



ENTERPRISE CAMPUS NETWORKING

Brocade ICX 6430/6450 Architecture Brief

This architecture brief describes the system architecture for the Brocade ICX 6400 (Integrated Campus Switch) stackable switch series. The Brocade ICX 6400 series delivers wire-speed, non-blocking performance across all ports to support latency-sensitive applications. The switches have four dual-purpose fiber ports that provide up to 10 GbE for uplinks or stacking.

BROCADE

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OVERVIEW

The Brocade® ICX® 6400 stackable switch series includes nine models.

Table 1 shows all available SKUs for the Brocade ICX 6400 family, as well as the port count and the number of 1 GbE and 10 GbE uplink/stacking ports available for each model.

Table 1. The Brocade ICX 6400 Family

| | Brocade ICX 6430 | | | | Brocade ICX 6450 | | | |
|---|------------------|----------|---------|----------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | 6430-24 | 6430-24P | 6430-48 | 6430-48P | 6450-24 | 6450-24P | 6450-48 | 6450-48P |
| 10/100/1000 Mbps RJ-45 ports | 24 | 24 | 48 | 48 | 24 | 24 | 48 | 48 |
| 1 GbE SFP ports (uplink/stacking) | 4 | 4 | 4 | 4 | 2 (upgradable to 10 GbE) | 2 (upgradable to 10 GbE) | 2 (upgradable to 10 GbE) | 2 (upgradable to 10 GbE) |
| 1/10 GbE SFP/SFP+ ports (uplink/stacking) | | | | | 2 | 2 | 2 | 2 |

| | Brocade ICX 6430 | | | | | Brocade ICX 6450 | | | |
|---|---------------------------------|-------------|--------------|-------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | ICX 6430-C12 | ICX 6430-24 | ICX 6430-24P | ICX 6430-48 | ICX 6430-48P | ICX 6450-24 | ICX 6450-24P | ICX 6450-48 | ICX 6450-48P |
| 10/100/1000 Mbps RJ-45 ports | 12 | 24 | 24 | 48 | 48 | 24 | 24 | 48 | 48 |
| 1 GbE SFP ports (uplink/stacking) | 2xSFP, 2xCu (uplink only) | 4 | 4 | 4 | 4 | 2 (upgradable to 10 GbE) | 2 (upgradable to 10 GbE) | 2 (upgradable to 10 GbE) | 2 (upgradable to 10 GbE) |
| 1/10 GbE SFP/SFP+ ports (uplink/stacking) | N/A | N/A | N/A | N/A | N/A | 2 | 2 | 2 | 2 |

Note: The Brocade ICX 6430-24 and ICX 6430-C12 are fanless models.

There are two base models: the Brocade ICX 6430 Switch and the Brocade ICX 6450 Switch.

In the Brocade ICX 6430, the CPU core speed is 500 MHz, with 256 MB of DDR2 RAM and 64 MB of flash memory. In the Brocade ICX 6450, the CPU core speed is 800 MHz, with 512 MB of DDR2 RAM, and 64 MB of flash memory.

Both base models have RJ-45 connectors for UART console and Out-Of-Band (OOB) CPU management ports. These models also have thermal sensors and fans for internal thermal management.

The earliest code that can run on the Brocade ICX 64xx series is Brocade FastIron 7.4. This is the same as other products in the Brocade ICX/FastIron family. However, the Brocade ICX 64xx image runs FastIron 7.4 on top of a Linux kernel. The Brocade ICX 6430-C12 runs on FastIron 8.0 or later.

SOFTWARE

Instead of the traditional Brocade FastIron bootloader, the Brocade ICX 64xx series uses U-Boot. U-Boot is an open source bootloader. To directly access U-Boot, press “b” during unit power-up. You can type “help” while in U-Boot to view available commands. For additional U-Boot commands, see Appendix A.

HARDWARE

The Brocade ICX 6400 12- and 24-port versions have one packet processor, while the Brocade ICX 6400 48-port versions have two. In the Brocade ICX 6450 model, each packet processor has 1.5 MB of packet buffer, while the 6430 model has 1 MB of packet buffer. Please see Figures 1, 2, and 3 for the port architecture mapping.

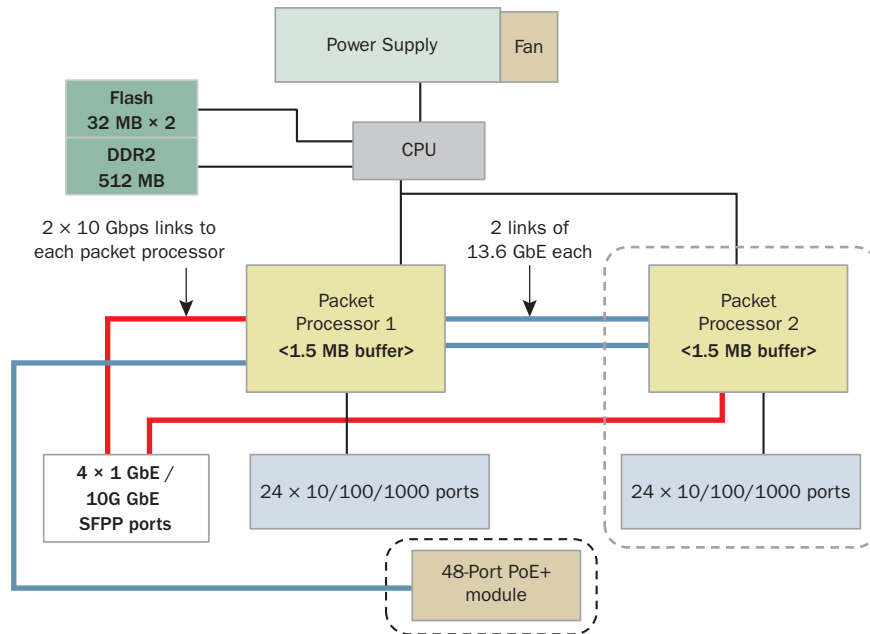


Figure 1. Brocade ICX 6450-48P port architecture diagram.

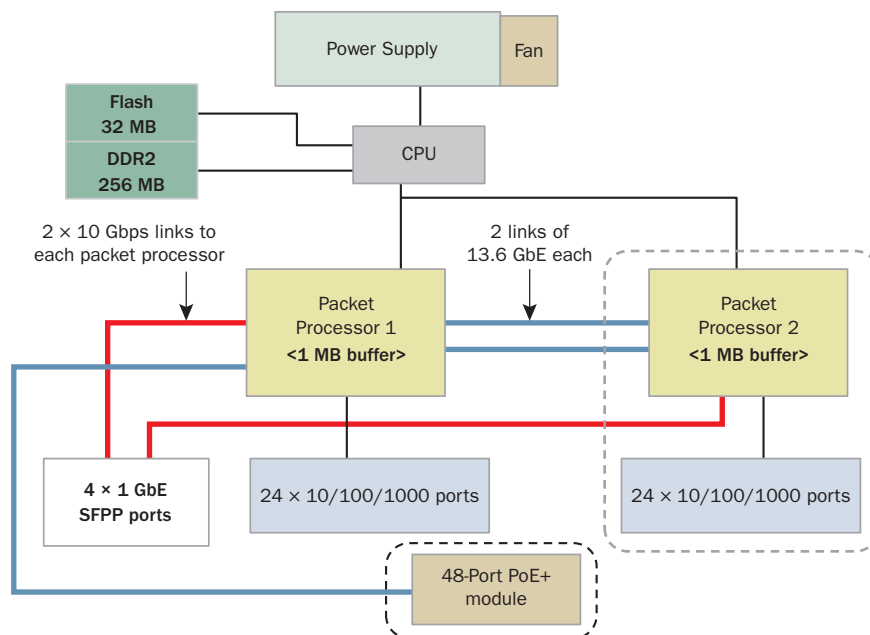


Figure 2. Brocade ICX 6430-48P port architecture diagram.

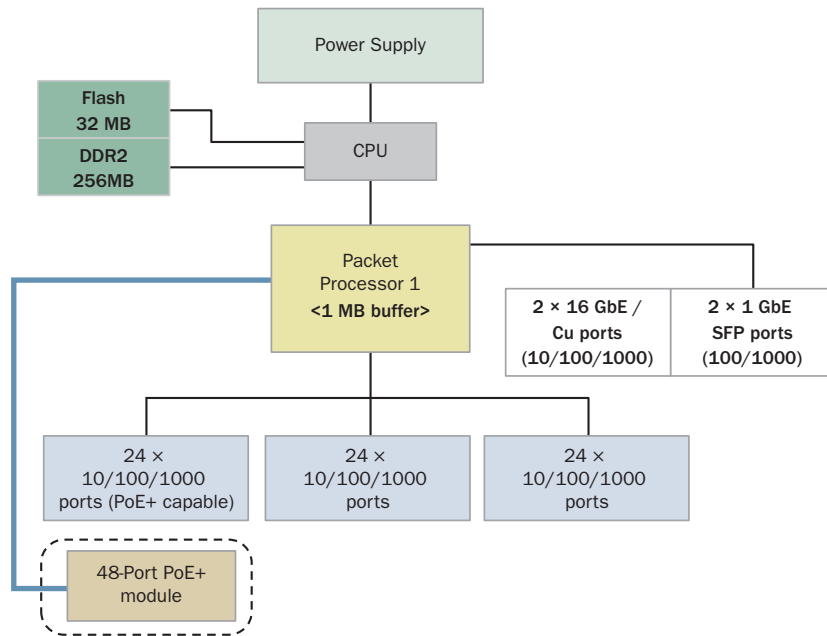


Figure 3. Brocade ICX 6430-C12 port architecture diagram.

Figures 1 and 2 show the port architecture for the 48-port models. The 24-port model does not have the blue dotted area. The 2 x 10 Gbps link between the 4 x 1 GbE and second packet processor all go into packet processor 1. The non-Power over Ethernet (PoE) models do not have the black dotted area.

The main differences between the Brocade ICX 6450 and 6430 are bolded in Figure 2.

Figure 3 shows the architecture for the 12-port Brocade ICX 6430-C12. Note that only the leftmost four ports support PoE+.

The Brocade ICX 6430 has one bank of 32 MB flash memory, while the Brocade ICX 6450 has two banks of 32 MB flash memory, totaling 64 MB. For both units, the flash memory is partitioned into two segments. The first segment is further divided into three partitions to hold U-Boot, the primary image, and the secondary image. The second segment has a JFFS2 file system and is used to store the configuration files and logs. Please see Figure 4 for the flash breakdown.

The Brocade ICX 6450 supports both the switch and router images, while the Brocade ICX 6430 supports only the switch image. Much of the software feature functionality is similar to the Brocade FCX® Series of switches and the Brocade ICX 6610 Series. Please see Appendix B for a comparison between the Brocade FastIron WS Series, the Brocade ICX 6450, and the Brocade FCX Series.

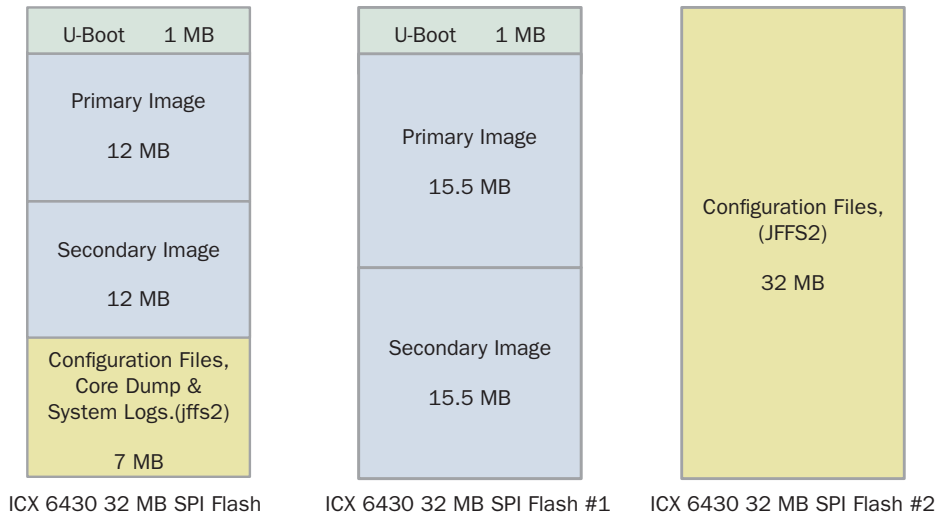


Figure 4. (Left) Brocade ICX 6430 32 MB SPI Flash breakdown. (Center and Right) Flash breakdown of the two 32 MB flash memory for the Brocade ICX 6450.

The Brocade ICX 6450 supports both the switch and router images, while the Brocade ICX 6430 supports only the switch image. Much of the software feature functionality is similar to the Brocade FCX® Series of switches and the Brocade ICX 6610 Series. Please see Appendix B for a comparison between the Brocade FastIron WS Series, the Brocade ICX 6450, and the Brocade FCX Series.

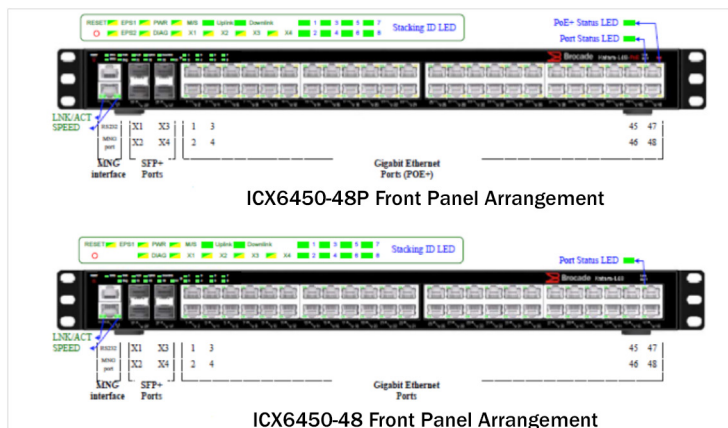


Figure 5. Front panel LEDs for the Brocade ICX 6450-48PoE and 6450-48.

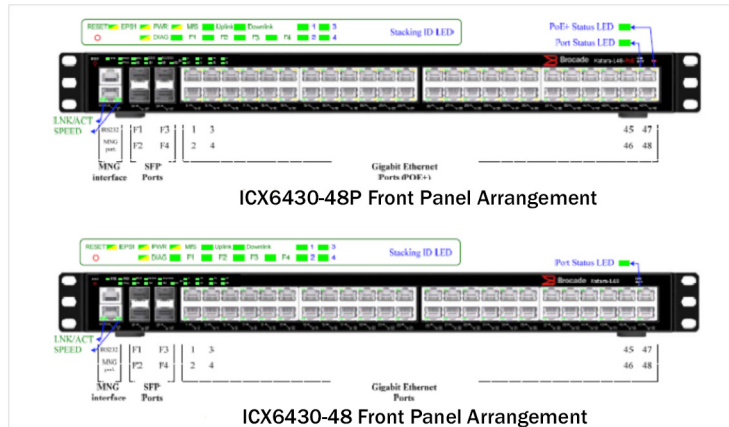


Figure 6. Front panel LEDs for the Brocade ICX 6430-48P and 6430-48.



Figure 7. Front panel LEDs for the Brocade ICX 6430-C12.

DIGITAL OPTICAL MONITORING (DOM)

DOM provides real-time monitoring of different parameters present in the optic module. These parameters include:

- Transceiver temperature
- Transceiver supply voltage
- Tx and Rx optics power and bias current
- Different alarm and warning flags

DOM is supported on both the Brocade ICX 6430 and ICX 6450 only for Flex-link ports.

KEY LAYER 2 DIFFERENCES BETWEEN THE BROCADE ICX 6430 AND 6450

Egress pass/drop queue counters vs. ACL counters

The hardware counters for egress pass/drop queue and Access Control List (ACL) counting are assigned to ACL counters by default in the Brocade ICX 6450 (CNC counters). This implies that the egress pass/drop queue counter show (show int eth x/x/x) will be zero by default. To unbind the hardware counters from ACL to egress pass/drop, the following hidden Command Line Interfaces (CLIs) are provided.

`[no] bind statistics-counter client {ingress-acl | egress-queue}`

The Brocade ICX 6430 does not support both egress pass/drop or ACL counters.

sFlow

sFlow is not supported in the Brocade ICX 6430, but it is supported in the Brocade ICX 6450.

Private VLAN (PVLAN)

The Brocade ICX 6450 supports tagged ports/hardware forwarding based PVLAN. This is similar to PVLAN support in current Brocade FCX and ICX 6610 platforms.

The Brocade ICX 6430 supports only untagged ports/software forwarding PVLAN. This is similar to PVLAN support in current Brocade FastIron WS, FastIron LS, FastIron GS, and FastIron SX platforms.

Spanning Tree Protocol (STP)

The Brocade ICX 6430 supports up to 32 configurable spanning tree instances, while the Brocade ICX 6450 supports 253 STP instances. They both support up to 32 Multiple STP (MSTP) instances.

Buffer Profiles

The Brocade ICX 6430 has only four hardware queues on the data ports. However, the user still sees eight queues. These eight queues map internally to the four hardware queues. See the mapping table (Table 2). The Brocade ICX 6430 has up to 2 MB of buffer memory and 4000 descriptors. The buffer/descriptor mapping in software (with the eight queues) and in hardware (with the four queues) are shown in Table 2.

Table 2. Software and Hardware Queue Mapping for the Brocade ICX 6430

| Software Traffic Class | Hardware Traffic Class |
|------------------------|------------------------|
| 0 | 0 |
| 1 | 0 |
| 2 | 1 |
| 3 | 1 |
| 4 | 1 |
| 5 | 2 |
| 6 | 2 |
| 7 | 3 |

Table 3. Buffer/Descriptor Allocation per Traffic Class in Software

| Software Buffer Allocation | | |
|----------------------------|---------------|-------------------|
| Traffic Class | 1 GbE Buffers | 1 GbE Descriptors |
| Per Port | 4032 | 3854 |
| 0 | 182 | 182 |
| 1 | 182 | 182 |
| 2 | 96 | 96 |
| 3 | 96 | 96 |
| 4 | 96 | 96 |
| 5 | 128 | 128 |

Table 4. Buffer/Descriptor Allocation per Traffic Class in Hardware

| Hardware Buffer Allocation | | |
|----------------------------|---------------|-------------------|
| Traffic Class | 1 GbE Buffers | 1 GbE Descriptors |
| Per Port | 4032 | 3854 |
| 0 | 182 | 192 |
| 1 | 96 | 96 |
| 2 | 128 | 128 |

The Brocade ICX 6450 has up to 3 MB of buffer memory and 6000 descriptors. The table below breaks down the buffer/descriptor allocation for the 1 GbE and 10 GbE ports.

Table 5. Buffer/Descriptor Allocation per Traffic Class in the Brocade ICX 6450

| Buffer/Descriptor Allocation in the Brocade ICX 6450 | | | | |
|--|---------------|-------------------|----------------|--------------------|
| Traffic Class | 1 GbE Buffers | 1 GbE Descriptors | 10 GbE Buffers | 10 GbE Descriptors |
| Per Port | 6143 | 5902 | 6143 | 5902 |
| 0 | 256 | 256 | 384 | 384 |
| 1 | 144 | 144 | 192 | 192 |
| 2 | 144 | 144 | 192 | 192 |
| 3 | 144 | 144 | 192 | 192 |
| 4 | 144 | 144 | 192 | 192 |
| 5 | 192 | 192 | 256 | 256 |
| 6 | 192 | 192 | 256 | 256 |
| 7 | 192 | 192 | 256 | 256 |

Redundant External Power Supply (EPS)

The EPS is a three-output power supply. Each output power supply can drive 12 V/100 W for system power and 54 V/370 W for PoE power. The EPS supports hot plugging of the cables while the device is powered.

The Brocade ICX 6450-48P has two EPS connectors to support full PoE+ on all ports.

Table 6 shows the internal wattage for each PoE-capable version of the Brocade ICX 6430 and 6450 switches, as well as the number of PoE+ ports supported with only the internal power supply and the number of ports with the EPS connection.

Table 6. Brocade ICX 6430 and 6450 EPS Support

| SKU | Internal PSU Capacity | Number of EPS Connections Supported* | PoE+ Ports Supported without EPS | PoE+ Ports Supported with EPS |
|-----------------|-----------------------|--------------------------------------|----------------------------------|---------------------------------|
| ICX 6430-24-PoE | 525 W | 1 | 12 | 24 with 1 EPS |
| ICX 6430-48-PoE | 525 W | 1 | 12 | 24 with 1 EPS |
| ICX 6450-24-PoE | 525 W | 1 | 12 | 24 with 1 EPS |
| ICX 6450-48-PoE | 880 W | 2 | 24 | 36 with 1 EPS and 48 with 2 EPS |

*With 12 V/100 W for the main board and 54 V/370 W for the PoE module

Stacking

Table 7 shows the optics that are supported by the Brocade ICX 6430 and ICX 6450, as well as their stacking distance capabilities.

Table 7. Brocade ICX 6430 and ICX 6450 Optics and Stacking Distance

| Optics | Uplink Distance (Max) | Horizontal Stacking Distance (Max) | |
|-------------------------|-----------------------|------------------------------------|------------------|
| | | Brocade ICX 6430 | Brocade ICX 6450 |
| E1MG-TX (non OM) | 100 m | 100 m | |
| E1MG-SX-OM | 550 m | 100 m | |
| 10G-SFPP-USR | 100 m | | 100 m |
| 10G-SFPP-SR | 300 m | | 100 m |
| 10G-SFPP-LRM OM3 (only) | 220 m | | 100 m |

All Brocade ICX 6400 platforms support stacking, but there are some limitations:

- Starting with release 8.0, a mixed stack can be created with Brocade ICX 6610 and Brocade ICX 6450 switches. For more information on mixed stacking, refer to the Brocade HyperEdge™ Deployment Guide and the Brocade HyperEdge Design Guide.
- Brocade ICX 6450s can stack with other ICX 6450s, but not with Brocade ICX 6430s. As of release 7.4.00a, 24-port Brocade ICX 6430s can stack with 48-port ICX 6430s.
- A new feature called Image Mismatch Auto Copy automatically copies the master running image to the mismatched member in the stack, along with the image signature.
- 10 GbE Ports on Demand (PoD) licenses are required to operate Ports 2 and 4 of the Brocade ICX 6450 in 10 GbE mode. This license is also required to operate the stack trunks feature.
- The Brocade ICX 6430-C12 does not stack.
-

APPENDIX A. COMMON MONITOR COMMANDS AND THEIR U-BOOT EQUIVALENTS

| MONITOR Command (Predecessor) | U-Boot Command (New for Brocade ICX 6400) | Functionality |
|--------------------------------------|--|--|
| NA | boot | Boots from the preconfigured partitioned set from the FI shell |
| "boot system flash primary " | "boot_primary" | Boots from the primary image |
| "boot system flash secondary " | "boot_secondary" | Boots from the secondary image |
| "copy tftp flash <server> boot" | "update_boot" | Loads U-boot image from tftp to flash |
| "copy tftp flash <server> primary" | "update_primary" | Loads FI image to primary partition from tftp server |
| "copy tftp flash <server> secondary" | "update_secondary" | Loads FI image to secondary partition |
| (Not supported) | "tftpboot <file_name>" | Loads the file from tftp server and boots the same. |
| "md" | "dd" | Displays memory |
| "ping <ipaddress>" | "ping <ipaddress>" | Pings to the IP address |
| ip | setenv serverip <tftpserver IP> setenv ipaddr <system OS IP> setenv <gateway> <netmask> setenv ethact egig0 | These steps are required only if user wants to load images from within U-boot and for remote debugging (developers only). <System OS IP> is different from OOB mgmt IP set from FI shell. |
| "reset" | "reset" | Resets the system |
| erasesector | erase | Erases flash memory |
| no password | no password | Skips password check when entering privilege mode |
| use default-configuration | use default-configuration | Loads FI with no configuration |
| ? | help | Lists all the commands |

APPENDIX B. SCALABILITY NUMBERS

| Feature | Brocade ICX 6450 | Brocade ICX 6430 |
|--------------------------------|---------------------|---------------------|
| L2 lookup | 16,000 | 8000 |
| IGMP snooping/multicast groups | 4,000 | 256 |
| Port-based VLAN | 4,096 | 4,096 |
| Ports per trunk | 8 | 8 |
| Max trunk groups | 124 | 29 |
| VSRP | 128 | 128 |
| 802.1s | 16 | 16 |
| STP/RSTP | 253 | 32 |
| Topology groups | 254 | 30 |
| MAC-based VLANs | 32 clients per port | 32 clients per port |
| MAC port security | 64 | 64 |
| MAC filter groups | 256 | 256 |
| Buffer memory | Up to 3MB | Up to 2 MB |
| Descriptors | 6,000 | 4,000 |

APPENDIX C. KEY DIFFERENCES BETWEEN THE BROCADE FASTIRON WS, BROCADE ICX 6450, AND BROCADE FCX

Feature breakdown for related devices to the ICX 6450.

| Feature | Brocade FastIron WS | Brocade ICX 6450 | Brocade FCX |
|--------------------------------------|---------------------|------------------|-------------|
| IPv4 host routes, static routes | Yes | Yes | Yes |
| RIP V1/V2 | Yes | Yes | Yes |
| RIP ECMP | No | Yes | Yes |
| OSPF V2 | No | Yes | Yes |
| VRRP/VRRP-E | Yes | Yes | Yes |
| Virtual interfaces | Yes | Yes | Yes |
| Rate limiting to CPU | Yes | Yes | Yes |
| Fragmentation/MTU support | No | Yes | Yes |
| L3 stacking | No | Yes | Yes |
| Hitless/hotswap for layer 3 stacking | No | Yes | Yes |
| IPv6 host support (data ports) | No | Yes | Yes |
| IPv6 static routes | No | Yes | Yes |

Scalability numbers of related devices to the ICX 6450.

| HW Table Size | Brocade FastIron WS | Brocade ICX 6450 | Brocade FCX |
|---------------|-------------------------------------|-------------------|-------------------|
| Route TCAM | 1024 shared between routing and PCL | 13 K routing TCAM | 16 K routing TCAM |
| ARP | 1 K | 4 K | 64000 |
| Next hop | Not available | 4 K | 12 K |

Key Feature Differences

The Routing TCAM for the Brocade ICX 6450 is as below:

| | |
|---------------------|-------|
| IPv4 Dynamic Routes | 12000 |
| IPv4 Host Routes | 456 |
| IPv6 Dynamic Routes | 164 |
| IPv6 Host Routes | 50 |

Key Hardware Table Size Differences

| Software Feature Limits (MAX) | Brocade FastIron WS | Brocade ICX 6450 | Brocade FCX |
|-------------------------------|---------------------|------------------|-------------|
| IP Routes | 1000 | 12000 | 15168 |
| Static Routes | 1020 | 2048 | 2048 |
| RIP/OSPF Routes | 1000 | 12000 | 15168 |
| Max ECMP Paths | 2 | 8 | 8 |

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