Modular, Chassis-Based Switching Routers for Campus, MAN and LAN/WAN Environments

Delivers up to 64 Gigabit Ethernet Ports and 96,000,000 pps Non-blocking Performance

Provides Hardware-Based Layer 2/3/4 Switching, Multi-Protocol Routing, VRRP Redundancy, over 1,000,000 BGP4 Routes and Packet over SONET

Includes VLANs, 4 Levels of QoS, Server Multi-Homing, Inter-Switch Trunk Groups and IP Multicast Support

Gigabit Ethernet up to 150 km

10 Gigabit Ready for Full Investment Protection

BIGIRON SWITCHING ROUTERS

Foundry Networks' award-winning BigIron product family, including the four-slot BigIron 4000 and eight-slot BigIron 8000 chassis, delivers a new level of high-performance capabilities for enterprise and service provider networks. BigIron's unique IronCore ASIC architecture delivers hardware-based distributed switching and routing that increases the availability of network bandwidth to accommodate the next generation of applications based on data and voice integration, multicast-based video, and other emerging technologies. By providing high performance throughput from the wiring closet into the data center and out to the edge of the WAN, BigIron's non-blocking architecture enables network managers to build scalable and highly available network designs. BigIron delivers the industry leading performance, price/performance and high-density 10/100/1000 Mbps connectivity. BigIron is also the only chassis that has been 10 Gigabit Ethernet ready since the day it started shipping in 1998. BigIron includes these features:

- 64 ports of non-blocked Gigabit Ethernet
- 256 Gbps of distributed switching capacity that delivers 96,000,000 packets per second (pps) throughput
- Hardware-based IP and IPX switching and routing
- Full multiprotocol support including:
  - IP, IPX, AppleTalk
  - PIM-SM, PIM-DM, DVMRP
  - RIP, RIP2, OSPF, BGP4
- Dynamic VLANs based on:
  - Port
  - Protocol
  - Subnet
- 4,096 IEEE 802.1q VLANs
- 4 hardware prioritized output QoS queues per port adjustable for:
  - Weighted Fair Queuing (WFQ)
  - Strict Priority (SP)
  - 802.1p queue mapping
- Policy-based Traffic Classification on:
  - ToS (Type of Service)
  - IP precedence mappings
  - Layer 2/3/4 defined traffic flows
- Redundant Management Modules
- Hot-swappable, Load-sharing AC and DC Power Supply Options

- Extensive Management Options:
  - Industry-standard Command Line Interface (CLI)
  - IronView Network Management (standalone and HP OpenView GUI)
  - Telnet
  - Web Browser-based GUI
- Robust security and wire-speed Access Control Lists (ACLs) and Extended ACLs for:
  - Denial of Service (DoS) protection from TCP SYN Attacks and Smurf Attacks
  - AAA, RADIUS, TACACS/TACACS+ Authentication
  - Multiple SyslogD Server Logging
- 10 Gigabit Ethernet Ready – no backplane upgrade required.

BigIron Key Features

High Performance Desktop Connectivity

BigIron delivers the industry's largest switching capacity of 256 Gbps that powers today's networking infrastructure. With this capacity, the BigIron can easily handle 64 non-blocking Gigabit Ethernet ports at a peak performance of 96,000,000 packets per second (pps) – delivering more than 100 times the performance of today's switches and routers at a much lower price. Many of the world's largest networking environments today use BigIron to pass thousands of terabytes of data on a daily basis.

High density switched 10/100 Mbps auto-negotiating auto sensing Ethernet ports and high-performance Gigabit Ethernet connectivity ensures that BigIron provides non-blocked wire-speed performance to every desktop. Port selectable Layer 2 or Layer 3 switching functionality means that BigIron provides a complete solution for enterprise desktops requiring line rate IP or IPX, as well as full multiprotocol support including AppleTalk. Enterprise, Internet and Application Service Providers (ISPs & ASPs) can rapidly deploy new Internet business applications by turning on BigIron's built-in hardware capabilities. In addition, Foundry's IronWare, the software that powers BigIron's robust features, contains true Internet industry-strength multiprotocol support that can process millions of BGP4 routes from hundreds of peers.

Ironclad QoS

Every BigIron port has four hardware-based adjustable priority queues. IronClad QoS working in conjunction with Foundry's traffic classification algorithms and wire-speed Access Control Lists (ACLs) gives the network administrator full control over traffic flows within and through a system of Foundry Networks devices. Classify traffic on the following attributes:

- Incoming (ingress) port
- IP Source/Destination address
- TCP/UDP port or socket
- MAC address
- AppleTalk socket number
- VLAN membership
- 802.1p tag
- Type of Service (ToS)

The network manager can choose between setting the system to operate using strict priority (SP) or Weighted Fair Queuing (WFQ). In SP, all higher priority traffic is serviced before the lower priority traffic, which can result in bandwidth starvation. In WFQ, all queues service traffic according to the weighted value settings, which means that all queues receive service and avoid bandwidth starvation.

Assignable WFQ weightings ensure the allocation of minimum bandwidth (delivered under full load) for each of the four priority queues. When the network administrator asks for or modifies the particular bandwidth for one of the priority queues, the management interface (CLI, GUI, or IronView application) responds back with the "normalized" setting adjusted for all four priority queues. Modifying one of the queues affects all the other queues.

In addition, the network administrator can reassign all the 802.1p priorities to specific queues as well as prioritize voice over IP traffic based on IP ToS field settings.

Dynamic VLANS

Using dynamic VLANs, a powerful feature supported on all of Foundry's products, network administrators can simplify network address administration and increase available bandwidth by logically assigning users to virtual communities of interest based on a port, protocol, subnet, or 802.1q basis.

- Port-based VLANs group users into different broadcast domains.
- Protocol-based VLANs define more granular VLAN communities based on AppleTalk, IP, IPX, DECnet, NetBIOS, or other protocol types. Membership can be determined automatically.
- Subnet-, Network-, and AppleTalk cable-based VLANs create even finer community definitions within a protocol.

IEEE 802.1q VLAN tagging enables the creation of standards based, vendor interoperable virtual LANs that span multiple devices.

Integrated Switch Routing (ISR)

To reduce the dependency on external routers, Foundry Networks' Integrated Switch Routing (ISR) feature enables VLANs configured on switching routers to route Layer 3 traffic from one protocol VLAN or IP subnet, IPX network, or AppleTalk cable VLAN to another VLAN using virtual interfaces (VEs). A virtual interface is a logical port on which you can configure Layer 3 routing parameters. This feature helps reduce the complexity of the network design when implementing VLANs by allowing network administrators to quickly respond to organizational changes without the added burden of additional equipment.

Extensive Spanning Tree Capabilities

Spanning Tree Protocol (STP) running on switches delays message forwarding during the spanning tree recalculation period following a topology change. This slow convergence is undesirable and unnecessary in some circumstances. Foundry Networks' STP enhancements include Fast Port Span, Fast Uplink, and Single and Multiple-Instance STP to help eliminate the delay and network complexity introduced by STP.

The Fast Port Span feature allows certain ports to enter the forwarding state in four seconds. Specifically, Fast Port Span allows faster convergence on ports that are attached to end stations and thus do not present the potential to cause Layer 2 forwarding loops. Because the end stations cannot cause forwarding loops, they can safely go through the STP state changes (blocking to listening to learning to forwarding) more quickly than is allowed by the standard STP convergence time. Fast Port Span performs the convergence on these ports in four seconds (two seconds for listening and two seconds for learning).

You can use the Fast Uplink feature on a Foundry device deployed as a wiring closet switch to decrease the convergence time for the uplink ports to another device to just four seconds (two seconds for listening and two seconds for learning). The wiring closet switch must be a Foundry device but the device at the other end of the link can be a Foundry device or another vendor's switch. Configuration of the Fast Uplink Span feature takes place entirely on the Foundry device.

Single-instance STP enables network managers to configure a single instance of the Spanning Tree Protocol (STP) to run on all the port-based VLANs on a device. The single STP feature is especially useful for connecting a Foundry device to third-party devices that run a single spanning tree in accordance with the 802.1q specification.

Hardware-Based Multicast Support

BigIron offers industry leading hardware-based multicast support that allows network managers to efficiently deploy applications such as video on demand. Foundry's Internet Group Membership Protocol (IGMP) multicast traffic reduction feature forwards a single copy of a transmission only to requesting ports. This reduces overall network traffic, improving performance while conserving bandwidth.

Foundry's ASICs are unique in their ability to recognize the multicast join and leave messages embedded in the multicast traffic flows at the port level, without having to send the traffic to a management processor for handling.

Network managers can easily create a network that can sustain and intelligently forward multicast traffic throughout the network. With the BigIron's support for various multicast routing protocols including DVMRP, PIM-SM (Sparse Mode) and PIM-DM (Dense Mode), network managers can easily design a network that can provide video on demand services, or multicast-based voice and video applications – without any detrimental effect to the network.

Access Control Lists and Security

Foundry Networks products offer hardware-based wire-speed Access Control Lists (ACLs), which enable network administrators to add granular bandwidth control by applying permit or deny filters to traffic based on source and destination IP address, IP protocol information, or TCP or UDP protocol information. You can configure the following types of ACLs:

- Standard – Permits or denies packets based on source IP address.
- Extended – Permits or denies packets based on source and destination IP address and based on other information, including:
  - Source/Destination host names
  - IP Subnet and Range
  - Source/Destination TCP or UDP port/socket
  - Well known port numbers (0-1023)

For ease of migration, it is possible to cut/copy/paste from Cisco ACLs into Foundry BigIron ACLs.

In addition to ACLs, the BigIron adds security features that protect the network against Denial of Service (DoS) conditions such as TCP SYN or Smurf attacks. These features help by eliminating unnecessary network downtime caused by malicious hacker attacks.

Carrier Class Reliability and Redundancy

Along with ISP-strength routing protocol scalability, BigIron offers users high capacity routing fault tolerance with the Management III and Management IV modules. Management III modules include 128 MB of SDRAM and a PowerPC 400 MHz processor. Management IV modules include 256 MB of SDRAM, a PowerPC 466 MHz processor, dual PCMCIA Type II slots, and an 80-MB flash card for configuration and control. For large environments, the network administrator can increase the memory up to 512 MB of SDRAM to support literally millions of routes with hundreds of peers.

With these capabilities, ISPs can define optimal paths to a destination based on policies that use IP address, autonomous system or community information. Grouping traffic preference on a larger basis enables route aggregation and allows one route to represent the characteristics of many within a network. The aggregation capability results in significantly decreased bandwidth requirements and reduced transmission costs.

Management III and Management IV modules are hot swappable with sub-second fault detection and fail-over. This ensures application uptime by automatically and transparently moving traffic to a backup management module in the event of a network outage. The redundant management modules also contain a configurable temperature sensor that sends a Syslog message and SNMP trap if the temperature on the module exceeds a specified warning level. The temperature sensor can also shut the module down automatically to prevent damage.

In addition, to ensure that a default gateway always exists even in the event of a major network outage, ISPs can enable protocol-based high-availability solutions using Foundry Standby Router Protocol (FSRP) and IETF Virtual Router Redundancy Protocol (VRRP).

While the BigIron 4000 chassis supports dual load sharing power supplies, only one is required to power a fully configured chassis. The BigIron 8000 chassis supports four load balancing and load sharing power supplies. Two power a fully configured 8-slot chassis with the third providing load sharing capabilities and the fourth enabling N+1 redundancy. Network administrators can also configure the chassis with both AC and DC power supplies, which enable the BigIron chassis to conform to any type of power requirement the ISP wishes to establish.

All interface modules within a BigIron chassis are hot swappable. This feature allows network administrators to easily install or remove modules within a BigIron without affecting other customers that are connected to the same chassis.

Finally, Foundry's Packet over SONET/SDH (PoS) modules support Bellcore's (now Telcordia Technologies) Automatic Protection Switching (APS). This feature allows for port-to-port switchover within the same module, across modules, or across two BigIrons within 50 ms, without any need for any routing protocol re-computation.

BigIron Interface Options

BigIron provides a full range of Ethernet and Gigabit Ethernet interface modules including:

- 24-port 10/100Base-TX
- 24-port 100Base-F

- 2-, 4-, and 8-port 1000Base-SX
- 2-, 4-, and 8-port 1000Base-LX
- 2-, 4-, and 8-port 1000Base-LH (Supporting Long Haul links up to 150 Km)
- 8-port 1000Base-T

BigIron also provides a full range of WAN interface modules including:

- 2- and 4-port Packet over SONET/SDH OC-3c
- 2-port Packet over SONET/SDH OC-12c
- 2-port Packet over SONET/SDH OC-48c

BigIron Architecture

The BigIron is a compact high performance Layer 3 Switch built on a fully non-blocking architecture that can sustain tomorrow's mission critical Internet traffic today. The BigIron chassis consists of distributed switching modules (built upon the IronCore ASICs) and a parallel crosspoint switch fabric that together provide up to 256 Gbps of total switching capacity, with 128 Gbps of throughput and 96,000,000 pps forwarding performance.

The IronCore ASICs on each interface module provide a high bandwidth, shared memory system that switches up to 32 Gbps of bandwidth for a total system switching capacity of 256 Gbps.

The local switching fabric houses the forwarding engines and provides packet level examination and classification based on Layer 2/3/4 information and performs IP subnet look-ups and packet modifications of IP and IPX packets. Additionally, each interface module has an 8 Gbps full-duplex data path to the crosspoint fabric that provides separate priority queues for each module destination.

The combination of local switching interface modules and the non-blocking parallel cross-point switch fabric delivers a two-level switching system that easily scales up to 64 Gigabit Ethernet ports. To ensure compatibility with existing infrastructures and provide long-term investment protection, the BigIron architecture can support a full range of interfaces including 10/100/1000 Mbps to 10 Gbps Ethernet as well as OC-3c up to OC-192c Packet over SONET/SDH (PoS).

Network Core

Figure 1 depicts a typical Enterprise Campus network environment with redundant BigIron 4000s and 8000s deployed in the backbone connecting the Data Center to the rest of the campus (Distribution). Network administrators can guarantee high availability by dual homing the connections to the core and using multiple Gigabit Ethernet connections or Trunk Groups. Using OSPF with ECMP enables a networking core that delivers fault tolerant and load balanced bandwidth.

By adding traffic classification and prioritization, the network manager can use Weighted Fair Queuing (WFQ) and Access Control Lists (ACLs) to guarantee bandwidth for critical applications.

With the added ability to support up to 64 ports of Gigabit Ethernet in a single chassis, placing BigIron at the core of the network establishes a solid networking foundation that offers the highest port growth possible in a single device. The high Gigabit port density and rich redundancy features of the BigIron chassis make it ideal for the network core. The multiprotocol, wire-speed Layer 3 capabilities ensure that high traffic volumes that traverse the backbone do not degrade network performance.

Wiring Closet Connectivity

Deployed in the wiring closet, BigIron 4000s and 8000s support connectivity for high-performance end stations using dedicated 100 Mbps or Gigabit Ethernet connections. For added bandwidth and redundancy, the network manager can allocate up to four 100 Mbps links into a single, redundant connection, which provides for more bandwidth and adds an additional level of link protection not offered by a single network connection.

In addition, the network administrator can deploy up to eight cross-module trunk ports and implement OSPF with ECMP to provide many varied levels of fault tolerance and load balancing capabilities between the different floors and on links to remote locations (in the event the BigIron connects to the Metropolitan Area Network).

By using Foundry's extensive and dynamic VLAN capabilities, the network administrator can create up to 4,096 different types of VLANs to simplify network design and configuration. BigIron enables the dynamic creation of VLANs on a port, protocol, and subnet basis.

FIGURE 1 | ENTERPRISE - CAMPUS NETWORK

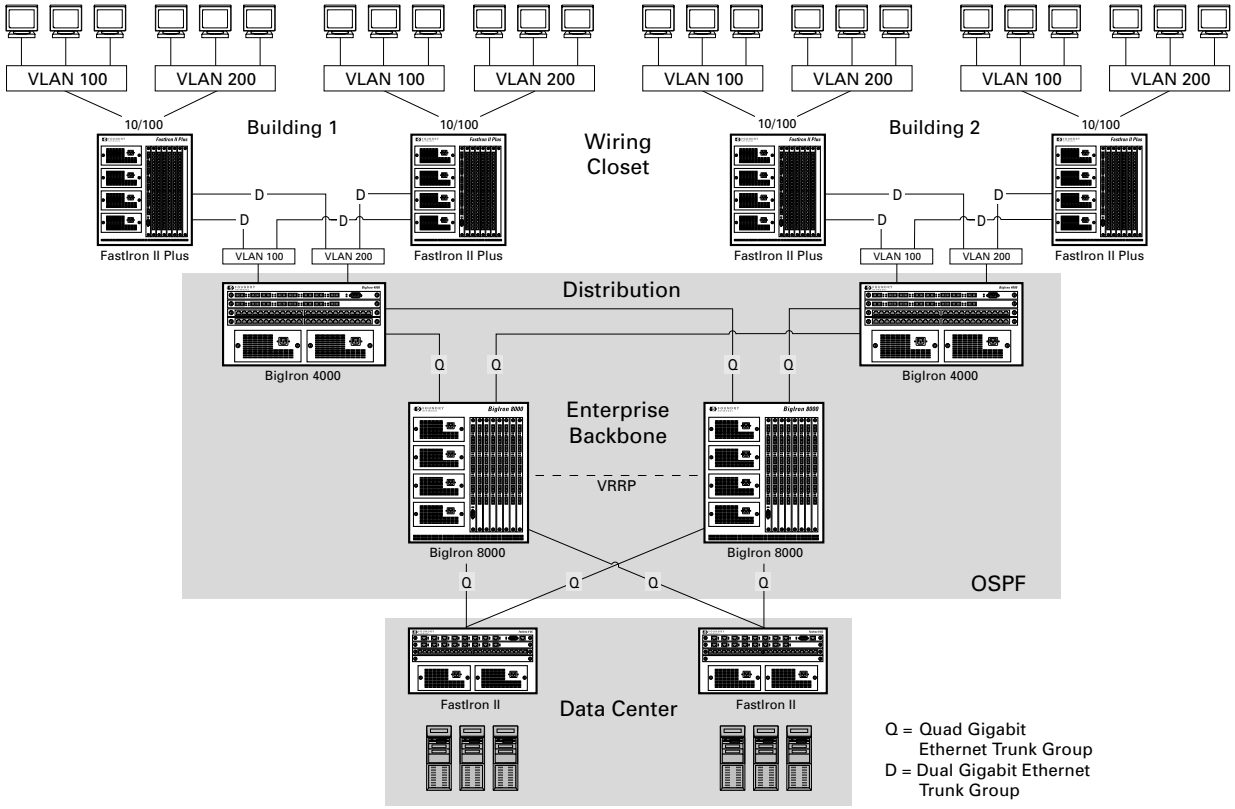
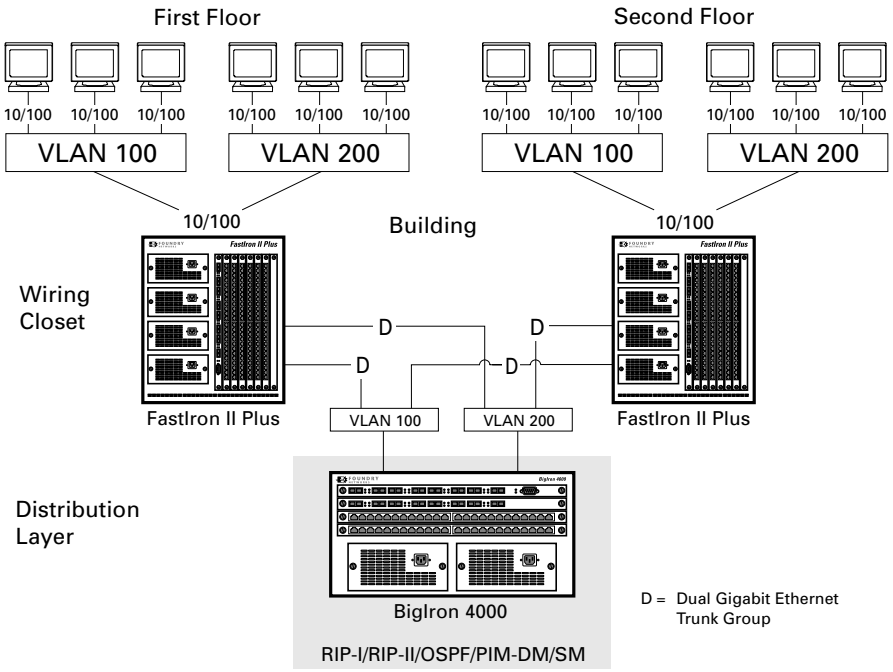


FIGURE 2 | WIRING CLOSET CONNECTIVITY



Ordering Information

Model Number	Description
BigIron	
B4000	BigIron 4000, 4-slot chassis with one (1) RPS3 Power Supply included
B4000-DC	BigIron 4000, 4-slot chassis with one (1) RPS3DC (48VDC) Power Supply included
B8000	BigIron 8000, 8-slot Chassis with one (1) RPS3 Power Supply included
B8000-DC	BigIron 8000, 8-slot Chassis with one (1) RPS3DC Power Supply included
Modules – Management I	
B8GM	BigIron Management Module with 8-ports Gigabit Ethernet Fiber (SX optics)
B8GM-2LX	B8GM with two (2) LX (single-mode Fiber) & six (6) SX (Multimode Fiber) Gig Optics
B8GM-4LX	B8GM with four (4) LX (single-mode Fiber) & four (4) SX (Multimode Fiber) Gig Optics
B8GM-8LX	B8GM with eight (8) LX (single-mode Fiber) Gig Optics
B8GCM	BigIron Management Module with 8-ports Gigabit Copper (1000BaseT, RJ45)
B4GM	BigIron Management Module with 4-port Gig Optics (SX optics)
B4GM-2LX	B4GM with two (2) LX (single-mode Fiber) & two (2) SX (Multimode Fiber) Gig Optics
B4GM-4LX	B4GM with four (4) LX (single-mode Fiber) Gig Optics
B16EM	BigIron Management Module with 16-port 10/100 Ethernet (RJ45)
Modules – Management II	
BZGMR	BigIron Management II Module without any ports (Management Processor function only).
B8GMR	BigIron Management II Module with 8-port Gig Optics (SX optics, for 50 or 62.5ms Multimode Fiber, SC Connectors)
B8GMR-2LX	B8GMR with two (2) LX (single-mode Fiber) & six (6) SX (Multimode Fiber) Gig Optics
B8GMR-4LX	B8GMR with four (4) LX (single-mode Fiber) & four (4) SX (Multimode Fiber) Gig Optics
B8GMR-8LX	B8GMR with eight (8) LX (single-mode Fiber) Gig Optics
BMR256-FC	256MB System DRAM option
Modules – Management III	
BZGMR3	BigIron Management III Module without any ports (Management Processor function only)
B8GMR3	BigIron Management III Module with 8-port Gig Optics (SX optics, for 50 or 62.5ms Multimode Fiber, SC Connectors)
B8GMR3-2LX	B8GMR3 with two (2) LX (single-mode Fiber) & six (6) SX (Multimode Fiber) Gig Optics
B8GMR3-4LX	B8GMR3 with four (4) LX (single-mode Fiber) & four (4) SX (Multimode Fiber) Gig Optics
B8GMR3-8LX	B8GMR3 with eight (8) LX (single-mode Fiber) Gig Optics
BMR256-FC	256MB System DRAM option
LAN Modules	
B8G	BigIron Gigabit Module, 8-port Gig Optics Module
B8G-2LX	B8G with two (2) LX (single-mode Fiber) & six (6) SX (Multimode Fiber) Gig Optics
B8G-4LX	B8G with four (4) LX (single-mode Fiber) & four (4) SX (Multimode Fiber) Gig Optics
B8G-8LX	B8G with eight (8) LX (single-mode Fiber) Gig Optics
B8GC	BigIron Gigabit Copper (1000BaseT) Module
B24E	24-port 10/100BaseTX(RJ45) Ethernet Module
B24FX	24-port Fast Ethernet 100BaseFx Fiber Module with MT-RJ Connectors
WAN Modules	
B2P155	BigIron 2-port Packet over SONET/SDH OC-3/155Mbps, Multimode Short Reach optics
B2P155-SM	BigIron 2-port Packet over SONET/SDH OC-3/155Mbps, Single-mode Intermediate Reach optics
B4P155	BigIron 4-port Packet over SONET/SDH OC-3/155Mbps, Multimode Short Reach optics
B4P155-SM	BigIron 4-port Packet over SONET/SDH OC-3/155Mbps, Single-mode Intermediate Reach optics
B2P622	BigIron 2-port Packet over SONET/SDH OC-12/622Mbps, Multimode Short Reach optics
B2P622-SM	BigIron 2-port Packet over SONET/SDH OC-12/622Mbps, Single-mode Intermediate Reach optics
Accessories	
10122-000	FastIron II/BigIron Blank Module Slot Panel
70067-000	FastIron II/BigIron 4000 4-slot chassis Rack Mount Kit
70067-100	FastIron II Plus/BigIron 8000 8-slot chassis Rack Mount Kit
30095-001	FastIron II/BigIron 4000 4-slot chassis Card Cage Fan Tray Assembly
30204-000	FastIron II/BigIron 4000 4-slot chassis Rear Panel Fan Assembly
30095-100	FastIron II Plus/BigIron 8000 8-slot chassis Card Cage Fan Tray Assembly
30205-000	FastIron II Plus/BigIron 8000 8-slot chassis Rear Panel Fan Assembly

Technical Specifications

Performance

BigIron 4000: Up to 48,000,000 packets per second
BigIron 8000: Up to 96,000,000 packets per second

Switching Capacity
BigIron 4000: Up to 128 Gbps
BigIron 8000: Up to 256 Gbps

Standards Compliance
802.3, 10BaseT
802.3u 100BaseTX, 100BaseFX
802.3z 1000BaseSX
802.3z 1000BaseLX
802.3x Flow Control
802.1p/q VLAN Tagging
802.1d Bridging
802.3 Ethernet Like MIB
Repeater MIB
Ethernet Interface MIB
SNMPV1, V2c
SNMP MIB II

Protocol Support
BGP4 (RFC 1771, RFC 1745, and RFC 1997)
IP (RFC 1812)
RIP (RFC 1058)
RIP V2 (RFC 1723)
OSPF (Interoperability with RFC 1583 and RFC 2328 V2)
OSPF Traps (RFC 1850)
IPX/RIP/SAP
AppleTalk
IGMP (RFC 1112)
DVMRP V3
VRRP (RFC 2338)
Foundry Standby Router Protocol (FSRP)
DNS Client
PIM Dense and Sparse Mode (RFC 2362)
ICMP Router Discovery Protocol (RFC 1256)
BGP4 (RFC 1771)
BGP4/IDRP for IP - OSPF Interactions (RFC 1754)
BGP3 MIB (RFC 1269)
IP forwarding table MIB (RFC 1354)
PPP over SONET (RFC 1619)
PPP in HDLC-like framing (RFC 1662)
TFTP (RFC 783)
BootP (RFC 1542)
BootP (RFC 951)
Telnet (RFC 854)
RMON Groups 1,2,3,9 (RFC 1757)
HTTP (RFC 2068)
BootP/DHCP Relay (RFC 2131)

Network Management
Integrated Command Line Interface
Telnet
SNMP
RMON
HP OpenView for Sun Solaris, HP-UX, IBM's AIX, and Windows NT
Standalone Windows NT
Embedded HTTP (supports Netscape or Internet Explorer browsers)

Element Security Options:
AAA
Radius
Secure Shell (SSH v1)
TACACS/TACACS+
Username/Password (Challenge and Response)
Bi-level Access Mode (Standard and EXEC Level)
Repellant for TCP SYN or Denial of Service or Smurf Attacks

BigIron 4000 Physical Dimensions
8.75"h x 17.5"w x 15"d (22.2 x 44.5 x 38.1 cm)
Weight: 60 lbs fully loaded (29.9 kg)

BigIron 8000 Physical Dimensions
20.75"h x 17.5"w x 15.25"d (52.7 x 44.5 x 38.7 cm)
Weight: 117 lbs fully loaded (43.7 kg)

Power Requirements
90-250 VAC, 5.5A, 50-60Hz per auto-sensing, auto-switching power supply

Environmental
Operating Temperature: 0 to 40° C (41° to 104° F)
Relative Humidity: 10 to 80%, @ 40° C (104° F), non-condensing
Maximum BTUs for fully populated BigIron 4000: 4552
Maximum BTUs for fully populated BigIron 8000: 9000
Storage Temperature: -40° to 70° C (-40° to 158° F)
Storage Humidity: 90% @ 65° C (149° F), non-condensing
Storage Altitude: 10,000 ft (3,000 m) maximum
Shock and Vibration: EN60068 (IEC68)

Safety Agency Approvals
EN 60950/IEC 950
UL 1950
CSA 950

Electromagnetic Emission Certification
FCC Class A
EN 55022/CISPR-22 Class A; VCCI Class A

Immunity
Generic: EN 50082-1
ESD: IEC 61000-4-2; 4 kV CD, 8 kV AD
Radiated: IEC 61000-4-3; 3 V/m
EFT/Burst: IEC 61000-4-4; 1.0 kV (powerline), 0.5 kV (signal line)
Conducted: IEC 61000-4-6;3 V

Warranty
1 year hardware
90 days software

Mounting Options
19" Universal EIA (telco) Rack
Tabletop

Specifications subject to change without notice.

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