Specifications

Traffic management/Routing (Optimized for best performance)	• IPv6 management • Quality of Service (QoS) (metering, remarking, DSCP/CoS) • BGP 4, RIPv1, RIPv2 • OSPF v2 (RFC 2328) with ECMP, OSPF (RFC 3101) • Dynamic Host Configuration Protocol (DHCP)/BootP and DHCP Relay (RFC 3046) • 802.1p (Priority Queues), IEEE 802.3x flow control • IGMPv1 (RFC 1112), IGMPv2 (RFC 2236) & IGMP v3 multicast snooping, IGMP Filtering, IP Forwarding • Jumbo frame (12 K); static routing
Security	Access control lists (ACLs) based on: • MAC and IP address (source, destination); Application type (Telnet, FTP, SMTP, and so forth.); TCP flags (ACK, URG, PSH, RST, SYN, FIN); IP address range or TCP port range; IP options and VLAN ID • HTTPS; SSH v1/v2; SNMP v1-3 • RADIUS (authentication and accounting) and TACACS+ and LDAP • 802.1x port authentication • Encryption algorithm (Name & Key length) Blowfish 16, DES 8, MD5 16 and 3DES 24
CLI	Industry-based CLI (Cisco like) and Networking OS graphical user interface
Secure management	• Automatic chassis detection • Management through CLI, telnet, Web, SNMP • Secure management through HTTPS, SSH v1/v2, SNMP v1-3 • Stacking support using 6.3 or above software code • Dual software images • Sflow version 5 • Upgrade through TFTP, FTP and serial download • Network Time Protocol (NTP) (multiple servers) • Port mirroring • Detailed statistics and switch diagnostics • Management ports physically isolated from data ports
Configuration tracking	Complete logging of all changes: • Identification of the user, time and date stamp, parameters changed • Changes attempted and denied • Local log with option to export data to a remote server

Why System x

System x is the leading provider of x86 systems for the data center. The portfolio includes rack, tower, blade, dense and converged systems, and supports enterprise class performance, reliability and security. System x also offers a full range of networking, storage, software and solutions, and comprehensive services supporting business needs throughout the IT lifecycle.

For more information

To learn more about the BladeCenter Virtual Fabric 10G Switch Module, contact your Lenovo representative or Business Partner or visit **lenovo.com**/thinkserver

[1] Visit: http://h18000.www1.hp.com/products/quickspecs/13127_na/13127_na.PDF for more information.

[2] Visit: http://www.tolly.com/DocDetail.aspx?DocNumber=209115, which shows Cisco 4900M power consumption at 375 Watts, versus a maximum of 82 watts for the Virtual Fabric 10 Gigabit Ethernet switch module.

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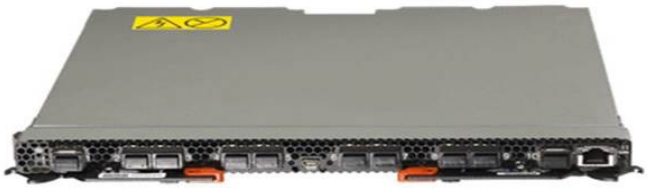
BladeCenter Virtual Fabric 10G Switch Module



Networks are changing; voice, video, storage and data are quickly converging onto a single backbone. Growth in cloud services and Web 2.0 multimedia content is pushing bandwidth demand to the network edge. These bandwidth demands are also increasing as clients employ virtualization and focus on maximizing server use.

Energize your blade-based architecture with the BladeCenter Virtual Fabric 10 Gigabit Switch Module. This switch module is designed for high performance and low-latency 10 Gigabit Ethernet (GbE) switching, investment protection as you migrate from 1 GbE to 10 GbE, and the convergence of networking, storage and computing onto a 10 GbE fabric.

Network consolidation

The next level of network consolidation has to do with I/O and storage. Gigabit Ethernet link aggregation is reaching its limits with cable management issues, power and cooling costs for multiple switches, and administrative overhead and limited bandwidth. Multicore processing environments with large memory configuration require substantial bandwidth. As the demands for mission-critical and real-time applications continue to expand, servers must offer increased processing capabilities in order to keep up. Because existing switch architectures cannot handle the data throughput required for these applications, they are fast becoming bottlenecks.

More bandwidth for heavy workloads

The BladeCenter Virtual Fabric 10 Gb switch module is your answer to bandwidth-intensive applications when using blades equipped with 10 Gb Ethernet (GbE) or converged network adapters from Broadcom, Chelsio, Emulex, Intel and QLogic.

This switch module provides 480 Gbps non-blocking, wire-speed bandwidth to meet your application requirements without compromising the integrity of your data. With ten 10 GbE uplink ports that can be trunked together—and 14 non-blocking 10 GbE internal ports—the 10 GbE switch module offers great performance and low oversubscription ratios, with bandwidth to spare for growing application needs.10 GbE at the server edge makes it possible to run applications requiring low latency (as low as 1.60 microseconds) while also increasing reliability as traffic routes securely through the backplane. BladeCenter H and HT can support up to four 10 GbE switch modules per chassis providing 800 Gbps of full duplex uplink bandwidth per chassis.

Unified networking and storage

A number of IT organizations are starting to look closely at 10 GbE as the potential converged network fabric. Some clients are already exploiting a converged fabric using 10 GbE for networking and for Fibre Channel storage area networks (FC SANs) and Internet Small Computer System Interface (iSCSI) SANs, especially with virtualization vendors' support. A number

of benchmarks have been completed showing cost and performance advantages. 10 GbE is becoming an even more compelling technology for networking and storage as clients see the value of FCoE. With the BladeCenter Virtual Fabric 10G switch module, clients have the comfort of knowing the hardware is FCoE-ready and supports the following industry-standard features that can deliver lossless transmission for traffic:

- Enhanced Transmission Selection (ETS): Provides bandwidth management
- Priority Based Flow Control (PFC): Provides lossless fabric for storage traffic
- Data Center Bridge Exchange (DCBX) protocol: Provides automated management, standardized for unified management of FCoE elements
- Fibre Channel Initialization Protocol (FIP) provides Fibre Channel (FC)-equivalent security for FCoE

Lower total cost of ownership (TCO)

Because Ethernet networks are ubiquitous today, the needed IT resources and skill sets are widely available. The learning curve for IT staff to move from 1 GbE to 10 GbE is minimal.

This 10 GbE switch offers excellent price/performance compared to external switches. Also, the Virtual Fabric switch uses SFP+ transceiver technology, further reducing costs. Clients can also use SFP+ DAC cables, which remove the need for a transceiver and can cost as little as 1/8th the price.

Advanced switching and routing features

By collapsing the network access and aggregation layers into one, the Virtual Fabric switch module can help businesses lower their TCO. While some blade Ethernet modules are only used to provide access to the "aggregation/edge switches" from the chassis, the Virtual Fabric switch module performs advanced features, including routing with Open Shortest Path First (OSPF), Virtual Router Redundancy Protocol (VRRP), filtering and full L2 and L3 capabilities—eliminating the need for these functions to be provided on an external aggregation layer switch. Fewer discrete devices in a network means fewer potential points of failure, lower energy bills, less time spent on management and lower TCO.

Energy efficiency

The switch module also saves significant money in the long term, by providing more performance per watt than other blade switches. For example, when looking at maximum switch throughput the Virtual Fabric switch delivers 30 percent more throughput per watt than an HP Virtual Connect Flex 10 (6 Gbps/watt versus 4.57 Gbps/watt[1]). The switch also uses one quarter the power that a Cisco 4900M would require.[2]

High reliability and availability

Because the Virtual Fabric switch offers integrated, high-availability support in both Layer 2 and 3, it helps minimize single points of failure, delivering network reliability and performance.

- Layer 2—High availability is supported with Link Aggregation Control Protocol (LACP), Rapid Spanning Tree, Cisco UplinkFast compatibility, PortFast compatibility, 802.1Q VLANs, broadcast storm control and controlled link failover with Network Interface Card (NIC) teaming. VRRP hot-standby further enables the effective use of Layer 2 NIC teaming failover.
- Layer 3—High availability is supported in a special extended version of VRRP that allows multiple 10 GbE switches to process traffic in an active-active configuration and concurrently process traffic (not sit in standby), enabling maximum performance and allowing easy failover in the unlikely event of a system problem.

Integration and easy management

- Standards-based integration into Cisco and other networks helps reduce downtime and learning curves.
- Stacking: a single switch image and configuration file can be used for up to eight switches, sharing only one IP address and one management interface.
- Common look and feel among Virtual Fabric switches helps administrators minimize the learning curve when they have a requirement for different switches.
- Support for two command-line interface (CLI) options—the Networking OS graphical user interface, as well as an industry-standard CLI.
- Easy software upgrades through Web user interface, Trivial File Transfer Protocol (TFTP), telnet or serial download allow for easy adaptation to existing maintenance procedures.
- Enhanced security and traffic management: 802.1x with port security allows dynamic, port-based security, providing server authentication. Easy to configure filters in L2 and L3 secure the traffic passing through the switch by allowing or denying traffic based on MAC address, IP address or Virtual Local Area Network (VLAN) ID. Dedicated VLAN for management traffic between the management module and the switch improves overall performance and security by segregating management traffic from data traffic.

Investment protection

The Virtual Fabric switch is designed with investment protection in mind. For clients currently using blade servers with the 1 GbE CFFh quad-port adapters today, this switch can support 1 GbE into the switch and provide 10 GbE uplinks to the network. As clients start to use the 10 GbE adapters in the blade servers, the switch supports 10 GbE downlinks to the server NICs.

With many clients using 1 GbE today, this switch provides the flexibility when they are ready to take the first step in moving to 10 GbE. As clients start to purchase new blades with 10 GbE adapters, they already have the switch to support the 10 GbE and 10 GbE uplinks.

Virtualization

The Virtual Fabric switch is a critical part of the Virtual Fabric for BladeCenter solution, which uses these switches and software, in addition to the Emulex Virtual Fabric Adapter. For many virtualization deployments there is demand for not only more than 1 GbE but also lots of Ethernet ports per server. This solution allows clients the flexibility to use two or four 10 GbE ports and to divide them into from two to sixteen virtual NICs (vNICS), allowing IT to allocate and adjust bandwidth based on requirements. The switch also helps simplify management further by allowing IT to manage vNICs in groups with common characteristics, in addition to providing isolation between vNICs for better availability and security. These capabilities help clients significantly reduce cost and complexity in virtualized environments, reducing switch costs up to 75 percent, reducing cabling and adapters up to 50 percent, and achieving better energy efficiency. For network convergence, Emulex also offer an optional software license for purchase that will allow clients to have a vNICs instance on each 10Gb port for iSCSI HW offload on FCoE acting like converged network adapters (CNAs).

The Virtual Fabric switch module also includes VMready® software:

- Configure Virtual Machines (VMs) once, while keeping their network attributes no matter where they move, helping to eliminate any ongoing administrative burden
- NMotion™ automatically detects VM movement from one physical server to another, and moves the network policies associated with the VM to the new physical server. This enables the VM to continue running without interrupting traffic or impacting performance, and without the need for any additional manual configuration
- Simplified server provisioning. Now failures are detected instantly and backup servers come online automatically without intervention from either server or network personnel
- Support for leading hypervisor providers

Specifications

Part number	46C7191
Form factor	Fits in a high-speed switch bay of BladeCenter® H or HT
Ports	Up to ten 10 Gb SFP+ ports (also designed to support 1 Gb SFP if required, flexibility of mixing 1 Gb/10 Gb) • One 10/100/1000 Mb copper RJ-45 used for management or data • Console interface: one RS 232 mini-USB connector
Max thru-put (bidirectional) Gbps	480 Gbps
Latency (average LILO)	As low as 1.60 µsec
Availability/Resiliency (ready for mission-critical applications)	Link Trunk Failover, NIC teaming • Spanning tree (802.1d) and Multiple Spanning tree groups (802.1s) • Rapid Spanning tree (802.1w) support for faster convergence • UplinkFast and Cisco Port Fast compatibility • VRRP (RFC2338 + active-active extension) • Hotlinks • Cisco EtherChannel compatibility • Broadcast storm control • User-configurable hashing options for LACP: SMAC, DMAC, SIP and DIP
MAC addresses	Up to 32K
VLANs	• Customizable VLAN support • 1,024 configurable VLANs (802.1Q) • 4 K VLAN IDs • Protocol-based VLANs