TR-19: 1998
FC-SW-3	Rev 6.3
FC-VI	Rev 1.61
IPFC	RFC 2625
FCP-2	Rev 7
SCSI Enclosure Services	Rev 8b
FC-SB-2	Rev 2.1
FC-FS	Rev 1.7
FC-MI	Rev 1.92
FC-DA	Rev 1.5
FC-SB-3	Rev 1.2

Regulatory Compliance

	Safety	EMC
Canada	CSA 60950	ICES-003 Class A
United States	UL 60950	FCC Part 15 Class A
Japan	IEC60950	VCCI Class A
European Community	EN60950 TUV, NEMKO	EN55022 Level A EN55024
Australia/New Zealand		AS/NZS 3548
International	IEC 60950	CISPR 22

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