



CISCO BPX 8600 SERIES WIDE-AREA EDGE SWITCHES

DELIVERING ENHANCED, REVENUE-GENERATING SERVICES AT THE NETWORK EDGE

A Powerful Engine for Maximizing Revenue Growth

SERVICE PROVIDER CUSTOMERS REQUIRE A WIDER RANGE OF NETWORKING SERVICES THAN EVER BEFORE. DEMAND FOR IP SERVICES IS SKYROCKETING; CUSTOMERS INCREASINGLY WANT ADDED VALUE FROM BASIC FRAME RELAY, ATM, AND LEASED-LINE SERVICES, AND DEMAND IS ON THE RISE FOR MANAGED VOICE AND DATA SERVICES. TO CAPITALIZE ON THE MARKET OPPORTUNITY THAT THESE DEMANDS REPRESENT, THE CHALLENGE IS HOW TO COST-EFFECTIVELY DELIVER THE INTEGRATED ATM AND IP SERVICES THAT WILL KEEP YOU AHEAD OF YOUR COMPETITORS. THE ANSWER: MEET YOUR CUSTOMERS AT THE NETWORK EDGE.

Figure 1 The BPX 8680 IP+ATM Universal Service Node integrates Cisco IOS and MPLS to deliver IP, broadband, and narrowband services.



THE NETWORK EDGE IS THE LEADING EDGE

The network edge is where service creation and differentiation have the most impact and where network switch deployment flexibility is most critical. Delivering premium-level Internet, scalable intranet, and managed data, voice, and video services to customers means meeting them at the edge of your network and linking seamlessly with their networking environments. For proven network-edge switch solutions, look to BPX® 8600 series wide-area edge switches from Cisco Systems.

Cisco BPX 8600 series switches are standards-based ATM switches with advanced IP and ATM capabilities. High-performance engines for revenue growth, the BPX 8600 switches provide the application-layer visibility of IP and the quality-of-service (QoS) characteristics of ATM.

The BPX 8650 IP+ATM switch provides ATM-based broadband services and integrates Cisco IOS™ software to support Multiprotocol Label Switching (MPLS) to deliver value-added IP services. The BPX 8680 Universal Service Node offers broadband, narrowband, and integrated Cisco IOS software and leverages the Cisco MGX 8800 series switches' technology and flexibility.

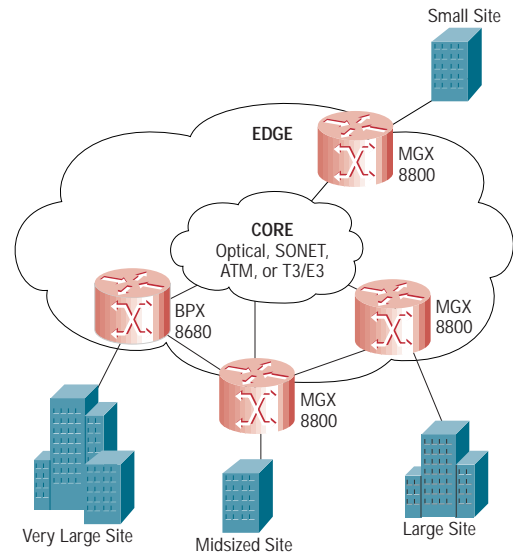
INTEGRATION MAKES THE DIFFERENCE

The market for wide-area IP services represents the fastest-growing opportunity for deploying new revenue-generating services. Now you can take advantage of opportunities no matter where they emerge. With the BPX 8600 series, you can deliver ATM and IP services from a single, integrated platform. Cisco's Intelligent QoS Management Suite helps you to differentiate your service offerings and meet customers' service-level expectations. Carrier-class reliability ensures that your services provide the around-the-clock availability that your customers demand. And with the industry's highest port densities and Cisco's MPLS capabilities, the BPX 8600 series provides unmatched ATM and IP scalability, allowing you to manage even the most explosive growth.

Integrated management capabilities simplify end-to-end management of your entire network, reducing capital and operations costs. Cisco's comprehensive suite of standards-based management tools allow you to manage a heterogeneous network, monitor service-level agreements (SLAs), and seamlessly integrate customer network management tools with your existing provisioning, billing, monitoring, and reporting infrastructure.

As the pioneer of the Internet and a leader in ATM traffic management and QoS, Cisco is uniquely qualified to build intelligent, integrated ATM and IP networks. Service providers who qualify to become Cisco Powered Network providers deliver demonstrated end-to-end networking service quality. When your customers see the Cisco Powered Network logo, they know that you provide reliable, secure, and innovative data services that they can depend on. That increased confidence and recognition, especially from business customers already familiar with Cisco, gives you an extra advantage as you expand into new data-services markets.

Figure 2 Service quality—to the end user—depends on the performance of the edge platform. The core infrastructure is optimized to cost-effectively transport edge services.



The BPX 8600 Series Adds Value to Your Network

MAXIMIZE REVENUE WITH A FLEXIBLE PLATFORM

Companies increasingly rely on outsourced services to maximize their profitability. In addition to basic data and Internet services, they need integrated, managed solutions that meet diverse needs across the enterprise. With Cisco BPX 8600 edge switches, you can provide them with best-in-class integrated services while eliminating technology risk.

The BPX 8600 series architecture allows you to tailor services to meet specific customer needs and differentiate your offerings from competitors. A full range of user interfaces and speeds up to OC-12/STM-4 (622 Mbps) enable you to deliver a wide range of data, video, Internet, LAN, virtual private network (VPN), and Systems Network Architecture (SNA) services. Intelligent QoS management features give you the flexibility to customize service offerings, adding value to basic data services.

The BPX 8600 series can be configured to support broadband, narrowband, and IP services, depending on your specific needs. Services supported include:

Broadband Services

- T3/E3 ATM
- OC-3/STM-1 ATM
- OC-12/STM-4 ATM

Narrowband Services Provided by MGX 8850 Multiservice Switch

- T1/E1 ATM
- n x T1/E1 IMA
- Frame Relay
- High-speed Frame Relay
- SNA
- Circuit Emulation
- ATM UNI 3.0/3.1
- SMDS

Integrated Services

- IP VPNs
- Voice over IP
- Managed intranets
- Premium Internet services
- IP Fax Relay

Frame Relay Services

Cisco is the leading provider of Frame Relay solutions for the world's largest service provider networks. With support for multiple classes of service, per-virtual-circuit buffering, and intelligent QoS management features, you can provision services that meet customers' expectations for high performance. The Cisco BPX 8600 series provides a transparent migration path from Frame Relay to ATM broadband services, with support for both network and service interworking.

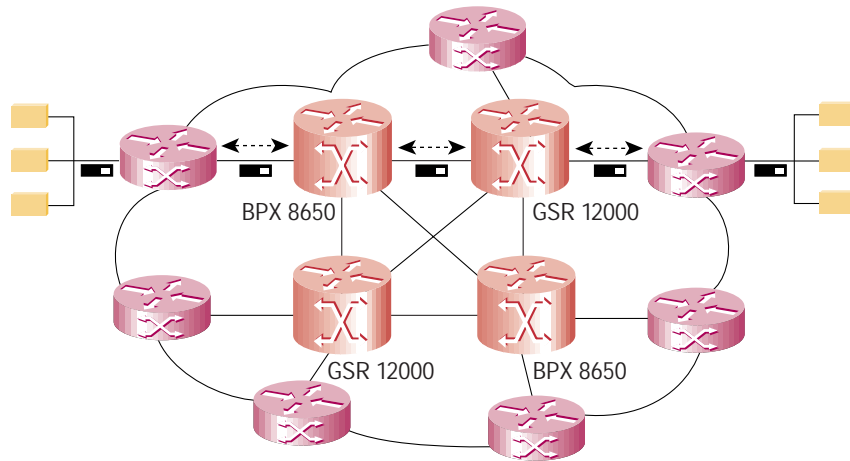
ATM Services

The BPX 8600 series supports high-speed data services for all traffic, including constant bit rate (CBR), real-time variable bit rate (RT-VBR), non-real time variable bit rate (NRT-VBR), available bit rate (ABR), and unspecified bit rate (UBR). Support for permanent virtual circuits (PVCs) and switched virtual circuits (SVCs) gives you the flexibility to tailor services to meet customer requirements. Multiservice aggregation capabilities enable the BPX 8600 series to simultaneously manage delay-sensitive and bursty traffic, ensuring that each receives the required QoS. Narrowband traffic is supported with the addition of Cisco edge concentrators. Backbone traffic can be switched at a variety of speeds, scaling up to OC-12/STM-4 with the industry's lowest delay and highest application throughput.

Circuit Emulation Services

You can leverage existing ATM infrastructures and use circuit emulation services to transport T1/E1 and T3/E3 traffic and emulate delay-sensitive leased-line services such as voice and video. The BPX 8600 circuit emulation services support full-rate T3/E3, T1/E1, and channelized T1/E1 services with applicable clock recovery mechanisms.

Figure 3 With an integrated IP+ATM network infrastructure, service providers can provision existing Frame Relay, ATM, and leased-line services and next-generation value-added IP services—all from a unified network architecture—without compromising the quality of service.



IP Services

The industry's fastest-growing opportunity, IP services are the leading revenue-generating service offerings. The Cisco BPX 8600 series supports MPLS, which enables you to provision customized, integrated IP+ATM services such as voice over IP, VPNs, and other leveraged services. MPLS delivers end-to-end QoS support for IP and ATM traffic while reducing data loss, and combines Layer 3 scalability benefits with the Layer 2 traffic management and reliability advantages of virtual circuits. When configured for MPLS, the BPX 8600 enables you to keep up with subscriber demand without continuous high infrastructure investment.

The BPX 8600 is also the switch of choice for Internet network access points (NAPs). It aggregates Internet traffic, supports a full range of access options, and scales services to accommodate thousands of subscribers on a single node. Service providers using the BPX 8600 for Internet services deliver the highest application throughput, lowest latency, and greatest scalability—without cell loss.

Figure 4 Cisco BPX 8650 IP+ATM Wide-Area Edge Switch



Managed Wide-Area Networks

Enhance basic data network service offerings with secure, fully managed integrated data and voice services. Managed WAN services allow you to add value and increase revenue while enabling your customers to reduce their overall network management costs. The BPX 8600 series provides you with carrier-class data communication solutions that free your customers from the economic and technical risks of managing complex communication networks.

Video and Voice Services

The intelligent QoS management features of the BPX, class-of-service (CoS) guarantees, and support for multicast traffic allow you to offer real-time, entertainment-quality video and voice services. The BPX 8600 series provides a standards-based platform for reliably delivering video-on-demand, videoconferencing, and voice telephony services with the required QoS, availability, and scalability. The ability to deliver these services over ATM or IP gives you great flexibility in meeting the needs of many different customer market segments.

With its innovative Virtual Switch Interface (VSI) technology, the BPX 8600 can be used as a carrier-class MPLS core switch to provide VoIP servers using MPLS.

Wireless

Support is available for analog and digital cellular, PCS, wireless data, and enhanced specialized mobile radio (ESMR) services from a single BPX 8600 series switch.

A wide range of network interfaces and advanced traffic management features allow you to build an ATM WAN over the most economic infrastructure, whether it's coaxial cable, fiber, satellite, or microwave. At the cornerstone of your ATM network, the BPX 8600 series can be rapidly deployed, reducing time to market.

INTELLIGENT QoS MANAGEMENT FEATURES ENABLE SERVICE DIFFERENTIATION

With the Cisco BPX 8600 series, you can provide service-level guarantees for any type of traffic or application—ATM, Frame Relay, Internet, voice over IP, VPN, video, and voice. Cisco's Intelligent QoS Management Suite includes the first fully compliant implementation of the ATM Forum's Traffic Management Standard Version 4.0 Specification. A sophisticated queuing architecture, QoS capabilities, and connection admission control (CAC) features work together to meet SLAs for any traffic type or application.

Automatic Routing Management

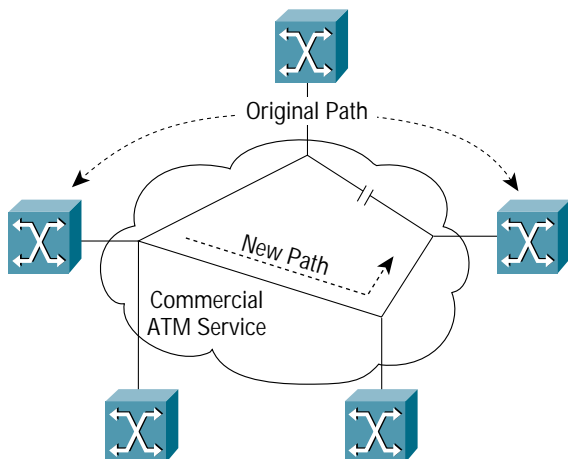
Cisco WAN switches use an end-to-end connection routing mechanism to provide connectivity across the network. Fully compliant Private Network-Network Interface (PNNI) routing via the Service Expansion Shelf and call signaling enable the creation of end-to-end SVC and SPVC connections—even in a multivendor network environment. Distributed network intelligence enables the switch's CAC function to work with advanced routing management features, automatically routing traffic through the network. If a link fails, the routing algorithm quickly and automatically reroutes connections over alternate paths while guaranteeing the required QoS. Automatic routing management ensures high service availability and QoS for all data services. PNNI routing allows you to scale networks to thousands of routing nodes with the same level of routing reliability.

The virtual trunking capability of the BPX 8600 ensures that Cisco's intelligent QoS features are extended edge to edge. Cisco BPX 8600 series switches can be interconnected through an ATM-virtual path (VP) crossconnect or large ATM core switch. As a result, each user connection on BPX 8600 switches receives the nonstop service availability, high application performance, and outstanding QoS characteristics of a Cisco BPX-based network.

Advanced Class-of-Service Management

Class-of-service management is essential for delivering the required QoS to all applications, and the BPX 8600 series supports up to 16 independent classes of service. Per-virtual circuit (VC) queuing, per-VC rate scheduling, a sophisticated queue-servicing algorithm, and egress queuing enable network managers to tailor individual connections to meet service-level guarantees for ATM classes of service. IP traffic is assigned its own classes of service, allowing network managers to easily manage both types of traffic over the same network.

Figure 5 Virtual trunking interconnects BPX 8600 nodes via an ATM core switch, yet retains the QoS performance of the BPX 8600.



Optimized Bandwidth Management

The BPX 8600 employs a virtual source/virtual destination (VS/VD) implementation of the ATM Forum Traffic Management Standard Version 4.0 for ABR services. The switch continuously monitors trunk utilization throughout the network and feeds congestion information back to the traffic source. Cell admission rates are automatically adjusted on a connection-by-connection basis, depending on whether and where congestion exists on the network, ensuring fair and cost-efficient bandwidth utilization. The robust VS/VD implementation proactively avoids queuing delays and virtually eliminates cell loss. Cisco's ForeSight® software provides VS/VD capability for Frame Relay traffic, resulting in the same high levels of bandwidth utilization and superior throughput and latency for Frame Relay customers.

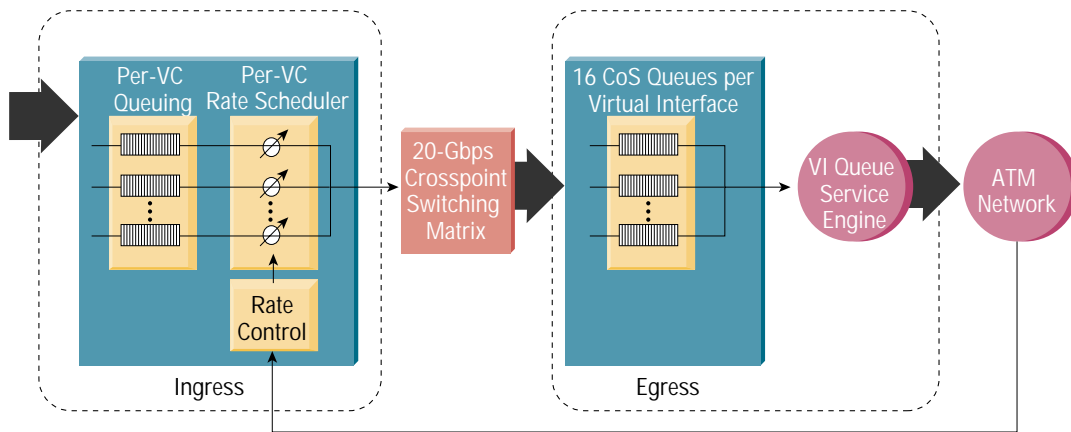
Built into custom application-specific integrated circuits (ASICs), per-virtual connection control capabilities manage queuing, rate scheduling, statistics collection, and fair allocation of bandwidth on an individual-connection basis. Up to 32,000 connections and one million cells of buffering are supported on each interface card. The BPX 8600 supports early packet discard (EPD) and partial packet discard (PPD) on a per-VC basis, resulting in fewer retransmissions than class-based implementations. As a result, the BPX 8600 series delivers high application performance and guaranteed network responsiveness for all users.

Cisco's optimized bandwidth-management capabilities enable you to typically achieve 95-percent trunk utilization—the highest in the industry. At the same time, VS/VD, ABR, and ForeSight technology significantly improve application throughput, ensuring real-time application performance and increased customer satisfaction.

Dynamic Buffer Management

Cisco Frame Relay and ATM service modules are equipped with large buffers and a patented dynamic buffer management algorithm mechanism for allocating buffers on a per-VC basis to deliver the required QoS. This deep pool of available buffers readily accommodates large bursts of traffic into the node. BPX 8600 series ATM interface modules provide up to a million cells of buffering.

Figure 6 Per-virtual-circuit queuing and rate scheduling proactively avoid congestion to deliver the highest levels of application throughput and lowest latency—virtually eliminating cell loss.



HIGH RELIABILITY ENSURES NONSTOP SERVICE AVAILABILITY

Proven in the world's largest production ATM and Frame Relay networks, the BPX 8600 series is designed for carrier-class reliability. Every system component can be configured for 100-percent redundancy, and all BPX 8600 series modules can be removed and reinserted without impacting service delivery or affecting the performance of other modules. Background diagnostics continually monitor switch functions on active, as well as standby modules, ensuring fault-tolerant operation. The result? Cisco wide-area switches routinely deliver 99.999-percent service availability, leading to high user satisfaction and reduced subscriber churn.

Hot-Standby Interfaces

Hot-standby interfaces offer optional redundancy, so if a module fails, the standby is fully on line within milliseconds. Switchover to standby interfaces is non-service affecting for most protocols, ensuring nonstop high application performance.

Automatic Protection Switching

The Cisco BPX 8600 series supports industry-standard, automatic protection switching (APS) for Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH) interfaces. Both 1+1 and 1:1 APS schemes are supported. If a fiber is cut or a card fails, APS performs switching to the backup fiber within milliseconds.

Automatic Rerouting

If a trunk fails, the automatic connection-management feature of the BPX 8600 automatically reroutes virtual circuits. This same automatic connection-routing algorithm is incorporated in Cisco's network modeling software, allowing you to design highly reliable networks that can withstand almost any combination of link failures. Modeling-simulation features allow you to design and test a network, using what-if scenarios to assess the impact of potential link failures. The result is a stronger network design and the industry's highest service availability.

Non-Service Affecting Software Upgrades

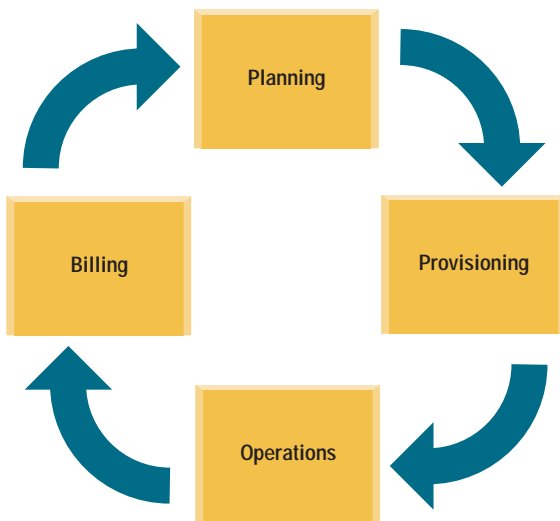
Non-service affecting software upgrades allow you to gracefully upgrade software or add new features without disrupting services. Customers receive the benefits of new features without interrupting service delivery or application performance.

SCALABILITY LETS YOU GROW YOUR NETWORK GRACEFULLY

The unmatched scalability of the BPX 8600 lets you stay ahead of exploding demand without requiring significant reinvestment in your network infrastructure. With the industry's highest port density, the BPX 8600 series switch supports up to 96 OC-3/STM-1 port interfaces or up to 144 T3/E3 port interfaces. Custom ASICs deliver the industry's most advanced ATM capabilities and highest port densities, slashing the average price per port for high-speed connections by more than 50 percent over previous solutions. As a result, the BPX 8600 series delivers the highest performance at the lowest cost per user in the industry.

Each BPX 8600 series switch supports thousands of broadband and narrowband connections, enabling you to add subscribers as demand increases. Up to 16 edge concentrator shelves allow you to easily add capacity as service demand grows. A fully configured BPX 8600 can support tens of thousands of subscribers.

Figure 7 Cisco Service Management power tools provide service planning, provisioning, operations, and billing of large, single, or multivendor networks.



CISCO SERVICE MANAGEMENT SOLUTIONS STREAMLINE PLANNING, PROVISIONING, OPERATIONS, AND BILLING

Cisco service-management solutions encompass every facet of networking—access, edge, and core, as well as both IP and ATM technologies. A comprehensive set of service management power tools form the service-creation architecture that allows you to design, deploy, and manage value-added services.

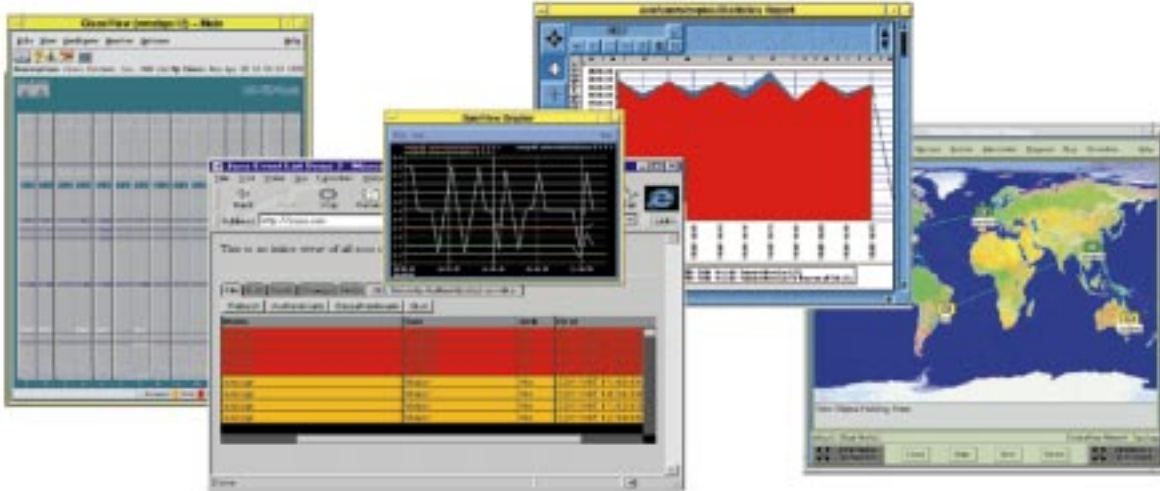
Service Planning

Cisco's service planning tools enable you to maximize profits and control costs while optimizing end-to-end service connectivity, performance, and security. Cisco's Service Planning Center (SPC) suite enables network managers to easily create IP+ATM service-level policies that define the connectivity, security, and performance service levels needed to meet SLAs or critical business application needs. The SPC allows network managers to define, assess, and repair end-to-end network policies in near real time across switched and routed networks. With comprehensive planning, auditing, troubleshooting, and modeling functionality, the SPC simplifies planning of network resources to help you achieve maximum end-to-end performance.

Service Provisioning

The Cisco Provisioning Center (CPC) provides a fast, automated way to provision services across an IP+ATM infrastructure. The CPC integrates with your existing service order management system to provide flow-through provisioning, reducing the cost of service and time to market. The CPC also integrates with third-party equipment management systems to provide true end-to-end, multivendor provisioning. With support for network and service labeling, customer ownership of network resources, customizable connection parameter templates, and just-in-time resource delivery, the CPC automates service provisioning to reduce management and operations costs.

Figure 8 Cisco's robust, scalable, and user-friendly Service Management power tools optimize network performance and speed service delivery.



Service Operations

Cisco's Info Center provides service assurance and support for VPNs and customer network management. The Info Center consolidates fault and alarm information from multiple sources, filters and correlates it in a real-time database, and distributes it to custom views of the network. Flexible and customizable, the Info Center allows you to customize views of network resources and services, generate dynamic topographical maps, and securely distribute partitioned and filtered information to your customers. A common interface helps you effectively manage events from multiple sources and from third-party management systems.

Cisco's WAN Manager provides network-wide topology, configuration, data collection, and security management, based on a robust client/server architecture that takes full advantage of the distributed network intelligence of the WAN network. Regardless of the size or configuration of your network, WAN Manager collects comprehensive service statistics, tracks resource performance, and provides powerful remote diagnostic and control functions. WAN Manager also integrates with upstream operations support systems via Simple Network Management Protocol (SNMP) Service Agent for flow-through connection management.

CiscoView is a graphical user interface (GUI)-based common device-management software application that provides dynamic status, statistics, and configuration for Cisco switches, routers, concentrators, and adapters. With CiscoView, network managers have a complete view of Cisco devices from a centralized location, simplifying device monitoring. Its GUI helps managers to quickly grasp essential inquiry information and understand management data. CiscoView can also be integrated with other management platforms, such as HP OpenView, NetView, and SunNet Manager, providing a seamless, powerful management system.

Service Billing

Cisco provides robust, scalable data-collection capabilities that enable you to gather network usage data for innovative usage-based billing to customers. Cisco's WAN Manager allows you to collect usage data for network connections and interfaces. Multiple statistics-agent modules can be configured for different portions of the network. The WAN Manager also integrates with upstream billing systems and third-party applications.

Cisco's NetFlow FlowCollector application is used with the NetFlow Switching data export feature on Cisco 7000 series routers and IP+ATM WAN switches. It provides detailed network usage information that can be used for advanced billing on a per-application and actual usage basis.

Figure 9 Cisco BPX 8620 Wide-Area Edge Switch



A Flexible Architecture Enables Flexible Deployment

POWERFUL ATM ENGINE

The BPX 8600 series switch includes a 20-Gbps crosspoint switching fabric in a 15-slot chassis. Three slots are reserved for common control modules, and 12 slots are provided for interface modules. The switch employs a midplane design, and each front card has a corresponding line module that provides the physical interface to the transmission media. This design permits easy upgrading or replacement of function modules without disturbing cabling.

Broadband Control Card

The broadband control card (BCC) is usually configured redundantly; it supports the following functions:

- ATM cell switching
- Internal and remote-node communication
- Node synchronization
- Network-management communication
- Shelf-management communication

Alarm Status Monitor Card

The alarm status monitor card (ASM) monitors the power supply voltage and shelf temperature of the BPX 8600. The ASM card also includes telco-standard relays, which can activate switch alarm indicators.

High-Density ATM Interface Cards

Cisco BPX 8600 series ATM interface cards incorporate custom ASICs that provide advanced ATM features and the industry's highest port densities. Advanced features include standards-based ATM traffic management, per-VC queue management, per-VC rate scheduling, and advanced interfaces for cell-based customer premises equipment (CPE) (via ATM User Network Interface [UNI] standard user interface) or to non-Cisco networks (via Network-to-Network [NNI] interface). High-density ATM interface cards deliver the industry's most advanced ATM implementations at the lowest cost per port.

- *BXM-T3*—Supports native ATM access and trunk ports at T3 speeds
- *BXM-E3*—Supports native ATM access and trunk ports at E3 speeds
- *BXM-155*—Supports native ATM access and trunk ports at speeds of OC-3/STM-1
- *BXM-622*—Supports native ATM access and trunk ports at speeds of OC-12/STM-4

BXM cards also enable you to configure both PVCs and SVCs for the following ATM services:

- Constant bit rate (CBR)
- Real-time variable bit rate (RT-VBR)
- Non-real time variable bit rate (NRT-VBR)
- Unspecified bit rate (UBR) with EPD
- Available bit rate (ABR)

Up to 16 ATM classes of service are supported, including those for IP traffic classes carried via Multiprotocol Label Switching (MPLS). The BPX 8600 architecture protects your hardware investment as the industry defines additional traffic types.

Multicast Functionality

The Cisco BPX 8600 series switch enables delivery of video applications such as video on demand, IP multicasting, distance learning, and videoconferencing. Multicast functionality ensures that latency-sensitive video traffic is delivered with the required QoS.

HIGH-DENSITY SERVICE CONCENTRATION

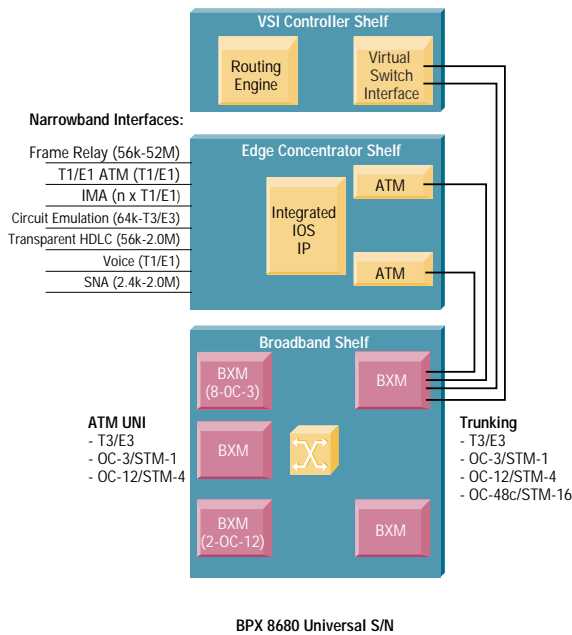
The BPX 8600 series supports a wide range of services via edge concentrator shelves, which terminate user connections and perform adaptation to ATM for non-native ATM traffic. Different service interfaces can be combined within a single shelf. Narrowband service modules may be configured for 1:n redundancy and broadband modules for 1:1 redundancy, allowing you to deliver superior service availability to your customers. Supported services include:

- Frame Relay
- High-speed Frame Relay
- ATM frame UNI
- ATM UNI 3.0 and 3.1
- SNA
- T1/E1 ATM UNI
- n x T1/E1 IMA UNI
- Circuit emulation
- SMDS

A MODULAR ARCHITECTURE SCALES TO SUPPORT LARGE NUMBERS OF USERS

The BPX 8600 series supports up to 16 edge concentrator shelves; each edge concentrator shelf aggregates traffic from thousands of users onto a single port of the multiport broadband interface card. This high port density maximizes use of the high-capacity switch fabric of the BPX 8600. As a result, a fully configured BPX 8680 Universal Service Node can support up to 16,000 DS-1 ports.

Figure 10 The BPX 8680 Universal Service Node has a modular, multishelf architecture designed for very large installations, scaling to 16,000 T1 ports. The BPX 8680 supports a full range of services and offers integrated IOS IP software that enables advanced Internet services.

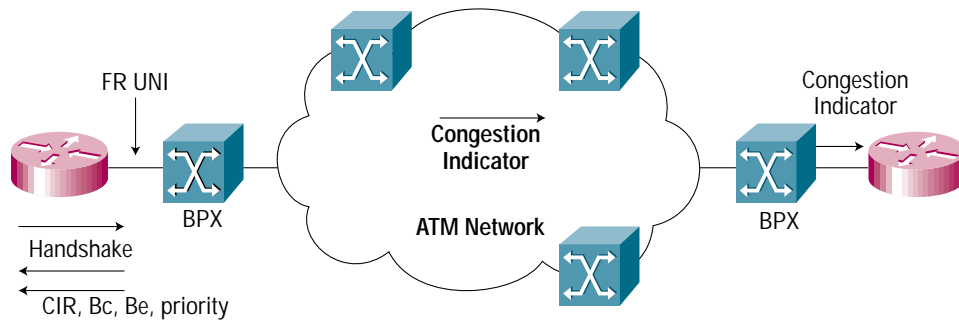


INTEGRATED CISCO IOS SOFTWARE PROVIDES BACKBONE-TO-PREMISES SERVICE DELIVERY

The Cisco BPX 8600 series integrates seamlessly with Cisco CPE networking equipment to provide end-to-end service delivery capabilities. Enhanced Local Management Interface (ELMI) enables automatic configuration of Frame Relay connections to Cisco routers, saving time, reducing the potential for configuration errors, and eliminating long troubleshooting times. After connections are configured on the switch, ELMI messages communicate committed information rate (CIR), Excess Burst (Be), and Committed Burst (Bc) parameters, and priorities to the routers.

The BPX 8650 IP+ATM switch performs IP routing functions, becoming, in effect, a high-performance IP switching router. Using standard IP routing protocols, a table of labels is generated that specifies how IP traffic is to be routed through the network. Connections are established based on a simple incoming label, which is translated into the virtual path identifier (VPI)/virtual channel identifier (VCI) for ATM cells. The BPX 8650 establishes a crossconnect through the switch fabric for transporting the traffic. With the BPX 8650, you can install an IP network and deliver advanced IP services, such as voice over IP, VPNs, and Web hosting services across the ATM backbone.

Figure 11 Enhanced LMI messages automatically configure Frame Relay connection parameters on attached routers. Congestion information is passed from the BPX 8600 to the router to extend bandwidth management to the network edge.



CISCO SERVICE AND SUPPORT MAXIMIZES YOUR NETWORK INVESTMENT

Service providers must meet many networking challenges. Cisco Support Solutions for service providers provide basic support services and enable you to select the hardware support options, advanced implementation services, and customized professional services to meet the needs of your specific business. As a service provider, you have access to the following support services:

Cisco's Base Service Plan—Provides you with registered access to Cisco's award-winning Web site, Cisco Connection Online (CCO), 24 x 7 access to the Cisco Technical Assistance Center (TAC) for technical support, and software updates.

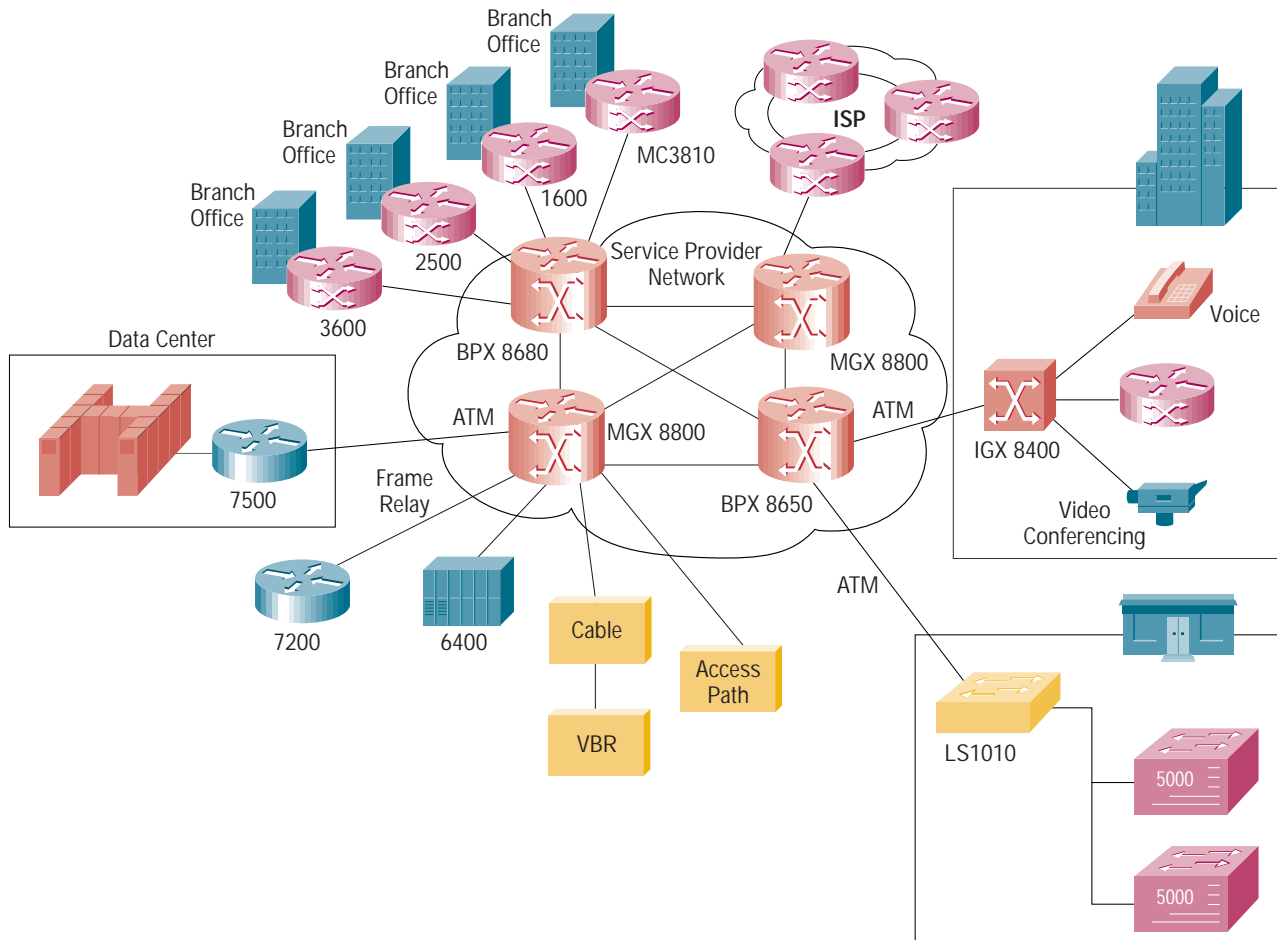
Advanced Implementation Services—For special networking projects or dedicated, ongoing support, turn to Cisco's advanced and customized services:

- The Network Implementation Service (NIS) helps you implement large-scale, complex networks across multiple sites.
- An Internet Service Provider (ISP) Expert Team provides Internet network design, performance engineering, security, and deployment assistance.
- The Cisco Professional Services and the Network Supported Account program provide focused service and support resources to help you maximize networking effectiveness. You can even receive support for CPE deployment.

- *Hardware Support Options*—Service providers can choose from several options for hardware upgrades, including Return for Replacement, Advance Replacement, or Onsite Support services.

Cisco support offerings for service providers are designed to ensure the maximum uptime, performance, and life span of your Cisco networking equipment.

Figure 12 Cisco Systems' end-to-end solutions deliver reliable, secure, innovative networking solutions.



ENHANCE YOUR REVENUE STREAM AND YOUR MARKET AGILITY

The BPX 8600 series wide-area edge switch is the platform of choice for delivering best-in-class ATM and IP services. Its QoS and traffic management capabilities enable you to differentiate services and guarantee service quality, while unmatched flexibility, scalability, and carrier-class reliability allow you to stay one step ahead of the exploding demand for networking services. With end-to-end networking solutions from Cisco Systems, your network becomes a powerful engine for maximizing revenue growth.

For more information about the Cisco BPX 8600 series wide-area switches, call Cisco today or visit www.cisco.com.

BPX 8600 Series System Specifications

Mechanical Configuration	<ul style="list-style-type: none"> • 15 module slots: <ul style="list-style-type: none"> – 2 slots reserved for redundant control/switch modules – 1 slot reserved for alarm status monitor (ASM) module – 12 general-purpose slots for interface modules
Cisco BPX 8620 Dimensions	<ul style="list-style-type: none"> • H x W x D: 22.75 x 17.72 x 27 in (57.8 x 45 x 68.6 cm) • Rack mountable in industry-standard EIA/RETMA racks (17.75-in. [45.1 cm] minimum between rails); rack-mount adapters are available for mounting in 23-in. (58.42 cm) telco racks
Cisco BPX 8650 IP+ATM Switch Dimensions	<ul style="list-style-type: none"> • H x W x D: 28 x 17.72 x 27 in (71.12 x 45 x 68.6 cm) • Rack mountable in industry-standard EIA/RETMA racks (17.75-in. [45.1 cm] minimum between rails); rack-mount adapters are available for mounting in 23-in. (58.42 cm) telco racks
Cisco BPX 8680 Universal Service Node Dimensions	<ul style="list-style-type: none"> • H x W x D: 22.75* x 17.72 x 27 in (57.8* x 45 x 68.6 cm) • Rack mountable in industry-standard EIA/RETMA racks (17.75-in. [45.1 cm] minimum between rails); rack-mount adapters are available for mounting in 23-in. (58.42 cm) telco racks
BPX 8600 Weight (Approximation)	<p>73 lb (33.2 kg) empty BPX shelf with fans, but without power supplies</p> <ul style="list-style-type: none"> • 6 lb (2.7 kg) each BPX card • 2 lb (0.9 kg) each DC power entry module • 18 lb (8.2 kg) empty AC power supply tray • 16 lb (7.3 kg) each AC power supply
Cisco BPX 8620 Power Requirements	<ul style="list-style-type: none"> • 1400W dissipation (max) • –48 VDC or 208/240 VAC input
Cisco BPX 8650 IP+ATM Switch Power Requirements	<ul style="list-style-type: none"> • 1770W dissipation (max) • –48 VDC or 208/240 VAC input
Cisco BPX 8680 Universal Service Node Power Requirements	<ul style="list-style-type: none"> • 1400W dissipation per shelf (max) • –48 VDC or 208/240 VAC input
Crosspoint Switch Fabric	<ul style="list-style-type: none"> • Peak switching capacity of 19.2 Gbps • Twelve 800/1600-Mbps switch ports that support up to OC-12/STM-4 cell rate • Arbiter establishes up to 20 million cell connections per second
Network Interfaces	<ul style="list-style-type: none"> • T3/DS3 (44.736 Mbps) with physical layer convergence procedure (PLCP) per TA-TY-000773 • E3 (34.368 Mbps) per ITU-T Rec. G.804 • OC-3/STM-1 (155.520 Mbps), complies with SONET standards Bellcore TR-253-CORE, ANSI T1.105; complies with SDH standards ITU-T G.707, G.708, G.709, G.957, G.958 • OC-12/STM-4 (622.08 Mbps), complies with SONET standards Bellcore TR-253-CORE, ANSI T1.105; complies with SDH standards ITU-T G.707, G.708, G.709, G.957, G.958 • Automatic protection switching per ITU-T Rec. G.783

Common Network Interface Features	<ul style="list-style-type: none"> • Up to 16 independent queues for class-based queuing • Queues programmable for maximum queue depth, minimum service bandwidth, maximum service bandwidth, cell loss priority (CLP) thresholds, Explicit Forward Congestion Indication (EFCI) thresholds • Fully compliant ABR VS/VD implementation • Explicit rate marking • EFCI Marking • ForeSight closed-loop, rate-based congestion management
Broadband Service Interfaces	<ul style="list-style-type: none"> • T3/DS3 UNI (44.736 Mbps) with PLCP per TA-TY-000773 • E3 UNI (34.368 Mbps) per ITU-T Rec. G.804 • OC-3/STM-1 UNI (155.520 Mbps), complies with SONET standards Bellcore TR-253-CORE, ANSI T1.105; complies with SDH standards ITU-T G.707, G.708, G.709, G.957, G.958 • OC-12/STM-4 UNI (622.08 Mbps), complies with SONET standards Bellcore TR-253-CORE, ANSI T1.105; complies with SDH standards ITU-T G.707, G.708, G.709, G.957, G.958
Optional Redundancy	<p>All components are optionally redundant to 100-percent system redundancy, including the control processor, cross point switch, network interfaces, service interfaces, critical backplane signals, power supplies, power modules, and cooling fans.</p>
Network Management Interfaces	<p>Interfacing-to-network management is provided via:</p> <ul style="list-style-type: none"> • One 802.3 attachment unit interface (AUI) for local connectivity to network management systems • Two asynchronous control/printer ports
Alarms, Indicators, and Controls	<ul style="list-style-type: none"> • Major node alarm, minor node alarm, alarm cut-off, and history indicators • Visual and audible (major and minor) relay closures provided for connection to Central Office (CO) alarm system, including power supply status indicators and activity indicator. • Each interface module has a minimum of three visual indicators: <ul style="list-style-type: none"> – Active (green) – Standby (yellow) – Fail (red)
Clock Sources	<ul style="list-style-type: none"> • Internal, free-running oscillator, Stratum 3 • Can be phase-locked to any trunk or line • May be phase-locked to either of two T1/E1 external clock inputs
Node Synchronization	<ul style="list-style-type: none"> • Stratum 3 clock per ATT PUB 62411 • Software-programmable source: internal clock, transmission line, auxiliary port to an external clock source
Acoustical Measured 2 ft from the frame on all sides	<ul style="list-style-type: none"> • Front 61.0 dB • Back 65.2 dB • Left Side 57.0 dB • Right Side 57.5 dB

Shock	• Withstands 10G, 10 ms. at 1/2 sine wave
Vibration	• Withstands 1/4G, 20 to 500 Hz
Heat Transfer to Room	• Up to 7200 BTUs depending on node configuration
Certification	<p>EMI</p> <ul style="list-style-type: none"> • FCC Part 15, EN55022 (CISPR-A Certification), IEC 801-2 (VCCI Class 2) <p>Safety</p> <ul style="list-style-type: none"> • UL 1950, CSA 950, EN60950 <p>ESD/Immunity</p> <ul style="list-style-type: none"> • EN55082-1, -2, -3, -4, -5



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