

## 28000 Series Ethernet/ Fast Ethernet Switches



### Improve Network Performance

The Bay Networks 28000 Series™ switches enhance existing Ethernet LANs by providing 2 gigabits per second (Gbps) of internal switching and scalable 10/100 megabit-per-second (Mbps) dedicated bandwidth to support today's high-performance, high-demand networks.

### Reduce Network Segmentation Costs

By delivering dedicated, scalable bandwidth, where and when it is needed, the 28000 Series switches relieve the performance bottlenecks that plague traditional shared-media networks. Featuring Bay Networks Fast Frame™ technology, the switches' 2 Gbps internal switching fabric allows multiple conversations to take place simultaneously, providing up to 200 times the aggregate bandwidth available on 10 Mbps Ethernet networks.

### Eliminate Network Congestion

The 28000 Series switches support standard 10 Mbps IEEE 802.3 Ethernet, allowing for seamless integration into existing Ethernet environments. In addition, compliance with the IEEE 802.3 Fast Ethernet specification enables the 28000 Series switches to support high-speed 100 Mbps connections, delivering additional bandwidth for particularly demanding applications.

### Create High-Speed Backbones

The 28000 Series switch family is fully integrated with the latest release of the Optivity® network management system for complete port-level monitoring and control. Combined with Optivity's configuration switching capabilities and working with Bay Networks System 5000™ and Distributed 5000™ hub families, the 28000 Series switches also contribute to a virtual networking solution that combines the benefits of both switched and shared-media technologies.

The 28000 Series switches are a key component of the Bay Networks high-performance Ethernet strategy. Working with other Bay Networks Fast- and switched-Ethernet products, such as BayStack™ 100BASE-T Stackable Hubs, the BayStack Ethernet Workgroup Switch™, and the Access Stack Node (ASN™) and Backbone Node (BN™) routers, the 28000 Series switches contribute to the industry's most complete 100 Mbps Ethernet solution.

## Benefits

### Improve Network Performance

Delivering 2 Gbps internal switching and scalable 10/100 Mbps bandwidth, the 28000 Series Ethernet and Fast Ethernet switches provide up to 200 times the aggregate bandwidth available on traditional 10 Mbps Ethernet networks.

### Reduce Network Segmentation Costs

Installed in the network center, 28000 Series switches provide distributed network segments with dedicated 10 Mbps or 100 Mbps links, delivering a cost-effective solution for segmenting the network to improve performance. As a result, more expensive router ports can be reserved for establishing network domains based on network-layer subnetting or geographic locations. The 28000 Series solution also allows users linked to the switch to be moved anywhere in the network without changing their addresses, reducing the administrative costs associated with making similar modifications in a routed environment.

### Eliminate Network Congestion

By offering 100 Mbps “big pipe” connections to high-utilization devices such as departmental servers, 28000 Series switches relieve the data bottlenecks found on 10 Mbps shared-media networks. For particularly demanding power workgroups, where even dedicated 10 Mbps links are quickly overwhelmed, 28000 Series switches can provide dedicated 100 Mbps links to keep the network running at peak performance.

### Create High-Speed Backbones

The 28000 Series switches support high-speed 100 Mbps backbones to link wiring closet network segments to high-utilization devices such as departmental servers located in the network center. Both unshielded twisted pair (UTP) and fiber optic media options are available, offering flexible solutions that meet the needs of existing cabling plants.

## Features

### 28000 Series Ethernet

#### Switches Description

The 28000 Series of Ethernet and Fast Ethernet switches deliver internal switching and high-speed connectivity to support today’s most demanding network environments. Featuring a 2 Gbps internal switching fabric, the switches provide scalable, dedicated bandwidth to attached end users, shared-media segments, servers, and high-end workstations, relieving the bandwidth congestion common in traditional Ethernet environments.

Three switch models are available, each offering different media, performance, and configuration options to satisfy a variety of applications (see Figure 1).

#### *Model 28200 Modular 10/100 Ethernet*

*Switch* The Model 28200 Modular 10/100 Ethernet Switch delivers flexible, high-speed 10 and 100 Mbps Ethernet segment switching for demanding wiring closet and backbone applications. Four front-panel media dependent adapter (MDA) slots hold any combination of 10 and 100 Mbps Ethernet modules offering a variety of media interfaces, allowing the switch to be configured to meet specific application requirements. A total of four MDA modules are available:

- **Model 28200-14** The Model 28200-14 10BASE-FL MDA offers four ST-type fiber connectors for supporting 10 Mbps switched Ethernet over 50/125 and 62.5/125  $\mu\text{m}$  multimode fiber optic cabling.
- **Model 28200-15** The Model 28200-15 10BASE-T MDA provides eight RJ-45 modular receptacles for supporting 10 Mbps switched Ethernet connections over Category 3, Category 4, and Category 5 UTP cabling.
- **Model 28200-104** The Model 28200-104 100BASE-FX MDA delivers two duplex SC connectors for supporting switched 100 Mbps Fast Ethernet connections over 50/125 and 62.5/125  $\mu\text{m}$  multimode fiber optic cabling.

- **Model 28200-105** The Model 28200-105 100BASE-TX MDA offers two RJ-45 modular receptacles for supporting switched 100 Mbps Fast Ethernet connections over Category 5 UTP cabling.

All Model 28200 MDAs feature user-configurable port types through which individual connections can be configured via software to operate in half- or full-duplex mode and to implement flow control for 100 Mbps full-duplex ports.

#### *Model 28115 10/100 Ethernet Switch*

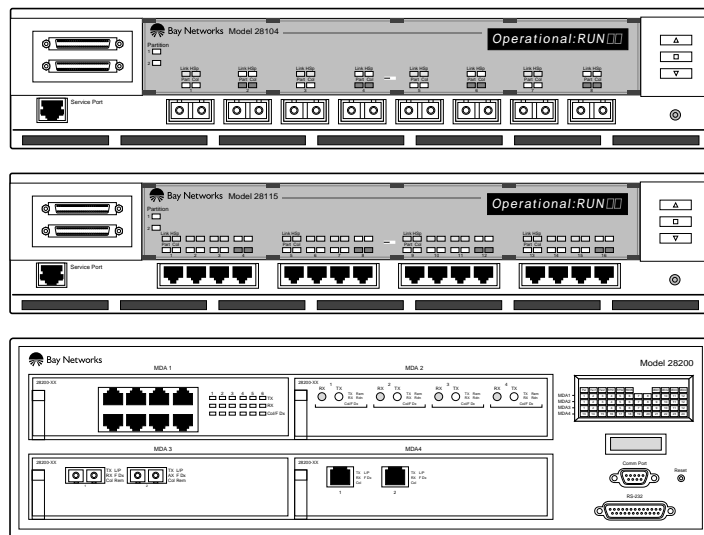
The Model 28115 10/100 Ethernet Switch offers 16 RJ-45 modular receptacles for supporting both 10 and 100 Mbps Ethernet transmissions over UTP cabling. At 10 Mbps, the Model 28115 hub attachment ports are compatible with the IEEE 802.3 10BASE-T standard. At 100 Mbps, the attachment ports support the IEEE 802.3 100BASE-T specification for Fast Ethernet operation over high-performance Category 5 UTP cabling. Port speed is a configuration option, set through the console/service port on the switch or through the Optivity network management system.

A Model 28115R is also available, which, in addition to the features available with the Model 28115, also provides configurable redundant feeder ports for supporting redundant links to mission-critical devices to ensure reliable, fault-tolerant operations. The Model 28115R also supports additional MAC addresses on each port, increasing the number of allowable MAC addresses per switch for virtual LAN applications.

#### *Model 28104R Fast Ethernet Switch*

The Model 28104R 100 Mbps Fiber Optic Ethernet Switch offers eight SC-type connectors for supporting 100 Mbps Fast Ethernet connections over multimode 62.5/125 fiber optic cabling. The attachment ports support the Fast Ethernet Alliance’s 100BASE-F specification.

Figure 1 | 28000 Series Ethernet/Fast Ethernet Switches



### Switch Expansion

All 28000 Series switches include two high-speed front-panel expansion ports for supporting direct 200 Mbps full-duplex connections to other switches. Up to seven 28000 Series switches can be linked in a single stack, providing a scalable solution for high-performance environments.

The switches automatically detect connections between units, creating a high-performance 400 Mbps backplane extension that offers a number of network expansion options. Through the appropriate connection cables and transceivers, the expansion ports can also support 100 Mbps full-duplex connections to other devices such as servers or workstations over Category 5 UTP and multimode fiber optic cabling.

Full-duplex support — available on both the expansion and attachment ports — enables devices at both ends of a link to transmit simultaneously, doubling available bandwidth. While ordinary Fast Ethernet allows only one transmission to occur at a time, the 100BASE-T specification employs a continuous signaling system that enables frame transmission to take place in both directions.

### Reliability

The 28000 Series switches include a number of features that help ensure reliable and consistent performance in mission-critical environments.

The switches support redundant links between devices, in which one link automatically assumes standby status to provide a backup data path in the event of a primary link failure. The switches also support the Bay Networks LattisSpan™ feature, which enables any port to be configured as an automatically correcting redundant link.

The Model 28200, Model 28104R, and Model 28115R also support a Redundant Power Supply Unit (RPSU), which provides a backup power source should a switch's internal power supply fail. In the event of a primary power source failure, the RPSU is automatically activated, ensuring no interruption in performance and no loss of data.

### 28000 Series Management

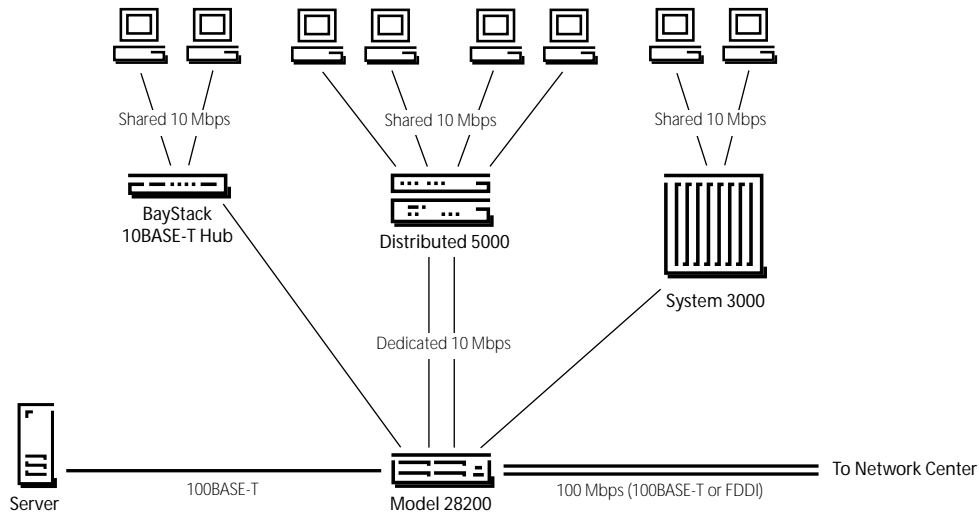
The 28000 Series Ethernet switch family is fully integrated with the latest release of the Optivity network management system, delivering a comprehensive solution for managing networks comprised of both shared-media and switched technologies.

Working together, the switches and Optivity also provide a virtual networking solution that takes full advantage of the advanced switching capabilities available with the 28000 Series family. Optivity includes the powerful LANarchitect™ tool that allows network managers to assign devices or individual ports to logical workgroups, regardless of their physical location. This virtual networking capability allows managers to flexibly deploy switching where it is needed without changing the network's physical infrastructure or making changes in the wiring closet.

For detailed remote monitoring and management, the Model 28200 also supports an internal RMON probe, which provides highly sophisticated network troubleshooting and problem resolution capabilities. With the RMON probe, network managers can perform detailed packet capture and filtering operations on remote network segments, providing unprecedented visibility into the distributed network.

In place of an integrated RMON probe, the Model 28115R and Model 28104 include a port-mirroring capability, which provides a standalone RMON analyzer attached to the switch with a copy of traffic traversing a selected port. The standalone probe

Figure 2 | Microsegmentation Using 28000 Series Switches



performs RMON-type analysis on the duplicate data, providing users with a detailed breakdown of network traffic.

For local and at-a-glance management, the 28000 Series Ethernet switches also include a front-panel dot matrix LED display to report device status, while an RS-232 local console/service port is available for local setup, configuration, and diagnostic operations.

#### Fast Ethernet Adapter Cards

Bay Networks offers IEEE 802.3u-compatible 100BASE-T adapter cards to provide a complete switch-to-desktop Fast Ethernet solution. The EtherExpress PRO/100 10/100 Mbps Fast Ethernet Adapter, available in both PCI and EISA bus architectures, supports both 10 and 100 Mbps operations for use in mixed Ethernet and Fast Ethernet networks. Used in conjunction with the 28000 Series switches, the adapters contribute to a complete, end-to-end high-speed Ethernet network.

## Applications

The 28000 Series switch family is designed to provide high-performance solutions for a variety of applications, including client/server networks, microsegmented workgroups, data centers, and power workgroups.

In congested 10 Mbps Ethernet workgroups where users compete for a fixed amount of bandwidth, a Model 28200 Modular Ethernet Switch can be used to microsegment the network to improve overall performance. Microsegmentation divides a single large 10 Mbps network into multiple independent 10 Mbps segments, reducing bandwidth contention and improving network throughput. With the addition of 100 Mbps big pipe connections to high-utilization devices such as departmental servers, the Model 28200 delivers a cost-effective solution for relieving congestion and restoring network performance (see Figure 2).

In the network center, the 28000 Series switches offer a powerful and cost-effective solution for implementing high-speed switched backbones to improve access to centralized resources. Distributed network segments can be connected via copper or fiber downlinks to the 100 Mbps expansion ports on centralized Model 28115 or Model 28104 switches, providing each with a dedicated, high-speed link to the network center. Existing 10 Mbps Ethernet segments can connect to the 100 Mbps backbone through a Model 28200 Modular Ethernet Switch or a BayStack Ethernet Workgroup Switch; 100 Mbps segments

can link directly to the high-speed network (see Figure 3). All users connected to the switched environment can be easily moved throughout the network without changing their addresses, reducing the administrative costs associated with making similar changes in a routed environment.

For client/server environments, 28000 Series switches relieve the data bottlenecks that occur when multiple users attempt to access a single server. In traditional shared 10 Mbps Ethernet environments, single server links are quickly saturated, hindering network performance. With a Model 28115 or Model 28200 Ethernet switch, users can establish a 100 Mbps big pipe connection to the server and dedicated 10 Mbps connections to clients, providing sufficient bandwidth to accommodate user requirements (see Figure 4).

In power workgroups, where high-performance, high-utilization workstations can easily overwhelm shared 10 Mbps links, Model 28115 and Model 28200 switches can provide dedicated network connections. If the workgroup grows, new users get their own dedicated link, providing a scalable, high-performance solution (see Figure 5).

Figure 3 | High-Speed Backbones Using 28000 Series Switches

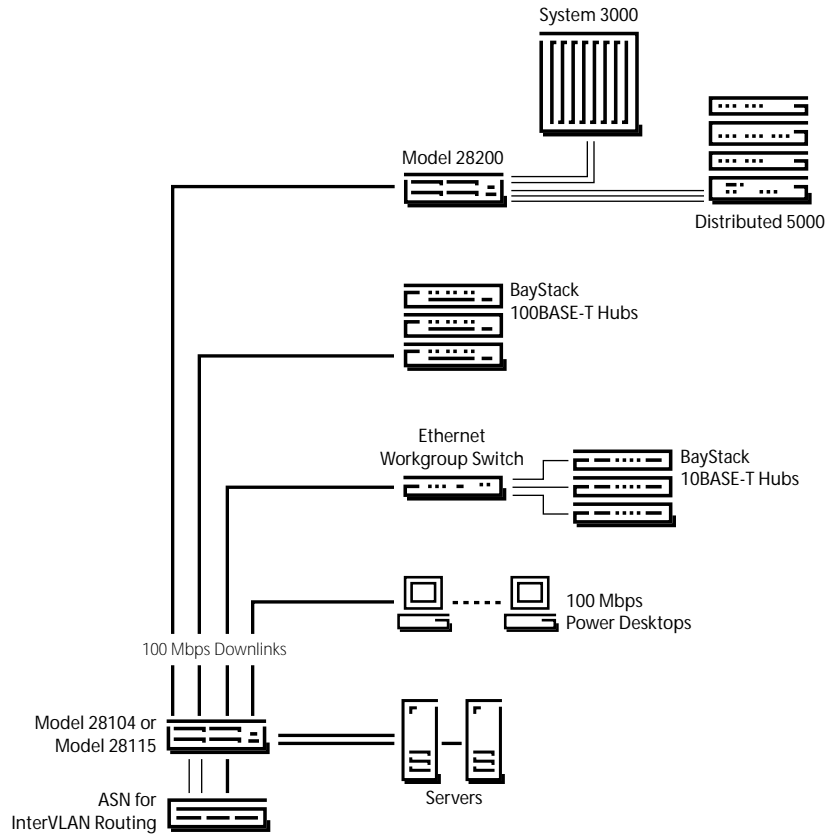


Figure 4 | Client/Server Environments

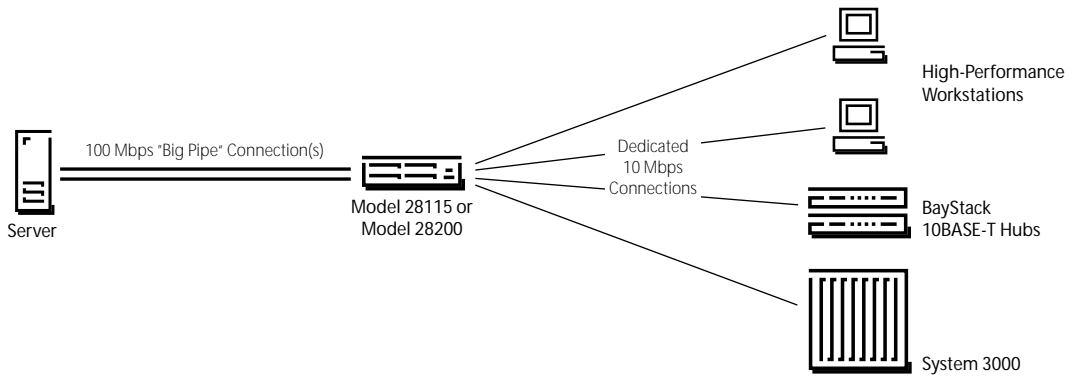
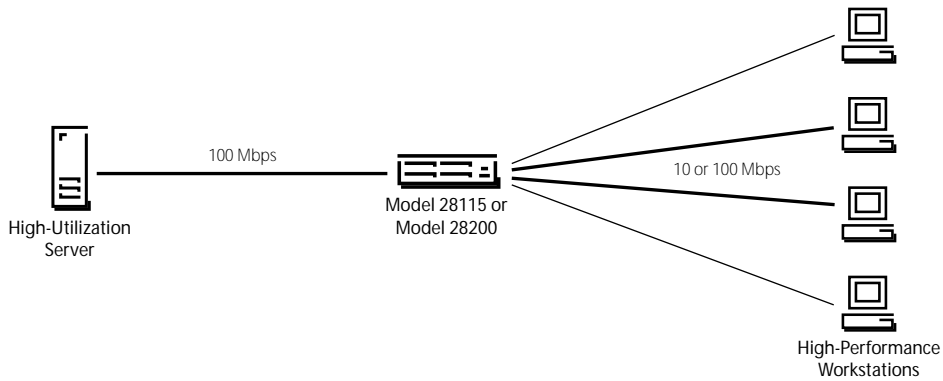


Figure 5 | Power Workgroups



## Technical Specifications

Technical specifications for the 28000 Series Ethernet/Fast Ethernet switches appear in Table 1.

Table 1 | 28000 Series Ethernet/Fast Ethernet Switches Technical Specifications

<b>Network Protocol and Standards Compatibility</b>	IEEE 802.3i 10BASE-T IEEE 802.3u 100BASE-T
<b>Data Rates</b>	10 Mbps (10BASE-T; 10BASE-FL) 100 Mbps (100BASE-TX; 100BASE-FX)
<b>Electrical Specifications</b>	
Input Voltage	90-264 V ac
AC Line Frequency	47-63 Hz
Volt Amperes Rating	500 VA
Input Power	
Model 28115(R) and Model 28104R	200 watts maximum
Model 28200	275 watts maximum
Thermal Rating	940 Btu/hr max.
Internal Fuse	6.3 A at 250 V
<b>Environmental Specifications</b>	
Operating Temperature	5°C to 40°C
Storage Temperature	-25°C to 70°C
Operating Humidity	85% max. relative humidity, noncondensing
Storage Humidity	95% max. relative humidity, noncondensing
Operating Altitude	10,000 ft (3,048 m), 40°C max.
Free Fall/Drop	ISO 4180-s, NISTA 1A
Vibration	IEC 68-2-6/34
Shock/Bump	IEC 68-2-27/29

**Table 1 | 28000 Series Ethernet/Fast Ethernet Switches Technical Specifications (continued)**

<b>Electromagnetic Emissions</b>	Meets FCC Part 15, Subpart B, Class A Meets EN 55022 (CISPR 22: 1985), Class A (Models 28115, 28115R and 28104) Meets EN 55022 (CISPR 22: 1985), Class B (Model 28200) Meets VCCI Class 1 ITE
<b>Electromagnetic Susceptibility</b>	
Electrostatic Discharge (ESD)	IEC 801-2, Level 2/4
Radiated Electromagnetic Field	IEC 801-3, Level 2
Electrical Fast Transient/Burst	IEC 801-4, Level 2/3
Electrical Surge	IEC 801-5, Level 1/3
<b>Safety Agency Approvals</b>	
UL listed (UL 1950)	
CSA certified (CSA 22.2 #950)	
TUV licensed (EN 60 950)	
Safety Requirements	UL 1950 with D3 deviations CSA 22.2 #950 with D3 deviations IEC 950/EN 60 950 (TUV) UL-94-V1 flammability requirements for all PC boards
<b>Physical Dimensions</b>	
Model 28115(R)/28104R Ethernet/Fast Ethernet Switches	(H) 4.15 in. x (W) 17.21 in. x (D) 17.98 in. (H) 10.5 cm x (W) 43.7 cm x (D) 45.7 cm
Model 28200 Modular Ethernet/Fast Ethernet Switch	(H) 5.25 in. x (W) 17.25 in. x (D) 16.98 in. (H) 13.3 cm x (W) 43.8 cm x (D) 43.1 cm
Model 28200-14, -15, -104, -105 MDAs	(H) 1.75 in. x (W) 6.5 in. x (D) 10.0 in. (H) 4.4 cm x (W) 16.5 cm x (D) 25.4 cm
Model 514 Fiber Optic and Model 515 UTP transceivers	(H) 1.35 in. x (W) 8.00 in. x (D) 4.21 in. (H) 3.4 cm x (W) 20.3 cm x (D) 10.7 cm
<b>Weight</b>	
Model 28115/Model 28104R Fast Ethernet Switching Hubs	26 lbs (11.7 kg)
Model 28200 Modular Ethernet Switch	19.7 lbs (8.9 kg) empty 23.15 lbs (10.5 kg) with four MDAs installed
Model 28200-14, -15, -104, -105 MDAs	1.6 lbs (0.654 kg)
Model 514 Fiber Optic and Model 515 UTP transceivers	2.5 lbs (1.2 kg)

## Ordering Information

Ordering information for the 28000 Series Ethernet/Fast Ethernet switches appears in Table 2.

Table 2 | 28000 Series Ethernet/Fast Ethernet Switches Ordering Information

Order Number	Description
28104R	Model 28104 100 Mbps Fiber Optic Fast Ethernet Switch
28115	Model 28115 Fast Ethernet Switch
28115R	Model 28115/ADV Fast Ethernet Switch with Advanced Software and RPSU connection
AQ2012001	Model 28200 Modular Ethernet Switch Chassis
AQ2012003	Model 28200-14 10BASE-FL MDA Module for Model 28200
AQ2012002	Model 28200-15 10BASE-T MDA Module for Model 28200
AQ2012005	Model 28200-104 100BASE-FX MDA Module for Model 28200
AQ2012004	Model 28200-105 100BASE-TX MDA Module for Model 28200
514	Model 514 100 Mbps Fiber Optic Transceiver
515	Model 515 100 Mbps UTP Transceiver
RPSU	Redundant Power Supply Unit



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

### United States

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

Bay Networks, Inc.  
8 Federal Street  
Billerica, MA 01821-5501  
Phone: 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  
Fax: +33-92-966-996  
Phone: +33-92-966-966

### Intercontinental

Bay Networks, Inc.  
8 Federal Street  
Billerica, MA 01821-5501  
Fax: 508-670-9323  
Phone: 1-800-8-BAYNET

World Wide Web: <http://www.baynetworks.com>

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