State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

ADDRESS CORRESPONDENCE TO ATTENTION OF:

ROBERTA WAGNER
304-558-0067

RFQ COPY
TYPE NAME/ADDRESS HERE

VENDOR

Software Information Systems, LLC
200 Association Drive, Suite 210
Charleston, WV 25311

SHIP TO

HEALTH AND HUMAN RESOURCES
MANAGEMENT INFORMATION SERVICE

321 CAPITOL STREET, SUITE 200
CHARLESTON, WV
25301   304-558-9195

DATE PRINTED	
10/02/2013	

BID OPENING DATE: 11/05/2013   BID OPENING TIME   1:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
				THE WEST VIRGINIA PURCHASING DIVISION IS SOLICITING BIDS ON BEHALF OF THE WEST VIRGINIA DEPARTMENT OF HEALTH AND HUMAN RESOURCES TO ESTABLISH A CONTRACT FOR THE ONE-TIME PURCHASE OF SWITCHES TO REPLACE EXISTING NETWORK SWITCHES OPERATING WITHIN AN EXISTING CISCO NETWORK INFRASTRUCTURE LOCATED AT VARIOUS DEPARTMENT OF HEALTH AND HUMAN RESOURCES' OFFICES ACROSS THE STATE.		
0001	1	EA		725-57	See attached	
				STANDARD MANUFACTURER WARRANTY ON ALL EQUIPMENT LISTED ON PRICING PAGE OR EQUAL.		
0002	126	EA		725-57		''
				CATALYST 2960S 48 GIGE POE 740W, 4 X SFP LAN BASE SWITCH, PART NUMBER WS-C2960S-48FPS-L OR EQUAL.		

RECEIVED
2013 NOV -4 AM 8:13
WV PURCHASING DIVISION

SIGNATURE	TELEPHONE 304-769-1645	DATE 11-5-2013
TITLE Sr. Client Executive	FEIN 61-1371685	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO SOLICITATION, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

State of West Virginia
Department of Administration
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LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
0003	23	EA	725-57			
	23 CATALYST 2960S 24 GIGE POE 370W, 2 X SFP LAN BASE					
	SWITCH, PART NUMBER WS-C2960S-24PS-L OR EQUAL.					
0004	127	EA	725-57			
	CISCO CATALYST 2960S FLEXSTACK STACK MODULE, PART					
	NUMBER C2960S-STACK OR EQUAL.					
0005	86	EA	725-57			
	CISCO FLEXSTACK 50CM STACKING CABLE, PART NUMBER					
	CAB-STK-E-0.5M OR EQUAL.					
0006	20	EA	725-57			
	CISCO FLEXSTACK 1M STACKING CABLE, PART NUMBER					
	CAB-STK-E-1M OR EQUAL.					

SIGNATURE	TELEPHONE	DATE
TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE

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State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

Solicitation

ADDRESS CORRESPONDENCE TO ATTENTION OF:

ROBERTA WAGNER
304-558-0067

RFQ COPY
TYPE NAME/ADDRESS HERE

VENDOR

Software Information Systems, LLC
200 Association Drive, Suite 210
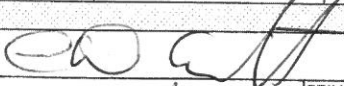Charleston, WV 25311

SHIP TO

HEALTH AND HUMAN RESOURCES
MANAGEMENT INFORMATION SERVICE

321 CAPITOL STREET, SUITE 200
CHARLESTON, WV
25301   304-558-9195

DATE PRINTED
10/02/2013

BID OPENING DATE: 11/05/2013   BID OPENING TIME   1:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
0007	29	EA	725-57	CISCO FLEXSTACK 3M STACKING CABLE, PART NUMBER CAB-STK-E-3M OR EQUAL.		
0008	52	EA	725-57	CISCO GE SFP, LC CONNECTOR SX TRANSCEIVER, PART NUMBER GLC-SX-MM OR EQUAL.		
0009	149	EA	725-57	AC POWER CORD, 16AWG, PART NUMBER CAB-16AWG-AC OR EQUAL.		

****** THIS IS THE END OF RFQ   HHR14099 ****** TOTAL: $ 455 815.00

SIGNATURE   TELEPHONE   DATE

TITLE   FEIN   **ADDRESS CHANGES TO BE NOTED ABOVE**

WHEN RESPONDING TO SOLICITATION, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

Solicitation

NUMBER	PAGE
HHR14099	1

ADDRESS CORRESPONDENCE TO ATTENTION OF:

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304-558-0067

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TYPE NAME/ADDRESS HERE

VENDOR

Software Information Systems, LLC
200 Association Drive, Suite 210
Charleston, WV 25311

SHIP TO

HEALTH AND HUMAN RESOURCES
MANAGEMENT INFORMATION SERVICE

321 CAPITOL STREET, SUITE 200
CHARLESTON, WV
25301   304-558-9195

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10/18/2013

BID OPENING DATE: 11/05/2013   BID OPENING TIME   1:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT

ADDENDUM NO. 1

ADDENDUM IS ISSUED:

1. TO PROVIDE RESPONSES TO VENDORS' QUESTIONS
REGARDING THE ABOVE SOLICITATION. QUESTION AND
ANSWER PAGES ARE ATTACHED.

2. TO PROVIDE ADDENDUM ACKNOWLEDGEMENT. THIS DOCUMENT
SHOULD BE SIGNED AND RETURNED WITH YOUR BID.
FAILURE TO SIGN AND RETURN MAY RESULT IN THE
DISQUALIFICATION OF YOUR BID.

****************** END OF ADDENDUM NO. 1 *************

SIGNATURE _____

TELEPHONE 304-768-1645   DATE 11-5-2013

TITLE Sr. Client Executive

FEIN 61-1371685

ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO SOLICITATION, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

#9 (3.1.9)	149	AC Power cord, 16AWG, part number CAB-16AWG-AC or equal.		
			Grand Total Bid	

THIS IS A ONE-TIME PURCHASE OF CISCO SWITCHES AND RELATED HARDWARE

CONTRACT ITEMS MUST BE SHIPPED F.O.B. DESTINATION.

AGENCY WILL EVALUATE BIDS BASED ON THE LOWEST GRAND TOTAL BID.   A CONTRACT WILL BE AWARDED TO THE VENDOR THAT PROVIDES THE CONTRACT ITEMS MEETING THE REQUIRED SPECIFICATIONS FOR THE LOWEST GRAND TOTAL BID PRICE.

PAYMENT TO VENDOR WILL BE MADE IN ARREARS AFTER DELIVERY, AND 100% ACCEPTANCE OF CONTRACT ITEMS BY AGENCY.

Vendor Name: _Software Information Systems LLC_
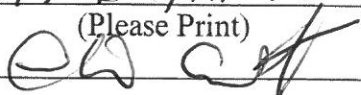
Vendor Address: _200 Association Drive Ste L 210_
Charleston, WV   25311

Vendor Telephone Number: _304   768-1645_

Vendor Fax Number: _304   768-1671_

Vendor Email: _carnott @ thinksis.com_

Vendor Authorized Representative: _Charles D. Arnott_
(Please Print)

Vendor Authorized Representative Signature: _[signature]_

Date: _11-5-2013_

Exhibit A
REQUEST FOR QUOTATIONS
HHR14099 CISCO NETWORK SWITCHES

PRICING PAGE

Desired Item #	Quantity	Description	Unit Price	Extended Price
#1 (3.1.1)	1	Standard manufacturer warranty on all equipment listed on pricing page or equal	*See Alternte Sheet*	
#2 (3.1.2)	126	Catalyst 2960S 48 GigE PoE 740W, 4 x SFP LAN Base Switch, part number WS-C2960S-48FPS-L or equal.		
#3 (3.1.3)	23	23 Catalyst 2960S 24 GigE PoE 370W, 2 x SFP LAN Base Switch, part number WS-C2960S-24PS-L or equal.		
#4 (3.1.4)	127	Cisco Catalyst 2960S FlexStack Stack Module, part number C2960S-STACK or equal.		
#5 (3.1.5)	86	Cisco FlexStack 50cm Stacking Cable, part number CAB-STK-E-0.5M or equal.		
#6 (3.1.6)	20	Cisco FlexStack 1m Stacking Cable, part number CAB-STK-E-1M or equal.		
#7 (3.1.7)	29	Cisco FlexStack 3m Stacking Cable, part number CAB-STK-E-3M or equal.		
#8 (3.1.8)	52	Cisco GE SFP, LC connector SX Transceiver, part number GLC-SX-MM or equal.		

All components included to meet the requirements

Desired Item #	Quantity	Description	Alternate Description	Alternative List Price	Extended List Price
#1 (3.1.1)	1	Standard manufacturer warranty on all equipment listed on pricing page or equal.	Brocade Assurance Limited Lifetime Warranty. Advanced Part Replacement, Next Business Day Service for lifetime (or 5 years after End of Sale (EOS) announcement) of the product for the original owner. (ICX 6450 Also includes 3 years of software upgrades and 8x5 TAC support).	inc	$ -
#2 (3.1.2)	126	Catalyst 2960S 48 GigE PoE 740W, 4xSFP Lan Base Switch, part number WS-C2960S-48FPS-L or equal.	ICX 6610 48 GigE PoE Switch, 48 port 1G RJ45 PoE+, plus 8 x 1G SFPP uplinks ports(upgradeable to 10G). 4 x 40G stacking ports. Exhaust air flow. Base S/W, part number ICX6610-48P-E	$ 3,200.00	$ 403,200.00
#3 (3.1.3)	23	23 Catalyst 2960S 24 GigE PoE 370W, 2 x SFP LAN Base Switch, part number WS_C2960PS-L or equal.	ICX 6450 24 GigE PoE Switch, 24-port 1G Switch PoE+ 390W, 2x1G SFP+ (upgradable to 10G) & 2x1G/10G SFP+ Uplink/Stacking Ports, part number ICX6450-24P	$ 1,500.00	$ 34,500.00
#4 (3.1.4)	127	Cisco Catalyst 2960S FlexStack Stack Module, part number C2960S-STACK or equal.	NA	inc	$ -
	252		40GE QSFP Direct Attached Copper Cable, 1m, 1-pack, part number 40G-QSFP-C-0101	inc	$ -
#5 (3.1.5)	86	Cisco FlexStack 56cm Stacking Cable, part number CAB-STK-E-.5M or equal.	DIRECT ATTACHED 10G SFP+ COPPER CABLE, 1M, STACKING CABLE, part number 10G-SFPP-TWX-0101	$ 55.00	$ 4,730.00
#6 (3.1.6)	20	Cisco FlexStack 1m Stacking Cable, part number CAB-STK-E-1M or equal.	DIRECT ATTACHED 10G SFP+ COPPER CABLE, 1M, STACKING CABLE, part number 10G-SFPP-TWX-0101	$ 55.00	$ 1,100.00
#7 (3.1.7)	29	Cisco FlexStack 3m Stacking Cable, part number CAB-STK-E-3M or equal.	DIRECT ATTACHED 10G SFP+ COPPER CABLE, 3M, STACKING CABLE, part number 10G-SFP-TWX-0301	$ 85.00	$ 2,465.00
#8 (3.1.8)	52	Cisco GE SFP, LC connector SX Transceiver, part number GLC-SC-MM or equal.	1000Base-SX SFP optic, MMF, LC connector, Optical Monitoring Capable, part number E1MG-SX-OM	$ 190.00	$ 9,880.00
#9 (3.1.9)	149	AC Power cord, 16AWG, Part number CAB-16AWG-AC or Equal.	Power Cord for USA version	inc	$ -
					$ 455,875.00

BROCADE ICX 6430 AND 6450 SWITCHES

ENTERPRISE LAN SWITCHING

Enterprise-Class Stackable Switching at an Entry-Level Price

HIGHLIGHTS

- Offers enterprise-class stackable switching at an entry-level price, allowing organizations to buy what they need now and easily scale as demand grows and new technologies emerge

- Delivers unprecedented feature/price value for enterprise applications, including Unified Communications (UC) and mobility, with 10 Gigabit Ethernet (GbE) and PoE/PoE+

- Provides unmatched availability for low-cost switching with redundant uplink/stacking ports, hitless stacking failover, and configurable power redundancy

- Simplifies network operations and protects investments with the Brocade HyperEdge Architecture, enabling consolidated network management and advanced services-sharing across heterogeneous switches

- Offers attractive 12-port, compact, and enterprise-class fanless switch models for deployments outside of the wiring closet

- Includes the Brocade Assurance Limited Lifetime Warranty and three years of technical support

Today's organizations expect their enterprise campus LANs to deliver more services to more users at a lower cost. These services include next-generation business applications as well as anytime, anywhere access for mobile devices. At the same time, campus LANs must be able to scale easily to meet future demands and efficiently evolve within dynamic business environments.

Brocade® ICX® 6430 and 6450 Switches provide enterprise-class stackable LAN switching solutions to meet the growing demands of campus networks. Designed for small to medium-size enterprises, branch offices, and distributed campuses, these intelligent, scalable edge switches deliver enterprise-class functionality at an affordable price—without compromising performance and reliability. The Brocade ICX 6430 and 6450 are available in

12-, 24-, and 48-port 10/100/1000 Mbps models and 1 Gigabit Ethernet (GbE) or 10 GbE dual-purpose uplink/stacking ports (see Figures 1 and 2)—with or without IEEE 802.3af Power over Ethernet (PoE) and 802.3at Power over Ethernet Plus (PoE+)—to support enterprise edge networking, wireless mobility, and IP communications.

BUILT FOR MAXIMUM COST-EFFICIENCY AND INVESTMENT PROTECTION

With Brocade ICX 6430 and 6450 Switches, organizations can buy only what they need today and easily scale user ports and services as their network requirements evolve. Brocade offers maximum investment protection through flexible software licensing options that bring advanced services and performance to lower-cost ports.

BROCADE

In particular, the Brocade HyperEdge™ Architecture allows premium switch features and services to be shared with entry-level switches (Brocade ICX 6450 only). The Brocade ICX switches also are hardware-capable for easy software implementation (software available in a future release) of emerging security (IEEE 802.1AE MACsec) and energy savings (IEEE 802.3az EEE) standards, helping to protect today's investments while supporting tomorrow's needs.

Brocade ICX 6430 and 6450 Switches come with three years of technical support from the Brocade Technical Assistance Center and software maintenance updates. With these capabilities, organizations gain peace of mind while freeing up IT budget and resources to grow their businesses.

AUTOMATED DEPLOYMENT AND MANAGEMENT

Brocade ICX 6430 and 6450 Switches help simplify network deployment and management by enabling auto-discovery of new Brocade ICX switches within the stack. IT organizations can auto-configure switches using pre-set instructions on the network. To further simplify management, these stacked switches collectively utilize only a single IP address and offer transparent forwarding across the stack.

By embedding sFlow capabilities into the Brocade ICX 6450, Brocade delivers an "always-on" monitoring technology that operates with wire-speed performance. sFlow dramatically reduces implementation complexity compared to traditional network monitoring solutions that rely on mirrored ports, probes, and line-tap technologies.

HIGH AVAILABILITY AND RESILIENCY

Brocade Ethernet switch stacking technology helps IT organizations meet growing user demand by delivering high availability through real-time state synchronization across the stack and instantaneous hitless failover support. In addition, organizations can use hot-insertion and removal of stack members to avoid interrupting network service when adding or replacing a switch. High-performance Link Aggregation Groups (LAGs) increase 10 GbE uplink bandwidth and redundancy to the core, giving users uninterrupted high performance to support the most demanding applications. Brocade ICX 6430 and 6450 Switches also offer an external power supply for added resiliency and increased PoE/PoE+ port availability (see Figure 3).

STACKING TECHNOLOGY FOR THE MOST DEMANDING CAMPUS LAN ENVIRONMENTS

Brocade Ethernet switch stacking technology makes it possible to stack up to eight Brocade ICX 6450 Switches into a single logical switch (except the Brocade ICX 6450-C), providing simple and robust expandability for future growth at the network edge. This stacked switch has only a single IP address to simplify management and offers transparent forwarding across a pool of up to 384 1 GbE ports and 32 10 GbE ports. When new switches join the stack, they automatically inherit the stack's existing configuration file, enabling true plug-and-play network expansion. Flexible licensing of 1 GbE to 10 GbE ports for uplink and stacking allows organizations to optimize network performance based on

specific requirements. Brocade stacking technology also delivers high availability, enabling instantaneous hitless failover to a standby stack controller if the master stack controller fails. In addition, organizations can use hot-insertion and removal of stack members to avoid interrupting network services.

For networks with lower bandwidth requirements, the Brocade ICX 6430 offers the same rugged stacking capability (except the Brocade ICX 6430-C) at a reduced price, providing a lower-density solution of up to 192 1 GbE access ports with 16 1 GbE uplink and stacking ports, and a maximum stack height of four switches.

Built to Power Next-Generation Edge Devices

The Brocade ICX 6430 and 6450 can deliver both PoE power and data across network connections, providing a single-cable solution for the latest edge devices (see Figure 4). Brocade ICX switches are compatible with industry-standard Voice over IP (VoIP) equipment as well as legacy IP phones. In addition, they support the PoE+ standard (IEEE 802.3at) to provide up to Class 4 (30 watts) power to each device. This high-powered solution simplifies wiring for next-generation edge devices, such as video conferencing and VoIP phones, surveillance cameras, and 802.11n wireless Access Points (APs). The PoE capability reduces the number of power receptacles and power adapters while increasing reliability and wiring flexibility. The Brocade ICX 6450 can provide PoE power to all ports and PoE+ (30 watts) to all ports when an external power supply is deployed.

Figure 1.
Brocade ICX 6450 Switches support four dual-mode 1 GbE/10 GbE SFP/SFP+ ports for uplink and stacking, and up to 48 1 GbE RJ-45 ports. Brocade ICX 6430-24 and 6430-48 Switches support four 1 GbE SFP ports for uplink and stacking to provide a cost-optimized solution for lower-traffic networks.
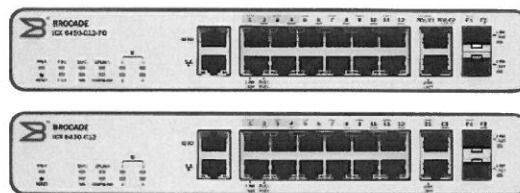
Figure 2.
The Brocade ICX 6430-C and ICX 6450-C Compact Switches support two 1 GbE RJ-45 and two 1 GbE SFP ports for uplink and 12 1 GbE RJ-45 ports with four PoE/PoE+ capable ports in a compact and fanless design—ideal for deployment outside the wiring closet. The ICX 6450-C can be powered either from its internal power supply or with POE/PoE+, through its two RJ45 uplink ports enabling the switch to be deployed in environments where no AC power outlet is present.

Plug-and-Play Operations for Powered Devices

Brocade ICX switches support the IEEE 802.1AB Link Layer Discovery Protocol (LLDP) and ANSI TIA 1057 Link Layer Discovery Protocol-Media Endpoint Discovery (LLDP-MED) standards that enable organizations to deploy interoperable multivendor solutions for Unified Communications (UC). Configuring IP endpoints such as VoIP phones can be a complex task, requiring manual and time-consuming configuration. LLDP and LLDP-MED provide a standard, open method for configuring, discovering, and managing network infrastructure.

The LLDP protocols also reduce operational costs by simplifying and automating network operations. For example, LLDP-MED provides an open protocol for configuring Quality of Service (QoS), security policies, Virtual LAN (VLAN) assignments, PoE power levels, and service priorities.

Compact Switch Solution for Deployment Outside the Wiring Closet

The Brocade ICX 6430-C/6450-C Compact Switch offers enterprise-class LAN switching capabilities, performance, reliability, security, and manageability in a small form factor with fanless operation for deployment outside the wiring closet. It is ideal for deployment in classrooms, retail locations, factories, small offices, workgroup, and space-constrained environments. The Brocade ICX 6430-C/6450-C is available in a 12-port 10/100/1000 Mbps model with IEEE 802.3af PoE and 802.3at PoE+ support on four ports plus four additional 1 GbE uplink ports. Additionally, the Brocade ICX 6450-C can be powered either from its internal AC power supply or with POE/PoE+ power, coming from one or both of its two RJ45 uplink ports, providing increased deployment flexibility by enabling the switch to be deployed in areas where no AC power outlet is present.

In the enterprise, the Brocade ICX 6430-C/6450-C Compact Switch can be used to extend the reach of the network outside the wiring closet, bringing connectivity to more users and supporting additional wireless AP deployment without running more wires. Additionally, the Brocade ICX 6450-C offers L3 routing and GRE support enabling secure and flexible deployment in remote areas. To simplify deployment in-situ, the Brocade ICX 6430-C/6450-C offer flexible mounting options, such as wall brackets and a magnetic mount kit.
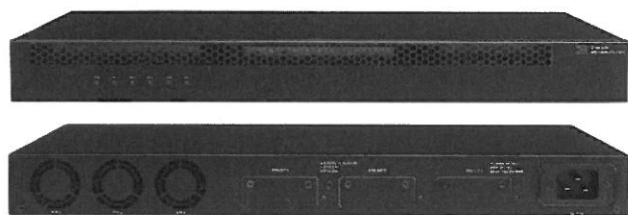

Figure 3.

The optional Brocade ICX 6400-EPS1500 is an external power supply source to provide additional power to the Brocade ICX switches (except the Brocade ICX 6430-C/6450-C and 6430-24). It also can be used for system power redundancy and increased PoE/PoE+ power budget to enable additional PoE/PoE+ ports. Each Brocade ICX 6400-EPS1500 can connect up to three Brocade ICX 6430 and 6450 Switches.

BROCADE HYPEREDGE ARCHITECTURE

The Brocade HyperEdge Architecture brings campus networks into the modern era to better support mobility, security, and application agility. This evolutionary architecture integrates innovative wired and wireless technologies to streamline application deployment, simplify network management, and reduce operating costs.

The HyperEdge Architecture enables organizations to build networks that are:

- **Agile:** By eliminating Spanning Tree Protocol (STP) between HyperEdge Domain switches through a flatter Layer 2 design, the HyperEdge Architecture increases link utilization and reduces application deployment complexity. The Distributed AP Forwarding functionality of Brocade wireless Access Points (APs) efficiently secures and directs mobile traffic at the network edge without tunneling data back to a central controller at the network core.

- **Automated:** By grouping premium and entry-level switches with intelligent wireless APs into a consolidated management domain, HyperEdge Domain switches eliminate the need to provision and manage devices individually—simplifying network deployment and management.

- **Cost-effective:** The HyperEdge Architecture enables the propagation of advanced features and services from premium switches to entry-level switches, allowing IT organizations to purchase only what they need today and add intelligent services as the business evolves. Further cost savings are achieved with Brocade wireless solutions using controller-less or controller-shared license deployment options.

Cost-Optimized Cooling Options

The Brocade ICX 6430 48-port and Brocade ICX 6450 24- and 48-port switches offer industry-standard side-to-back airflow with quiet fans at less than 40 dB (except the Brocade ICX 6450-48P). The Brocade ICX 6430-C/6450-C and 6430-24 Switches are available in a fanless configuration, helping to minimize sound and costs for deployments where users are present, such as classrooms and open office environments.

Basic Layer 3 Capabilities

Brocade ICX 6450/6450-C Switches offer an upgrade option to bring Layer 3 capabilities to the network edge, reducing complexity, and enhancing the reliability of enterprise networks.

Data Center ToR Server Connectivity

The Brocade ICX 6430 and 6450 are designed to fit in server racks by consuming only one rack unit. In data center environments where most servers are 1 GbE-capable, the Brocade ICX 6430 and 6450 provide a compact and cost-effective 1 GbE Top-of-Rack (ToR) switch by simply connecting the 1 GbE Network Interface Cards (NICs) in the servers to the Brocade ICX 6430 and 6450 1 GbE ports (see Figure 5). This configuration uses 10 GbE links (Brocade ICX 6450) or 1 GbE links (Brocade ICX 6430) to connect to Brocade ICX data center aggregation switches.

SIMPLIFIED, SECURE STANDARDS-BASED MANAGEMENT AND MONITORING

Brocade ICX 6430 and 6450 Switches provide simplified, standards-based management capabilities that help organizations reduce administrative time and effort while securing their networks.

sFlow-based "Always-On" Network Monitoring

sFlow is a standards-based network export protocol (RFC 3176) that addresses many of the challenges that network managers face today. By embedding sFlow into the Brocade ICX 6450/6450-C Switches, Brocade delivers an "always-on" technology that operates with wire-speed performance. sFlow dramatically reduces implementation costs compared to traditional network monitoring solutions that rely on mirrored ports, probes, and line-tap technologies. Moreover, sFlow gives organizations a full, enterprise-wide monitoring capability for every port in the network.

Simplified Deployment with Auto-Configuration

Brocade ICX 6430 and 6450 Switches support auto-configuration, simplifying deployment with a truly plug-and-play experience. Organizations can use this feature to automate IP address and feature configuration without requiring a highly trained network engineer onsite. When the switches power up, they automatically receive an IP address and configuration from DHCP and Trivial File Transport

Protocol (TFTP) servers. At this time, the switches can also automatically receive a software update to be at the same code revision as currently installed switches.

Open-Standards Management

Brocade ICX 6430 and 6450 Switches include an industry-standard Command Line Interface (CLI) and support Secure Shell (SSHv2), Secure Copy (SCP), and SNMPv3 to restrict and encrypt management communications to the system. In addition, support for Terminal Access Controller Access Control System (TACACS/TACACS+) and RADIUS authentication helps ensure secure operator access. Embedded Web management is also provided through a GUI-based device interface, and organizations can use Brocade Network Advisor to achieve full device and network management visibility.

Out-of-Band Management

Brocade ICX 6430 and 6450 Switches include a 10/100/1000 Mbps RJ-45 Ethernet port dedicated for out-of-band management, providing a remote path to manage the switches, regardless of the status or configuration of the data ports.

UNIFIED WIRED/WIRELESS NETWORK MANAGEMENT WITH BROCADE NETWORK ADVISOR

Managing enterprise campus networks continues to become more complex due to the growth in services that rely on wired and wireless networks. Services such as Internet, e-mail, video conferencing, real-time collaboration, and distance learning all have specific configuration and management requirements. At the same time, organizations face increasing demand to provide uninterrupted services for high-quality voice and Unified Communications (UC), wireless mobility, and multimedia applications.

To reduce complexity and the time spent managing these environments, the easy-to-use Brocade Network Advisor discovers, manages, and deploys configurations to groups of IP devices. By using the Brocade Network Advisor Device Configuration Manager tool, organizations can configure Virtual LANs (VLANs) within the network, manage wireless access point realms, or execute CLI commands on specific IP devices or groups of IP devices. sFlow-based proactive monitoring is ideal for performing
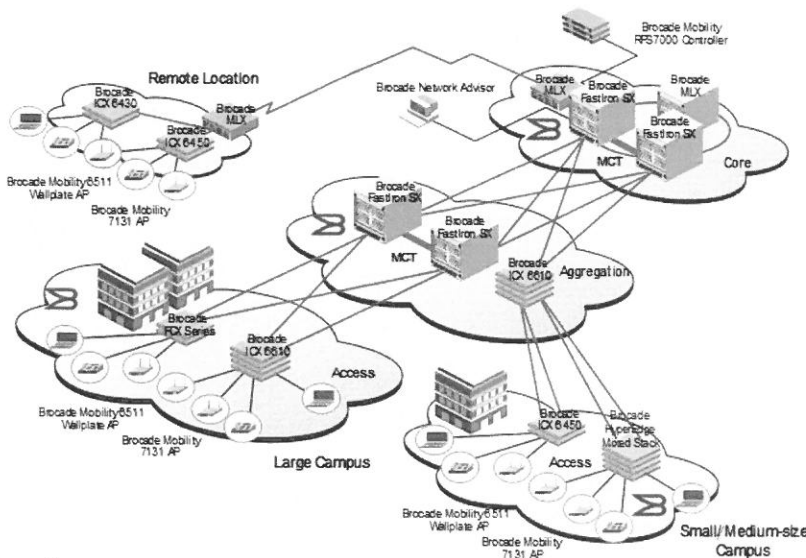

Figure 4.

Brocade ICX 6430 and 6450 Switches are suitable for a wide range of small to medium-size enterprises and branch office deployments at the network access layer.

network-wide troubleshooting, generating traffic reports, and gaining visibility into network activity from the edge to the core. Brocade Network Advisor centralizes management of the entire family of Brocade wired and wireless products, including the Brocade ICX switches.

WARRANTY

Brocade ICX 6430 and 6450 Switches are covered by the Brocade Assurance Limited Lifetime Warranty. For details, visit www.brocade.com/warranty.

BEST-IN-CLASS SUPPORT

Brocade ICX 6430 and 6450 Switches are supported by next-business-day advance replacement where available, as well as software defect repairs and maintenance updates. In an effort to further improve

service levels and operational efficiency, Brocade includes three years of technical support for Brocade ICX 6430 and 6450 Switches, providing direct access to the Brocade Technical Assistance Center during normal 8×5 business hours.

BROCADE GLOBAL SERVICES

Brocade Global Services has the expertise to help organizations build scalable, efficient cloud infrastructures. Leveraging 15 years of expertise in storage, networking, and virtualization, Brocade Global Services delivers world-class professional services, technical support, network monitoring services, and education, enabling organizations to maximize their Brocade investments, accelerate new technology deployments, and optimize the performance of networking infrastructures.

CLOUD-OPTIMIZED NETWORK ACQUISITION

Brocade helps organizations easily address their information technology requirements by offering flexible network acquisition and support alternatives to meet their financial needs. Organizations can select from purchase, lease, and Brocade Network Subscription options to align network acquisition with their unique capital requirements and risk profiles. To learn more, visit www.Brocade.com/CapitalSolutions.

MAXIMIZING INVESTMENTS

To help optimize technology investments, Brocade and its partners offer complete solutions that include professional services, technical support, and education. For more information, contact a Brocade sales partner or visit www.brocade.com.
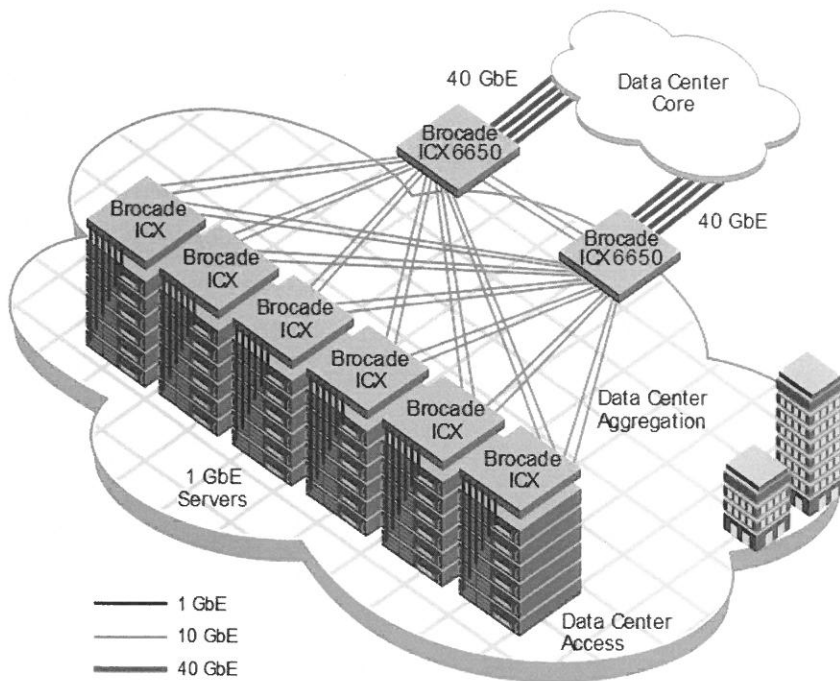

Figure 5.

Brocade ICX 6430 and 6450 Switches provide ToR access while Brocade ICX 6650 Switches provide data center aggregation.

BROCADE ICX 6430/6450 FEATURE AND MODEL SPECIFICATIONS

	Brocade ICX 6430					Brocade ICX 6450				
	6430-C12	6430-24	6430-24P	6430-48	6430-48P	6450-C12-PD	6450-24	6450-24P	6450-48	6450-48P
10/100/1000 Mbps RJ-45 ports	12	24	24	48	48	12	24	24	48	48
10/100/1000 Mbps RJ-45 uplink ports	2					2				
1 GbE SFP ports (uplink/stacking)	2*	4	4	4	4	2*				
1/10 GbE SFP/SFP+ ports (uplink/stacking)							4 (Optional 2-port license)	4 (Optional 2-port license)	4 (Optional 2-port license)	4 (Optional 2-port license)
Stacking bandwidth (data rate, full duplex)		4 Gbps	4 Gbps	4 Gbps	4 Gbps		40 Gbps	40 Gbps	40 Gbps	40 Gbps
Units per stack		4	4	4	4		8	8	8	8
Internal AC power supply rating	100 W	36 W	525 W	65 W	525 W	100 W	65 W	525 W	100 W	880 W
External power supply (redundant power and PoE power)			Optional 525 W	Optional 525 W	Optional 525 W		Optional 525 W	Optional 525 W	Optional 525 W	Optional 525 W × 2
PoE/PoE+ power budget (internal power supply)	68 W		390 W		390 W	68 W		390 W		780 W
PoE Class 3 ports (internal power supply)	4		24		24	4		24		48
PoE+ ports (internal power supply)	2		12		12	2		12		24
Max PoE Class 3 ports (with internal and external power supplies)	4		24		48	4		24		48
Max PoE+ ports (with internal and external power supplies)	2		24		24	2		24		48
PoE/PoE+ powered (Powered Device PD)						Yes				
Base software	Layer 2	Layer 2	Layer 2	Layer 2	Layer 2	Layer 3 with static routes	Layer 3 with static routes	Layer 3 with static routes	Layer 3 with static routes	Layer 3 with static routes
Layer 3 routing (RIP, OSPF)						Optional	Optional	Optional	Optional	Optional
Switching capacity (data rate, full duplex)	32 Gbps	56 Gbps	56 Gbps	104 Gbps	104 Gbps	32 Gbps	128 Gbps	128 Gbps	176 Gbps	176 Gbps
Forwarding capacity (data rate, full duplex)	24 Mpps	42 Mpps	42 Mpps	77 Mpps	77 Mpps	24 Mpps	96 Mpps	96 Mpps	132 Mpps	132 Mpps

* Stacking is not supported on the Brocade 6430-C12/6450-C12-PD. 100Base-FX is supported on the Brocade ICX 6430-C12/6450-C12-PD.

BROCADE ICX 6430/6450 SPECIFICATIONS

System Architecture

Connector options	10/100/1000 Mbps ports: RJ-45
	Brocade ICX 6430: 1 Gbps SFP ports for uplink/stacking: SX, LX, TX, LHA, LHB, direct-attached copper cable (Twinax) for stacking
	Brocade 6430-C/6450-C: 100 Mbps/1 Gbps SFP ports for uplink: FX, SX, LX, TX, LHA, LHB; 10/100/1000 Mbps RJ-45 ports for uplink
	Brocade ICX 6450: 1/10 Gbps SFP+ ports for uplink/stacking: USR, SR, LR, ER, LRM, direct-attached copper cable (Twinax) for stacking
	Out-of-band Ethernet management: 10/100/1000 Mbps RJ-45
	Console management: RJ-45 serial
	External power connector: Redundant system power supply and extended PoE power supply (except the Brocade ICX 6430-24/6430-C12/6450-C12-PD)
Maximum MAC addresses	Brocade ICX 6430, 6430-C: 8000
	Brocade ICX 6450, 6450-C: 16,000
Maximum VLANs	Brocade ICX 6430-C: 1024
	Brocade ICX 6430, 6450, 6450-C: 4096
Maximum STP (spanning trees)	Brocade ICX 6430, 6430-C: 32
	Brocade ICX 6450, 6450-C: 253
Maximum routes (in hardware)	Brocade ICX 6450, 6450-C: 12,000 (IPv4)
	Brocade ICX 6450, 6450-C: 1070 (IPv6)
Trunking	Brocade ICX 6430 Maximum ports per trunk: 8 Maximum trunk groups: 29
	Brocade ICX 6430-C Maximum ports per trunk: 8 Maximum trunk groups: 16
	Brocade ICX 6450, 6450-C Maximum ports per trunk: 8 Maximum trunk groups: 124
Priority queues	Brocade ICX 6430, 6430-C: 4
	Brocade ICX 6450, 6450-C: 8
Maximum jumbo frame size	9216 bytes
Layer 2 switching	• 802.1s Multiple Spanning Tree
	• 802.1X Authentication
	• Auto MDI/MDIX
	• BPDU Guard, Root Guard
	• Dual-Mode VLANs
	• MAC-based VLANs, Dynamic MAC-based VLAN activation
	• Dynamic VLAN Assignment
	• Dynamic Voice VLAN Assignment
	• Fast Port Span
	• GARP VLAN Registration Protocol
	• IGMP Snooping (v1/v2/v3)
	• IGMP Proxy for Static Groups
	• IGMP v2/v3 Fast Leave
	• IGMP Tracking
	• Inter-Packet Gap (IPG) adjustment
	• Link Fault Signaling (LFS)
	• MAC Address Locking, MAC Port Security
	• MAC-Layer Filtering, Filtering on source and destination MAC address

Layer 2 switching (continued)	• MAC Learning Disable
	• MLD Snooping (v1/v2)
	• Multi-device Authentication
	• Per-VLAN Spanning Tree (PVST/PVST+/PVRST)
	• Mirroring: Port-based, ACL-based, MAC Filter-based, and VLAN-based
	• Port Loop Detection
	• Private VLAN
	• Protected Link Groups
	• Protocol VLAN (802.1v), Subnet VLAN
	• Remote Fault Notification (RFN)
	• Single-instance Spanning Tree
	• Single-link LACP
	• Trunk Groups
	• Uni-Directional Link Detection (UDLD)
IPv6 support	• Host functionality management
	• Hardware support for IPv6
	• IPv6 static routing (Brocade ICX 6450/6450-C only)
Base Layer 3 routing (Brocade ICX 6450/6450-C)	• IPv4 and IPv6 Static Routes
	• Port-based Access Control Lists
	• Host Routes
	• Virtual Interfaces, up to 255 virtual interfaces
	• Routed Interfaces
	• Route-only Support
	• IP helper
	• Routing Between Directly Connected Subnets
	• ECMP
	• Layer 3/Layer 4 ACLs
Premium Layer 3 routing (Brocade ICX 6450/6450-C)	• OSPF v2
	• RIP v1/v2
	• Virtual Route Redundancy Protocol (VRRP)
	• VRRP-E
	• GRE
Metro features (except the Brocade ICX 6430-C/6450-C)	• Metro-Ring Protocol MRP (v1, v2)
	• Virtual Switch Redundancy Protocol (VSRP)
	• VLAN Stacking (Q-in-Q)
	• VRRP
	• Topology Groups

Quality of Service (QoS)	• ACL Mapping and Marking of ToS/DSCP
	• ACL Mapping and Marking of 802.1p
	• ACL Mapping to Priority Queue
	• ACL Mapping to ToS/DSCP
	• Classifying and Limiting Flows Based on TCP Flags
	• DHCP Relay
	• DiffServ Support
	• Honoring DSCP and 802.1p
	• MAC Address Mapping to Priority Queue
	• Priority Queue Management using Weighted Round Robin (WRR),
	• Strict Priority (SP), and a combination of WRR and SP
IEEE standards compliance	• 802.1AB LLDP/LLDP-MED
	• 802.1D-2004 MAC Bridging
	• 802.1p Mapping to Priority Queue
	• 802.1Q with Tagging
	• 802.1s Multiple Spanning Tree
	• 802.1w Rapid Spanning Tree (RSTP)
	• 802.1X Port-based Network Access Control
	• 802.3 10BASE-T
	• 802.3ab 1000BASE-T
	• 802.3ad Link Aggregation (Dynamic and Static)
	• 802.3ae 10 Gigabit Ethernet
	• 802.3af Power over Ethernet
	• 802.3at Power over Ethernet Plus
	• 802.3u 100BASE-TX
	• 802.3x Flow Control
	• 802.3z 1000BASE-SX/LX
	• 802.3 MAU MIB (RFC 2239)
	• 802.1AE- MACsec (HW-capable): Brocade ICX 6450/6450-C only
	• 802.3az-2010 - EEE (HW-capable)
Traffic management	• ACL-based inbound rate limiting and traffic policies
	• Broadcast, multicast, and unknown unicast rate limiting
	• Inbound rate limiting per port
	• Outbound rate limiting per port and per queue
High availability	• Redundant external power supply
	• Layer 3 VRRP protocol redundancy
	• Real-time state synchronization across the stack
	• Hitless failover from master to standby stack controller
	• Protected link groups
	• Hot insertion and removal of stacked units

Management

Management and control	• Auto Configuration
	• Brocade HyperEdge technology (Brocade ICX 6450 only)
	• Configuration Logging
	• Digital Optical Monitoring (DOM)
	• Display Log Messages on Multiple Terminals
	• Embedded Web Management
	• Embedded DHCP Server
	• Industry-standard Command Line Interface (CLI)
	• Key-based activation of optional software features
	• Integration with HP OpenView for Sun Solaris, HP-UX, IBM AIX, and Windows
	• Brocade Network Advisor support
	• MIB Support for MRP, Port Security, MAC Authentication, MAC-based VLANs
	• Out-of-band Ethernet Management
	• RFC 783 TFTP
	• RFC 854 TELNET Client and Server
	• RFC 951 Bootp
	• RFC 1157 SNMPv1/v2c
	• RFC 1213 MIB-II
	• RFC 1493 Bridge MIB
	• RFC 1516 Repeater MIB
	• RFC 1573 SNMP MIB II
	• RFC 1643 Ethernet Interface MIB
	• RFC 1643 Ethernet MIB
	• RFC 1724 RIP v1/v2 MIB
	• RFC 1757 RMON MIB
	• RFC 2068 Embedded HTTP
	• RFC 2131 DHCP Server and DHCP Relay
	• RFC 2570 SNMPv3 Intro to Framework
	• RFC 2571 Architecture for Describing SNMP Framework
	• RFC 2572 SNMP Message Processing and Dispatching
	• RFC 2573 SNMPv3 Applications
	• RFC 2574 SNMPv3 User-based Security Model
	• RFC 2575 SNMP View-based Access Control Model SNMP
	• RFC 2818 Embedded HTTPS
	• RFC 3176 sFlow (Brocade ICX 6450/6450-C only)
	• SNTP Simple Network Time Protocol
	• Multiple Syslog Servers
Embedded security	• 802.1X Accounting
	• MAC authentication
	• DHCP snooping
	• Dynamic ARP inspection
	• Bi-level Access Mode (Standard and EXEC Level)
	• EAP pass-through support
	• Packet filtering on TCP Flags
	• IEEE 802.1X username export in sFlow
	• Protection against Denial of Service (DoS) attacks

Secure management	• Authentication, Authorization, and Accounting (AAA) • Advanced Encryption Standard (AES) with SSHv2 • Bi-level Access Mode (Standard and EXEC Level) • RADIUS/TACACS/TACACS+ • Secure Copy (SCP) • Secure Shell (SSHv2) • Username/password • Web authentication

Physical Specifications

Dimensions	• Brocade ICX 6430-C12/6450-C12-PD models: 1.7 in. (H) × 10.6 in. (W) × 8.4 in. (D) 4.34 cm (H) × 26.92 cm (W) × 21.33 cm (D) • All 24-port models: 1.7 in. (H) × 17.44 in. (W) × 9.45 in. (D) 4.34 cm (H) × 44.3 cm (W) × 24 cm (D) • All 48-port models: 1.7 in. (H) × 17.44 in. (W) × 14.57 in. (D) 4.34 cm (H) × 44.3 cm (W) × 37 cm (D) • ICX6400-EPS1500: 1.7 in. (H) × 17.44 in. (W) × 14.57 in. (D) 4.34 cm (H) × 44.3 cm (W) × 37 cm (D)
Weight	• Brocade ICX 6430-C12: 4 lb (1.81 kg) • Brocade ICX 6430-24: 7.58 lb (3.44 kg) • Brocade ICX 6430-24P: 10.08 lb (4.57 kg) • Brocade ICX 6430-48: 11.09 lb (5.03 kg) • Brocade ICX 6430-48P: 13.8 lb (6.26 kg) • Brocade ICX 6450-C12-PD: 4.62 lb (2.09 kg) • Brocade ICX 6450-24: 7.39 lb (3.35 kg) • Brocade ICX 6450-24P: 10.03 lb (4.55 kg) • Brocade ICX 6450-48: 11.07 lb (5.02 kg) • Brocade ICX 6450-48P: 14.11 lb (6.4 kg) • Brocade ICX 6400-EPS1500: 14.85 lb (6.75 kg)

Environment

Temperature	• Operating temperature: 0°C to 45°C (32°F to 113°F) • Operating temperature for Brocade ICX 6430-C12: 0°C to 40°C (32°F to 104°F) • Storage temperature: -40°C to 70°C (-40°F to 158°F)
Humidity	• Operating relative humidity: 5% to 95%, non-condensing • Non-operating relative humidity: 0% to 95%, non-condensing
Storage altitude	• 10,000 ft (3000 m) maximum

Acoustic (25°C)	• Brocade ICX 6430-C12: Fanless (ambient) • Brocade ICX 6430-24: Fanless (ambient) • Brocade ICX 6430-24P: 39.2 dBA • Brocade ICX 6430-48: 37.2 dBA • Brocade ICX 6430-48P: 39.3 dBA • Brocade ICX 6450-C12-PD: Fanless (ambient) • Brocade ICX 6450-24: 37.9 dBA • Brocade ICX 6450-24P: 39.2 dBA • Brocade ICX 6450-48: 37.2 dBA • Brocade ICX 6450-48P: 55.5 dBA • Brocade ICX 6400-EPS1500: 60.9 dBA
Vibration	• IEC 68-2-36, IEC 68-2-6
Shock and drop	• IEC 68-2-27 • IEC 68-2-32
MTBF (25°C, CL: 60%)	• Brocade ICX 6430-C12: 1,124,442 hours • Brocade ICX 6430-24: 1,229,732 hours • Brocade ICX 6430-24P: 505,469 hours • Brocade ICX 6430-48: 748,262 hours • Brocade ICX 6430-48P: 384,288 hours • Brocade ICX 6450-C12-PD: 868,732 hours • Brocade ICX 6450-24: 906,243 hours • Brocade ICX 6450-24P: 485,749 hours • Brocade ICX 6450-48: 756,081 hours • Brocade ICX 6450-48P: 397,590 hours • Brocade ICX 6400-EPS1500: 789,923 hours

Power

Power supplies	• Integrated AC power supply for system and PoE power • External 1500 W AC power supply for redundant system power and extended PoE power
Power inlet (Max current rating at 100 V input)	• Brocade ICX 6430-C12: 1.8 Amp • Brocade ICX 6430-24: 0.9 Amp • Brocade ICX 6430-24P: 6 Amp • Brocade ICX 6430-48: 1.5 Amp • Brocade ICX 6430-48P: 6 Amp • Brocade ICX 6450-C12-PD: 1.8 Amp • Brocade ICX 6450-24: 1.5 Amp • Brocade ICX 6450-24P: 6 Amp • Brocade ICX 6450-48: 2 Amp • Brocade ICX 6450-48P: 10 Amp • Brocade ICX 6400-EPS1500: 16 Amp
Input voltage	• Universal 100 to 240 VAC
AC power cord current rating	• Brocade ICX 6430-C12/6450-C12-PD: 10 Amp, 100 to 240 V • Brocade ICX 6430 and 6450 switches: 13 Amp, 100 to 240 V • Brocade ICX 6400-EPS1500: 20 Amp, 100 to 240 V
DC power cord current rating	• Brocade ICX 6400-EPS1500: 5.6 Amp at 12 V rail; 6.85 Amp at 54 V rail • Brocade ICX 6400-EPS1500: 3 DC cables included; cable length: 3 feet
Input line frequency	• 50 to 60 Hz
Heat dissipation (no PoE load)	• Brocade ICX 6430-C12: 62 BTU/hr • Brocade ICX 6430-24: 67 BTU/hr • Brocade ICX 6430-24P: 104 BTU/hr • Brocade ICX 6430-48: 128 BTU/hr • Brocade ICX 6430-48P: 132 BTU/hr • Brocade ICX 6450-C12-PD: 68.3 BTU/hr • Brocade ICX 6450-24: 124 BTU/hr • Brocade ICX 6450-24P: 129 BTU/hr • Brocade ICX 6450-48: 186 BTU/hr • Brocade ICX 6450-48P: 192 BTU/hr

Regulatory Compliance and Safety Approvals

Electromagnetic compatibility	• FCC Part 15, Subpart B, Class A • ICES-003: 2004 • VCCI—Technical Requirement (V-3/2011.04)/ Class A • EN 55022: 2006+A1: 2007 Class A • EN 61000-3-2: 2006+A1:2009+A2:2009 Class A • EN 61000-3-3: 2008 • EN 61000-6-1: 2007 • EN 61000-6-3: 2007 • EN 55024: 1998+A1:2001+A2:2003 • EN 300 386 (V1.4.1): 2008 • IEC 61000-4-2: 2008 ED. 2.0 • IEC 61000-4-3: 2006+A1:2007+A2:2010 ED. 3.2 • IEC 61000-4-4: 2004+A1:2010 ED. 2.0 • IEC 61000-4-5: 2005 ED. 2.0 • IEC 61000-4-6: 2008 ED. 3.0 • IEC 61000-4-8: 2009 ED. 2.0 • IEC 61000-4-11: 2004 ED. 2.0
Safety	• CAN/CSA-C22.2 NO. 60950-1-07; UL 60950-1 2nd Edition; IEC 60950-1 2nd Edition; EN 60950-1:2006 Safety of Information Technology Equipment; EN 60825-1 Safety of Laser Products—Part 1: Equipment Classification, Requirements and User's Guide; EN 60825-2 Safety of Laser Products—Part 2: Safety of Optical Fibre Communication Systems
Environmental regulatory compliance	• RoHS-compliant (6 of 6); WEEE-compliant

Measured Power Utilization

Models	Idle[1]	5% Throughput[2]	100% Throughput[3]
Brocade ICX 6430-C12	10 W	92.6 W	93 W
Brocade ICX 6430-24	7 W	19 W	20 W
Brocade ICX 6430-24P	9 W	391 W	396 W
Brocade ICX 6430-48	15 W	37 W	38 W
Brocade ICX 6430-48P	16 W	401 W	403 W
Brocade ICX 6450-C12-PD	11.6 W	94.3 W	94.6 W
Brocade ICX 6450-24	20 W	29 W	37 W
Brocade ICX 6450-24P	21 W	395 W	400 W
Brocade ICX 6450-48	30 W	51 W	55 W
Brocade ICX 6450-48P	31 W	771 W	776 W

[1] All ports are disconnected with no PoE load.

[2] 5 percent traffic load on all ports connected with maximum possible PoE loads (if equipped).

[3] 100 percent traffic load on all ports connected with maximum possible PoE loads (if equipped).

BROCADE ICX 6430/6450 ORDERING INFORMATION

Part Number	Description
ICX6430-C12	12-port 1 GbE compact switch (4 PoE+), 2×100 Mbps/1 GbE SFP and 2×100 Mbps/1 GbE copper uplinks, fanless
ICX6430-24	24-port 1 GbE switch, 4×1 GbE SFP uplink/stacking ports, fanless
ICX6430-24P	24-port 1 GbE switch PoE+ 390 W, 4×1 GbE SFP uplink/stacking ports
ICX6430-48	48-port 1 GbE switch, 4×1 GbE SFP uplink/stacking ports
ICX6430-48P	48-port 1 GbE switch PoE+ 390 W, 4×1 GbE SFP uplink/stacking ports
ICX6450-C12-PD	12-port 1 GbE compact switch (4 PoE+), 2×100 Mbps/1 GbE SFP and 2×100 Mbps/1 GbE copper uplinks, fanless, L3 static, PoE-powered
ICX6450-24	24-port 1 GbE switch, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports
ICX6450-24-A	24-port 1 GbE switch, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports, TAA
ICX6450-24P	24-port 1 GbE switch PoE+ 390 W, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports
ICX6450-24P-A	24-port 1 GbE switch PoE+ 390 W, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports, TAA
ICX6450-48	48-port 1 GbE switch, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports
ICX6450-48-A	48-port 1 GbE switch, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports, TAA
ICX6450-48P	48-port 1 GbE switch PoE+ 780 W, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports
ICX6450-48P-A	48-port 1 GbE switch PoE+ 780 W, 2×1 GbE SFP+ (upgradable to 10 GbE) and 2×1 GbE/10 GbE SFP+ uplink/stacking ports, TAA

Accessories and Options	
ICX6450-PREM-LIC	Brocade ICX 6450/6450-C premium license (Layer 3 features)
ICX6450-2X10G-LIC-POD	Brocade ICX 6450 2×10 GbE capacity-based license; upgrade 1 GbE uplink/stacking ports to 1GbE/10 GbE
ICX6400-EPS1500	Brocade ICX 6430/6450 1500 W external power supply for RPS/EPS (connect up to three switches)
ICX6400-RMK	Brocade ICX 6400 two-post rack mount kit, spare
ICX6400-C12-RMK	Brocade ICX 6400-C compact switch 2-post rack mount kit
ICX6400-C12-MGNT	Brocade ICX 6400-C compact switch magnet mount kit
10G-SFPP-TWX-0101	Direct-attached SFP+ copper cable, 1 m, one-pack, stacking cable
10G-SFPP-TWX-0301	Direct-attached SFP+ copper cable, 3 m, one-pack, stacking cable
10G-SFPP-TWX-0501	Direct-attached SFP+ copper cable, 5 m, one-pack, stacking cable
1G-SFP-TWX-0101	Direct-attached 1 Gbps SFP copper cable, 1 m, stacking cable
1G-SFP-TWX-0501	Direct-attached 1 Gbps SFP copper cable, 5 m, stacking cable
10G-SFPP-USR	10GE USR SFP+ optic (LC), target range 100 m over MMF, one-pack
10G-SFPP-SR	10GBASE-SR, SFP+ optic (LC), target range 300 m over MMF
10G-SFPP-LR	10GBASE-LR, SFP+ optic (LC), for up to 10 km over SMF
10G-SFPP-ER	10GBASE-ER SFP+ optic (LC), for up to 40 km over SMF
10G-SFPP-LRM	10GBASE-LRM, 1310 nm SFP+ optic (LC), TAR
E1MG-TX	1000BASE-TX SFP copper, RJ-45 connector
E1MG-SX-OM	1000BASE-SX SFP optic, MMF, LC connector, optical monitoring-capable
E1MG-LX-OM	1000BASE-LX SFP optic, SMF, LC connector, optical monitoring-capable
E1MG-LHA-OM	1000BASE-LHA SFP optic, SMF, LC connector, optical monitoring-capable; 80 km
E1MG-LHB	1000BASE-LHB SFP optic, SMF, LC connector, 150 km maximum reach
E1MG-100FX-OM	100BASE-FX SFP optic MMF, LC connector, optical monitoring-capable (Brocade ICX 6400-C only)

Corporate Headquarters
San Jose, CA USA
T: +1-408-333-8000
info@brocade.com

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

Asia Paci c Headquarters
Singapore
T: +65-6538-4700
apac-info@brocade.com

BROCADE

BROCADE ICX 6610 SWITCH

ENTERPRISE LAN SWITCHING

Chassis-Like Capabilities in a Stackable Form Factor

HIGHLIGHTS

- Delivers chassis-level performance and availability, providing an optimal user experience for streaming video, VDI, UC, and other critical applications

- Offers unprecedented stacking performance with 320 Gbps of stacking bandwidth, eliminating inter-switch bottlenecks

- Provides up to 1 Tbps of total switching capacity with up to 384 1 GbE and 64 10 GbE per stack for campus network edge and aggregation layers

- Provides unmatched availability with four redundant 40 Gbps stacking ports per switch, hitless stacking failover, hot switch replacement, and dual hot-swappable power supplies and fans

- Simplifies network operations and protects investments with the Brocade HyperEdge™ Architecture, enabling consolidated network management and advanced services sharing across heterogeneous switches

Today's enterprise networks are expected to deliver services thought impossible just a few years ago. High-Definition (HD) video conferencing, real-time collaboration, Unified Communications (UC), and Virtual Desktop Infrastructure (VDI) are only a few of the applications that organizations are deploying to enhance employee productivity, improve customer service, and create a competitive advantage. These same networks must also provide anytime, anywhere mobile access and scale to meet rising user expectations. At the same time, organizations face continued pressure to reduce costs and do more with less. More than ever, campus networks need to quickly and efficiently evolve with the ever-changing business environment.

COMBINING THE BEST OF A CHASSIS AND A STACKABLE SWITCH

The Brocade® ICX® 6610 Switch redefines the economics of enterprise networking by providing unprecedented levels of performance, availability, and flexibility in a stackable form factor—delivering the capabilities of a chassis with the flexibility and cost-effectiveness of a stackable switch.

Class-Leading Performance for Today and Tomorrow

The Brocade ICX 6610 delivers wire-speed, non-blocking performance across all ports to support latency-sensitive applications such as real-time voice/video streaming and VDI. Brocade ICX 6610 Switches can be stacked using four full-duplex 40 Gbps stacking ports that provide an
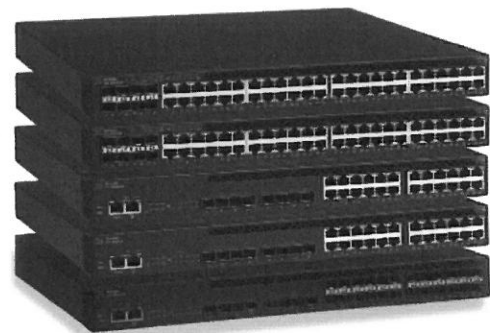
BROCADE

unprecedented 320 Gbps of backplane stacking bandwidth with full redundancy, eliminating inter-switch bottlenecks. Additionally, each switch can provide up to eight 10 Gigabit Ethernet (GbE) ports for high-speed connectivity to the aggregation or core layers.

High Availability

When every second matters, Brocade ICX 6610 Switches help deliver continuous availability to optimize the user experience. Brocade stacking technology delivers high availability, performing real-time state synchronization across the stack and enabling instantaneous hitless failover to a standby controller in the unlikely event of a failure of the master stack controller. Organizations also can use hot-insertion/ removal of stack members to avoid interrupting service when adding a switch to increase the capacity of a stack or replacing a switch that needs servicing.

In addition to stack-level high availability, Brocade ICX 6610 Switches include system-level high-availability features, such as dual hot-swappable, load-sharing, and redundant power supplies. The modular design also has dual hot-swappable fan trays. These features provide another level of availability for the campus wiring closet in a compact form factor. Additional design features include intake and exhaust temperature sensors and fan spin detection to quickly identify abnormal or failed operating conditions—helping to minimize mean time to repair.
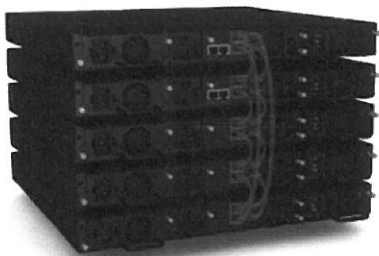
Figure 1.

Brocade ICX 6610 Switches can be stacked using four standard 40 Gbps QSFP ports that provide a fully redundant virtual chassis backplane with 320 Gbps of stacking bandwidth.

Unmatched Simplicity and Investment Protection

The Brocade ICX 6610 is easy to deploy, manage, and integrate into both new and existing networks. Organizations can buy only what they need today and easily scale up as demand grows and new technologies emerge.

The flexibility of a stackable switch allows organizations to forgo investing in a chassis upfront and put precious capital to better use elsewhere. Organizations can purchase an initial switch to get started and add a new Brocade ICX 6610 Switch to the stack as their business grows.

With capabilities such as bandwidth on demand, the Brocade ICX 6610 enables organizations to grow their networks when necessary. Organizations can initially deploy 1 GbE uplink ports and upgrade to 10 GbE ports when desired with an easy-to-activate software license.

Organizations also have peace of mind with the Brocade Assurance® Limited Lifetime Warranty. This warranty can help improve Total Cost of Ownership (TCO) while freeing up both capital and resources to re-invest into the business. For warranty details, visit www.brocade.com/warranty.

The Brocade ICX 6610 uses standard 40 GbE ports and QSFP cables for stacking. This not only delivers class-leading stacking performance and availability, but also increases cabling options and reduces cable costs—unlike competitive offerings, which rely on proprietary stacking ports and cables.

Hardware support for the new MACsec, Energy Efficient Ethernet (EEE), and 40 GbE standards provides maximum future-proofing and investment protection, enabling organizations to deploy these capabilities as needed when more network devices supporting them become available.

BUILT FOR THE MOST DEMANDING ENTERPRISE NETWORK ENVIRONMENTS

Brocade stacking technology makes it possible to stack up to eight Brocade ICX 6610 Switches into a single logical chassis switch, providing simple and robust expandability for future growth at the network edge or aggregation layer. Also, this stacked virtual switch has only a single IP address to simplify management, and offers transparent forwarding across a pool of up to 384 1 GbE and 64 10 GbE ports. When new switches are added to the stack, they automatically inherit the stack's existing configuration file, enabling true plug-and-play network expansion.

Brocade stacking technology also delivers high availability, performing real-time state synchronization across the stack and enabling instantaneous hitless failover to a standby controller, if the master stack controller fails. In addition, organizations can use hot-insertion/removal of stack members to avoid interrupting service.

Brocade ICX 6610 Switches offer four dedicated full-duplex 40 Gbps stacking ports that provide full redundancy and an unprecedented 320 Gbps of stacking bandwidth, essentially eliminating the need to work around inter-switch bottlenecks (see Figure 1).

Unlike competitive offerings that use proprietary stacking ports, the use of standard 40 Gbps QSFP ports offers optimum flexibility and future-proofing. These dedicated stacking ports free up the 10 GbE ports for high-speed connectivity to the aggregation or core layers.
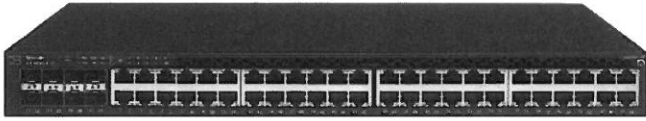
Figure 2.

Brocade ICX 6610 Switches support eight dual-mode 1 GbE/10 GbE SFP/SFP+ ports (left) and up to 48 1 GbE RJ-45 or 24 1 GbE SFP ports (right).

Up to Eight 10 GbE Ports on Demand per Switch

Brocade ICX 6610 Switches offer eight dual-mode Small Form-Factor Pluggable (SFP)/SFP+ ports, enabling high-bandwidth connectivity to the aggregation or core layers. These ports can be upgraded from 1 GbE to 10 GbE by simply applying a software license, eliminating the need to install a hardware module. In addition, organizations can aggregate these ports across the stack to provide high-speed, redundant links between the wiring closet and the aggregation layer, or between the aggregation and the core layer. With the ability to use short-range and long-range optics, along with copper Twinax cables, the Brocade ICX 6610 supports flexible and cost-effective network architectures (see Figure 2).

The Brocade ICX 6610 delivers industry-leading 8-port 10 GbE density in a 1U switch, providing up to 80 Gbps of uplink bandwidth to the aggregation or core layers of the network. This bandwidth enables a 1:1 subscription ratio throughout the network. As a result, organizations can deploy highly utilized networks to avoid congestion during peak hours.

Built to Power Next-Generation Edge Devices

The Brocade ICX 6610 can deliver both power and data across network connections, providing a single-cable solution for the latest edge devices. Brocade ICX 6610 Switches are compatible with industry-standard VoIP equipment as well as legacy IP phones. In addition, they support the Power over Ethernet (PoE+) standard (802.3at) to provide up to 30 watts of power to each device. This high-powered solution simplifies wiring for next-generation edge devices, such as video conferencing and Voice over IP (VoIP) phones, pan/tilt surveillance cameras, and 802.11n wireless Access Points (APs). The PoE capability reduces the number of power receptacles and power adapters while increasing reliability and wiring flexibility. With a 1500-watt power budget per switch (with two power supplies), the Brocade ICX 6610 24- and 48-port PoE models can supply up to Class 4 PoE+ (30 watts) power to every port.

Plug-and-Play Operations for Powered Devices

The Brocade ICX 6610 supports the IEEE 802.1AB Link Layer Discovery Protocol (LLDP) and ANSI TIA 1057 Link Layer Discovery Protocol-Media Endpoint Discovery (LLDP-MED) standards that enable organizations to deploy interoperable multivendor solutions for UC. Configuring IP endpoints such as VoIP phones can be a complex task, requiring manual and time-consuming configuration. LLDP and LLDP-MED address this challenge by providing a standard, open method for configuring, discovering, and managing network infrastructure. The LLDP protocols also help reduce operational costs by simplifying and automating network operations. For example, LLDP-MED provides an open protocol for configuring Quality of Service (QoS), security policies, Virtual LAN (VLAN) assignments, PoE power levels, and service priorities.

Flexible Cooling Options

All Brocade ICX 6610 Switches support reversible front-to-back airflow options. This data center-friendly design improves mounting flexibility in racks, while adhering to the cooling guidelines of the hosting environment. Organizations can specify airflow direction at the time of order and can reverse the direction after deployment by swapping the power supplies and fan assembly (see Figure 3).

Figure 3.

The Brocade ICX 6610 provides four 40 Gbps high-performance QSFP stacking ports (center) and dual, hot-swappable load-sharing power supplies and fan trays (left and right).

BROCADE HYPEREDGE ARCHITECTURE

The Brocade HyperEdge Architecture brings campus networks into the modern era to better support mobility, security, and application agility. This evolutionary architecture integrates innovative wired and wireless technologies to streamline application deployment, simplify network management, and reduce operating costs.

The HyperEdge Architecture enables organizations to build networks that are:

- **Agile:** By eliminating Spanning Tree Protocol (STP) between HyperEdge Domain switches through a flatter Layer 2 design, the HyperEdge Architecture increases link utilization and reduces application deployment complexity. The Distributed AP Forwarding functionality of Brocade wireless Access Points (APs) efficiently secures and directs mobile traffic at the network edge without tunneling data back to a central controller at the network core.

- **Automated:** By grouping premium and entry-level switches with intelligent wireless APs into a consolidated management domain, HyperEdge Domains eliminate the need to provision and manage devices individually—simplifying network deployment and management.

- **Cost-effective:** The HyperEdge Architecture enables the propagation of advanced features and services from premium switches to entry-level switches, allowing IT organizations to purchase only what they need today and add intelligent services as the business evolves. Further cost savings is achieved with Brocade wireless solutions using controller-less or controller-shared license deployment options.
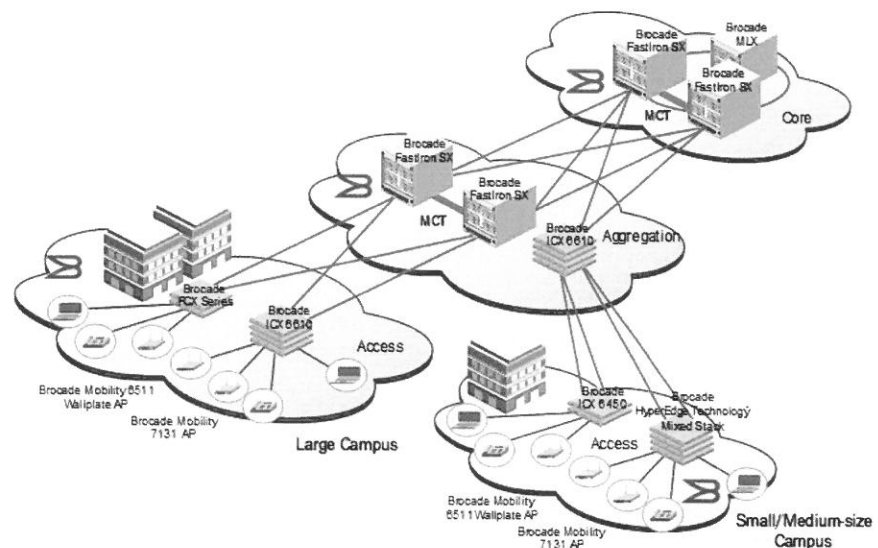
Figure 4.

The Brocade ICX 6610 is suitable for deployment at the network access and aggregation layers, thanks to its high performance, availability, and flexibility.

Full Layer 3 Capabilities

Brocade ICX 6610 Switches also offer powerful IPv4 and IPv6 Layer 3 switching capabilities. Organizations can use premium Layer 3 features—such as IPv4/IPv6 OSPF and RIP routing, Policy-Based Routing (PBR), VRRP, and Protocol-Independent Multicast (PIM)—to reduce complexity and enhance the reliability of large enterprise networks by bringing Layer 3 capabilities to the network edge and/or aggregation layer (see Figure 4). Advanced Layer 3 capabilities include BGP routing, enabling remote offices to connect Brocade ICX 6610 Switches to service provider networks. Premium and advanced routing capabilities can be added to any Brocade ICX 6610 Switch model through software key-based activation.

SIMPLIFIED, SECURE STANDARDS-BASED MANAGEMENT AND MONITORING

The Brocade ICX 6610 provides simplified, standards-based management capabilities that help organizations reduce administrative time and effort while securing their networks.

sFlow-based "Always-On" Network Monitoring

sFlow is a modern, standards-based network export protocol (RFC 3176) that addresses many of the challenges that network managers face today. By embedding sFlow into the Brocade ICX 6610, Brocade delivers an "always-on" technology that operates with wire-speed performance. sFlow dramatically reduces implementation costs compared to traditional network monitoring solutions that rely on mirrored ports, probes, and line-tap technologies. Moreover, sFlow gives organizations full, enterprise-wide monitoring capability for every port in the network.

Simplified Deployment with Auto-Configuration

The Brocade ICX 6610 supports auto-configuration, simplifying deployment with a truly plug-and-play experience. Organizations can use this feature to automate IP address and feature configuration of the switches without requiring a highly trained network engineer onsite. When the switches power up, they automatically receive an IP address and

configuration from DHCP and Trivial File Transport Protocol (TFTP) servers. At this time, the switches can also automatically receive a software update to be at the same code revision as currently installed switches.

Open-Standards Management

The Brocade ICX 6610 includes an industry-standard Command Line Interface (CLI) and supports Secure Shell (SSHv2), Secure Copy (SCP), and SNMPv3 to restrict and encrypt management communications to the system. In addition, support for Terminal Access Controller Access Control System (TACACS/TACACS+) and RADIUS authentication helps ensure secure operator access.

Out-of-Band Management

The Brocade ICX 6610 includes a 10/100/1000 Mbps RJ-45 Ethernet port dedicated to out-of-band management, providing a remote path to manage the switches, regardless of the status or configuration of the data ports.

Data Center ToR Switch for 1 GbE and 10 GbE Server Connectivity

Thanks to its class-leading 10 GbE port count, the Brocade ICX 6610 is an ideal solution as a Top-of-Rack (ToR) switch in a mixed 1 GbE/10 GbE server connectivity environment. It is designed to fit in server racks, consuming only one rack unit and offering dual integrated power supplies and fan assemblies with reversible front-to-back/back-to-front airflow for flexible cooling options. In data center environments where most servers have 1 GbE and some 10 GbE network interfaces, the Brocade ICX 6610 provides a compact and cost-effective 1 GbE/10 GbE ToR switch (see Figure 5). This configuration uses 10 GbE links to connect to Brocade ICX data center aggregation switches.

Figure 5.

The Brocade ICX 6610 provides ToR 1 GbE and 10 GbE server connectivity with the Brocade ICX 6650 providing data center aggregation.

UNIFIED WIRED/WIRELESS NETWORK MANAGEMENT WITH BROCADE NETWORK ADVISOR

Managing enterprise campus networks continues to become more complex due to the growth in services that rely on wired and wireless networks. Services such as Internet, e-mail, video conferencing, real-time collaboration, and distance learning all have specific configuration and management requirements. At the same time, organizations face increasing demand to provide uninterrupted services for high-quality voice and Unified Communications (UC), wireless mobility, and multimedia applications.

To reduce complexity and the time spent managing these environments, the easy-to-use Brocade Network Advisor discovers, manages, and deploys configurations to groups of IP devices. By using the Brocade Network Advisor Device Configuration Manager tool, organizations can configure Virtual LANs (VLANs) within the network, manage wireless access point realms, or execute CLI commands on specific IP devices or groups of IP devices. sFlow-based proactive monitoring is ideal for performing network-wide troubleshooting, generating traffic reports, and gaining visibility into network activity from the edge to the core. Brocade Network Advisor centralizes management of the entire family of Brocade wired and wireless products, including the Brocade ICX switches.

WARRANTY

The Brocade ICX 6610 Switch is covered by the Brocade Assurance Limited Lifetime Warranty. For details, visit www.brocade.com/warranty.

MAXIMUM OPERATIONAL-EFFICIENCY AND INVESTMENT PROTECTION

To further improve operational efficiency, Brocade ICX 6610 Switches come with 90 days of free technical support from the Brocade Technical Assistance Center and free software updates. With these capabilities, organizations gain peace of mind while freeing up IT budget and resources to grow their businesses.
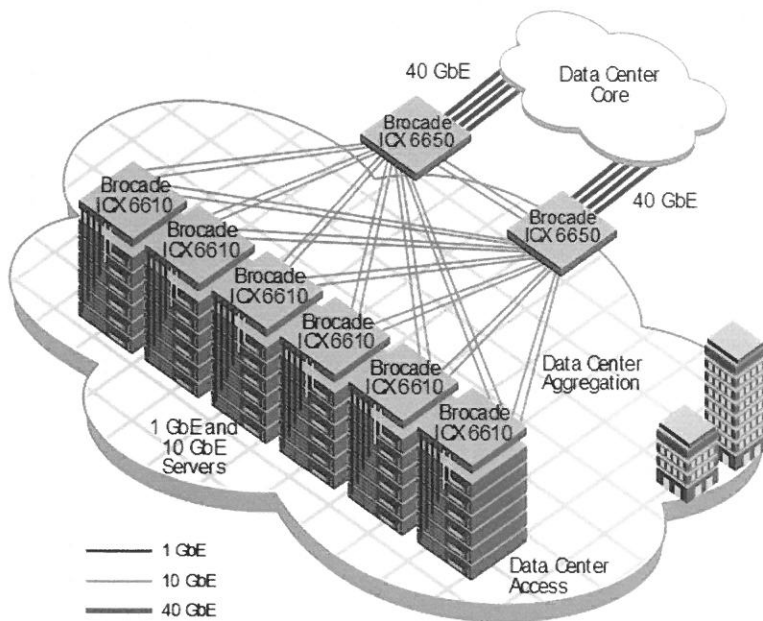
BROCADE GLOBAL SERVICES

Brocade Global Services has the expertise to help organizations build scalable, efficient cloud infrastructures. Leveraging 15 years of expertise in storage, networking, and virtualization, Brocade Global Services delivers world-class professional services, technical support, network monitoring services, and education, enabling organizations to maximize their Brocade investments, accelerate new technology deployments, and optimize the performance of networking infrastructures.

CLOUD-OPTIMIZED NETWORK ACQUISITION

Brocade helps organizations easily address their information technology requirements by offering flexible network acquisition and support alternatives to meet their financial needs. Organizations can select from purchase, lease, and Brocade Network Subscription options to align network acquisition with their unique capital requirements and risk profiles. To learn more, visit www.Brocade.com/CapitalSolutions.

MAXIMIZING INVESTMENTS

To help optimize technology investments, Brocade and its partners offer complete solutions that include professional services, technical support, and education. For more information, contact a Brocade sales partner or visit www.brocade.com.

BROCADE ICX 6610 FEATURE/MODEL COMPARISON

	24 or 48 RJ-45 Ports		24 SFP Ports	24 or 48 PoE+ Ports	
	Brocade ICX 6610-24	**Brocade ICX 6610-48**	**Brocade ICX 6610-24F**	**Brocade ICX 6610-24P**	**Brocade ICX 6610-48P**
Switching capacity (data rate, full duplex)	528 Gbps	576 Gbps	528 Gbps	528 Gbps	576 Gbps
Forwarding capacity (data rate, full duplex)	396 Mpps (wire speed)	432 Mpps (wire speed)	396 Mpps (wire speed)	396 Mpps (wire speed)	432 Mpps (wire speed)
Stacking bandwidth (data rate, full duplex)	320 Gbps	320 Gbps	320 Gbps	320 Gbps	320 Gbps
10/100/1000 Mbps RJ-45 ports	24	48	N/A	24	48
100/1000 Mbps SFP ports	N/A	N/A	24	N/A	N/A
Dual-mode 1/10 GbE SFP/SFP+ ports (10 GbE SFP+ optional upgrade license)	8	8	8	8	8
40 Gbps QSFP stacking ports	4	4	4	4	4
PoE power budget (two power supplies)	N/A	N/A	N/A	1500 W	1500 W
Maximum PoE Class 3 ports	N/A	N/A	N/A	24 (one power supply)	48 (one power supply)
Maximum PoE+ ports	N/A	N/A	N/A	24 (one power supply)	48 (two power supplies)
Redundant/load sharing; hot-swappable power supplies Max output (second optional)	2×250 W	2×250 W	2×250 W	2×1000 W	2×1000 W
Weight (one power supply/one fan tray)	6.42 kg (14.15 lb)	6.78 kg (14.95 lb)	6.69 kg (14.75 lb)	7.10 kg (15.65 lb)	7.46 kg (16.45 lb)
Dimensions	429 mm (16.880 in.) W × 406.4 mm (16.00 in.) D × 44 mm (1.732 in.) H - 1RU				
Airflow	Front to back (reversible)				

BROCADE ICX 6610 SPECIFICATIONS

System Architecture

Connector options	• 10/100/1000 ports: RJ-45 • 1 Gbps SFP ports: SX, LX, LHA, LHB, 1000Base-BX, CWDM • 10 Gbps SFP+ ports: Direct-attached copper (Twinax), SR, LR • Stacking ports: 40 GbE QSFP for use with direct-attached 1 meter or 5 meter stacking cable • Out-of-band Ethernet management: 10/100/1000 Mbps RJ-45 • Console management: RJ-45 serial
Maximum MAC addresses	32,000
Maximum VLANs	4096
Maximum STP (spanning trees)	254
Maximum routes (in hardware)	16,000
Trunking	Maximum ports per trunk: 8 Maximum trunk groups: 124
Maximum jumbo frame size	9216 bytes
Layer 2 switching	• 802.1s Multiple Spanning Tree • 802.1x Authentication • Auto MDI/MDIX • BPDU Guard, Root Guard • Dual-Mode VLANs • Dynamic VLAN Assignment • Dynamic Voice VLAN Assignment • Fast Port Span • GARP VLAN Registration Protocol • IGMP Snooping (v1/v2/v3) • Link Fault Signaling (LFS) • MAC Address Locking; Port Security • MAC-Layer Filtering • MAC Learning Disable • MLD Snooping (v1/v2) • Multi-device Authentication • Per-VLAN Spanning Tree (PVST/PVST+/PVRST) • Mirroring - Port-based, ACL-based, MAC Filter-based, and VLAN-based • Port Loop Detection • Private VLAN • Protected Link Groups • Protocol VLAN (802.1v), Subnet VLAN • Remote Fault Notification (RFN) • Single-instance Spanning Tree • Single-link LACP • Trunk Groups • Uni-Directional Link Detection (UDLD)

Base Layer 3 routing	• IPv4 static routes • ECMP • Port-based Access Control Lists • L3/L4 ACLs • Host routes • Virtual Interfaces • Routed Interfaces • Route-only Support • Routing Between Directly Connected Subnets • HyperEdge service propagation
Premium Layer 3 routing	• IPv4 and IPv6 static and dynamic routes • OSPF v2, OSPF v3 (IPv6) • PIM-SM, PIM-SSM, PIM-DM, PIM passive (IPv4/IPv6 multicast routing functionality) • PBR • RIP v1/v2, RIPng (IPv6) • Virtual Route Redundancy Protocol (VRRP) • VRRP-E, VRRP-E (IPv6) • VRRPv3 (IPv6)
Advanced Layer 3 routing	• BGP4, BGP4+(IPv6) • GRE • IPv6 over IPv4 tunnels • VRF (IPv4 and IPv6)
Metro features	• Metro-Ring Protocol (v1, v2) • Virtual Switch Redundancy Protocol (VSRP) • VLAN Stacking (Q-in-Q) • VRRP • Topology Groups
Quality of Service (QoS)	• ACL Mapping and Marking of ToS/DSCP • ACL Mapping and Marking of 802.1p • ACL Mapping to Priority Queue • ACL Mapping to ToS/DSCP • Classifying and Limiting Flows Based on TCP Flags • DHCP Relay • DiffServ Support • Honoring DSCP and 802.1p • MAC Address Mapping to Priority Queue • Priority Queue Management using Weighted Round Robin (WRR), Strict Priority (SP), and a combination of WRR and SP

IEEE standards compliance	• 802.1AB LLDP/LLDP-MED
	• 802.1D-2004 MAC Bridging
	• 802.1p Mapping to Priority Queue
	• 802.1s Multiple Spanning Tree
	• 802.1w Rapid Spanning Tree
	• 802.1x Port-based Network Access Control
	• 802.3 10 Base-T
	• 802.3ab 1000 Base-T
	• 802.3ad Link Aggregation (Dynamic and Static)
	• 802.3ae 10 Gigabit Ethernet
	• 802.3af Power over Ethernet
	• 802.3at Power over Ethernet Plus
	• 802.3u 100 Base-TX
	• 802.3x Flow Control
	• 802.3z 1000 Base-SX/LX
	• 802.3 MAU MIB (RFC 2239)
	• 802.3ba 40 Gbps Ethernet
	• 802.1AE- MACsec (HW Capable)
	• 802.3az-2010 - EEE (HW Capable)
	• 802.1Q VLAN Tagging
Traffic management	• ACL-based inbound rate limiting and traffic policies
	• Broadcast, multicast, and unknown unicast rate limiting
	• Inbound rate limiting per port
	• Outbound rate limiting per port and per queue
High availability	• Redundant hot-swappable internal power supplies
	• Hot-swappable fan trays
	• L3 VRRP protocol redundancy
	• Real-time state synchronization across the stack
	• Hitless failover from master to standby stack controller
	• Protected link groups
	• Hot insertion and removal of stacked units

Management

Management and control	• Auto Configuration
	• Brocade HyperEdge technology
	• Configuration Logging
	• Digital Optical Monitoring
	• Display Log Messages on Multiple Terminals
	• Embedded Web Management
	• Embedded DHCP Server
	• Industry-standard Command Line Interface (CLI)
	• Key-based activation of optional software features
	• Integration with HP OpenView for Sun Solaris, HP-UX, IBM AIX, and Windows
	• Brocade Network Advisor support
	• MIB Support for MRP, Port Security, MAC Authentication, and MAC-based VLANs
	• Out-of-band Ethernet Management
	• RFC 783 TFTP
	• RFC 854 TELNET Client and Server
	• RFC 951 Bootp
	• RFC 1157 SNMPv1/v2c
	• RFC 1213 MIB-II
	• RFC 1493 Bridge MIB
	• RFC 1516 Repeater MIB
	• RFC 1573 SNMP MIB II
	• RFC 1643 Ethernet Interface MIB
	• RFC 1643 Ethernet MIB
	• RFC 1724 RIP v1/v2 MIB
	• RFC 1757 RMON MIB
	• RFC 2068 Embedded HTTP
	• RFC 2131 DHCP Server and DHCP Relay
	• RFC 2570 SNMPv3 Intro to Framework
	• RFC 2571 Architecture for Describing SNMP Framework
	• RFC 2572 SNMP Message Processing and Dispatching
	• RFC 2573 SNMPv3 Applications
	• RFC 2574 SNMPv3 User-based Security Model
	• RFC 2575 SNMP View-based Access Control Model SNMP
	• RFC 2818 Embedded HTTPS
	• RFC 3176 sFlow
	• SNTP Simple Network Time Protocol
	• Support for Multiple Syslog Servers

Embedded security	• 802.1X Accounting
	• MAC Authentication
	• Bi-level Access Mode (Standard and EXEC Level)
	• EAP pass-through support
	• IEEE 802.1X username export in sFlow
	• Protection against Denial of Service (DoS) attacks
Secure management	• Authentication, Authorization, and Accounting (AAA)
	• Advanced Encryption Standard (AES) with SSHv2
	• RADIUS/TACACS/TACACS+
	• Secure Copy (SCP)
	• Secure Shell (SSHv2)
	• Username/Password
	• Web authentication

Environment

Temperature	Operating temperature: 0°C to 40°C 32°F to 104°F
	Storage temperature: −25°C to 70°C 13°F to 158°F
Humidity	Relative humidity: 5% to 95%, non-condensing
Altitude	Storage altitude: 10,000 ft (3000 m) maximum
Acoustic	From 39.6 dB (24 ports, 1 fan, 1 PSU) to 48.7 dB (48 ports, 2 fans, 2 PSUs)

Power

Power supplies	Up to two internal, redundant, field-replaceable, load-sharing AC or DC power supplies with dedicated system and PoE power
Power inlet	C13
Input voltage	Typical 100 to 240 VAC
Input line frequency	50 to 60 Hz

Power Draw (no PoE loads)

Models	With 1 Power Supply	With 2 Power Supplies
Brocade ICX 6610-24	120 W	140 W
Brocade ICX 6610-48	165 W	185 W
Brocade ICX 6610-24F	125 W	145 W
Brocade ICX 6610-24P	120 W	140 W
Brocade ICX 6610-48P	165 W	185 W

Compliance/ Certification

Electromagnetic emissions	FCC Class A (Part 15); EN 55022/CISPR-22 Class A; VCCI Class A; ICES-003 Electromagnetic Emission; AS/NZS 55022; EN 61000-3-2 Power Line Harmonics; EN 61000-3-3 Voltage Fluctuation and Flicker; EN 61000-6-3 Emission Standard (supersedes: EN 50081-1)
Safety	CAN/CSA-C22.2 NO. 60950-1-07; UL 60950-1 Second Edition; IEC 60950-1 Second Edition; EN 60950-1:2006 Safety of Information Technology Equipment; EN 60825-1 Safety of Laser Products—Part 1: Equipment Classification, Requirements and User's Guide; EN 60825-2 Safety of Laser Products—Part 2: Safety of Optical Fibre Communication Systems
Immunity	EN 61000-6-1 Generic Immunity and Susceptibility (supersedes EN 50082-1); EN 55024 Immunity Characteristics (supersedes EN 61000-4-2 ESD); EN 61000-4-3 Radiated, Radio Frequency, Electromagnetic Field; EN 61000-4-4 Electrical Fast Transient; EN 61000-4-5 Surge; EN 61000-4-6 Conducted Disturbances Induced by Radio-Frequency Fields; EN 61000-4-8 Power Frequency Magnetic Field; EN 61000-4-11 Voltage Dips and Sags
Environmental regulatory compliance	RoHS-compliant (6 of 6); WEEE-compliant

BROCADE ICX 6610 ORDERING INFORMATION

Part Number	Description
ICX6610-24-E	24-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 250 W power supply. Base software.
ICX6610-24-PE	24-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 250 W power supply. Premium software.
ICX6610-24-I	24-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 250 W power supply. Base software.
ICX6610-24-PI	24-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 250 W power supply. Premium software.
ICX6610-24P-E	24-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 1000 W power supply. Base software.
ICX6610-24P-PE	24-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 1000 W power supply. Premium software.
ICX6610-24P-I	24-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 1000 W power supply. Base software.
ICX6610-24P-PI	24-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 1000 W power supply. Premium software.
ICX6610-24F-E	24-port 1 GbE SFP, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 250 W power supply. Base software.
ICX6610-24F-PE	24-port 1 GbE SFP, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 250 W power supply. Premium software.
ICX6610-24F-I	24-port 1 GbE SFP, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 250 W power supply. Base software.
ICX6610-24F-PI	24-port 1 GbE SFP, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 250 W power supply. Premium software.
ICX6610-48-E	48-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 250 W power supply. Base software.
ICX6610-48-PE	48-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 250 W power supply. Premium software.
ICX6610-48-I	48-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 250 W power supply. Base software.
ICX6610-48-PI	48-port 1 GbE RJ45, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 250 W power supply. Premium software.
ICX6610-48P-E	48-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 1000 W power supply. Base software.
ICX6610-48P-PE	48-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side exhaust, hot-swappable fan assembly and 1000 W power supply. Premium software.
ICX6610-48P-I	48-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 1000 W power supply. Base software.
ICX6610-48P-PI	48-port 1 GbE RJ45 PoE+, plus 8×1 GbE SFPP uplink ports (upgradable to 10 GbE). 4×40 GbE QSFP stacking ports. 1 power-supply-side intake, hot-swappable fan assembly and 1000 W power supply. Premium software.

Accessories and Options

Part Number	Description
ICX6610-PREM-LIC	Brocade ICX 6610 premium software license
ICX6610-ADV-LIC	Brocade ICX 6610 advanced software license
ICX6610-ADV-UPG-LIC	Brocade ICX 6610 premium to advanced software upgrade
ICX6610-10G-LIC-POD	License to upgrade 4 ports of 1 GbE SFPP uplink to 10 GbE
RPS15-E	Brocade ICX 6610/6650 non-PoE 250 W PSU, power-supply-side exhaust airflow
RPS15-I	Brocade ICX 6610/6650 non-PoE 250 W PSU, power-supply-side intake airflow
RPS16-E	1000 W power supply for Brocade ICX 6610 PoE models, power-supply-side exhaust airflow
RPS16-I	1000 W power supply for Brocade ICX 6610 PoE models, power-supply-side intake airflow
RPS16DC-E	510 W DC power supply for Brocade ICX 6610, power-supply-side exhaust airflow
RPS16DC-I	510 W DC power supply for Brocade ICX 6610, power-supply-side intake airflow
ICX6610-FAN-E	Power-supply-side exhaust airflow fan for the Brocade ICX 6610 (two fans required with two power supplies)
ICX6610-FAN-I	Power-supply-side intake airflow fan for the Brocade ICX 6610 (two fans required with two power supplies)
40G-QSFP-C-0101	40 GbE QSFP direct-attached copper cable, 1 m, one-pack
40G-QSFP-C-0501	40 GbE QSFP direct-attached copper cable, 5 m, one-pack

BROCADE

RFQ No. __HHR14099__

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

MANDATE: Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: _Software Information Systems LLC_

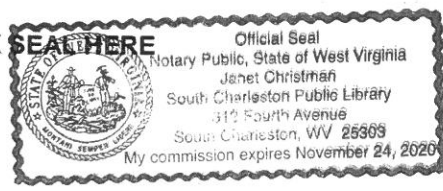Authorized Signature: _____ Date: _11-2-2013_

State of _West Virginia_

County of _Kanawha_ , to-wit:

Taken, subscribed, and sworn to before me this _2_ day of _November_ , 20 _13_

My Commission expires _Nov 2020_ , 20___.

NOTARY PUBLIC _Janet Christman_

Purchasing Affidavit (Revised 07/01/2012)

CERTIFICATION AND SIGNATURE PAGE

By signing below, I certify that I have reviewed this Solicitation in its entirety; understand the requirements, terms and conditions, and other information contained herein; that I am submitting this bid or proposal for review and consideration; that I am authorized by the bidder to execute this bid or any documents related thereto on bidder's behalf; that I am authorized to bind the bidder in a contractual relationship; and that to the best of my knowledge, the bidder has properly registered with any State agency that may require registration.

Software Information Systems LLC
(Company)

(Authorized Signature)

Charles D. Arnett   Sr. Client Executive
(Representative Name, Title)

304 768 4645   304 · 768 - 4631
(Phone Number)   (Fax Number)

11-5-2013
(Date)

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: HHR14099

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

☑ Addendum No. 1	☐ Addendum No. 6
☐ Addendum No. 2	☐ Addendum No. 7
☐ Addendum No. 3	☐ Addendum No. 8
☐ Addendum No. 4	☐ Addendum No. 9
☐ Addendum No. 5	☐ Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Softwin Information Systems LLC
Company

(signature)
Authorized Signature

_11-5-2013_
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.