Access Stack Node

Ensures Network Availability

Enhances Network Performance

Extends Network Connectivity

Simplifies Network Administration

Provides Low Cost of Ownership

The Bay Networks Access Stack Node (ASN™) is a stackable router architecture providing cost-effective solutions for enterprise network centers. Bay Networks Switched Internetworking Services (BaySIS™) operating in the ASN provides features for today's evolving internetworks with migration to the future of switched intra- and internetworking.

The ASN provides seamless integration of multiple units stacked together for management as a single router. This architecture eases the management of a growing network because adding interfaces beyond a unit's capacity does not require replacement of routers — or additional complexity — in the network. A stack of four ASNs supports up to 48 network interfaces with forwarding performance up to 200,000 packets per second (pps).

The ASN maximizes connectivity and enhances interoperability by supporting all major network and bridging protocols, wide area services, and IBM standards. Additionally, the ASN's fault-resilient system software ensures high network availability.

The ASN's LAN interfaces (100BASE-T, Ethernet, Token Ring, and FDDI) and WAN interfaces (Synchronous, T1, E1, ISDN BRI, and ISDN PRI) meet the connectivity needs for remote and campus offices by offering the modularity and flexibility to build configurations with industry-leading price/performance. Additionally, the ASN's Hardware-based Data Compression Coprocessor net module maximizes WAN use by allowing compression over all WAN interfaces in the ASN. This net module reduces the number of circuits required to meet network bandwidth needs, thus lowering recurring costs.

Bay Networks EZ Install and EZ Update simplify installation, configuration, and software maintenance. ASNs are easily configured, monitored, and controlled via Bay Networks Optivity® family of network management applications.

The ASN complements Bay Networks BayStack™ Access Node (AN®) and Access Node Hub (ANH™), BayStack Advanced Remote Node (ARN™), Backbone Link Node (BLN®), Backbone Concentrator Node (BCN®), and System 5000™ router to satisfy connectivity, performance, and availability requirements ranging from workgroup or remote site access to high-performance, highly available network centers. The Bay Networks router family connects up to 104 network interfaces and delivers aggregate system forwarding performance greater than 1,000,000 pps. Bay Networks family of routers, hubs, switches, remote access devices, and network management products comprise an end-to-end standards-based solution while providing a smooth transition to switched internetworking.

Bay Networks

Benefits

Ensures Network Availability

The ASN executes the industry-leading distributed, fault-resilient Bay Networks Routing Services (BayRS™) system software that maintains high availability through software features such as hardware fault isolation, software fault isolation and recovery, and online dynamic reconfiguration.

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

Redundant LAN interface and redundant router features, along with redundant power supplies, ensure continued network operation. LAN interfaces distributed in an ASN stack and configured for redundant operation take advantage of Bay Networks symmetrical processing architecture to create a resilient platform for high availability applications.

Alternate path routing and Dial-on-Demand bandwidth features back up the primary data paths to assure network availability during periods of high traffic congestion and protect against business disruption in the event of a discontinued data path.

Enhances Network Performance

Leveraging proven Bay Networks Backbone Node (BN®) technologies, including a symmetric multiprocessing architecture and Parallel Packet Express (PPX®) processor interconnect, the ASN provides high system performance up to 50,000 pps per ASN unit with high internal bandwidth to support today's faster intranetwork applications.

Additionally, the Hardware-based Data Compression Coprocessor net module enables efficient use of WAN services by reducing the amount of traffic sent across the network.

A four-unit ASN stack supports forwarding performance up to 200,000 pps with 512 megabits per second (Mbps) of bandwidth between units in the stack. User-configurable DRAM and fast packet cache options let the ASN meet network performance requirements by optimizing system memory requirements.

Extends Network Connectivity

The ASN addresses remote office concentration requirements by providing a cost-effective, entry-level solution for network centers. By supporting up to 16 network interfaces per unit, ASNs fulfill the expansion needs of network centers by providing a highly scalable solution for the higher connectivity requirements of regional offices. The ASN's unique "stackable" architecture supports up to four ASNs that can interconnect many networks.

The ASN supports the entire suite of BayRS, including industry-standard SNA integration and comprehensive LAN and WAN protocol support.

Simplifies Network Administration

An ASN of any size is managed as a single device in the network. As the ASN expands, the workload of a network operations staff does not increase to support the router. The ASN requires only one software image and configuration file no matter how large the stack becomes, reducing the number of configuration files and nodes that require creation.

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

Bay Networks Optivity Internetwork™ integrates several router management applications — ControlCenter,™ RouterMan,™ PathMan,™ and Site Manager — to provide a comprehensive set of network management capabilities using both a command line and a GUI-based interface. The range of applications allow local control of the ASN as well as centralized configuration, monitoring, and control of the ASN from Windows or UNIX network management systems. Additionally, EZ Internetwork's™ Quick2Config™ allows a new ASN installation to be brought into service in the shortest amount of time.

Provides Low Cost of Ownership

The ASN offers a unique cost-effective solution that enables a site to start small and scale to a large configuration in terms of both number of interfaces and performance.

The ASN is configurable to mix different interfaces in a more economical package than the BCN for smaller network centers while retaining many of the performance and resiliency features of the BCN. The ASN is a cost-effective network center device that reduces equipment costs with features such as high port densities and integrated T1 Channel Service Units (CSUs). The ASN also reduces recurring operational costs by supporting large numbers of virtual circuits in a single node. Additionally, the ASN's data compression feature reduces the number of circuits required, while support for switched services match circuit costs to actual business uses.

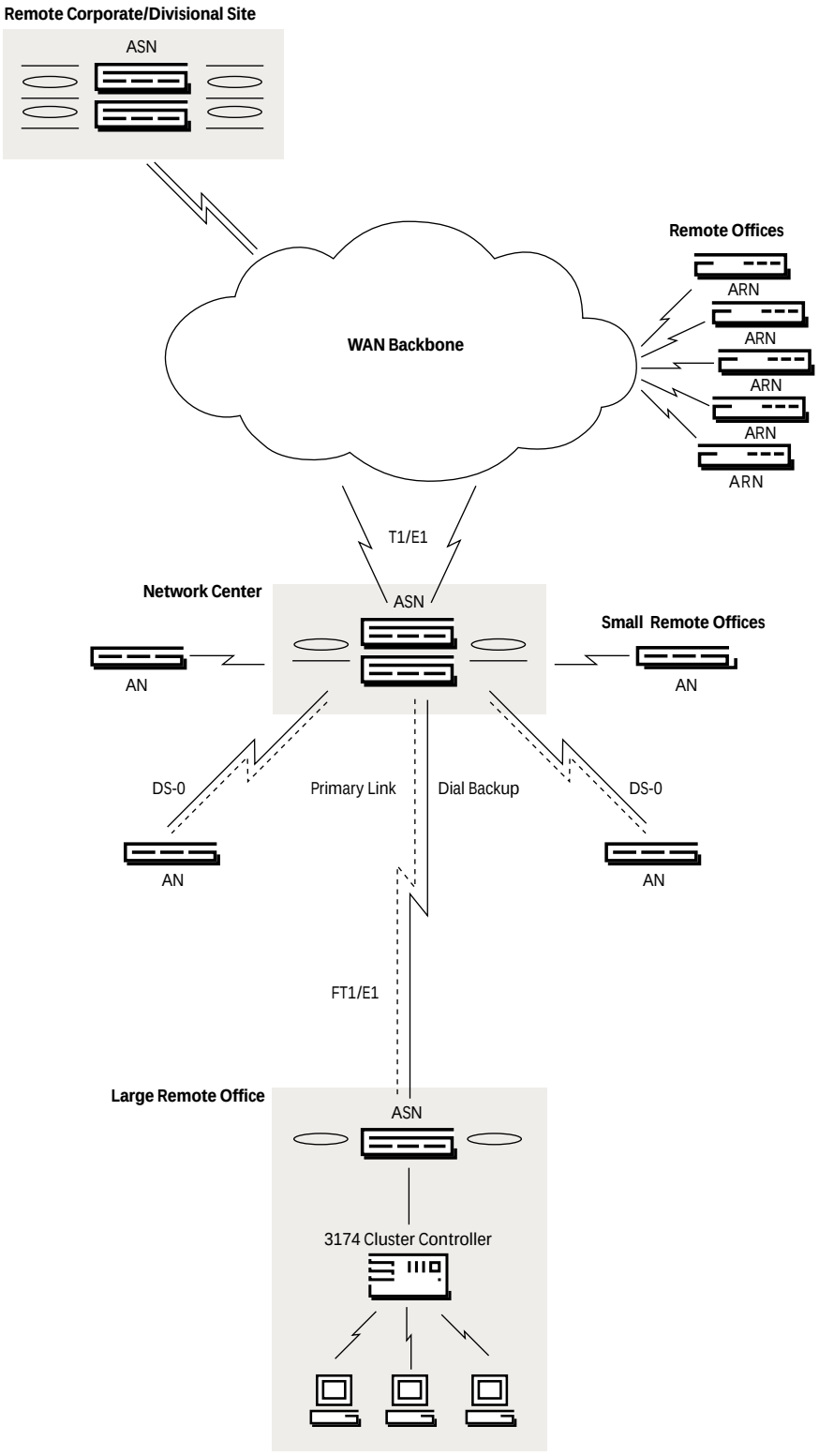
ASNs ease network expansion by allowing individual routers to be acquired and interconnected as needed to create a single multiprocessor router. Planning for future network equipment acquisition is also simplified because less anticipation of future needs is necessary. Acquisition of the ASN configuration that meets current needs is all that is required.

Flexible Network Environments

The ASN uses a highly scalable architecture, which provides cost-effective, growth-oriented solutions for enterprise network centers (see Figure 1). Typical applications and configurations include:

- ***Remote Office*** Large offices consisting of several LANs, SNA/SDLC devices, or high-speed LANs connected to a network center with high-speed circuits and backup links using Frame Relay, ISDN, SMDS, or DACS services.
- ***Network Center*** Site with application servers and services supporting an extended enterprise network. Multiple smaller remote sites are connected to this site using primary and backup links. This site also uses a number of trunk interfaces for connecting to a multiprotocol WAN backbone at rates of T1/E1 and higher over ATM, SMDS, Frame Relay, ISDN, or DACS services.

Figure 1 | **Network Design Options**



Hardware Features

High-Performance Processor

The ASN's processor module is based on the Bay Networks Backbone Node's Fast Routing Engine (FRE®) technology, using Motorola's MC68040 microprocessor to maintain high filtering and forwarding rates across its network interfaces (see Figure 2). The aggregate forwarding performance is up to 50,000 pps per unit and up to 200,000 pps per four-unit stack. The ASN's 8, 16, or 32 megabytes of DRAM is configurable to support buffers that prevent traffic overflow — and resulting network delays — caused by large bursts of traffic (e.g., file transfer operations) and to support tables that describe networks of users, services, and connections.

The ASN's optional 256 KB Fast Packet Cache increases forwarding performance through hardware acceleration of frequently accessed packet information.

The ASN supports a standard PC Type 2 Flash memory card for nonvolatile storage of the ASN's system software, configuration file, and event log. To provide redundancy, the Flash can be locally divided into two partitions of equal size or additional PC cards can be used to store backup copies of the software image and configuration file.

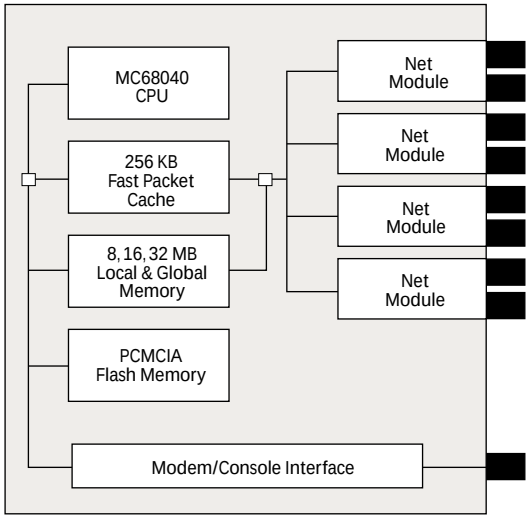
The ASN's processor module has four interface module (net module) positions for cost-effective network connectivity.

LAN and Serial Interfaces

The ASN provides network connectivity via a selection of net modules. Net modules are available to provide Ethernet, 100BASE-T (Fast Ethernet), Token Ring, FDDI, Synchronous, T1, E1, ISDN BRI, and ISDN PRI interfaces to meet a wide variety of connectivity requirements.

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 for a choice of Ethernet connectivity.

Figure 2 | **ASN Design Logic**



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. Full-duplex operation supported on the 100BASE-TX port, including flow control, is compatible with the BayStack Ethernet switch family.

Token Ring/802.5 The Token Ring interface can operate at either 4 or 16 Mbps ring speeds (software configurable). 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 overhead and 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 types: 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. Hybrid net modules have one Multimode and one Single-mode interface for mixed-media applications. Additionally, an RJ-11 connector is included to control an external optical bypass unit.

All Bay Networks FDDI interfaces are ANSI Class A Dual Attachment Stations (DAS) that can also be operated as Class B Single Attachment Stations (SAS) or dual homed. 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, RS-232, RS-422, and X.21. The Synchronous interface operates from 1,200 bps to 2.048 Mbps, full duplex, providing support for T1 and E1 rates concurrently on all ports. Higher interface speed may be achieved by reducing the number of ports in use.

Dial Backup, Dial-on-Demand, and Bandwidth-on-Demand using Raise DTR and V.25bis dial signaling are supported over V.35 and RS-232 interfaces. Synchronous and Asynchronous PPP, as well as Polled Asynchronous PPP, is supported by the ASN's Synchronous interface. This enables the router to use low-cost modems and analog telephone calls to establish PPP connections for interface flexibility and compatibility with modem-based compression. 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 and Binary Synchronous Communications (BSC) 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 Synchronous Pass-Through.

Bay Networks support of legacy BSC and X.25 devices and hosts allows traffic to be converged onto a multiprotocol backbone, eliminating duplication of networks. Bay Networks routers support primary and secondary connections at network endpoints while dynamically routing data across an existing Internet Protocol (IP) backbone network.

Bay Networks provides net modules with up to four Synchronous interfaces.

ISDN Basic Rate Interface (BRI) Each ISDN BRI port on Bay Networks routers provides two 64 Kbps B channels for data and one 16 Kbps D channel for signaling. Rate adaptation for 56 Kbps transmission rates on B channels is also supported. The BRI ports support all major international signaling specifications (see Table 1).

Table 1 | **Supported ISDN BRI Signaling Specifications**

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

Bay Networks provides ISDN BRI support via a Quad port net module using S/T interfaces. An ASN with BRI interfaces eliminates the need for an external ISDN terminal adapter.

Multichannel T1 (MCT1) Interface The MCT1 net module provides two 1.544 Mbps interfaces for high-density access to services such as digital cross-connect switches (DACS). This interface increases link density by allowing data to be segmented into multiple DS-0 connections for transmission over leased point-to-point links. Up to 24 DS-0 (56/64 Kbps) channels can be used individually or grouped into Fractional T1 channels for a highly flexible network environment.

The MCT1 net module can also be used as an inexpensive T1 or Fractional T1 access link to Frame Relay services.

The MCT1 features a configurable DSU/CSU for direct connection to a T1 network. An RJ-48C and a 15-pin D-subminiature (DB-15) connector for T1 cable attachment is provided for each port. The interface provides comprehensive testing and management features, including integrated support for loopback testing and BERT line testing.

Multichannel E1 (MCE1) Interface The MCE1 net module provides a 2.048 Mbps G.703 interface for high-density access to a variety of international telecommunications services. The MCE1 allows multiple DS-0s to be transmitted or received over leased point-to-point links. Up to 31 DS-0 (64 Kbps) channels are supported. The MCE1 net module has both 75 ohm and 120 ohm connectors, allowing it to be used in leased line or ISDN PRI links. The 75 ohm interface is provided via BNC connectors and includes external clocking. The 120 ohm interface is provided via an 8-pin modular connector. Supported diagnostics include an Integrated BERT Line Tester and Fractional/E1 Loopback.

The MCE1 net module complies with the CTR12 European Standard (for 120 ohm), TS016 Australian National standard (for 75 ohm), and NTR4 U.K. National standard (for 75 ohm).

Table 2 | **Supported ISDN PRI Signaling Specifications**

Region/Country	ISDN Standard
Australia	AUSTEL TS014
European	Euro ISDN (iCTR4)
Japan	INS-1500
North America	AT&T 4ESS AT&T 5ESS Nortel DMS-250

ISDN Primary Rate Interface (PRI) ISDN PRI software in the ASN's System software suite enables the ASN to connect directly to an ISDN switched service network via a Bay Networks Multichannel T1 (MCT1) or Multichannel E1 (MCE1) net module. Bay Networks ISDN PRI complies with all major international signaling specifications (see Table 2). The European standard provides 30 B channels plus one D channel. The North American standard provides 23 B channels plus one D channel.

Hardware-Based Data Compression Coprocessor Net Module

Bay Networks Hardware-based Data Compression Coprocessor net module offloads compression and decompression tasks from the main CPU, allowing CPU resources to be used for higher throughput or other packet processing functions. The Hardware-based Data Compression net module supports ISDN, PPP, and Frame Relay links. It is also interoperable with hardware and software compression operating in other Bay Networks routers. The draft RFC Compression Control Protocol (CCP) is supported along with the Bay Networks WAN Compression Protocol (WCP).

Two compression modes are available: Continuous Packet Compression (CPC) and Packet-by-Packet Compression (PPC). CPC mode maintains a compression history to maximize throughput. PPC optimizes throughput in customer specific applications.

The Hardware-based Data Compression Coprocessor net module is available in two models to support different numbers of network paths. The 32 context and 128 context models can be configured to use an 8 KB compression dictionary for each PPP circuit or Frame Relay virtual circuit up to the number of contexts provided in each model.

The Hardware-based Data Compression Coprocessor net module occupies one net module position, and one net module is configured per ASN base unit to provide compression services for all WAN interfaces installed in that base unit.

Stack Packet Exchange — Hot-Swap (SPEX-HS)

Bay Networks SPEX™-HS net module and Cable combine to interconnect ASN base units together into a single router and allow any individual unit in an ASN stack to be removed from or added to the stack without affecting the operation of the remaining units in the stack. The SPEX-HS Cable has four connectors to mate with the SPEX-HS net modules and forms a bus interconnecting two to four ASN units. Only one cable is required for an entire stack. Two cables provide redundancy and higher bandwidth.

The SPEX-HS net module operates the interconnect bus at 256 Mbps. When two SPEX-HS cables are used, the effective speed of the SPEX-HS is 512 Mbps. This reduces bus contention and transfer time for data sent between base units in the stack.

The benefits of the resilient Bay Networks BayRS software architecture are fully realized with the SPEX-HS feature. BayRS router software will automatically recover faults in individual modules without affecting other operating modules. The SPEX-HS stack interconnection extends this capability to allow failed hardware that cannot be automatically recovered by the software system to be isolated and repaired quickly without affecting other ASNs in the stack.

Packaging and Power Options

Quiet and compact, the ASN can operate in either a wiring closet, desktop, or network center environment and is rack mountable (see Figure 3). The ASN is available in a single power supply model with one 100 to 240 VAC power supply and in redundant power supply models supporting 100 to 240 VAC or -48 VDC power supplies. The redundant power supply models have an internal power supply and a connection for an external power supply. The external power supply provides power if the internal supply fails without disrupting the operation of the ASN base unit. The external power is supplied by one power module in a High-output Power Redundant Power Supply Unit (HRPSU). The HRPSU supports a stack of four ASNs or a mixed stack with ASNs, BayStack routers, hubs, and Ethernet switches, as well as Distributed 5000™ hubs.

LEDs indicate module status for easy troubleshooting assistance (see Table 3).

Figure 3 | **Access Stack Node Connector Panel**

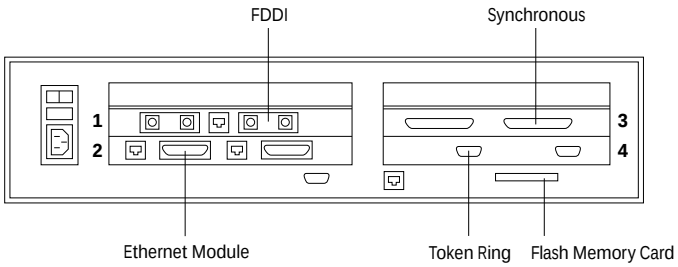


Table 3 | **LEDs**

LED	Status Indicator
DCD1	Data Carrier Detect present on Synchronous Net Module COM1 port
DCD2	Data Carrier Detect present on Synchronous Net Module COM2 port
P1	Transmitting and receiving data on Ethernet Net Module AUI1 or 10BT1 port
P2	Transmitting and receiving data on Ethernet Net Module AUI2 or 10BT2 port
Link	Physical connection to Fast Ethernet network on 100BASE-T Net Module
Collision	Indicates packet collision detected by 100BASE-T Net Module
Rx	Receiving data on 100BASE-T Net Module
Tx	Transmitting data from 100BASE-T Net Module
SPD	Indicates 100 Mbps operation of 100BASE-T Net Module
DPX	Indicates full-duplex operation of 100BASE-T Net Module
WFAIL	Detection of a wire fault in either the Receive or Transmit line (Token Ring)
NSRT	Port has inserted into the Token Ring LAN
RCVR	Receiving data from the Token Ring LAN
SD	Incoming signal detected by FDDI interface
TX	Transmitting data across FDDI interface
S and P	Router is present on the FDDI ring as secondary or primary
BRI	Indicates call active on any of the BRI Net Module's B channels
FR	Transmitting a frame from SPEX Net Module
FC	Indicates SPEX Net Module is using Flow Control

BayRS Software Features

Extensible Networking Capabilities

Bay Networks BayRS, with support for the ASN, maximizes connectivity and interoperability in multivendor, multiprotocol environments by supporting all major network and bridging protocols and wide area services (see Table 4). Industry-standard IBM transport is also supported via Source Route Bridge, Data Link Switching (DLSw), BSC Pass-Through, Transparent Synchronous Pass-Through, 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

Table 4 | **Bay Networks Routing Services for ASN**

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*		√		√
BSC Pass-Through	√	√	√	√
Transparent Synchronous Pass-Through	√	√	√	√
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	√	√	√	√

* DLSw for SDLC requires Corporate Suite.

Table 4 | **Bay Networks Routing Services for ASN (continued)**

Feature	System Suite	LAN Suite	WAN Suite	Corporate Suite
Dial-Up Services				
Bandwidth-on-Demand	√	√	√	√
Dial Backup	√	√	√	√
Dial-on-Demand	√	√	√	√
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			√	√
SecurID	√	√	√	√
Dynamic Loader	√	√	√	√
Availability				
Software Fault Isolation and Recovery	√	√	√	√
Online Operational Servicing (Hot-Swap)	√	√	√	√
Flash Card Partitioning	√	√	√	√
Interface Redundancy	√	√	√	√
Router Redundancy	√	√	√	√
Dynamic Reconfiguration	√	√	√	√
Redundant Power	√	√	√	√

ASNs to provide fully featured router functionality to meet a wide range of network requirements.

Four BayRS software options are available for the ASN — System, LAN, WAN, and Corporate (see Table 4). This allows the ASN to be configured with software that fits a site's particular requirements.

Distributed Software Architecture

The ASN uses BayRS software, which features an innovative, highly efficient software architecture that distributes forwarding, filtering, and management functions across each unit in a stack 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 ASN processor module. Each processor 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 ASN processor modules within the stack configuration.

Certain computation- and memory-intensive routing update protocols, such as Open Shortest Path First (OSPF), are activated on only one ASN processor module within a stack configuration. This allows the processor-intensive activities required by OSPF's link-state routing protocol to be performed by a single processor module that distributes the results to other processor modules within the stack. In the unlikely event of an ASN processor module failure, OSPF's "hot-standby soloist" is automatically and quickly activated on another ASN processor module, without

Figure 4 | **Distributed Software Architecture**

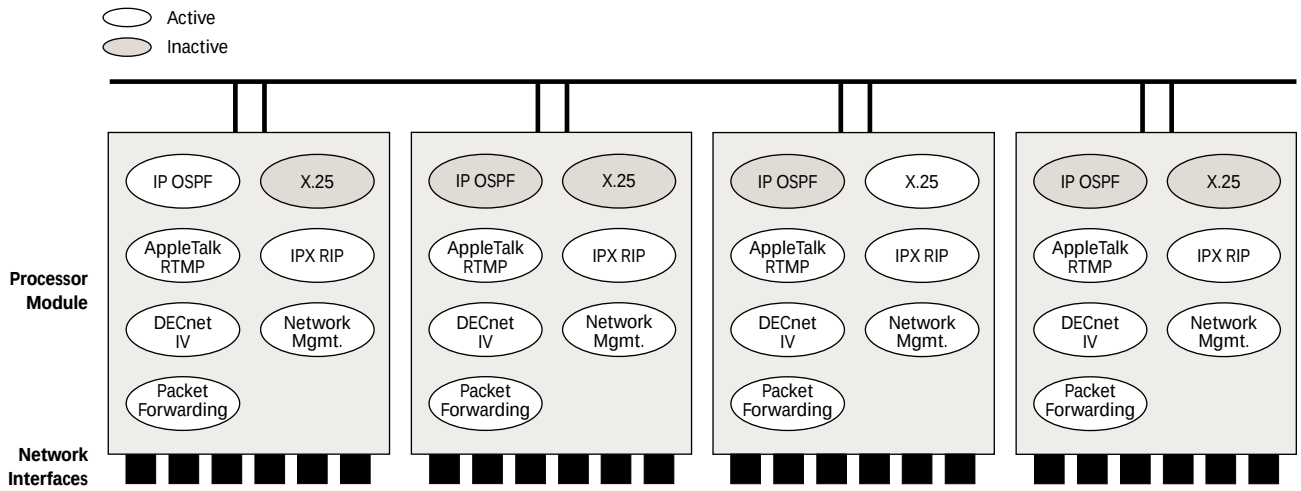
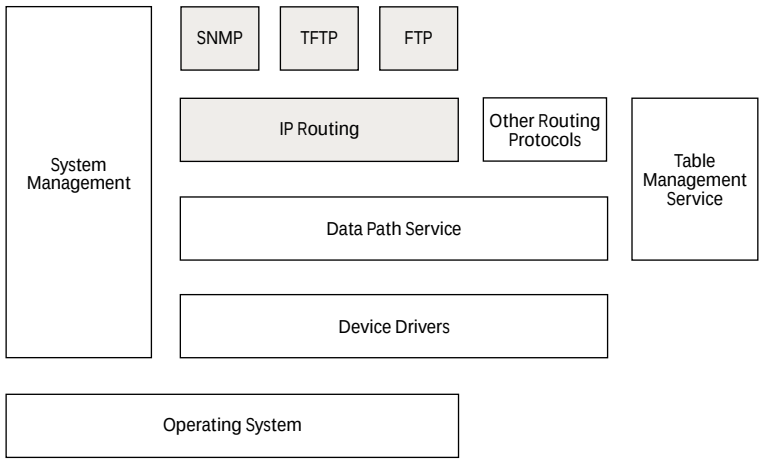


Figure 5 | **BayRS Software Architecture**



the loss of current routing information. Less intensive routing protocols, such as IPX RIP, VINES RTP, and AppleTalk RTMP, can be active on multiple ASN processor modules. Additionally, overhead processes, such as network management tasks, are distributed among the stacked ASNs (see Figure 4).

Layered BayRS Architecture

BayRS features a layered system software architecture (see Figure 5). 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 net module interfaces that provide 100BASE-T, Ethernet, Token Ring, FDDI, T1, E1, 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 ASN 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 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 ASN stack configurations, fault isolation can include individual ASN processor module, Flash card, or power supply hardware.

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 ASN or other ASNs within a stack configuration, and automatically restarts the failed process. If the process cannot be recovered, it is terminated.

Partial Boot Bay Networks partial boot capability enables the ASN 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 ASN. 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 ASN reboots. To preserve changes, the ASN's active configuration must be saved permanently to a file on the PCMCIA Flash memory. This file defines the ASN's 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 ASN provides maximum system availability through online operational servicing capabilities. When configured with SPEX-HS net modules and Cable, individual ASNs can be inserted or removed from a stack configuration without affecting the operation of the rest of the stack. This eliminates downtime for upgrades and repairs of ASN stack configurations. The ASN automatically boots and returns to operation when it is reconnected to the stack system and power is turned on.

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 net module in a 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 quickly, ensuring continued availability. IP, IPX, and Source Route Bridging are supported by this feature.

A unique application of high availability with ASNs is to stack at least two ASN base units connected via SPEX-HS (or dual SPEX-HS cables). Use Bay Networks redundant interfaces to provide protected LAN connections and multiple WAN interfaces for alternative paths, to yield a small, mixed interface router that has complete 1-for-1 redundancy of logic, power supply, power source, and data paths. This configuration is easy to manage as a single router and switches almost imperceptibly to the alternative path when a fault occurs.

Redundant Router Support

The ASN supports 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 routers 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.

Redundant Power

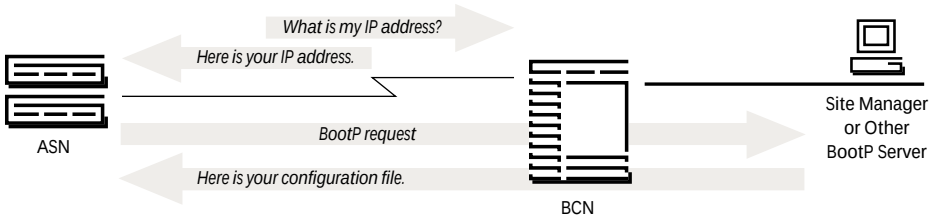
The ASN supports an external power supply to provide power in the event of a fault of the internal power supply. The transition does not disrupt router operation or cause a reboot. Replacement of the internal supply can be scheduled for a maintenance window so users are not affected.

The external power supply is housed in an HRPSU chassis and is hot-swappable. Up to four power modules can be installed in the HRPSU to support a full stack of ASNs or a mixed stack of ASN, Distributed 5000, and BayStack family units. The separate AC power input to the HRPSU allows configuration of redundant power sources for the stack as well.

Remote Installation and Management

EZ Install and EZ Update simplify ASN installation and make router reconfiguration and software updates from a central site quick and easy.

Figure 6 | **EZ Install**



EZ Install EZ Install eliminates the time and expense of sending a technical resource to install and configure an ASN. All that is required at the remote site is connecting the ASN's LAN and serial interfaces and turning on the power. With EZ Install, the ASN obtains its software image from Flash memory and its configuration file through the network. Using EZ Install, an ASN 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 6). After an ASN's configuration file has been successfully downloaded to DRAM via EZ Install, the unit'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 ASN configuration file and software image are stored in the ASN's nonvolatile Flash memory for use as backup in case any problems are encountered while downloading new software. To use EZ Update, the ASN is dynamically configured to boot its configuration file and software image from the central site. The ASN can then be rebooted or power-cycled, and a new configuration file and/or software image will be downloaded to the ASN's 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 ASN'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 the Windows-based Optivity Campus™ and EZ Internetwork products are powerful tools for providing comprehensive node configuration, monitoring, and control. The ASN also supports the Technician Interface that further eases configuration and maintenance tasks.

In addition, Bay Networks and Dynamic Software Builder and Loader features reduce router memory requirements and enable remote sites to be configured quickly and easily without disrupting network operations.

Security is ensured with a two-level password mechanism (read vs. read/write) and by the ASN's support of SecurID software. The ASN supports a TFTP client/server agent and an SNMP agent that enables configuration, monitoring, and control of each of the ASN's network interfaces. The SNMP agent can respond to Get/Set requests independently. All MIB variables (MIB II and Bay Networks extensive, enterprise-specific MIB) are also provided.

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 ControlCenter, Bay Networks revision control application; 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 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 ManageWise 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 that automatically discovers and displays all hubs, bridges, switches, routers, and endstations to create an accurate blueprint of the network configuration. 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 ManageWise enables NetWare systems in IPX-only and mixed IP/IPX networks to be managed from a single console. Optivity for NetWare NMS 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.

EZ Internetwork A component of the DOS/Windows-based Optivity Workgroup™ application suite, EZ Internetwork provides a comprehensive set of network management capabilities accessible through a point-and-click, Windows-based user interface for the Bay Networks ASN, and BayStack AN and ANH routers. EZ Internetwork integrates Quick2Config, Bay Networks application that allows Bay Networks router configuration files to be quickly and easily created or modified with a Windows-based version of RouterMan (see the "Optivity Internetwork" section). With Quick2Config, the most novice network administrator can have the router configured and operational in minutes. Quick2Config is fully compatible with Bay Networks Site Manager application.

Technician Interface This terminal-based (TTY-compatible) tool enables local or remote installation and maintenance. The Technician Interface 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. The Technician Interface also supports out-of-band access to the BLN and BCN through a modem connection.

Bay Networks further simplifies installation and maintenance by supporting inbound and outbound Telnet sessions, the simple remote terminal protocol. Supporting incoming Telnet allows the Technician Interface to be accessed by a local or remote terminal. Outbound Telnet support enables the Technician Interface 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 Technician Interface supports a single outbound Telnet session.

Dynamic Software Builder and Loader Site Manager's Software Builder works with the AN/ANH's Dynamic Loader to preserve the routers' Flash memory and DRAM space. The Software Builder allows software images to be customized. Only required software functionality is maintained in the remote router's software image. For example, if a remote site requires only IP and IPX support, other network protocols can be deleted from the software image to preserve Flash memory space.

The Dynamic Loader feature preserves DRAM space by loading to DRAM only the routing functionality that is required by a particular ASN configuration. Using the previous example, if a particular branch office does not require IPX support, then Dynamic Loader will load only IP from Flash memory to DRAM, rather than the ASN's complete software image.

Table 5 | **Specifications**

Architecture	Processor module based on Motorola 68040 microprocessor
	Four net modules per processor module
	Four-unit stack configuration via SPEX-HS
	Symmetric multiprocessor architecture with multiple units
	256 Mbps processor interconnect with SPEX-HS
	512 Mbps processor interconnect with two SPEX-HS
	32 Context hardware compression coprocessor net module
	128 Context hardware compression coprocessor net module

Table 5 | **Specifications (continued)**

Connectivity	Ethernet Interface (15-pin AUI connector or 8-pin modular)
	Token Ring Interface (9-pin MAU connector)
	FDDI (two MIC, one RJ-11 — optical bypass)
	Synchronous Interface (44- and 50-pin connector to RS-422, RS-232, V.35, X.21 adapter cable)
	ISDN BRI and ISDN PRI (8-pin modular)
	100BASE-T Interface (40-pin MII connector or 8-pin modular)
MCT1	(RJ-48C, 15-pin DB connector)
MCE1	(BNC — 75 ohm, 8-pin modular — 120 ohm)
Packaging	
Nonredundant	
Type	Tabletop/Rack-Mount
Dimensions	4.33 x 17.50 x 17.00 in.
(H x W x D)	10.99 x 44.45 x 43.18 cm
Weight	25 lb (11.34 kg)
AC Voltage	100 – 240 VAC at 4.0 A max. (50 – 60 Hz)
Wall Receptacle	NEMA 5-15R (100 – 240 VAC; for use in North America)
Redundant	
Type	Tabletop/Rack-Mount
Dimensions	4.33 x 17.50 x 17.00 in.
(H x W x D)	10.99 x 44.45 x 43.18 cm
Weight	27 lb (12.30 kg)
AC Voltage	100 – 240 VAC at 4.0 A max (50 – 60 Hz)
Wall Receptacle	NEMA 5-15R (100 – 240 VAC; for use in North America)
DC Voltage Requirements	
Input Voltage	– 48 VDC
Input Current	8.5 A max
Inrush Current	60 A max
Environmental and Regulatory	
Altitude	0 – 8,000 ft (0 – 2,400 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

System Requirements

The Access Stack Node (ASN) configurations described in this data sheet are currently supported in BayRS Version 11.0, unless otherwise indicated in this document.

Ordering Information

BayRS software must be ordered separately for each Access Stack Node. Each Access Stack Node includes a manual titled *Installing and Maintaining the Bay Networks Access Stack Node.* One complete set of Bay Networks documentation (Router Installation Documents, Router Management Documents, and Technician's Interface and Hardware Documents) is recommended for each central site.

Table 6 | **Ordering Information**

Order Number	Description
Access Stack Node (ASN)	
AF0002008	ASN Nonredundant AC base unit with 8 MB DRAM
AF0002009	ASN Nonredundant AC base unit with 16 MB DRAM
AF0002010	ASN Nonredundant AC base unit with 32 MB DRAM
AF0002011	ASN Redundant AC base unit with 8 MB DRAM
AF0002012	ASN Redundant AC base unit with 16 MB DRAM
AF0002013	ASN Redundant AC base unit with 32 MB DRAM
AF0002014	ASN Redundant DC base unit with 8 MB DRAM
AF0002015	ASN Redundant DC base unit with 16 MB DRAM
AF0002016	ASN Redundant DC base unit with 32 MB DRAM
System Hardware Redundancy Options	
AA0002001	HRPSU AC base unit
AA0005003	HRPSU AC power module (200 W; 24-pin)
AA0018016	HRPSU output cable (200 W; 24-pin)
AA0018017	RPSU output cable (200 W; 16-pin)
AA0018018	HRPSU output adapter for 16-pin cable
Power Cords for ASN and HRPSU	
7910	10A/240 V power cord for Australia
7911	10A/200-230 V for Europe
7912	10A/220-230 V for Denmark
7913	10A/220-230 V for India/South Africa
7914	10A/220-230 V for Israel
7915	10A/220 V for Italy
7916	10A/220-230 V for Switzerland
7917	10A/240 V for United Kingdom
7918	10A/100 V for Japan
7931	10A/220-250 V for North America
Power Cord for ASN only	
7919	10A/110-120 V for North America
Power Cord for HRPSU only	
AA0018020	Redundant AC Power Supply power cord (North America)
AA0020001	Redundant AC Power Supply power cord (Japan)

Note: One AC power cord is available at no charge with each ASN or HRPSU base unit. The appropriate power cord is ordered as a separate line item. If no power cord is ordered, the appropriate 120 VAC North American power cord will be shipped.

Table 6 | **Ordering Information (continued)**

Order Number	Description
Network Modules (Net Modules)	
34000	Dual Ethernet
34001	Dual Synchronous
AF2104006	Quad Synchronous
34002	Dual Token Ring
34008	Quad ISDN BRI
34010	100BASE-T
AF2104016	Dual MCT1
AF2104004	Single MCE1
AF1204001	Dual Attached Multimode FDDI
AF1204002	Single-mode FDDI
AF1204003	Hybrid Single-mode/Multimode FDDI
AF1204004	Hybrid Multimode/Single-mode FDDI
AF2104007	32 Context Hardware Compression Coprocessor
AF2104012	128 Context Hardware Compression Coprocessor
Stack Packet Exchange (SPEX) Module and Cable	
7166	SPEX-HS cable
34007	SPEX-HS Stack Interconnect Module
BayRS	
AF0008017	ASN BayRS Basic software suite
AF0008018	ASN BayRS LAN software suite
AF0008019	ASN BayRS WAN software suite
AF0008020	ASN BayRS Corporate software suite
Memory Upgrades	
AA0004001	Fast Packet Cache
50027	Upgrade to 16 MB DRAM
AF0011005	Upgrade to 32 MB DRAM

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United States

Bay Networks, Inc.
4401 Great America Parkway
Santa Clara, CA 95054
1-800-8-BAYNET

Bay Networks, Inc.
8 Federal Street
Billerica, MA 01821-5501
1-800-8-BAYNET

Europe, Middle East, and Africa

Bay Networks EMEA, S.A.
Les Cyclades – Immeuble Naxos
25 Allée Pierre Ziller
06560 Valbonne, France
+33-4-92-96-69-96 Fax
+33-4-92-96-69-66 Phone

Pacific Rim, Canada, and Latin America

Australia +61-2-9927-8888
Brazil +55-11-247-1244
Canada 416-733-8348
China +8610-6238-5177
Hong Kong +852-2-539-1388
India +91-11-301-0404
Japan +81-3-5402-7001
Mexico +52-5-480-1241
Singapore +65-323-3522

World Wide Web: **http://www.baynetworks.com**

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