Cisco Nexus 4001I Switch Module for IBM BladeCenter

Product Overview

The Cisco Nexus™ 4001I Switch Module for IBM BladeCenter (Figure 1) is a blade switch solution for IBM BladeCenter H and HT chassis, providing the server I/O solution required for high-performance, scale-out, virtualized and nonvirtualized x86 computing architectures. It is a line-rate, extremely low-latency, nonblocking, Layer 2, 10 Gigabit Ethernet blade switch that is fully compliant with the INCITS Fibre Channel over Ethernet (FCoE) and IEEE 802.1 Data Center Bridging (DCB) standards.

At the center of the Cisco Nexus 4001I is the unified switch application-specific integrated circuit (ASIC), a new, purpose-built, high-performance, line-rate switch ASIC that delivers extremely low and consistent latency across all packet sizes independent of the configured networking features. The unified switch ASIC supports standard Ethernet as well as Priority Flow Control (PFC) and Enhanced Transmission Selection, required for lossless Ethernet transmission. LAN and SAN networking protocols are delivered through Cisco® NX-OS Software, the industry's first modular, fault-tolerant, highly available operating system designed specifically to support unified fabric data center networks. Using the combination of the unified switch ASIC and Cisco NX-OS, the Cisco Nexus 4001I extends the benefits of the Cisco Nexus Family of data center switches to blade servers: the fastest growing segment of the server market.

Figure 1. Cisco Nexus 4001I Switch Module for IBM BladeCenter

Main Benefits

The Cisco Nexus 4001I provides four major benefits:

- **Lower total cost of operation (TCO):** Deployment of unified fabric with the Cisco Nexus 4001I at the blade server access enables a significant reduction in the number of switches, LAN and SAN network interface cards (NICs), ports, optic modules, and cables. This consolidation of server access network elements significantly reduces the overall capital and operation costs of the data center network through reduction in the number of network elements that need to be purchased, managed, powered, and cooled.
- **High performance:** The Cisco Nexus 4001I is a line-rate, feature-rich, extremely low-latency switch capable of enabling server access migration from Gigabit Ethernet to 10 Gigabit Ethernet to lossless 10 Gigabit Ethernet, as well as supporting the demanding latency requirements of high-performance computing (HPC) clusters and high-frequency trading applications.

- **Enhanced server virtualization:** Using unified fabric at the server access with Cisco Nexus 4001I provides the uniform interfaces, simplified cabling, and consistent server access design required to gain the advantages of automated virtual machine mobility. The Cisco Nexus 4001I used in conjunction with the Cisco Nexus 1000V Switch delivers an operationally consistent and transparent server access design for virtual machine deployments, substantially reducing the overhead needed to configure, troubleshoot, and repair the server access link between the virtual NIC (vNIC), virtual switch, and the blade switch.
- **Increased resilience:** The Cisco Nexus 4001I extends Cisco NX-OS to the blade server access, providing a fault-tolerant network with single modular operating system across the data center.

Configuration

- Fourteen fixed 10 Gigabit Ethernet server-facing downlinks (autosensing ports; can also operate in Gigabit Ethernet mode)
- Six fixed 10 Gigabit Ethernet uplinks (autosensing ports; can also operate in Gigabit Ethernet mode)
- Two management ports: one external 10/100/1000BASE-T port and one internal port for advanced management module (AMM) connectivity
- One RS-232 serial console port

The Cisco Nexus 4001I inserts into the high-speed slot (HSS) of the IBM BladeCenter H or HT chassis. The Cisco BladeCenter H and HT chassis are designed to support up to four Cisco Nexus 4001I switches per chassis.

Transceiver and Cabling Options

The Cisco Nexus 4001I supports a wide variety of 10 Gigabit Ethernet connectivity options using Cisco 10GBASE Small Form-Factor Pluggable Plus (SFP+) modules. For in-rack or adjacent-rack cabling, the Cisco Nexus 4001I supports SFP+ direct-attach 10 Gigabit Ethernet copper, an innovative solution that integrates transceivers with Twinax cables into an energy-efficient and low-cost solution. For longer cable runs, multimode and single-mode optical SFP+ transceivers are supported. Table 1 lists the supported 10 Gigabit Ethernet transceiver options.

Table 1. Cisco Nexus 4001I 10G Transceiver Support Matrix

Cisco Part Number	Description
SFP-10G-SR	10GBASE-SR SFP+ module (multimode fiber [MMF])
SFP-10G-LR	10GBASE-LR SFP+ module (single-mode fiber [SMF])
SFP-H10GB-CU1M	10GBASE-CU SFP+ cable 1m (Twinax cable)
SFP-H10GB-CU3M	10GBASE-CU SFP+ cable 3m (Twinax cable)
SFP-H10GB-CU5M	10GBASE-CU SFP+ cable 5m (Twinax cable)

The Cisco Nexus 4001I is backward compatible with existing Gigabit Ethernet infrastructure. Both the uplink and downlink 10 Gigabit Ethernet interfaces can also operate in Gigabit Ethernet mode. Table 2 lists the Gigabit Ethernet SFP transceivers that are supported.

Table 2. Cisco Nexus 4001I Gigabit Ethernet Transceiver Support Matrix

Cisco Part Number	Description
GLC-T	1000BASE-T SFP
GLC-SX-MM	GE SFP, LC connector SX transceiver (MMF)
GLC-LH-SM	GE SFP, LC connector LX/LH transceiver (SMF)

Features and Benefits

The rich feature set of the Cisco Nexus 4000 Series Blade Switches makes these the ideal blade switches for access-layer applications. The series protects investments in data center IBM BladeCenter environments with standards-based 10 Gigabit Ethernet and FCoE features that allow IT departments to consolidate networks based on their own requirements and timing. The combination of high port density, lossless Ethernet, wire-speed performance, and extremely low latency makes the Cisco Nexus 4000 Series switches ideal for meeting the growing demand for 10 Gigabit Ethernet that can support unified fabric in enterprise and service provider data centers, protecting enterprises' investments.

IEEE 802.1 DCB enables Ethernet fabrics to support lossless transmission to increase network scalability, support I/O consolidation, ease management of multiple traffic flows, and optimize performance. Cisco's unified fabric consolidates all data center I/O onto Layer 2 Ethernet. Unified fabric reduces capital and operating costs by reducing the number of server adapters, cables, and upstream switches needed. All I/O (LAN, SAN, and cluster) typically is consolidated onto two Ethernet links. IEEE 802.1 DCB and FCoE enable the incorporation of Fibre Channel frames within a unified fabric, facilitating wire-once strategies in which all servers become capable of SAN connection.

IEEE 802.1 DCB and related standards summarized in Table 3 are supported by the Cisco Nexus 4000 Series.

Table 3. IEEE DCB Features and Benefits

Feature	Business Benefit
IEEE 802.1Qbb: PFC	• Simplifies management of multiple traffic flows over a single network link • Creates lossless behavior for Ethernet by allowing class-of-service (CoS)-based flow control
IEEE 802.1Qaz: Enhanced Transmission Selection	Enables consistent management of quality of service (QoS) at the network level by providing consistent scheduling of different traffic types (IP, storage, etc.)
IEEE 802.1AB: Data Center Bridging Exchange (DCBX) Protocol	Simplifies network deployment and reduces configuration errors by providing autonegotiation of IEEE 802.1 DCB features between the NIC and the switch and between switches

Cisco NX-OS Software Overview

Cisco NX-OS is a data center–class operating system built with modularity, resiliency, and serviceability at its foundation. Based on the industry-proven Cisco MDS 9000 SAN-OS Software, Cisco NX-OS helps ensure continuous availability and sets the standard for mission-critical data center environments. The self-healing and highly modular design of Cisco NX-OS makes zero-impact operations a reality and enables exceptional operational flexibility.

Focused on the requirements of the data center, Cisco NX-OS provides a robust and rich feature set that fulfills the Ethernet and storage networking requirements of present and future data centers. With an XML interface and a command-line interface (CLI) like that of Cisco IOS® Software, Cisco NX-OS provides state-of-the-art implementations of relevant networking standards as well as a variety of true data center–class Cisco innovations.

Cisco NX-OS Software Benefits

Table 4 summarizes that benefits that Cisco NX-OS offers.

Table 4. Benefits of Cisco NX-OS Software

Feature	Benefit
Common Software Throughout the Data Center Cisco NX-OS runs on all Cisco data center switch platforms: Cisco Nexus 7000, 5000, 4000, 2000, and 1000V Series	• Simplification of data center operating environment • End-to-end Cisco Nexus and NX-OS fabric • No retraining necessary for data center engineering and operations teams

Software Compatibility Cisco NX-OS interoperates with Cisco products running any variant of the Cisco IOS Software OS and also with any networking OS that conforms to the networking standards listed as supported in this data sheet.	• Transparent operation with existing network infrastructure • Open standards • No compatibility concerns
Modular Software Design Cisco NX-OS is designed to support distributed multithreaded processing. Cisco NX-OS modular processes are instantiated on demand, each in a separate protected memory space. Thus, processes are started and system resources allocated only when a feature is enabled. The modular processes are governed by a real-time preemptive scheduler that helps ensure timely processing of critical functions.	• Robust software • Fault tolerance • Increased scalability • Increased network availability
High Feature Velocity The modularity of Cisco NX-OS allows new features, enhancements, and problem fixes to be integrated into the software quickly. Thus, modular fixes can be developed, tested, and delivered in a short time span	• Quick development of feature enhancements and problem fixes • Rich feature set • Quick resolution of critical caveats and bugs
Troubleshooting and Diagnostics Cisco NX-OS is built with unique serviceability functions to enable network operators to take early action based on network trends and events, enhancing network planning and improving network operations center (NOC) and vendor response times. Smart Call Home and Cisco Online Health Management System (OHMS) are some of the features that enhance the serviceability of Cisco NX-OS	• Quick problem isolation and resolution • Continuous system monitoring and proactive notifications • Improved productivity of operations teams
Ease of Management Cisco NX-OS provides a programmatic XML interface based on the NETCONF industry standard. The Cisco NX-OS XML interface provides a consistent API for devices. Cisco NX-OS also provides support for Simple Network Management Protocol (SNMP) Versions 1, 2, and 3 MIBs.	• Rapid development and creation of tools for enhanced management • Rich SNMP MIBs for efficient remote monitoring
Role-Based Access Control With role-based access control (RBAC), Cisco NX-OS enables administrators to limit access to switch operations by assigning roles to users. Administrators can customize access and restrict it to the users who require it.	• Tight access control mechanism based on user roles • Improved network device security • Reduction in network problems arising from human error

Cisco Data Center Network Manager

The Cisco Nexus 4001I is supported in Cisco Data Center Network Manager (DCNM). Cisco DCNM is designed for hardware platforms enabled for Cisco NX-OS, which are the Cisco Nexus Family of products. Cisco DCNM is a Cisco management solution that increases overall data center infrastructure uptime and reliability, hence improving business continuity. Focused on the management requirements of the data center network, Cisco DCNM provides a robust framework and rich feature set that meets the routing, switching, and storage administration needs of present and future data centers. In particular, Cisco DCNM automates the provisioning process, proactively monitors the LAN by detecting performance degradation, secures the network, and streamlines the diagnosis of dysfunctional network elements.

Product Specifications

Table 5 lists the specifications for the Cisco Nexus 4001I. Table 6 lists management standards and support.

Table 5. Specifications

Description	Specification
Performance	• 400-Gbps switching capacity • Forwarding rate of 300 million packets per second (mpps) • Low, predictable, and consistent latency of 1.5 microseconds regardless of packet size, traffic pattern, or enabled features on 10 Gigabit Ethernet interface • Line-rate traffic throughput on all ports • Configurable maximum transmission units (MTUs) of up to 9216 bytes (jumbo frames)

Hardware tables and scalability	MAC addresses	8192
	Number of configurable VLANS	512 (configurable range 1 to 4096)
	Spanning-tree instances (sum of the VLANs per port: that is, the number of VLANs times the number of ports)	• Rapid Spanning Tree Protocol (RSTP): 3000 • Multiple Spanning Tree (MST) Protocol: 10,000
	Access control list (ACL) entries	512
	Number of EtherChannels	7
	Number of ports per EtherChannel	6
	Queues	8 hardware queues per port
	Memory	2-GB DDR2 DIMM with ECC
	Flash memory	1-GB eUSB
Power consumption	12V at 5.75A (69W) (maximum)	
Indicators	Total of 16 LEDs on the faceplate • 12 LEDs for uplink port status • 2 switch-status LEDs • 2 management-port-status LEDs	
Dimensions (L x W x H)	10.27 x 11.57 x 0.79 in. (260.93 x 293.9 x 20 mm)	
Weight	Approximately 3.94 lb (1.79 kg)	
Environmental ranges	• Operating temperature: 32 to 104°F (0 to 40°C) • Storage temperature: –13 to 158°F (–25 to 70°C) • Operating relative humidity: 10 to 85% noncondensing • Storage relative humidity: 5 to 95% noncondensing	
Predicted mean time between failure (MTBF)	Approximately 187,265 hours	

Table 6. Management and Standards Support

Description	Specification	
MIB support	Generic MIBs • SNMPv2-SMI • CISCO-SMI • SNMPv2-TM • SNMPv2-TC • IANA-ADDRESS-FAMILY-NUMBERS-MIB • IANAifType-MIB • IANAiprouteprotocol-MIB • HCNUM-TC • CISCO-TC • SNMPv2-MIB • SNMP-COMMUNITY-MIB • SNMP-FRAMEWORK-MIB • SNMP-NOTIFICATION-MIB • SNMP-TARGET-MIB • SNMP-USER-BASED-SM-MIB • SNMP-VIEW-BASED-ACM-MIB • CISCO-SNMP-VACM-EXT-MIB Ethernet MIBs • CISCO-VLAN-MEMBERSHIP-MIB Configuration MIBs • ENTITY-MIB • IF-MIB • CISCO-ENTITY-EXT-MIB • CISCO-ENTITY-FRU-CONTROL-MIB • CISCO-ENTITY-SENSOR-MIB • CISCO-SYSTEM-MIB • CISCO-SYSTEM-EXT-MIB • CISCO-IP-IF-MIB • CISCO-IF-EXTENSION-MIB • CISCO-SERVER-INTERFACE-MIB • CISCO-NTP-MIB • CISCO-IMAGE-MIB • CISCO-IMAGE-UPGRADE-MIB	Monitoring MIBs • DIFFSERV-DSCP-TC • NOTIFICATION-LOG-MIB • CISCO-SYSLOG-EXT-MIB • CISCO-PROCESS-MIB • RMON-MIB • CISCO-RMON-CONFIG-MIB • CISCO-HC-ALARM-MIB Security MIBs • CISCO-AAA-SERVER-MIB • CISCO-AAA-SERVER-EXT-MIB • CISCO-COMMON-ROLES-MIB • CISCO-COMMON-MGMT-MIB • CISCO-SECURE-SHELL-MIB Miscellaneous MIBs • CISCO-LICENSE-MGR-MIB • CISCO-FEATURE-CONTROL-MIB • CISCO-CDP-MIB • CISCO-RF-MIB
Standards	• IEEE 802.1D: Spanning Tree Protocol • IEEE 802.1p: CoS Prioritization • IEEE 802.1Q: VLAN Tagging • IEEE 802.1s: Multiple VLAN Instances of Spanning Tree Protocol • IEEE 802.1w: Rapid Reconfiguration of Spanning Tree Protocol • IEEE 802.3: Ethernet • IEEE 802.3ad: Link Aggregation Control Protocol (LACP) • IEEE 802.3ae: 10 Gigabit Ethernet • SFF 8431 SFP+ CX1 support • RMON	

Software Requirements

Cisco Nexus 4000 Series switches are supported by Cisco NX-OS Software Release 4.0 and later. Cisco NX-OS interoperates with any networking OS, including Cisco IOS Software, that conforms to the networking standards mentioned in this data sheet.

Regulatory Standards Compliance

Table 7 summarizes regulatory standards compliance for the Cisco Nexus 4000 Series.

Table 7. Regulatory Standards Compliance: Safety and EMC

Specification	Description
Regulatory compliance	Products should comply with CE Markings according to directives 2004/108/EC and 2006/95/EC.
Safety	• US: UL 1950 or UL 6950 Listed Accessory Report • Canada: CSA C22.2 No. 950 or 60950 • Germany: TUV/VDE IEC 950/EN 60950 (TUV component report and IEC60950 CB Report and Certificate)
EMC: Emissions	• 47CFR Part 15 (CFR 47) Class A • AS/NZS CISPR22 Class A • CISPR22 Class A • EN55022 Class A • ICES003 Class A • VCCI Class A • EN61000-3-2 • EN61000-3-3 • KN22 Class A • CNS13438 Class A
EMC: Immunity	• EN61000-3-2 • EN61000-3-3 • EN55024 • CISPR24 • KN24
RoHS	The product is RoHS 5 compliant with exceptions for leaded ball grid array (BGA) balls and lead press-fit connectors.

Ordering Information

Table 8 provides ordering information for the Cisco Nexus 4001I.

Table 8. Ordering Information

Part Number	Description
Chassis	
N4K-4001I-XPX	Cisco Nexus 4001I Switch Module for IBM Blade Center
Software Licenses	
N4K-4001I-SSK9	Cisco Nexus 4001I Storage Protocol Services License
Cables and Optics	
SFP-10G-SR(=)	10GBASE-SR SFP+ Module
SFP-10G-LR(=)	10GBASE-LR SFP+ Module
SFP-H10GB-CU1M(=)	10GBASE-CU SFP+ Cable 1 Meter
SFP-H10GB-CU3M(=)	10GBASE-CU SFP+ Cable 3 Meter
SFP-H10GB-CU5M(=)	10GBASE-CU SFP+ Cable 5 Meter
GLC-T(=)	1000BASE-T SFP
GLC-SX-MM(=)	GE SFP, LC connector SX transceiver
GLC-LH-SM(=)	GE SFP, LC connector LX/LH transceiver

Service and Support

Cisco offers a wide range of services to help accelerate your success in deploying and optimizing the Cisco Nexus 4000 Series in your data center. The innovative Cisco Services are delivered through a unique combination of people, processes, tools, and partners and are focused on helping you increase operational efficiency and improve your data center network. Cisco Advanced Services use an architecture-led approach to help you align your data center infrastructure with your business goals and achieve long-term value. Cisco SMARTnet® Service helps you resolve mission-critical problems with direct access at any time to Cisco network experts and award-winning

resources. With this service, you can take advantage of the Smart Call Home service capability, which offers proactive diagnostics and real-time alerts on your Cisco Nexus 4000 Series switches. Spanning the entire network lifecycle, Cisco Services help increase investment protection, optimize network operations, support migration operations, and strengthen your IT expertise.

For More Information

For more information, please visit http://www.cisco.com/go/nexus4000.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV
Amsterdam, The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

Printed in USA C78-560881-00 10/09