BayStack Advanced Remote Node

BayStack™

Delivers Extended Interface Density and Flexibility

Supports High-Performance Networking

Provides Maximum Investment Protection

The Bay Networks BayStack™ Advanced Remote Node (ARN™) delivers an innovative access router architecture with the performance and modularity to solve today's application needs and meet the increasing demands of the evolving corporate intranet. Its design integrates the functions of multiple devices to reduce the complexity of remote network management. As a result, the ARN significantly lowers the total cost of ownership and provides the highest degree of investment protection for enterprise networks.

Two wide area network (WAN) adapter module "slots" provide an array of options for integrating devices (ISDN BRI, DSU/CSU, V.34 modem) for primary and backup WAN connectivity. This modular design reduces the number of physical devices and amount of cabling required for system operation, and also facilitates remote network management.

Bay Networks Routing Services (BayRS™) offers the most comprehensive WAN service support (leased line, Frame Relay, X.25, SMDS, Dial Services, even ATM), allowing customers to choose the most cost-effective primary and backup links available for their remote site applications. BayRS WAN optimization supplies key features such as Data Compression, Traffic Prioritization, Uniform Traffic Filters, and Dial Optimized Routing, significantly reducing costs by increasing available network bandwidth and maximizing traffic control.

An optional expansion module offers additional serial interfaces and/or a LAN interface for integrating existing low-speed legacy device traffic (SDLC, BSC, polled Async, or X.25) and LAN-based client/server traffic over a consolidated WAN link to the corporate backbone.

The ARN employs Motorola MC68040 and MC68360 microprocessors to handle the demands of compute-intensive internetwork applications, including multiprotocol routing, SNA integration, traffic management, and high-speed WAN communication.

Seamless integration with the enterprise internetwork is ensured through the Optivity Internetwork™ application's support for comprehensive node configuration, monitoring, and control. Additionally, optional embedded Ethernet RMON probes — Data Collection Modules (DCMs) — provide visibility into network activity at remote sites where there is typically no dedicated support staff.

The BayStack ARN is a critical part of the BayStack product family. Combined with the BayStack 10BASE-T Stackable Hubs, 100BASE-T Hubs, Ethernet/Fast Ethernet switches, and remote access devices, the ARN delivers a robust, scalable solution for providing remote office connectivity to the enterprise network.

Bay Networks

Benefits

Delivers Extended Interface Density and Flexibility

With support for up to two LAN and five serial interfaces, the ARN provides an ideal platform for remote sites combining multiple core legacy devices (SDLC, BSC, polled Async, or X.25), and LAN-based client/server traffic (IP and IPX) over Frame Relay, X.25, leased line, or dial (analog or ISDN) links (see Figure 1). By integrating transmission devices such as CSU/DSUs, ISDN BRI, or modems into the ARN's chassis, the number of multivendor, separately managed devices and subsequent cabling is reduced, simplifying remote management and enhancing reliability.

Supports High-Performance Networking

The ARN's high-performance architecture supports concurrent execution of compute-intensive applications including SNA network integration (DLSw, APPN, SDLC), WAN bandwidth optimization (compression, prioritization, filters), and remote office link security (firewalling, encryption). In addition, two types of link routing are supported: wire-speed LAN-to-LAN (Ethernet and/or Token Ring) and multiple high-speed WAN (T1/E1).

Provides Maximum Investment Protection

Beyond answering the needs of most current remote networks, the ARN's future-proof design provides ample performance headroom for emerging application requirements. The continuing development of WAN adapter modules also assures an easy, cost-effective migration path for ARN users looking to upgrade to the newest WAN access technologies as they become available.

Features

High-Performance Processors and Memory Modules

The high-performance, highly flexible base unit of the ARN router contains Motorola 33 MHz MC68040 and MC68360 microprocessors, ensuring high forwarding and filtering rates across each of its network interfaces.

In addition, 4, 8, 16, or 32 megabytes (MB) of DRAM can be installed and configured to support customized partitioning between local and global memory. Router software resides in local memory while global memory is dedicated to packet buffers. Through these reserved buffers, the ARN prevents traffic overflow and resulting network delays caused by large bursts of traffic, such as file transfer operations.
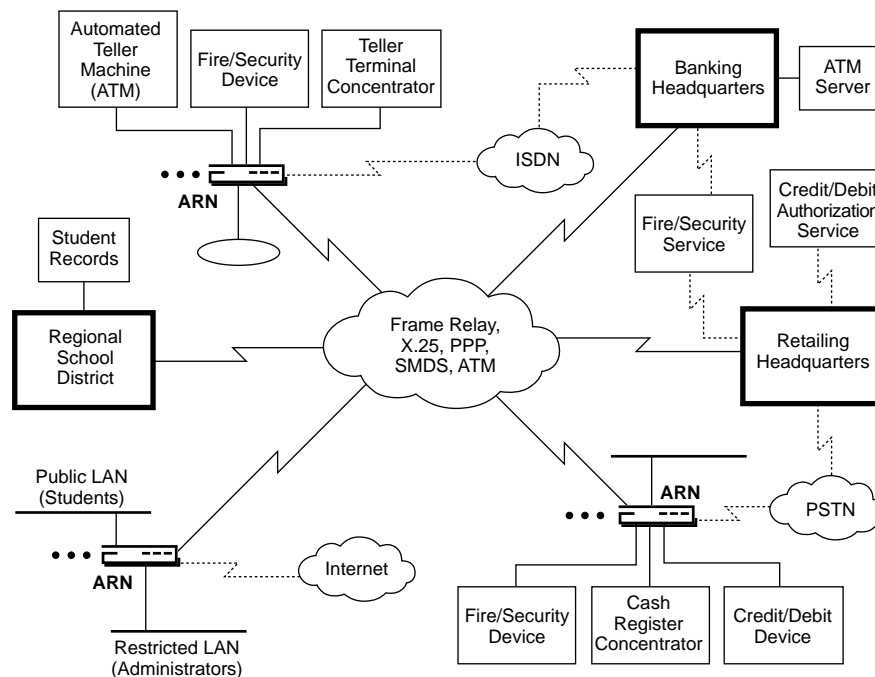
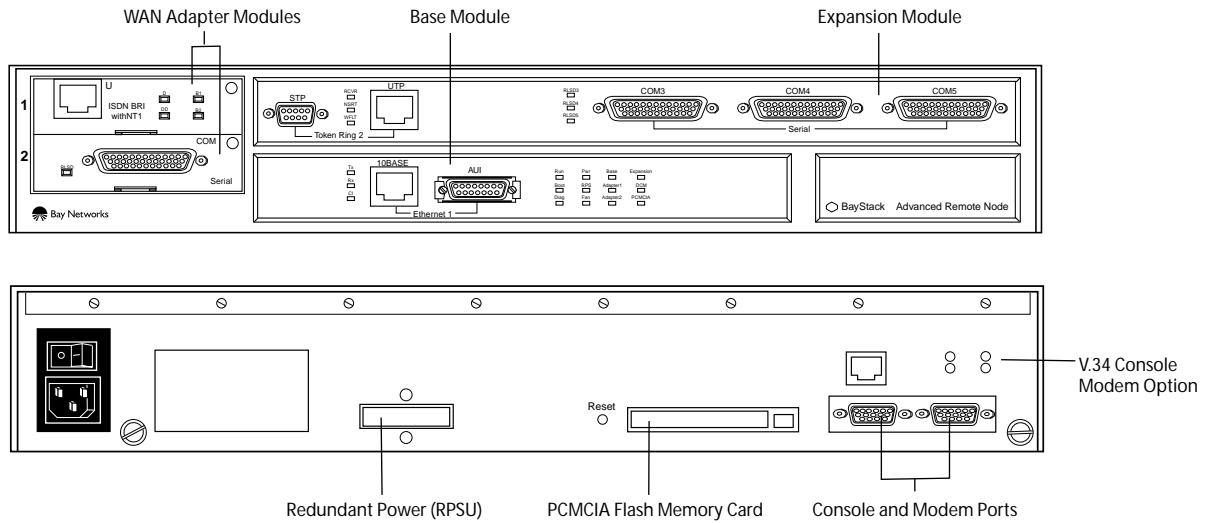Figure 1 | **Network Design Options**

Figure 2 | **Front and Rear View of Advanced Remote Node (ARN)**

WAN Adapter Modules   Base Module   Expansion Module

Redundant Power (RPSU)   PCMCIA Flash Memory Card   Console and Modem Ports   V.34 Console Modem Option

Base Module Expansion Options

PCMCIA Flash Memory Card: Either 4 or 8 MB of externally accessible Flash memory allows for nonvolatile storage of router software and configuration files. Software image and configuration files can be downloaded remotely to the Flash memory card, simplifying router upgrades and fault recovery procedures. To facilitate remote configuration and management, the PCMCIA Flash memory card can even be programmed at the network center, mailed to a remote site and easily installed by untrained personnel.

To provide redundancy, the PCMCIA Flash memory card can be logically divided into two partitions of equal size. Each partition is a uniquely addressable and fully functional Flash file system volume where copies of boot images and configuration files can be stored.

V.34 Console Modem Module: In addition to the ARN's standard console and external modem interfaces, a V.34 console modem option can be installed to simplify remote router deployment. The module also supports out-of-band troubleshooting should remote network access become unavailable.

Redundant Power Supply Unit: For mission-critical deployments, an optional Bay Networks RPSU (Redundant Power Supply Unit) can be connected to the ARN router, providing a secondary power source in case its primary power supply fails.

Ethernet RMON Probe: An optional DCM can be attached directly to the ARN's Ethernet base module, providing comprehensive monitoring capability to the router. The probe contains a 25 MHz Motorola MC68040 microprocessor and 2 MB of DRAM memory, and supports all nine groups of the Ethernet RMON MIB (RFC 1757), including Layer 3 traffic monitoring. Through continuous monitoring of the ARN's Ethernet LAN segment, the DCM collects, correlates, and summarizes long-term network activity data. The resulting historical information can then be used to detect trends in network performance, faults, and traffic flows, as well as to determine the optimum configuration to maximize network performance.

LED Matrix Display

A comprehensive matrix of LEDs present clear, at-a-glance status readouts of key ARN system components, including the base module, WAN adapters, expansion and data collection modules, PCMCIA memory, RPSU status, fans, and router software loading. Along with providing quick insights into the router's status, the LED matrix can also be used to supply networking administrators with a remote view of the router's status via SNMP.

Integral WAN Connectivity

The ARN router's slide-in WAN adapter modules offer the functionality of WAN transmission devices, supplying an integrated solution that is easily managed as a single platform. Similar to the other Bay Networks routers, the ARN's WAN flexible interfaces enable users to choose among today's alternative wide area networking links, including PPP (synchronous or asynchronous), Frame Relay, X.25, ISDN, SMDS, or ATM.

Up to two WAN adapter modules can be inserted into the router, ensuring easy, cost-effective upgrades to newly available, higher bandwidth WAN services while preserving the initial router investment (see Figure 2).

Table 1 | **Supported ISDN Signaling Specifications**

Region/ Country	ISDN Standard
Australia	AUSTEL TS013
Europe	Euro ISDN (CTR4)
France	VN-3
Japan	INS-64
North America	National ISDN-1
	AT&T 4ESS and 5ESS ISDN
	Northern Telecom DMS-100 and DMS-250

WAN adapter module options include:

- *Serial:* The serial interface supports V.35, RS-232, RS-449/422 balanced, RS-530, and X.21. Using either internal or external clocking, serial interfaces can be operated at speeds from 1200 bps to 2.048 Mbps, full duplex, and support the use of T1 and E1 services.

  The ARN's serial interfaces can also be used to integrate remote site SNA devices such as SDLC and BSC controllers, allowing them to share WAN access with a site's LAN traffic. Bay Networks support of Binary Synchronous Communications (BSC) pass-through allows customers to converge BSC 3270 device traffic, such as that of an automated teller machine, onto a high-performance, multiprotocol IP backbone, eliminating costly dial-up BSC links. Using standard TCP/IP as the internetwork transport, dynamic rerouting capability provides added resiliency for mission-critical BSC data.

- *ISDN Basic Rate Interface (BRI):* Supplying two 64 Kbps B channels for data and one 16 Kbps D channel for signaling, ISDN BRI adapter modules provide an integrated, high-performance solution for companies interested in using the extensive dial services offered by Bay Networks, including Dial Backup, Dial-on-Demand, and Bandwidth-on-Demand.

  ISDN BRI options are available with or without an integral Network Termination 1 (NT1) device, allowing users to choose the solution that best fits the requirements of each site. The ISDN BRI "U" adapter module provides the necessary integral NT1 interface for direct connection to most North American ISDN BRI networks. For locations where the NT1 interface is provided by a service provider or PTT, the ISDN BRI "S/T" adapter module ensures the necessary connectivity. Both ISDN BRI modules support worldwide signaling specifications (see Table 1).

- *56/64 Kbps Data Service Unit/Channel Service Unit (DSU/CSU):* The integral 56/64 Kbps DSU/CSU adapter module provides direct synchronous access to either 56 Kbps DDS or 64 Kbps Clear Channel dedicated services, facilitating a simpler connection between the router and the service provider's facilities. Extensive diagnostic and loopback test capabilities, including the generation of and response to CCITT V.54 Remote Loopback, allows network administrators to readily pinpoint WAN connection difficulties with either router, DSU, or WAN facilities, making the ARN easier to troubleshoot.

- *V.34 Modem:* When Switched 56 or ISDN BRI services are not available or considered cost-effective, the ARN's integral V.34 modem adapter module can be used to support Bay Networks dial services capabilities at speeds ranging from 1,200 bps to 115,200 bps on standard analog telephone lines. Providing nominal speeds of 28.8 Kbps, the V.34 modem's standard V.42bis compression capabilities boost throughput to 115.2 Kbps or greater. Standard V.42 and MNP 10 error correction capabilities also ensure reliable transmission of mission-critical data.

Auxiliary Remote Expansion Modules

The ARN's optional expansion modules allow the router to be configured to support a second LAN interface (Ethernet or Token Ring) and/or three serial (Synchronous/Asynchronous) interfaces. Expansion module options include Tri-Serial, Ethernet, Ethernet plus Tri-Serial, Token Ring, or Token Ring plus Tri-Serial. The expansion module's serial interfaces provide three connections for synchronous or asynchronous WAN circuits and/or legacy devices.

Similar to the ARN's base module, Ethernet-based expansion modules can be continuously monitored through use of the Bay Networks RMON Data Collection Module (DCM).

Maximized Connectivity and Interoperability via BayRS

The ARN runs BayRS router software to maximize efficiency for remote office connectivity in multivendor, multiprotocol environments and supports all major network and bridging protocols.

Software Options: Three different levels of software are available for the ARN router, including IP Access, Remote Office, and Corporate (see Table 3 at the end of this document). This allows the ARN to be configured with software that best fits the remote site's requirements.

Traffic Management

Comprehensive traffic management capabilities are provided to the ARN router through the use of BayRS Data Compression, Traffic Prioritization, and Uniform Traffic Filters.

Data Compression: Configurable on a per-circuit or link basis, Bay Networks software-based Data Compression feature is supported by all Bay Networks routers, maximizing internetwork performance by reducing the amount of bandwidth required to transport traffic over the WAN. Data Compression is supported over Frame Relay, X.25, and PPP (over leased lines and dial-up analog or ISDN links), maximizing throughput over ARN full-duplex WAN links.

Traffic Prioritization: To ensure the highest quality of service, Traffic Prioritization allows high-priority delivery to be assigned to time-sensitive and/or mission-critical traffic, reducing the occurrence of session timeouts and improving application response times. Priority filters can be configured to place packets into one of three priority queues — high, normal, or low. Priority filters can be applied to the complete family of network and bridging protocols supported by Bay Networks routers.

Priorities can be assigned to packets based on their protocol, source, or destination address, packet type, and other protocol-specific fields, as well as other fields that are identifiable by a fixed offset in a packet.

Traffic Prioritization uses either a strict dequeuing algorithm or a bandwidth allocation dequeuing algorithm to transmit packets across a serial line. Strict dequeuing transmits all packets from the high-priority queue before transmitting packets from the normal and low-priority queues. Bandwidth allocation dequeuing ensures that large amounts of high-priority traffic do not prevent transmission of other traffic, based on configurable bandwidth allocation percentages for each queue.

Uniform Traffic Filters: Inbound and outbound Uniform Traffic Filters can be applied to all network and bridge protocol traffic. Uniform Traffic Filters is a useful tool for network administrators in developing an effective and comprehensive network security strategy. In addition, Uniform Traffic Filters preserves WAN bandwidth and can increase performance by reducing network congestion.

Uniform Traffic Filters can be configured to accept or drop packets at any Bay Networks router's network interface. Additionally, they can log matches between a packet and a filter, providing an audit trail for particular network activity.

Remote Installation and Management

Remote installation of the ARN router is simplified through the use of EZ Install and EZ Update, two software applications designed to make installations, reconfigurations, and software updates from a central site quick and easy. In addition, remote management is facilitated by the DCM's standard Ethernet RMON features, which can be used to analyze the attributes and operating patterns of the remote network.

EZ Install: The EZ Install application eliminates the time and expense of sending a technical resource to install and configure an ARN router. At the remote site, once the ARN's LAN and serial interfaces are connected and the unit is powered up, the ARN obtains its software image from Flash memory and its configuration file from EZ Install over the network. By using EZ Install, the ARN is able to automatically obtain its IP address from a central site Bay Networks router, and its configuration file from a central site server using the BootP protocol (see Figure 3). After verifying that an ARN's configuration file has been successfully downloaded to DRAM via EZ Install, the configuration data is saved to Flash memory for nonvolatile local storage.

EZ Update: The EZ Update application facilitates the automatic downloading of software updates and configuration files, minimizing the time and expense associated with remote site software maintenance. The existing ARN configuration file and software image are stored in the ARN's nonvolatile Flash memory for use as backup in case problems are encountered while downloading new software.

To use EZ Update, the ARN is dynamically configured to boot its configuration file and software image from the central site. The ARN can then be rebooted or power-cycled, and a new configuration file and/or software image downloaded to the ARN'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 ARN's Flash memory, replacing the previous configuration file and/or software image.

SNMP-Based Node Management

Bay Networks delivers a complete, SNMP-based enterprise management solution that provides operation, policy, and design services for end-to-end management of routers, hubs, and switches. This approach enables proactive network planning and accelerates problem solving, resulting in reduced costs associated with owning and operating corporate internetworks of any size.

The Bay Networks Optivity Enterprise™ family of UNIX-based Optivity® network management products includes three applications that are suited for internetworking environments where the ARN router is present: Optivity Internetwork, Optivity Planning™, and Optivity Analysis™. The ARN router also supports the Technician Interface, which further eases configuration and maintenance tasks through out-of-band management support. In addition, the Bay Networks Online Dynamic Reconfiguration and Dynamic Software Builder and Loader features can be used to reduce router memory requirements and to enable remote sites to be configured quickly and easily without disrupting network operations.
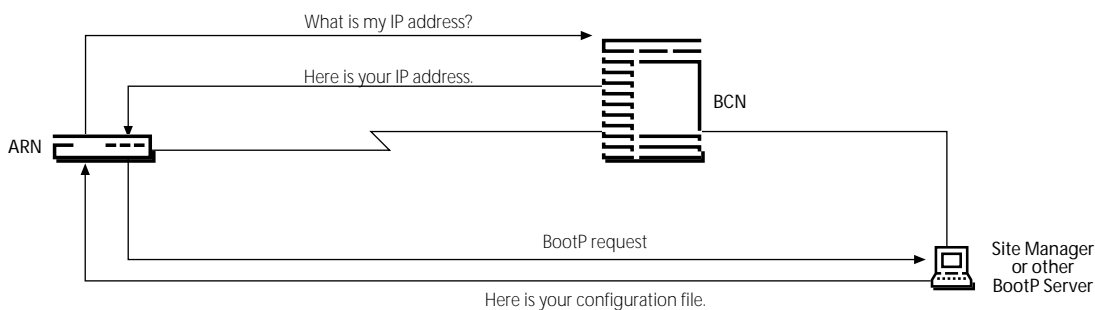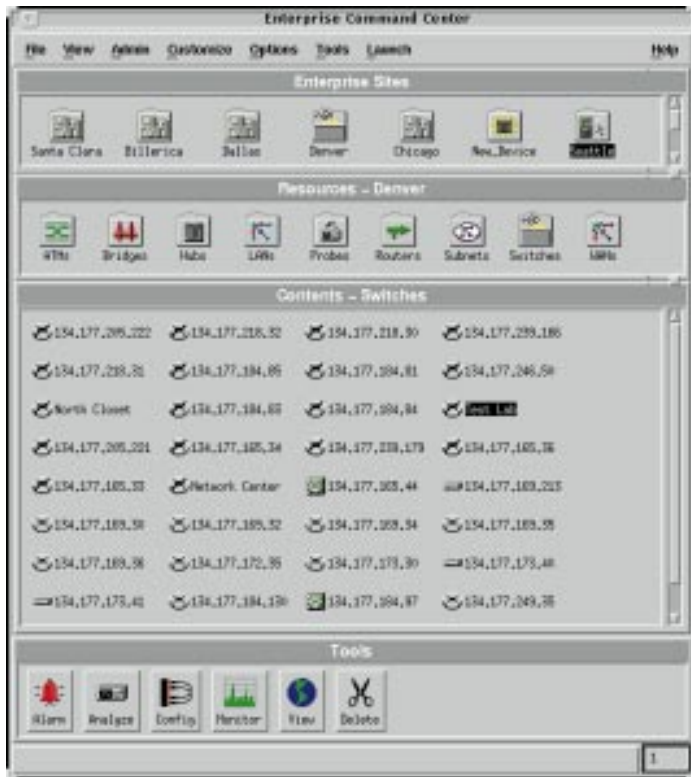
Figure 3 | **EZ Install**

What is my IP address?

Here is your IP address.

BCN

ARN

BootP request

Site Manager
or other
BootP Server

Here is your configuration file.

Figure 4 | **Enterprise Command Center**

Optivity Internetwork: A component of the Bay Networks UNIX-based Optivity Enterprise application suite, Optivity Internetwork provides the framework for system-level management, delivering comprehensive router configuration, monitoring, and control for complex router-based internetworks. Optivity Internetwork features the sophisticated, yet easy-to-use Enterprise Command Center interface, which delivers point-and-click access to other linked management applications, including Site Manager, the node management application for Bay Networks routers; RouterMan™, an intuitive router monitoring application; and PathMan™, a graphical network diagnostic tool.

The Enterprise Command Center is capable of managing enterprise networks consisting of multiple sites supporting hundreds of devices, logically grouping network resources by sites (see Figure 4). The top level identifies all sites within the enterprise, with icons representing campus locations and branch regions. Selecting a location reveals a series of resource folders that represent the various hubs, switches, routers, LANs, subnets, and WANs at the site. Selecting a folder within a specified location reveals the individual devices contained at the site and provides detailed configuration and software information at the device level.

The Enterprise Command Center simplifies and streamlines the management process by automatically launching appropriate applications for performing particular management functions. Optivity tools can be launched against a particular device by simply dragging and dropping the device icon onto an intelligent tool palette.

- *Site Manager:* The Site Manager application provides advanced router management, enabling Bay Networks bridges and routers to be configured, monitored, and controlled "inband" over the network from local and/or remote workstations. Site Manager simplifies router configuration through an intuitive point-and-click, Windows-based interface that includes field-sensitive online help.

- *RouterMan:* The RouterMan application offers real-time router performance and status reporting, and features an intuitive graphical user interface that provides overall router status at a glance. Fault and performance statistics, history, and analysis are provided by protocol or by interface. A simple color-coded interface and fault history log is also included to provide proactive detection of potential router problems.

- *PathMan:* The PathMan application dynamically determines the complete data path between any two network endstations, assisting network managers in troubleshooting large complex networks. All network components on the selected path automatically appear in a system-generated display of the route, showing exactly how devices are connected within the network. Color-coded icons display each device's status, enabling rapid problem identification.

Optivity Internetwork is supported by the leading SNMP platforms, including HP OpenView, Tivoli NetView for AIX (formerly IBM NetView for AIX), and Sun Microsystem's Solstice Domain Manager (formerly SunNet Manager).

Optivity Analysis: A key component of Bay Networks Optivity Enterprise network management suite, Optivity Analysis includes the award-winning OnSite RMON Tools application and the TrafficMan™ management application. Optivity Analysis provides global views for top-down fault isolation and analysis, segment statistics, quick configuration of enterprise-wide alarm thresholds, and an automated alarm notification and response system (see Figure 5).

Optivity Analysis also provides support for the emerging RMON2 management standard. RMON2 addresses Layers 3 through 7 of the OSI network model to provide visibility into how specific software applications are using bandwidth, as well as delivering powerful insights into how network traffic is flowing across routers.

Optivity Planning: Another component of Bay Networks Optivity Enterprise network management suite, Optivity Planning includes the NetReporter™ and DesignMan™ applications. Optivity Planning streamlines the design and configuration of enterprise networks by collecting data on network patterns over user-specified periods of time, and delivering new simulated network designs based on the playback of actual network traffic.

The Optivity Planning application simplifies data collection and report generation, and facilitates efficient network design. In addition, the DesignMan application helps to reduce the cost of network ownership by enabling "What if " analysis to be conducted on-screen, avoiding the need to manually reconnect the network to test new, more efficient configurations.

Technician Interface: This terminal-based (TTY-compatible) tool enables basic configuration and maintenance to be conducted locally or through Telnet. 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 interface also supports out-of-band access to the ARN using either internal or external modem connections.

Specifications
The BayStack ARN router adheres to the specifications listed in Table 2.
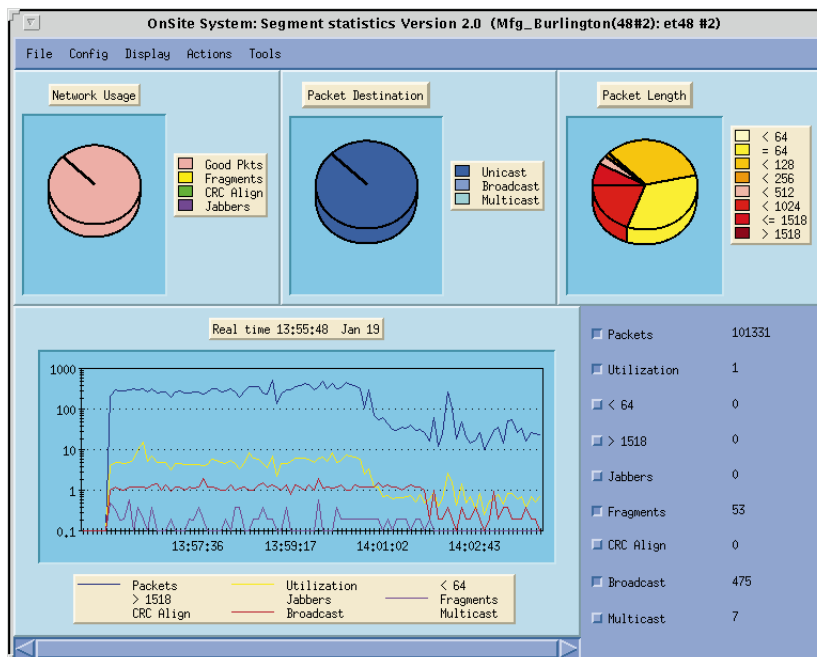
Figure 5 | **Segment Statistics**

Table 2 | **Specifications**

Architecture

Base module using Motorola MC68040 and MC68360 microprocessors

Two adapter modules per base module

One expansion module per base module

Two data collection modules - one per base module and one per expansion module

Connectivity

Ethernet (15-pin AUI connector, RJ-45)

Token Ring (9-pin MAU connector)

Serial (44-pin: RS-449/422, RS-232, RS-530, V.28, V.35, X.21)

ISDN BRI S/T (RJ-45)

ISDN BRI U (RJ-45: integral NT1)

56/64 Kbps DSU/CSU (RJ-48-C)

V.34 Modem (RJ-45)

Packaging

Type: Tabletop/Wall-Mount/Rack-Mount

AC Voltage: 100/240 VAC at 1.0 A maximum

Wall Receptacle: NEMA 5-15R (100/240 VAC)

(for use in North America)

Height: 2.80 in. (7.12 cm)

Width: 17.25 in. (43.84 cm)

Depth: 12.50 in. (31.77 cm)

Weight: 15 lb (6.80 kg)

Environmental and Regulatory

Altitude: 0 to 8000 ft (0 – 2400 m)

Humidity: 20% to 80% (noncondensing)

Temperature: 32° to 104°F (0° to 40°C)

Safety: UL 1950, TUV EN60 950, CSA 22.2 950

RFI/EMI: FCC Part 15, VDE 0878, Limit B, CISPR 22B

System Requirements
Software functionality and availability for the BayStack ARN Router appears in Table 3.

Ordering Information
Ordering information for the BayStack ARN router appears in Table 4.

Table 3 | **BayStack ARN Software Functionality and Availability**

BayRS Options

Feature	IP Access	Remote Office	Corporate
Network Protocols			
IP	✓	✓	✓
Novel IPX		✓	✓
AppleTalk Phase 2		✓	✓
DECnet Phase IV			✓
Banyan VINES			✓
OSI			✓
Xerox XNS			✓
IBM Integration			
Source Route Bridge	✓	✓	✓
LAN Network Manager Agent		✓	✓
Data Link Switching for Ethernet and Token Ring		✓	✓
Data Link Switching for SDLC		✓	✓
Transparent Sync Pass-Through	✓	✓	✓
BSC Pass -Through		✓	✓
APPN			✓
Bridging			
Transparent (Ethernet)	✓	✓	✓
Translation Bridge Ethernet/Token Ring	✓	✓	✓
Native Mode LAN (NML)	✓	✓	✓
Wide Area Networking			
HDLC Encapsulation	✓	✓	✓
Point-to-Point Protocol (PPP)	✓	✓	✓
Frame Relay	✓	✓	✓
SMDS	✓	✓	✓
X.25 (including IPEX)	✓	✓	✓
ATM DXI	✓	✓	✓
Dial Backup	✓	✓	✓
Bandwidth-on-Demand	✓	✓	✓
Dial-on-Demand	✓	✓	✓
Traffic Management			
Data Compression	✓	✓	✓
Traffic Prioritization	✓	✓	✓
Uniform Traffic Filters	✓	✓	✓
Multiline Circuits	✓	✓	✓
Dial Optimized Routing	✓	✓	✓
Node Management			
EZ Install/EZ Update	✓	✓	✓
Dynamic Loader	✓	✓	✓
RMON (requires DCM hardware option)	✓	✓	✓

Table 4 | **BayStack ARN Router Ordering Information**

Model No.	Description
Ethernet Base Module	
CV1001002	ARN with one Ethernet interface and 4 MB DRAM memory (110/220 V)
CV1001003	ARN with one Ethernet interface and 8 MB DRAM memory (110/220 V)
CV1001004	ARN with one Ethernet interface and 16 MB DRAM memory (110/220 V)
CV1001005	ARN with one Ethernet interface and 32 MB DRAM memory (110/220 V)
Token Ring Base Module	
CV1101003	ARN with one Token Ring interface and 8 MB DRAM memory (110/220 V)
CV1101004	ARN with one Token Ring interface and 16 MB DRAM memory (110/220 V)
CV1101005	ARN with one Token Ring interface and 32 MB DRAM memory (110/220 V)
WAN Adapter Modules	
CV0004001	Serial Adapter Module
CV0004002	ISDN BRI S/T (without NT1) Adapter Module
CV0004003	ISDN BRI U (with NT1) Adapter Module
CV0004004	56/64K DSU/CSU Adapter Module
CV0004005	V.34 Modem Adapter Module (North American only)
Expansion Modules	
CV0004011	Tri-Serial Expansion Module
CV0004012	Ethernet Expansion Module
CV0004013	Token Ring Expansion Module
CV0004014	Ethernet plus Tri-Serial Expansion Module
CV0004015	Token Ring plus Tri-Serial Expansion Module
System Software	
CV0008001	BayRS for IP Access on 4 MB PCMCIA Flash
CV0008002	BayRS for Remote Office on 4 MB PCMCIA Flash
CV0008003	BayRS for Corporate on 4 MB PCMCIA Flash
CV0008004	BayRS for IP Access on 8 MB PCMCIA Flash
CV0008005	BayRS for Remote Office on 8 MB PCMCIA Flash
CV0008006	BayRS for Corporate on 8 MB PCMCIA Flash
Data Collection Module	
CV0004021	Ethernet RMON DCM – fits base module and/or expansion module
Console Modem Module	
CV0004020	V.34 Console Modem Module (North American only)
Redundant Power Supply Unit	
RPSU	BayStack Redundant Power Supply Unit (low watt)

Note: Adapter modules, expansion modules, and system software must be ordered separately for each ARN. Each ARN includes an installation manual, power cord, and console/modem cable kit. The purchase of one complete set of Bay Networks documentation (Router Installation Documents, Router Management Documents, and Technician's Interface and Hardware Documents) for each central site is recommended.

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