SILKWORM 12000 HIGH AVAILABILITY

The Brocade SilkWorm 12000 Director provides the Reliability, Availability, and Serviceability (RAS) characteristics that facilitate the deployment of mission-critical enterprise Storage Area Networks (SANs).

Increased Reliability, Availability, and Serviceability for Enterprise SANs

As organizations increasingly rely on information resources to drive their daily operations and strategic initiatives, that information must be available virtually 100 percent of the time. To help support these continuous availability goals, Brocade® provides a wide array of SAN infrastructure solutions designed with high reliability in mind.

Supporting the most demanding business requirements for high availability is the Brocade SilkWorm® 12000 Director. A revolutionary dual 64-port director-class Fibre Channel switch based on the Brocade Intelligent Fabric Services Architecture, the SilkWorm 12000 combines 2 Gbit/sec performance with unprecedented scalability, flexibility, functionality, and reliability capabilities.

The SilkWorm 12000 features an integrated design with innovative hardware, software, firmware, and management tools. The comprehensive set of high-availability features includes:

- Non-disruptive software upgrades
- Non-disruptive control processor failover
- Hot-swappable components
- Extensive diagnostics
- System monitoring capabilities integrated with Brocade Fabric OS management tools

Together, these elements provide unprecedented Reliability, Availability, and Serviceability (RAS) levels for a director-class switch.

A VARIETY OF FEATURES TO PREVENT SYSTEM DOWNTIME

The highly available SilkWorm 12000 is specifically designed to address the most common types of failures that can cause the loss of data or system availability. As a result, the SilkWorm 12000 is highly adept at preventing both planned and unplanned downtime.

Addressing the Causes of Unplanned Downtime

To prevent unplanned downtime, the SilkWorm 12000 accounts for hardware failures, software failures, and the most common cause of downtime: human errors.

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Figure 1.
SilkWorm 12000 cable side view.

Figure 2.
SilkWorm 12000 blower side view.

The SilkWorm 12000 addresses potential hardware failures by:

- Utilizing the most reliable components available
- Eliminating single points of failure
- Employing redundant components throughout the switch
- Providing hot-swap capabilities for all Field-Replaceable Units (FRUs)

The SilkWorm 12000 addresses potential software failures by:

- Incorporating the most robust, highly reliable software components
- Utilizing redundant control processors with redundant software
- Providing non-disruptive control processor failover capabilities in the event of a software malfunction

The SilkWorm 12000 addresses potential issues related to human error by providing the following capabilities:

- Brocade Secure Fabric OS® helps prevent unauthorized users from accessing the SAN.
- Secure Fabric OS restricts management application access to the SAN.
- Brocade Advanced Zoning provides the additional security of hardware-enforced zoning to prevent unauthorized device access.

Addressing the Causes of Planned Downtime

To address the most common causes of planned downtime (such as scheduled maintenance, product upgrades, or the deployment or removal of new components), the SilkWorm 12000 enables non-disruptive hardware and software upgrades.

To prevent downtime, all major hardware components of the SilkWorm 12000 switch are field-replaceable and hot-swappable. Field-replaceable components can be installed without disrupting SAN operations—minimizing downtime for hardware upgrades. Port cards can be added without disrupting the switch or the SAN fabric.

To prevent downtime during software upgrades the SilkWorm 12000 provides hot code activation—which enables firmware upgrades to be downloaded and activated without disrupting other operations.

Courtesy of

HIGH-AVAILABILITY SWITCH FEATURES

High-availability features of the SilkWorm 12000 include redundant hardware components, hot-swappable and field-replaceable components that simplify servicing, and security capabilities that greatly reduce the risk of potential outages.

A Redundant Hardware Design

To help ensure the highest levels of availability, the SilkWorm 12000 incorporates a redundant hardware design with no single point of failure. Key components include:

- Redundant control processors with automatic non-disruptive failover and hot-swappable replacement capabilities
- Dual redundant AC inputs
- A redundant power subsystem with hot-swappable power supplies
- A redundant cooling system with three hot-swappable blowers
- Hot-swappable switching modules (blades)

To account for one of the most common causes of system disruption (power outages), the SilkWorm 12000 employs four hot-swappable power supplies designed to protect against the loss of an AC source. Two power supplies each receive power from one of two AC inputs. Under normal conditions, only two power supplies are required for full system operation.

Simplified Serviceability Characteristics

Because ease-of-service is a key factor in maintaining availability during planned maintenance, the SilkWorm 12000 is designed for field servicing that does not interrupt system operations. All major subsystems are hot-swappable and field-upgradeable, so planned maintenance and upgrades can be performed without scheduled downtime.

Hot-swappable components enable the replacement of failed components without impacting data traffic. In addition, modular hot-swappable FRUs can be easily replaced in the field. These FRUs include:

- Switch blade assembly
- Control processor blade assembly
- Small Form-Factor Pluggable (SFP) optical transceivers
- Blower assembly
- Power supply

All cables, blade assemblies, and power supplies are serviced from the cable side of the switch, and blowers are serviced from the opposite side. For greater flexibility, the chassis can be mounted with cables facing the front or rear of the equipment rack. Additional serviceability features include:

- Redundant flash memory that stores two firmware images per control processor
- Background health check daemon
- Memory scrubber, self-test, and bus ping to determine whether a bus is functioning
- Watchdog timers
- Predictive diagnostics analysis through Brocade Fabric Watch and Advanced Performance Monitoring

Advanced Security Capabilities

Because security is an essential factor in high availability, the SilkWorm 12000 with Secure Fabric OS is designed to prevent unauthorized users, administrators, applications, or devices from accessing the SAN and causing system outages. Fabric-based authentication and access control deliver the highest levels of configuration integrity.

To augment previous Brocade Zoning capabilities, Brocade Advanced Zoning enables hardware-enforced zoning by World Wide Name (WWN). This new feature maintains the superior security of hardware-enforced zoning configurations even if one or more hosts is attached to a different switch port. The same Brocade Frame Filtering technology that enables hardware-enforced WWN zoning might eventually be used to enable more detailed zoning by protocol or Logical Unit Number (LUN).

The SilkWorm 12000 also provides secure Telnet access through SSH Secure Shell, a network security protocol that helps ensure secure remote login and other network services over insecure networks (release 4.1).

To increase SAN management security, Brocade WEB TOOLS can operate over a secure browser using the Secure Sockets Layer (SSL) protocol. This protocol provides data encryption, server authentication, message integrity, and optional client authentication for TCP/IP connections. Because SSL is built into all major browsers and Web servers, installing a digital certificate activates the SSL capabilities. Courtesy of

Component	Failure Rate
Switch backplane	798,000 hours
Blower backplane	10,722,000 hours
Control processor	209,000 hours
16 port FC blade	191,000 hours
Power supply	500,000 hours
Blower FRU	473,000 hours
WWN card	2,154,000 hours

Table 1. Reliability prediction summary

HIGH-RELIABILITY FEATURES

The SilkWorm 12000 includes several integrated features designed to provide the highest levels of reliability in the industry. Hardware and software reliability features combine to generate impressive overall system reliability.

Hardware Reliability

To provide high reliability, the SilkWorm 12000 offers the following capabilities:

- Internal switch data protection through an error detection and correction mechanism.

- Power-On Self Test (POST).

- Error Detection and Fault Isolation (EDFI), such as Cyclic Redundancy Checking (CRC), parity checking, checksum, and illegal address checking.

- Dual control processors that enable fast, dynamic, and non-disruptive firmware upgrades. Each control processor contains two serial ports and one Ethernet port. In addition, offline control processor diagnostics and remote diagnostics simplify troubleshooting.

- I2C monitoring and control.

The most common measure of hardware reliability is Mean Time Between Failures (MTBF), and the reliability predictions for the SilkWorm 12000 are based on the related Bellcore TR322 Parts Count Method. This particular method is a very conservative estimate of component failure (which does not necessarily

Switch Model	Bellcore Failure Rate Prediction	Demonstrated Failure Rate*
SilkWorm 2400	194,000 hours	1,529,000 hours
SilkWorm 2800	187,000 hours	1,148,000 hours

* Based on field data collected through January 2002

Table 2. Reliability prediction versus field data (for a switch with one power supply and no media)

indicate the unavailability of the overall system). It defines the system failure rate as the sum of its components' failure rates, resulting in higher calculations for systems with redundant components. However, systems with redundant components would actually experience a lower probability of unavailability in a real-world environment.

Table 1 indicates the predicted reliability results for SilkWorm 12000 components, while Table 2 indicates the actual results data collected from the field.

As these statistics clearly indicate, the actual field performance of the SilkWorm switch components is demonstrably higher than the performance predicted by the Bellcore TR322 Parts Count Method.

Software Reliability

Software availability is typically defined by the probability of a particular service being available at the time it is required. However, software reliability is defined by whether the software, in addition to being available, also provides fully functional operation when required. Based on field-proven results, the Brocade system software is highly reliable during switch operation.

HIGH RAS CAPABILITIES FOR A STRATEGIC SAN INFRASTRUCTURE

While some switch vendors stake their claims to high reliability based on hardware capabilities, Brocade has a proven track record of providing both reliable hardware and software components. Combining a wide array of redundant hardware components and innovative software, the SilkWorm 12000 provides unprecedented overall RAS capabilities in a director-class switch. As a result, it helps support a strategic SAN infrastructure capable of addressing the most demanding business requirements. For more information about the SilkWorm 12000, visit **www.brocade.com/products**.

BROCADE
The intelligent platform for networking storage

Corporate Headquarters
San Jose, CA USA
T: (408) 487-8000
info@brocade.com

European Headquarters
Geneva, Switzerland
T: +41 22 799 56 40
europe-info@brocade.com

Asia Pacific Headquarters
Tokyo, Japan
T: +81-3-5402-5300
apac-info@brocade.com

Latin America Headquarters
Miami, FL USA
T: (305) 716-4165
latinam-sales@brocade.com