System 5000 Router Modules

Optimizes Network Performance

Optimizes Network Connectivity and Interoperability

Simplifies Network Management

Ensures Network Availability

Bay Networks System 5000 router modules provide scalable integrated routing to ease network design, minimize maintenance costs, and ensure future growth. The router modules ensure adequate performance of applications in remote offices and medium sized data centers as well as terminating WAN traffic. The router modules' support of Bay Networks Switched Internetwork Services (BaySIS™) ensures multivendor interoperability. BaySIS, an open architecture built on standards, delivers the services to build and maintain an enterprise-wide internetwork while providing features to evolve today's internetworks into the future of switched internetworking.

The System 5000 router modules support four Ethernet or Token Ring hub backplane connections and support two optional Ethernet, Token Ring, FDDI, 100BASE-T, Synchronous, and ISDN BRI network modules (net modules) for connectivity flexibility. Designed for the System 5000 Series Hub, the router modules are compatible with all 5000 hubs. Up to four router modules can be interconnected in the 5000 AH hub chassis via Bay Networks Parallel Packet Express (PPX®) backplane to form an extensible router that is managed as a single unit. The router modules operate as single-slot routers with hubs not equipped with the PPX backplane.

Based on Bay Networks Access Stack Node Router (ASN™), each router module features a Motorola 68040 processor and is capable of forwarding rates of 50,000 packets per second (pps) with 200,000 pps forwarding rates in a 4-module configuration.

Supporting Bay Networks Routing Services (BayRS™), the router modules maximize connectivity and enhance interoperability by supporting all major network and bridging protocols, wide area services, and IBM standards.

Bay Networks EZ-Install and EZ-Update simplify module installation, configuration, and software maintenance. The router modules are also easily configured and monitored via Bay Networks Optivity® family of network mangement applications.

The System 5000 router modules complement Bay Networks BayStack™ Access Node (AN®), BayStack Access Node Hub (ANH™), ASN, Backbone Link Node (BLN®), and Backbone Concentrator Node (BCN®) to satisfy all connectivity, performance, and availability requirements. Bay Networks family of routers, hubs, switches, and network management products comprise an end-to-end standards-based solution while providing a smooth transition to switched internetworking.

Bay Networks

Benefits

Optimizes Network Performance

Leveraging proven Access Stack Node (ASN) technologies, including a symmetric multiprocessing architecture, MC68040-based processor module, and Parallel Packet Express (PPX) processor interconnect, the System 5000 router modules provide high system performance of up to 50,000 pps per module and 200,000 pps per hub.

User-configurable DRAM and Flash memory coupled with the Dynamic Software Builder and Loader configuration software let the router modules meet internetwork performance requirements by optimizing system memory requirements.

Optimizes Network Connectivity and Interoperability

By supporting up to four connections to the hub backplane per module, the System 5000 router modules fulfill expansion needs by providing a highly scalable solution for the higher connectivity requirements of regional offices.

The router modules support the entire suite of Bay Networks Routing Services (BayRS), including industry-standard SNA integration and comprehensive LAN and WAN protocol support.

Simplifies Network Management

All router modules in a hub are managed as a single device in a network, so the workload in network operations does not increase to support additional router modules. The router modules require only one software image and configuration file no matter how many modules are installed, reducing the number of nodes that require creation, maintenance, upgrading, and backup of configuration files.

EZ-Install reduces installation time and expense by enabling the router modules to automatically get their configuration from a central site. EZ-Update enables new router software and/or configuration files to be downloaded easily and safely.

Bay Networks UNIX-based Optivity Internetwork™ integrates three router management applications — RouterMan,™ PathMan,™ and Site Manager — to provide a comprehensive set of network management capabilities accessible through a point-and-click, Windows-based user interface. The Windows-based Optivity Campus™ enables Ethernet and Token Ring networks in a NetWare environment to be managed from a central platform by providing features for managing shared media, frame-switched, and routed networks.

Ensures Network Availability

The router module executes the industry-leading distributed, fault-resilient BayRS system software that maintains high availability through software features including hardware fault isolation, software fault isolation and recovery, and online dynamic reconfiguration.

The router modules' online operational servicing (hot-swap) capability supports replacement of individual router modules within a hub without affecting the operation of the remaining router modules. The modules also support the use of multiple PCMCIA Flash memory cards for redundant nonvolatile storage of system software. Flash partitioning provides single router module configurations with file system redundancy.

Flexible Network Environments

The 5000 series router modules use a highly scalable architecture that provides cost-effective, growth-oriented solutions for remote, regional, and departmental office access (see Figure 1). Typical applications and configurations include:

- A single Ethernet router module with a dual Synchronous net module connected to a Frame Relay network.
- A single Token Ring router module with a dual Synchronous net module used for SDLC connection.
- A multislot router configuration with a dual Synchronous net module connected to Frame Relay and a 100BASE-T backbone.
- One router module with FDDI backbone connection and ATM Routing Engine connection to an emerging ATM campus backbone.

Hardware Features

High-Performance Router Module

Bay Networks supports Ethernet and Token Ring router modules that connect to the 5000 hub's 1 Gbps Parallel Packet Express (PPX) backplane interface, providing arbitration logic for one rail and transmit/receive logic for all four rails. Based on the Bay Networks ASN, the System 5000 router modules use Motorola's 68040 microprocessor to maintain high forwarding and filtering rates across its network interfaces (see Figure 2). The aggregate forwarding performance is up to 50,000 pps per module and up to 200,000 pps per 4-module configuration. The router modules' 8, 16, or 32 megabytes of DRAM is configurable to support customized global memory. Through these configurable buffers, the router modules prevent traffic overflow — and resulting network delays — caused by large bursts of traffic (file transfer operations, for example).

Figure 1 | **Network Design Options**

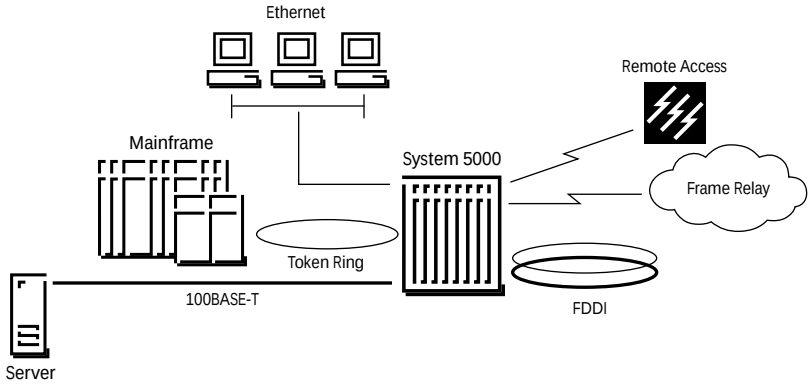
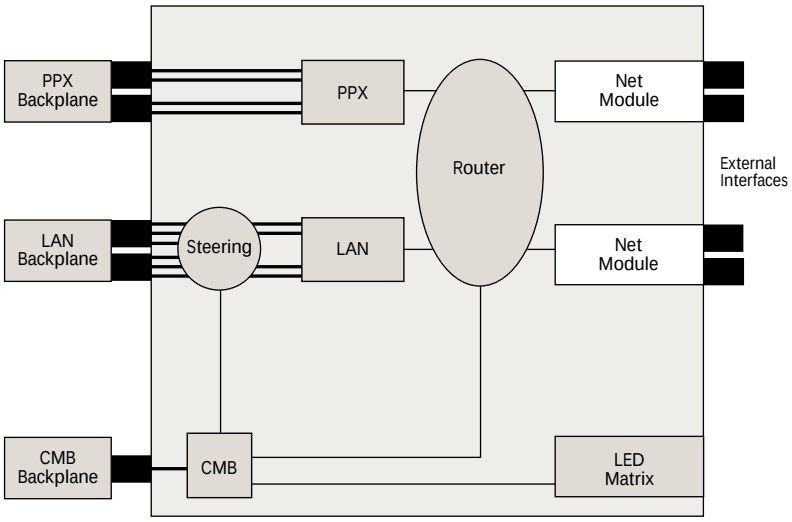


Figure 2 | **Router Modules' Design Logic**



The router modules' 256-KB Fast Packet Cache increases forwarding performance through hardware acceleration of frequently accessed packet information.

The System 5000 router modules support a standard Flash memory card for nonvolatile storage of the router's system software, configuration file, and event log. To provide redundancy, the Flash can be locally divided into two partitions of equal size so that backup copies of boot images and configuration files can be stored on each partition.

The System 5000 chassis module also features a Connector Management Bus (CMB) that provides the data path between the module's processor and the SNMP agent residing on the Network Management Module (NMM). The CMB data path is used for controlling the connection or assignment of router interfaces to backplane segments or rings, controlling the ring speed on backplane interfaces, controlling partitioning and wrapping of backplane interfaces, passing the chassis ID to the router module, passing the IP address of the NMM to the router module, maintaining a backup of the router module's CMB-related configuration data on the Supervisory module, and making interface, statistical, information, addressing, and status information available to the NMM.

The router modules have two interface module (net modules) positions for cost-effective network connectivity. Up to four System 5000 router modules can be supported in a 5000 hub that can be managed as a single routing platform.

The router modules, which are standard System 5000 modules, meet all applicable System 5000 requirements and can be used in any 5000 chassis.

Ethernet Router Module The Ethernet router module has four Ethernet interfaces that can connect to any of the 12 backplane Ethernet segments of the 5000 hub. The Ethernet router module features two expansion positions for net modules; any 5000 router net module can be used on the Ethernet router module. Additionally, a repeater chip used to collect per-interface statistics for reporting across the CMB is featured on the Ethernet router module.

Token Ring Router Module Bay Networks Token Ring router module features four Token Ring NICs (4 /16 Mbps — software selectable) that provide four router interfaces to the hub's backplane. Similar to the Ethernet version, the Token Ring router module features two expansion positions for net modules. The Token Ring router module can connect four interfaces to four of the five backplane rings. Three of the four interfaces are assigned to the first three backplane rings. The fourth interface can be steered between backplane rings 4 and 5.

Single-Board Configurations Each router module provides four backplane interfaces plus two expansion positions. Each expansion position provides from one to four additional interfaces depending on the interface type. The interfaces on the net modules do not connect to the backplane; instead, they are accessed via front-panel connectors. All compatible net modules can be installed in any expansion position.

Multi-Host Module Configurations
Multiple router host modules can be interconnected to build a single larger router. To support this interconnection, PPX capability has been added to the 5000AH backplane. PPX support is present in hub slots 6 through 14. System 5000 router modules may be plugged into any of those slots.

If the AH version backplane is not present in the hub, the router modules may still be used; however, each board will act as an independent router.

LAN and Serial Interfaces
The System 5000 router modules provide additional network connectivity via a selection of network modules (net modules). Each router module can support up to two net modules. Net modules are available that provide Ethernet, 100BASE-T (Fast Ethernet), Token Ring, FDDI, Synchronous, and ISDN BRI interfaces to meet a wide variety of connectivity requirements (see Table 1). ATM is also supported via the backplane.

Ethernet/802.3 The Ethernet/802.3 interface supports IEEE 802.3 and Version 1.0/2.0 Ethernet formats. Both a 10BASE-T and an AUI connector are provided on Ethernet ASN models for a choice of Ethernet connectivity. A cable from the interface's 15-pin AUI connector provides optional adaptation to a variety of media, including broadband, baseband, and fiber. This flexibility accommodates the media that best suits distance, cost, and reliability criteria.

Table 1 **Router Host Modules Net Modules**

	Number of Ports per Net Module	Maximum Number of Modules per Router Module
100BASE-T	1	1
Dual Ethernet	2	2
Dual Token Ring	2	2
FDDI (multimode and single-mode)	1	2
Dual Synchronous	2	2
Quad ISDN BRI	4	2

100BASE-T Bay Networks 100BASE-T interface design complies with the IEEE 802.3u 100BASE-T standard. The net module supports a single 100BASE-T interface. It provides one 8-pin modular (100BASE-TX) and one MII connector. The 100BASE-TX interface uses 2-pair Category 5 cable to interconnect network devices up to 100 meters apart. Connecting Media Adapter Units (MAU) to the MII connector provides a connection to fiber optic (100BASE-FX) or 4-pair Category 3 cable (100BASE-T4) alternative media. Full-duplex operation is supported by the 100BASE-TX port, including flow control, and is compatible with the Bay Networks LattisSwitch™ family of Ethernet switches. Each router module supports one 100BASE-T net module, providing connectivity for as many as four interfaces per four-slot configuration.

Token Ring/802.5 The Token Ring interface can operate at either 4- or 16-Mbps ring speeds (software configurable), providing the flexibility to migrate to higher speeds as performance requirements dictate. A 9-pin D-subminiature connector is provided for Token Ring cable attachment.

The Token Ring interface supports the IEEE 802.5 Media Access Control (MAC) token passing protocol, the 802.2 Type 1 (connectionless) protocol, the 802.2 Type 2 (connection-oriented) protocol, and the 16-Mbps Early Token Release (ETR) protocol. All Bay Networks Token Ring interfaces feature Madge Networks' advanced Token Ring accelerator software, FastMAC Plus, to provide advanced buffering techniques that minimize per-frame overhead on the TI Token Ring chip set. These features increase data transfer speed across the interface.

FDDI The FDDI interface provides a standard 100-Mbps dual attached FDDI interface. Bay Networks FDDI interfaces are available in two media styles: Multimode and Single-mode. The Multimode interface supports 62.5/125 or 50/125 micron fiber for distances up to 2 kilometers between stations. The Single-mode interface supports 9/125 micron fiber for distances up to 10 kilometers between stations. Additionally, an RJ-11 connector is included on each FDDI interface for attachment to an external optical bypass unit. This ensures that the FDDI signal can bypass the router in the event that the router stops operating, leaving the FDDI ring and other end stations operational.

All Bay Networks FDDI interfaces are ANSI Class A Dual Attachment Stations (DAS) and Class B Single Attachment Stations (SAS). The FDDI net module will also operate in dual homed configurations. The FDDI interface is compatible with ANSI X3T9.5 Physical Medium Dependent (PMD), Physical Protocol (PHY), Media Access Control (MAC), and Station Management (SMT) standards.

Synchronous The Synchronous interface supports V.35, RS232, RS422, and X.21. Both Synchronous interfaces operate concurrently from 1200 bps to 2.048 Mbps, full-duplex, allowing both lines to operate up to T1 and E1 rates. Higher interface speed may be achieved by reducing the number of ports in use. Dial Back-up, Dial-on-Demand, and Bandwidth-on-Demand using Raise DTR and V.25bis dial signaling are supported over V.35 and RS232 interfaces. Additionally, internal and external clocking and Bay Networks entire range of wide area networking protocols are supported by the Synchronous interface.

Alternatively, the Synchronous interface can be configured to integrate IBM SDLC traffic across the internetwork by connecting local or remote IBM equipment directly to the Synchronous interface, using either Bay Networks DLSw for SDLC or Transparent Sync Pass-Thru.

PU Type 2.0 and 2.1 devices are supported to provide a highly flexible interconnection solution. The Synchronous interface supports connection to these devices using a V.24/28 (RS232), V.35, or X.21 physical interface. Additionally, the Synchronous interface ensures optimum SDLC performance by supporting numerous SDLC parameters (see Table 2).

Table 2 | **SDLC Parameters**

Parameter	Function
NRZ/NRZI	Specifies line support: Non-Return to Zero or Non-Return to Zero Inverted
Half-/ Full-Duplex	Specifies how server communicates with downstream PU
Constant/Switched Carrier	Specifies how server controls Request To Send signal to a modem
Transmit Clocking	Specifies transmit clocking type: Internal or External

Table 3 | **Supported ISDN BRI Signaling Specifications**

Region/Country	ISDN Standard
Australia	AUSTEL TS013
Pan-European	Euro ISDN (iCTR3)
Japan	INS-64
North America	National ISDN-1 AT&T 5ESS Nortel DMS-100

ISDN Basic Rate Interface (BRI) ISDN BRI for Bay Networks routers provides two 64-Kbps B channels for data and one 16-Kbps D channel for signaling. Rate adaption for 56- and 64-Kbps transmission rates on B channels is also supported. Additionally, each BRI port can be multidropped on the same link with other ISDN devices. ISDN BRI supports all major international signaling specifications (see Table 3).

Bay Networks provides ISDN BRI support via a Quad interface net module. This interface eliminates the need for an external ISDN terminal adapter.

Parallel Packet Express (PPX)
The 1 gigabit-per-second PPX processor interconnect uses up to four redundant, dynamic load-sharing, 256-Mbps data paths to deliver the industry's highest aggregate system performance and availability. The PPX's data load is balanced across its four data paths using a random path selection algorithm. Each router module has access to all four paths simultaneously and can transmit over one path as it is receiving data from all four paths. If a single PPX data path becomes unavailable, the load is automatically distributed across the remaining paths, ensuring continuous operation.

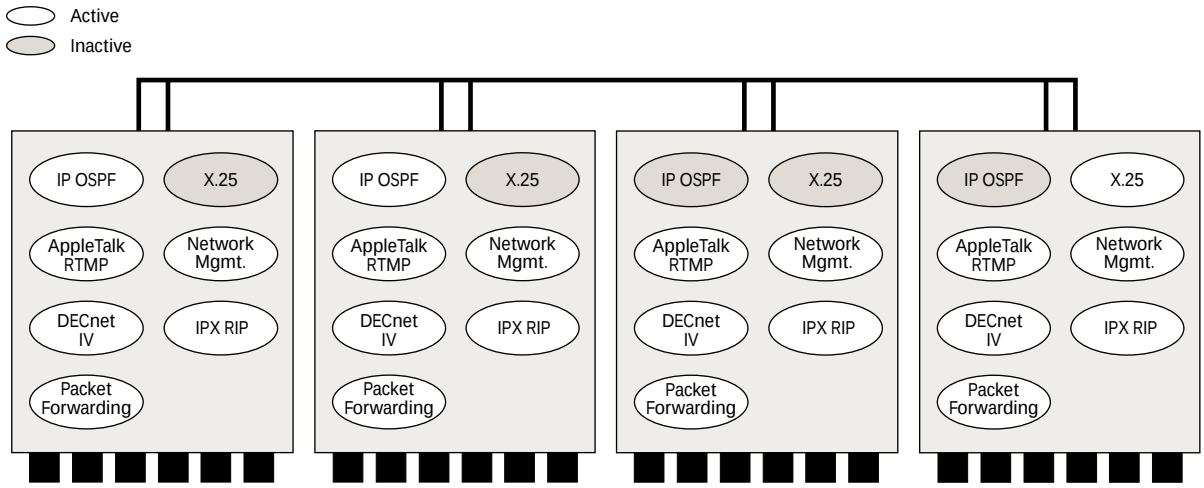
The PPX backplane is part of the 5000AH chassis and field upgrades. The chassis is adapted to the power, cooling, and interconnect requirements of switching with integrated routing. The 5000AH has nine slots with PPX connections. The large number of slots in the chassis provide maximum slot assignment flexibility and room for growth. Using the capabilities supported in the chassis, Bay Networks eases the migration from shared media to frame switching and ATM with associated routing functions in the same chassis.

BayRS Software Features

Extensible Networking Capabilities
Bay Networks Routing Services (BayRS), with support for the System 5000 router modules, maximize connectivity and interoperability in multivendor, multiprotocol environments by supporting all major network and bridging protocols and wide area services (see Table 6). Industry-standard IBM transport is also supported via Source Route Bridge, Data Link Switching (DLSw), Bisynchronous Pass-Thru, Transparent Sync Pass-Thru, and APPN support. Additionally, BayRS increases network performance, ensures network availability, and enhances network security through its Data Compression, Traffic Prioritization, Uniform Traffic Filters, and Multiline Circuits traffic management capabilities. Remote office connectivity and availability is also ensured via BayRS's dial-up services support. By supporting this wide range of features and capabilities, BayRS allows the System 5000 router modules to provide fully featured router functionality to meet a wide range of network requirements.

Four BayRS software options are available for the System 5000 router modules — System, LAN, WAN, and Corporate (see Table 6). This allows the router modules to be configured with software that fits a site's particular requirements.

Figure 3 | **Distributed Software Architecture**



Distributed Software Architecture

The router modules use BayRS software, which features an innovative, highly efficient software architecture that distributes forwarding, filtering, and management functions across each unit in a multiple router configuration. In addition to delivering industry-leading performance, this architecture provides complete fault resiliency.

All processing for each network interface is done by its directly attached host module. Each router module uses its own copy of the routing/bridging code, forwarding/filtering tables, and network management code. Routing and management updates are automatically included in the processor module's tables when they are received, and then passed to all other router modules within the hub.

Certain computation- and memory-intensive routing update protocols, such as OSPF, are activated on only one router module within a hub. This allows the processor-intensive activities required by OSPF's link-state routing protocol to be performed by a single router module that distributes the results to other router modules within the stack. In the unlikely event of a router module failure, OSPF's "hot-standby soloist" is automatically and quickly activated on another router module, without the loss of current routing information. Less intensive routing protocols, such as IPX RIP, VINES RTP, and AppleTalk RTMP, can be active on multiple router modules. Additionally, overhead processes, such as network management tasks, are distributed among the router modules (see Figure 3).

Layered BayRS Architecture

BayRS features a layered system software architecture (see Figure 4). All elements of the system software reside on each of the processor modules for maximum performance and availability.

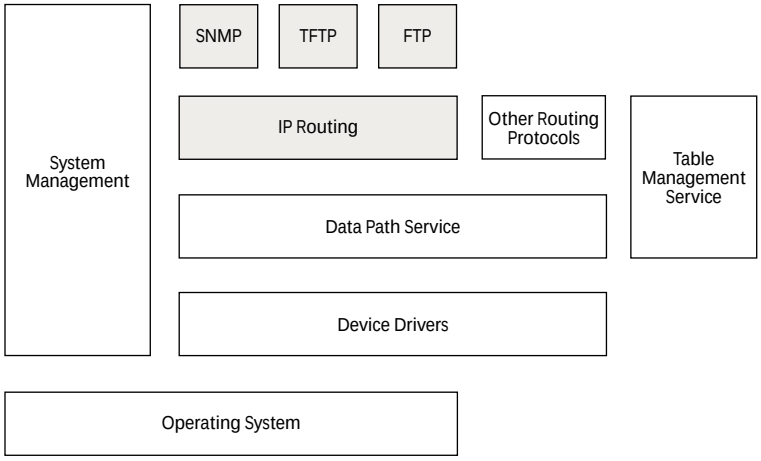
The operating system manages basic system resources, such as CPU and memory, as well as interprocess and interprocessor communications. The operating system also provides support for fault management and recovery. The device drivers control the router modules' interfaces that provide Ethernet, Token Ring, FDDI, Synchronous, and ISDN interfaces. The data path service supports circuit management and MAC-layer formatting for both inbound and outbound frames. A highly optimized, general purpose routing table management service is used by all routing protocols to support high-performance packet forwarding and filtering.

System management directly supports SNMP-based management, static and dynamic reconfiguration, the Flash memory-based file system, and Bay Networks Technician Interface, a simple command-line interpreter for installation and maintenance operations.

Fault Management

The router module provides extensive internal fault management capabilities that eliminate total system failure in the event of a hardware or software component malfunction. These capabilities ensure continued node and network availability by isolating malfunctions before they can affect other components in the

Figure 4 | **BayRS Software Architecture**



node and other connected networks. Network management can be notified of fault conditions via the automatic generation of an SNMP trap.

Hardware Fault Isolation If a hardware failure occurs, the malfunctioning component is logically disabled and isolated from the rest of the system. Hardware failures can be isolated to an individual net module or network interface. Within multiple router module configurations, fault isolation can include individual router module or Flash card.

Software Fault Isolation and Recovery A software process can also fail independently without affecting the operation of other processes. The operating system automatically isolates the failed software process without disrupting other protocols executing on the router module or other router modules within a hub, and automatically restarts the failed process. If the process cannot be recovered, it is terminated.

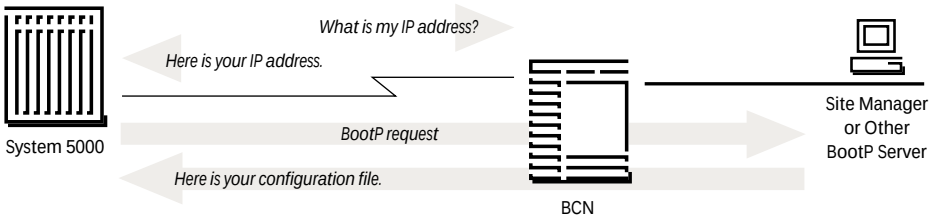
Partial Boot Bay Networks partial boot capability enables the router modules to be started with failed hardware components and/or configuration errors. Power-up diagnostics determine the status of each processor module and link module. Any failed processor module is not booted. The software automatically configures around improperly configured hardware.

Online Dynamic Reconfiguration
Online dynamic reconfiguration eliminates the need to schedule network downtime to reconfigure any router module. Configuration parameters can be changed by issuing SNMP Set commands while the node is operational. Any changes made with SNMP Set are volatile and are lost when the router module reboots. To preserve changes, the router modules' active configuration must be saved permanently to a file on the PCMCIA Flash memory. This file defines the router modules' new baseline configuration and ensures that the node will be properly configured to meet the current network requirements. The changes made may be saved on the Flash memory card at any time.

Online Operational Servicing (Hot-Swap)
The router modules provide maximum system availability through online operational servicing capabilities. Individual router modules can be inserted or removed from a hub without affecting the operation of the rest of the stack. This eliminates downtime for upgrades and repairs of multiple-router module configurations. The router modules automatically boot and return to operation when they are reconnected to the hub.

Redundant Network Interfaces
Bay Networks LAN interfaces can be configured for 1-for-1 redundancy, allowing two similar LAN interfaces on the same or different router module in the same router to be attached to a single LAN. One of the interfaces is designated Primary and is fully operational while the other is in a nonoperational backup mode. If the Primary interface fails, the backup interface becomes operational, ensuring continued availability. IP, IPX, and Source Route Bridging are supported by this feature.

Figure 5 | **EZ-Install**



Redundant Router Support
The router modules support redundant router capability that provides protection against catastrophic events such as fire or flood, which can eliminate any single router. In Router Redundancy, two identical routers are used. One of the router modules is placed in Primary mode and the other in Backup mode. If the Primary router fails, the backup will become active and resume routing traffic. IP, IPX, and Source Route Bridge are supported by this feature.

Remote Installation and Management
EZ-Install and EZ-Update simplify router module installation and make router reconfiguration and software updates from a central site quick and easy.

EZ-Install EZ-Install eliminates the time and expense of sending a technical resource to install and configure a router module. All that is required is inserting the module in the hub and connecting the module's LAN and serial interfaces. With EZ-Install, the router module obtains its software image from Flash memory and its configuration file through the network. Using EZ-Install, a router module automatically obtains its IP address from an upstream Bay Networks router and its configuration file from a central-site server using the BootP protocol (see Figure 5). After a router module's configuration file has been successfully downloaded to DRAM via EZ-Install, the module's configuration file can be saved to Flash memory for nonvolatile local storage.

EZ-Update EZ-Update facilitates the automatic downloading of software updates and configuration files, minimizing the time and expense associated with software maintenance. The existing router module configuration file and software image are stored in its nonvolatile Flash memory for use as backup in case any problems are encountered while downloading new software. To use EZ-Update, the router module is dynamically configured to boot its configuration file and software image from the central site. The router can then be rebooted or power-cycled, and a new configuration file and/or software image will be downloaded to its DRAM from a central-site server. Once it has been determined that the new configuration file or software update is acceptable, it can be saved to the router module's Flash memory, replacing the previous configuration file and/or software image.

SNMP-Based Node Management
Bay Networks offers a complete SNMP-based, enterprise management solution for any environment. As members of Bay Networks Optivity family of network management tools, the UNIX-based Optivity Internetwork and Optivity LAN™ applications and the Windows-based Optivity Campus products are powerful tools for providing comprehensive node configuration, monitoring, and control. The router modules also support the Technician Interface (TI) and a command-line interface that further ease configuration and maintenance tasks.

Optivity Internetwork A component of Bay Networks UNIX-based Optivity Enterprise™ application suite, Optivity Internetwork provides a sophisticated, yet easy-to-use management solution for complex router-based internetworks. Optivity Internetwork simplifies and improves management of complex router internetworks by integrating Site Manager, the node management application for Bay Networks routers; RouterMan, an intuitive router monitoring application; and PathMan, a graphical network diagnostic tool.

Optivity Internetwork operates with the leading SNMP platforms — HP OpenView, IBM NetView for AIX, and Solstice SunNet Manager for additional capabilities.

Optivity LAN 7.0 This application, also a part of the UNIX-based Optivity Enterprise application suite, provides hub and switch management functions. By delivering a system-level perspective, it offers a comprehensive, powerful solution for managing and troubleshooting hub-based and switch-based enterprise networks.

Optivity LAN 7.0 delivers several key tools for managing enterprise networks, including Enterprise Command Center, which provides a paradigm enabling centralized, system-level management for the operations center; Enterprise Health

Advisor, offering a complete, scalable system for at-a-glance visibility and rapid troubleshooting of network performance and fault problems; LANsummary, which delivers simultaneous visibility into LAN segments spread across the campus or the enterprise; RMON-based packet capture and seven-layer decode, which supports both Bay Networks Advanced Analyzer™ agents and other vendors' RMON-compliant hubs, enabling multivendor networks to be managed as a cohesive system; Expanded View,™ which provides real-time at-a-glance visability and control of hubs and switches to the port level; Autotopology,™ which discovers and displays all hubs, bridges, switches, routers, and end stations to create an accurate blueprint of the network configuration; LANarchitect,™ which allows individual ports, slots, or clusters to be assigned to specific virtual networks regardless of their physical location via an intuitive drag-and-drop process; and EZ-Install, which provides automated, policy-based setup of hubs — ideal for centralized control of remote network installations.

Optivity LAN 7.0 also provides the functionality introduced in earlier releases. The Optivity approach to network management greatly reduces the time and expense of performing daily administrative tasks, such as adds, moves, and changes, to the network. Additionally, drag-and-drop operations simplify the configuration process, and online configuration rules provide assistance in creating efficient networks. By handling configuration tasks through Optivity instead of making physical changes into the wiring closet, large networks can be managed quickly and effectively from a single location.

Optivity LAN 7.0 provides an intuitive, scalable solution for managing heterogeneous Ethernet, Token Ring, and FDDI networks as a cohesive system. Seamless integration is provided between SunConnect SunNet Manager, HP OpenView Network Node Manager, and IBM NetView for AIX.

Optivity Campus Bay Networks provides two Windows-based network management applications that enable Ethernet and Token Ring networks to be managed from a central platform — Optivity Campus for Novell's ManageWise management platform and Optivity Campus for HP OpenView (Windows). These applications offer a wide range of features for managing shared media, frame-switched, and routed networks.

Optivity Campus contains the Autotopology dynamic mapping feature and the Expanded View application (see the "Optivity LAN 7.0" section). Optivity Campus also includes applications for managing particular network devices, including RouterMan for Windows, which provides complete real-time monitoring and management of multiple routers from a single workstation.

Designed for midsize to large enterprise networks, Optivity Campus for Novell's ManageWise management platform enables NetWare systems in IPX-only and mixed IP/IPX networks to be managed from a single console. Optivity Campus for Novell's ManageWise management platform operates in a client/server arrangement requiring a DOS/Windows station and a NetWare server.

Optivity Campus for HP OpenView (Windows) provides a single-station solution for NetWare accounts not desiring NetWare server dependence. Based on a DOS/Windows architecture, this application provides advanced management for department and campus-sized networks.

Technician Interface (TI) This terminal-based (TTY-compatible) tool enables local or remote installation and maintenance. TI is based on a simple command line interpreter that supports SNMP-based access to the MIB, displays the event log, and supports file system management and other administrative commands. Local connection is accomplished by attaching a terminal to the 5000 chassis' supervisor port.

Bay Networks further simplifies installation and maintenance by supporting inbound and outbound Telnet sessions, the simple remote terminal protocol. Supporting incoming Telnet allows TI to be accessed by a local or remote terminal. Outbound Telnet support enables TI to also originate an outgoing Telnet session to another Bay Networks router or to other network equipment that accepts inbound Telnet. This is used to access remote routers in nonroutine situations when Site Manager or SNMP is unavailable. Each instance of the TI supports a single outbound Telnet session.

CMB Processor Command-Line Interface (CLI) The CLI provides control of segment steering and ring speed selection in cases where the hub's network management module is not available. This CLI shares the serial channel to the CLI with the TI. A top-level menu allows the selection between the TI and the CMB processor CLI.

Compact Packaging

The router host module provides LEDs that indicate module status for easy troubleshooting assistance (see Table 4).

Table 4 | **LEDs**

LED	Status Indicator
Segment Connection	Indicates if Ethernet segment is connected
Ring Connection	Indicates if Token Ring is connected
Module Status	Indicates if netmodule is running, booting, or in diagnostic mode
PPX Transmit	Indicates if data transmission is in progress
PPX Arbiter	Indicates if router module is functioning as the PPX arbitrator

Table 5 | **System 5000 Router Modules Specifications**

Architecture	Processor module based on Motorola 68040 microprocessor Two net modules per router host module Four-module configuration in 5000 series hub Symmetric multiprocessor architecture with multiple units
Connectivity	Ethernet interface (15-pin AUI connector or 8-pin modular and System 5000 chassis backplane connection) Token Ring Interface (9-pin MAU connector and System 5000 chassis backplane connection) FDDI (two MIC, one RJ-11 — optical bypass) Synchronous Interface (44-pin connector to RS422, RS232, V.35, X.21 adapter cable) ISDN BRI (8-pin modular) 100BASE-T interface (40-pin MII connector or 8-pin modular)
Packaging	(H) 15.00 x (W) 1.20 x (D) 10.50 in. [(H) 38.10 x (W) 3.10 x (D) 26.70 cm.]
Environmental and Regulatory	
Altitude	0 – 8000 ft (0 – 2400 m)
Humidity	20% – 80% (noncondensing)
Temperature	32° – 104° F (0° – 40° C)
Safety	UL 1950, TUV EN60 950, CSA C22.2 #950
RFI/EMI	FCC Part 15 Class A EN55022 Class B

Table 6 | **Bay Networks Routing Services for the System 5000 Router Modules**

Feature	System Suite	LAN Suite	WAN Suite	Corporate Suite
Network Protocols				
IP with RIP, OSPF, EGP/BGP	√	√	√	√
OSI		√		√
DECnet Phase IV		√		√
Novell IPX with RIP, NLSP		√		√
Banyan VINES		√		√
AppleTalk Phase 2		√		√
Xerox XNS		√		√
ST-II	√	√	√	√
IBM Integration				
Source Route Bridge	√	√	√	√
LAN Network Manager Agent		√		√
Data Link Switching (DLSw) for				
Ethernet and Token Ring	√	√	√	√
Data Link Switching for SDLC*		√		√
Bisynchronous Pass-Thru	√	√	√	√
Transparent Sync Pass-Thru	√	√	√	√
APPN				√
Bridging				
Transparent (Ethernet and FDDI)	√	√	√	√
Translation Bridge				
Ethernet-Token Ring	√	√	√	√
Ethernet-FDDI	√	√	√	√
Token Ring-FDDI	√	√	√	√
Native Mode LAN (NML)		√		√
Wide Area Networking				
HDLC Encapsulation	√	√	√	√
Point-to-Point Protocol (PPP)	√	√	√	√
Frame Relay			√	√
SMDS			√	√
X.25			√	√
ATM DXI		√	√	√
ISDN BRI	√	√	√	√
ISDN PRI	√	√	√	√
Dial-Up Services				
Bandwidth-on-Demand	√	√	√	√
Dial Back-up	√	√	√	√
Dial-on-Demand	√	√	√	√

Table 6 | **Bay Networks Routing Services for the System 5000 Router Modules (continued)**

Feature	System Suite	LAN Suite	WAN Suite	Corporate Suite
Traffic Management				
Data Compression				
PPP	√	√	√	√
X.25 and Frame Relay			√	√
Traffic Prioritization	√	√	√	√
Uniform Traffic Filters	√	√	√	√
Multiline Circuits	√	√	√	√
Node Management				
EZ-Install / EZ-Update				
over HDLC	√	√	√	√
over Frame Relay			√	√
Secure ID	√	√	√	√
Dynamic Loader	√	√	√	√
Availability				
Software Fault Isolation and Recovery	√	√	√	√
Online Operational Servicing (Hot-Swap)	√	√	√	√
Flash Card Partitioning	√	√	√	√
Interface Redundancy	√	√	√	√
Router Redundancy	√	√	√	√
Dynamic Reconfiguration	√	√	√	√

* DLSw for SDLC requires Corporate Suite.

System Requirements

The System 5000 Router Modules configurations described in this data sheet are currently supported in BayRS Version 10.0 unless otherwise indicated in this document.

Ordering Information

Ordering information for the System 5000 Router Modules appears in Table 7.

Table 7 | **System 5000 Router Modules Ordering Information**

Order Number	Description
Base Router Module	
AD1004003	System 5000 Ethernet Router Module
AD1104001	System 5000 Token Ring Router Module
Network Modules (Net Modules)	
AD1033007	Dual Ethernet
AD1133002	Dual Token Ring Net Module
AD2133002	Dual Synchronous
AD1233002	Multimode FDDI
AD2233002	100BASE-T
AD2133004	Quad ISDN BRI
BayRS	
AD0008001	System 5000 BayRS System software suite
AD0008002	System 5000 BayRS LAN software suite
AD0008003	System 5000 BayRS WAN software suite
AD0008004	System 5000 BayRS Corporate software suite
Memory Options	
AD0011005	5000 Router DRAM: 8 MB
AD0011006	5000 Router DRAM: 16 MB
AD0011007	5000 Router DRAM: 32 MB

For more sales and product information, please call **1-800-8-BAYNET**.

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