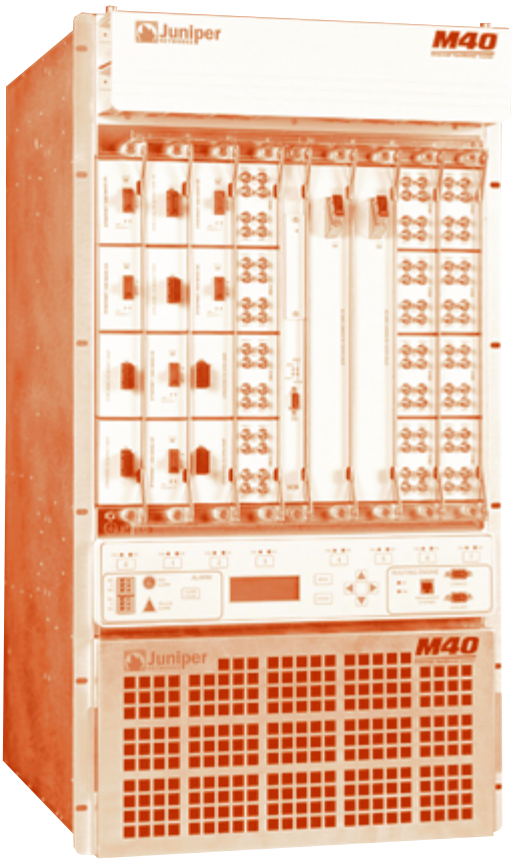
Juniper NETWORKS

DATASHEET

M40 Internet Backbone Router

The M40 router puts you ahead of the technology curve to meet both today's and tomorrow's service provider requirements.

- *Predictable performance for all packet sizes under all network conditions*
- *Reliability for mission-critical traffic*
- *Rich packet processing for superior traffic management*
- *Flexible routing policy language for greater control over network operations*



The M40 router offers global connectivity and reliable IP service delivery while supporting rich packet processing, such as filtering, rate limiting, and sampling.

The M40 Internet backbone router is designed specifically for the needs of high-growth service providers. It features uncompromising forwarding performance, rich packet processing, reliable IP service delivery, unparalleled port density and flexibility, and best-in-class JUNOS Internet software. The M40 router delivers the bandwidth required to cost-efficiently grow networks to OC-48c/STM-16 speeds, while also offering powerful tools, such as packet filtering, sampling, and MPLS traffic engineering, to ensure greater control during network expansion.

PC MAGAZINE Technical Innovation Awards 1999

DataComm MAGAZINE TESTER'S CHOICE SEPTEMBER 1999

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Advantages

Features	Benefits
Architecture	
Highly integrated ASIC forwarding	■ Oversized ASICs designed to perform lookups at a rate of 40 Mpps. ■ Throughput rate of 40+ Gbps. ■ Scales well with large, complex forwarding tables. ■ Full utilization of expensive circuits. ■ Packet size does not affect forwarding performance. ■ Rock solid system stability. ■ Lower part count for high reliability.
Routing and forwarding performance cleanly separated	■ Routing fluctuations and network instability do not impede packet forwarding. ■ Rapid convergence. ■ Reliable and predictable performance for latency sensitive traffic, such as voice over IP and streaming video multicasting.
Single-stage buffering	■ Eliminates head-of-line blocking. ■ Efficiently uses available interface bandwidth. ■ Optimal support for multicast traffic. ■ Reduces latency by requiring only one write to and one read from shared memory.
Features are implemented in ASICs	■ Industry-leading performance with value-added IP services enabled.
Field replaceable Flexible PIC Concentrators and power supplies	■ Increases system serviceability and availability. ■ Decreases mean time to repair (MTTR).
JUNOS Internet software deployed in the largest and fastest growing networks	■ Proven performance and reliability.
Interfaces	
Market-leading port density	■ Efficient use of POP rack space. ■ Future growth not limited by space.
Fine granularity of interchangeable interfaces	■ Flexibly deployed in multiple environments, including core, peering, high-speed access, and hosting. ■ Lowers the cost of entry configurations.
Environment	
Maximum chassis power of 35 A @ 48 V	■ Efficient use of POP power (<1 Amp/rack inch). ■ Lowers POP cooling requirements.
Customer Services	
Flexible and comprehensive support packages	■ Increases network availability. ■ Eases network configuration and deployment. ■ Flexibility to fit your business model. ■ Worldwide 24x7x365 access.
Professional consulting	■ Eases network planning and configuration. ■ Adds expertise to on-site engineering team.
Product and technology training	■ Provides hands-on configuration experience. ■ Increases product and network design knowledge.

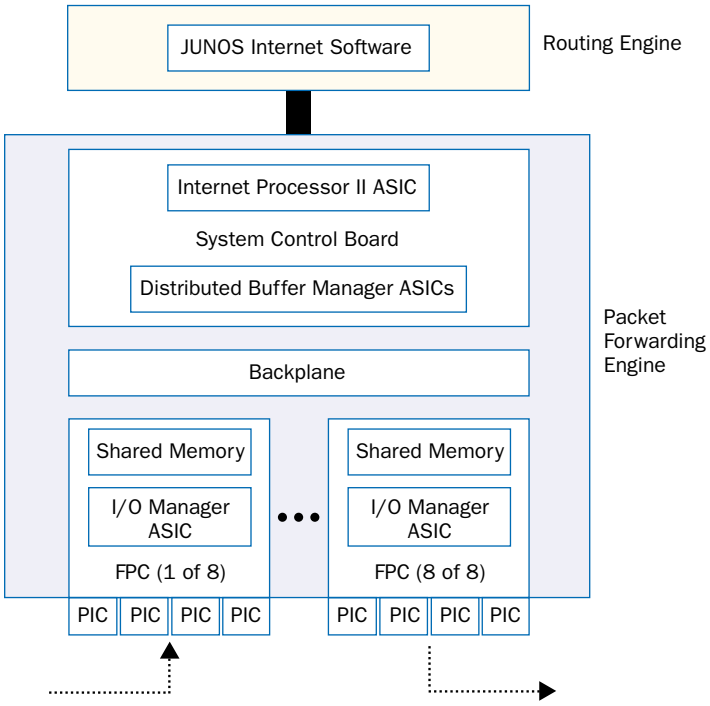
Architecture

The two key components of the M40 architecture are the Packet Forwarding Engine (PFE) and the Routing Engine, which are connected via a 100-Mbps link. Control traffic passing through the 100-Mbps link is prioritized and rate limited to help protect against denial-of-service attacks.

- The PFE is responsible for packet forwarding performance. It consists of the Flexible PIC Concentrators (FPCs), physical interface cards (PICs), System Control Board (SCB), and state-of-the-art ASICs.
- The Routing Engine maintains the routing tables and controls the routing protocols. It consists of an Intel-based PCI platform running JUNOS software.

The architecture ensures industry-leading IP service delivery by cleanly separating the forwarding performance from the routing performance. This separation ensures that stress experienced by one component does not adversely affect the performance of the other since there is no overlap of required resources.

Logical View of M40 Architecture



Leading-edge ASICs

The feature-rich M40 ASICs deliver a comprehensive hardware-based system for packet processing, including route lookups, filtering, sampling, rate limiting, load balancing, buffer management, switching, encapsulation, and de-encapsulation functions. To ensure a non-blocking forwarding path, all channels between the ASICs are oversized, dedicated paths.

Internet Processor II ASIC

The Internet Processor II ASIC supports a lookup rate of over 40 Mpps. With over one million gates, the Internet Processor II ASIC delivers high-speed forwarding performance with advanced IP services, such as filtering and sampling, enabled. It is the largest, fastest, and most advanced ASIC ever implemented on a router platform and deployed in the Internet.

Distributed Buffer Manager ASICs

The Distributed Buffer Manager ASICs allocate incoming data packets throughout shared memory on the FPCs. This single-stage buffering improves performance by requiring only one write to and one read from shared memory. There are no extraneous steps of copying packets from input buffers to output buffers. The shared memory is completely nonblocking, which in turn, prevents head-of-line blocking.

I/O Manager ASICs

Each FPC is equipped with an I/O Manager ASIC that supports packet parsing, packet prioritizing, and queuing. This ASIC divides the packets, stores them in shared memory (managed by the Distributed Buffer Manager ASICs), and re-assembles the packets for transmission.

Media-specific ASICs

The media-specific ASICs perform physical layer functions, such as framing. Each PIC is equipped with an ASIC or FPGA that performs control functions tailored to the PIC's media type.

Packet Forwarding Engine

The PFE provides Layer 2 and Layer 3 packet switching, route lookups, and packet forwarding. The Internet Processor II ASIC forwards up to 40 Mpps for all packet sizes. The throughput is 40+ Gbps.

The PFE supports the same ASIC-based features supported by other M-series routers. For example, class-of-service features include rate limiting, classification, priority queuing, Random Early Detection, and Weighted Round Robin to increase bandwidth efficiency. Filtering and sampling are also available for restricting access, increasing security, and analyzing network traffic.

Finally, the PFE delivers maximum stability during exceptional conditions, while also providing a significantly lower part count. This stability reduces power consumption and increases mean time between failure.

Flexible PIC Concentrators

The enhanced FPCs house PICs and connect them to the rest of the PFE. There is a dedicated, full-duplex 3.2-Gbps channel between each FPC and the core of the PFE.

You can insert up to eight FPCs in an M40 chassis. The OC-48c/STM-16 PIC occupies an entire FPC. Otherwise, each FPC supports up to four PICs in any combination, providing unparalleled interface density and configuration flexibility.

Each FPC contains shared memory for storing data packets received; the Distributed Buffer Manager ASICs on the SCB manage this memory. In addition, the FPC houses the I/O Manager ASIC, which performs a variety of queue management and class-of-service functions.

Physical Interface Cards

PICs provide a complete range of fiber optic and electrical transmission interfaces to the network. The M40 router offers flexibility and conserves rack space by supporting a wide variety of PICs and port densities. All PICs occupy one of four PIC spaces per FPC except for the OC-48c/STM-16 PIC, which occupies an entire FPC slot.

Additionally, a Tunnel Services PIC and Multilink Services PIC are available. The Tunnel Services PIC enables the router to function as the ingress or egress point of an IP-IP unicast tunnel, a Cisco generic routing encapsulation (GRE) tunnel, or a Protocol Independent Multicast - Sparse Mode (PIM-SM) tunnel. The Multilink Services PIC enables the bonding of multiple T1 links or multiple E1 links using the Multilink Point-to-Point Protocol (MLPPP) and Multilink Frame Relay (MLFR) Protocol.

For a list of available PICs, see the *M-series Internet Backbone Routers Physical Interface Cards* datasheet.

System Control Board

Hosting the Internet Processor II ASIC, the SCB performs sampling, filtering, and packet forwarding decisions. The SCB also houses a processor that processes exception and control packets, monitors system components, and controls FPC resets.

Routing Engine

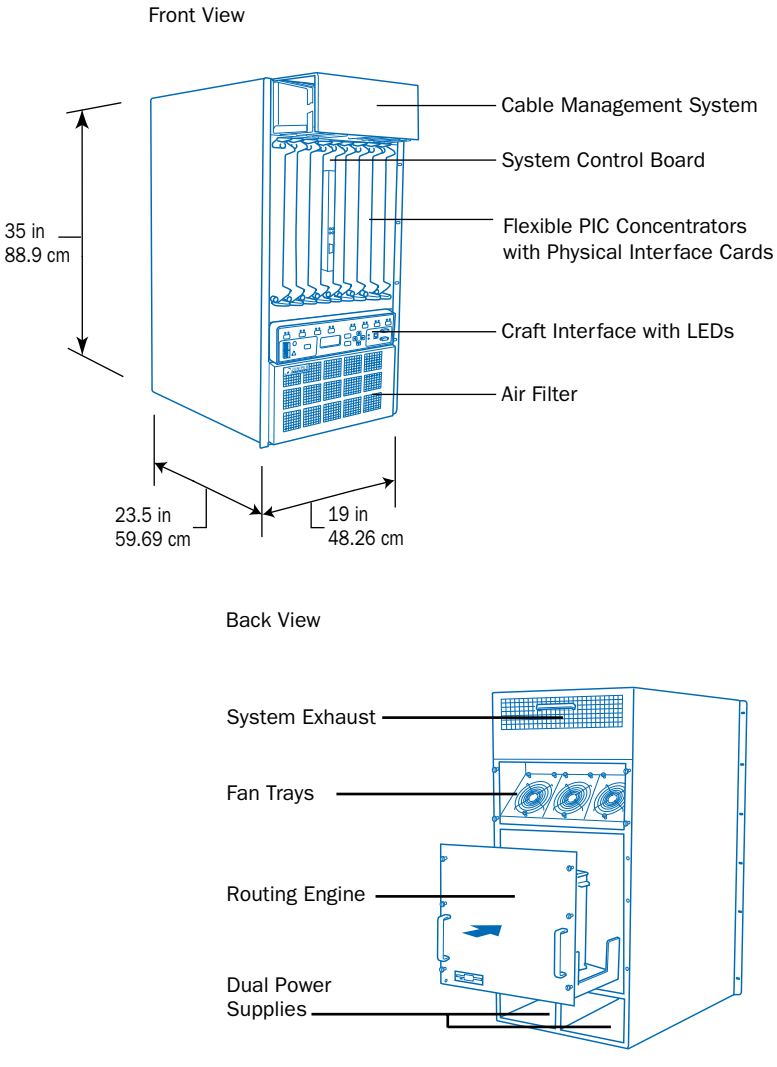
The Routing Engine maintains the routing tables and controls the routing protocols, as well as the JUNOS software processes that control the router's interfaces, the chassis components, system management, and user access to the router. These routing and software processes run on top of a kernel that interacts with the PFE.

- The Routing Engine processes all routing protocol updates from the network, so PFE performance is not affected.
- The Routing Engine constructs and maintains routing tables with a complete set of Internet features and provides full flexibility for advertising, filtering, and modifying routes. Routing policies are set according to route parameters, such as prefixes, prefix lengths, and BGP attributes.

JUNOS Internet Software

JUNOS software is optimized to scale to large numbers of network interfaces and routes. The software consists of a series of system processes running in protected memory on top of an independent operating system. The modular design improves reliability by protecting against system-wide failure and by preventing the failure of one process from affecting the other software processes. JUNOS software offers unmatched configuration flexibility by providing an XML-based JUNOScript API in addition to the CLI interface.

M40 Router



Specifications

Specification	Description		
Physical	Height	35 in / 88.9 cm	
	Width	19 in / 48.26 cm	
	Depth	23.5 in / 59.69 cm	
	Weight	Maximum configuration 280 lbs / 127 kg	
	Mounting	Front or center rack mount	
SCB	■ One Internet Processor II ASIC for 40-Mpps packet lookup ■ 51.2-Gbps throughput (25.6-Gbps full duplex) ■ Two Distributed Buffer Manager ASICs for coordinating pooled, single-stage buffering ■ PowerPC 603e processor running at 200 MHz for handling exception packets ■ 44-MHz PCI bus, which connects the PowerPC 603e processor and the Internet Processor II ASIC ■ 8-MB SSRAM ■ 64–MB DRAM ■ 512-KB boot flash EPROM (programmable on the board)		
Routing Engine	■ 333-MHz Pentium II with 768-MB DRAM ■ 80-MB flash drive for primary storage ■ 6.4-GB hard drive for secondary storage ■ 120-MB LS-120 drive for tertiary storage ■ 10/100 Base-T auto-sensing RJ-45 Ethernet port for out-of-band management ■ Two RS-232 (DB9 connector) asynchronous serial ports for console and remote management		

FPC	■ 3.2-Gbps full-duplex throughput per FPC
	■ Enhanced I/O Manager ASIC
	  ■ Parsing, prioritizing, and queuing of packets
	  ■ 2-MB parity-protected SSRAM per I/O Manager ASIC
	■ 200 ms of delay-bandwidth buffering per FPC		

Power Requirements	DC	Maximum power	1600 watts
		Maximum current	35 A at 48 V
		Input voltage	-42 to -75 VDC operating range
	AC	Maximum power	1,664 watts
		Maximum current	8 A at 208 V
		Input voltage	180 to 264 VAC operating range
Environmental	Temperature	32 to 104 degrees F / 0 to 40 degrees C	
	Maximum Altitude	No performance degradation to 10,000 ft / 3,048 m	
	Relative Humidity	5 to 90 percent noncondensing	
	Seismic/ Earthquake	Tested to meet Bellcore Zone 4 earthquake requirements	
	Thermal Output	3,850 BTU/hour	
Agency Approvals	Safety	■ CSA C22.2 No. 950 ■ * UL 1950 ■ EN 60950, 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	
	EMC	■ AS 3548 Class A (Australia) ■ BSMI Class A (Taiwan) ■ EN 55022 Class A emissions (Europe) ■ FCC Class A (USA) ■ VCCI Class A (Japan)	
	Immunity	■ EN 61000-3-2 Power Line Harmonics ■ EN 61000-4-2 ESD ■ EN 61000-4-3 Radiated Immunity ■ EN 61000-4-4 EFT ■ EN 61000-4-5 Surge ■ EN 61000-4-6 Low Frequency Common Immunity ■ EN 61000-4-11 Voltage Dips and Sags	
	NEBS	■ GR-63-Core: NEBS, Physical Protection ■ GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment ■ SR-3580 NEBS Criteria Levels (Level 3 Compliance)	
	ETSI	■ ETS-300386-2 Switching Equipment	

Ordering Information

Model Number	Description
Router	
M40-B-DC	M40 base unit: 8-slot chassis with cooling system, backplane, Routing Engine, two DC power supplies, complete documentation (CD ROM).
M40-B-AC	M40 base unit: 8-slot chassis with cooling system, backplane, Routing Engine, two AC power supplies (AC power cables are country specific and sold separately), complete documentation (CD ROM).
Components	
RE-M40-333-768	333-MHz Routing Engine with M40 back chassis subsystem (Compact-PCI motherboard and chassis, 100 BaseT port, 768-MB EDO DRAM, 80-MB flash drive, 6.4-GB hard drive, 120-MB LS-120 drive). Requires JUNOS release 4.2 or later. Included in base price.
SCB-E-M40	Enhanced System Control Board with Internet Processor II ASIC
FPC	
FPC-E	Enhanced Flexible PIC Concentrator
Power Cables	
CBL-M40-PWR-AU10	M40 AC power cable, Australia (10A, 8.2 ft / 2.5 m)
CBL-M40-PWR-AU	M40 AC power cable, Australia and New Zealand (15A, 8.2 ft / 2.5 m)
CBL-M40-PWR-EU	M40 AC power cable, Europe (16A, 8.2 ft / 2.5 m)
CBL-M40-PWR-IT	M40 AC power cable, Italy (16A, 8.2 ft / 2.5 m)
CBL-M40-PWR-UK	M40 AC power cable, UK (13A, 8.2 ft / 2.5 m)
CBL-M40-PWR-US20	M40 AC power cable, US, Canada and Japan (20A, 8.2 ft / 2.5 m)
Software	
JUNOS	JUNOS Internet software (flash PC card) for USA and Canada (not for export)
JUNOS-WW	JUNOS Internet software (flash PC card) for all countries except the USA and Canada (satisfies USA government requirements for the export of encryption technology)

Part Number: 100001-009 08/01

Juniper NETWORKS

www.juniper.net

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For contact information, refer to www.juniper.net/contactus.html.