PA-A6 Enhanced ATM Port Adapter for Cisco 7200, 7301, 7500, and 7600 Series Routers

The enhanced Cisco® ATM Port Adapter (product number ATM PA-A6) is a single-port, single-wide ATM port adapter for the Cisco 7200 Series, Cisco 7301 Series, Cisco 7500 Series, and Cisco 7600 Series routers using the FlexWAN module.

This Cisco ATM Port Adapter supports advanced ATM hardware features such as per-virtual circuit and per-virtual path traffic shaping, as well as all ATM service classes such as real-time variable bit rate (VBR-rt), constant bit rate (CBR), non-real-time variable bit rate (VBR-nrt), available bit rate (ABR), and unspecified bit rate (UBR). The Cisco ATM Port Adapter also supports 8191 ATM virtual circuits.

The applications for the Cisco ATM Port Adapter follow:

- Broadband subscriber access aggregation
- High-speed customer premises equipment (CPE) WAN link
- High-speed WAN uplink
- High-speed enterprise backbone

Table 1 gives the features and benefits of the Cisco ATM Port Adapter, and Table 2 lists the features and platforms it supports.

Table 1. Features and Benefits of Cisco ATM Port Adapter

Features	Benefits
Single-interface ATM port adapter with support for 8000 virtual circuits	Allows service providers offering broadband aggregation to support 8000 subscribers on a single ATM interface
Advanced traffic management per virtual circuit	Allows support for various applications that require guaranteed or best-effort service
Dynamic bandwidth selection	Enables wholesale service providers to sell different classes of service (CoSs) to retail service providers by controlling bandwidth at the ATM virtual-circuit level
Broad range of WAN media interfaces from DS0 to OC-3 (40+ port adapters)	Allows flexible network configurations

Table 2. Product Features and Platforms Supported

Platforms Supported	PA-A6-OC3MM/SMI/SML	PA-A6-T3/E3
Cisco 7200 Series and Cisco 7200VXR Series, NPE-400 and above	12.2(15)T, 12.3 Mainline and later	12.2(15)T, 12.3 Mainline and later
Cisco 7301 Series	12.2(15)T, 12.3 Mainline and later	12.2(15)T, 12.3 Mainline and later
Cisco 7304 Series	12.2(31)SB and later	12.2(31)SB and later
FlexWan Module for the Cisco 7600	12.2(14)SX, 12.2(17)SX, 12.2(18)SXD, 12.2(18)SXE, and later	12.2(14)SX, 12.2(17)SX, 12.2(18)SXD, 12.2(18)SXE, and later
Cisco 7500 Series with VIP4-50	12.3(1) and later	12.3(1) and later
Cisco 7500 Series with VIP6-80	12.3(1) and later	12.3(1) and later
Cisco 7500 Series with VIP4-80	12.3(1) and later	12.3(1) and later
Form Factor	Single-width port adapter	Single-width port adapter

Platforms Supported	PA-A6-OC3MM/SMI/SML	PA-A6-T3/E3
Available Bit Rate (ABR)	Supported	Supported
Non-Real-Time Variable Bit Rate (VBR-nrt)	Supported	Supported
Real-Time Variable Bit Rate (VBR-rt)	Supported	Supported
Constant Bit Rate (CBR)	Supported	Supported
Unspecified Bit Rate (UBR)	Supported	Supported
LAN Emulation (LANE)	Supported	Supported
IP-to-ATM Class of Service (CoS)	Supported	Supported
Per-VC and Per-VP Traffic Shaping	Supported	Supported
VoATM	Supported	Supported
FRF.8/FRF.5	Supported	Supported

Ordering Information

Table 3 gives ordering information for the Cisco ATM Port Adapter.

Table 3. Ordering Information for Cisco ATM Port Adapter

Product Model	Product Description
PA-A6-OC3MM	1-port ATM OC-3c/STM-1 multimode port adapter, enhanced
PA-A6-OC3SMI	1-port ATM OC-3c/STM-1 single-mode (IR) port adapter, enhanced
PA-A6-OC3SML	1-port ATM OC-3c/STM-1 single-mode (LR) port adapter, enhanced
PA-A6-T3	1-port ATM DS3 port adapter, enhanced
PA-A6-E3	1-port ATM E3 port adapter, enhanced

Software Supported

Cisco 7200VXR and 7301 support the PA-A6 series by Cisco IOS® Software version 12.2(15)T, 12.3 Mainline and later

Cisco 7500 VIP4-50/80 and VIP6-80 support the PA-A6 series by Cisco IOS Software version 12.3 Mainline and later

Cisco 7600 FlexWan and Enhanced FlexWan support the PA-A6 series by Cisco IOS Software version 12.2(14)SX, 12.2(17)SX, 12.2(18)SXD, 12.2(18)SXE, and later

Main Feature Summary

The Cisco ATM Port Adapter combines high performance and a wide array of new ATM features that are ideal for both enterprise WAN and service provider backbone applications:

- Internet Engineering Task Force (IETF) RFC 2684 (updated RFC 1483) support for multiple protocol encapsulations over ATM
- IETF RFCs 2364 and 2516 for PPP over ATM (PPPoA)
- IETF RFC 1577 support for classical IP and Address Resolution Protocol (ARP) over ATM
- Support for 8191 virtual circuits
- ATM service classes: UBR, VBR-nrt, ABR, CBR, and VBR-rt (support at command-line interface [CLI])
- ATM Forum User-Network Interface (UNI) 3.0, 3.1, and 4.0
- Supports ATM Adaption Layer 5 (AAL5) for data services

- Supports AAL2 for voice services (Cisco 7200 with OC-3/STM-1, DS3, and E3 interfaces only)
- Layer 2 per-virtual circuit and per-virtual path queuing and traffic shaping
- ATM permanent virtual connections (PVCs) and switched virtual connections (SVCs)
- LANE 2.0 client and server
- F4 and F5 operations and maintenance (OAM) cell support
- Multiprotocol over ATM (MPoA) client and server
- Multiprotocol Label Switching (MPLS), MPLS traffic engineering, MPLS virtual private network (VPN), MPLS CoS
- Integrated Local Management Interface (ILMI)

Extended Virtual-Connection Capabilities

The Cisco ATM Port Adapter supports up to 8192 virtual connections. Any combinations of virtual circuit and virtual path can be supported up to a maximum number of 8191 virtual circuit/virtual path combinations. These virtual circuits can be either PVCs that are created manually or SVCs created through point-to-point and point-to-multipoint UNI signaling.

These capabilities contribute to the high-performance throughput, and specifically benefit applications that require many virtual circuits, such as in DSL applications and in a campus LAN.

Advanced Traffic Management

Advanced traffic management mechanisms in the Cisco ATM Port Adapter architecture allow for the support of bursty client/server traffic, while supporting applications that require guaranteed or best-effort service.

The Cisco ATM Port Adapter supports multiple ATM service classes, including ABR, VBR-nrt, UBR, VBR-rt, and CBR.

Supported Service Categories

Table 4 gives typical uses for the Cisco ATM Port Adapter service classes.

Table 4. Typical Uses for Cisco ATM Port Adapter Service Classes

Cisco ATM Port Adapter Service Classes	Typical Uses
VBR-nrt	Used for all applications that require a level-of-service guarantee through the ATM network
UBR	Used mostly for data applications that require only best-effort service and little configuration
ABR	Used to maximize bandwidth utilization of the ATM link through the use of congestion feedback notification (with ability to define minimum bandwidth)
VBR-rt	Intended for real-time applications, such as compressed voice over IP (VoIP) and videoconferencing, that require tightly constrained delays (cell transfer delay [CTD]) and delay variation (cell delay variation [CDV])
CBR	Designed for ATM virtual circuits that need a static amount of bandwidth that is continuously available for the duration of the active connection

Per-Virtual Circuit and Per-Virtual Path Traffic Shaping

Traffic shaping is a function typically provided on ATM edge devices to ensure that bursty traffic conforms to a predetermined contract. Specifically, traffic shaping ensures that traffic from one virtual circuit does not adversely impact another, resulting in data loss. This function is very important when connecting to an ATM WAN or public ATM network, especially when the ATM switches enable traffic policing that discards all traffic that exceeds the predetermined contract at the ingress of the ATM network.

The Cisco ATM Port Adapter supports traffic shaping on a per-virtual circuit basis and per-virtual path basis. Supporting traffic shaping in hardware means that there is no performance degradation when shaping is enabled. Providing traffic shaping on a per-virtual circuit and per-virtual path basis allows flexibility and control over every virtual circuit and virtual path configured.

Depending on the selected ATM service class, the Cisco ATM Port Adapter supports highly configurable parameters such as peak cell rate (PCR), sustainable cell rate (SCR), maximum burst size (MBS), and minimum cell rate (MCR). These parameters can be defined based on the specific bandwidth requirements of an individual virtual circuit, as needed for a specific application.

The Cisco ATM Port Adapter hardware shapes the virtual circuit to the specific parameters using a wheel-based scheduling algorithm to ensure fairness across the ATM interface. If two cells compete for the same time slot, the virtual circuits, by default, are prioritized in the following order (starting with highest priority):

0 CBR, control

1 AAL5 or AAL2 VoATM virtual circuit (any service category)

2 VBR-rt

3 VBR-nrt

4 ABR

5 UBR, UBR+

Prioritizing the virtual circuits in this manner ensures that the high-priority and guaranteed traffic have precedence over the best-effort traffic. It is also possible to configure a custom prioritization scheme on a per-virtual circuit basis.

To provide further flexibility, the Cisco ATM Port Adapter allows each of these parameters to be set over a wide range of small increments.

Supported Traffic-Shaping Granularity - OC-3, DS3, and E3 Versions

Parameter	Range	Increments
PCR	56 kbps to line rate	2.29-kbps increments for OC-3c/STM-1, 0.674-kbps increments for DS3, and 0.515-kbps increments for E3
SCR	56 kbps to line rate	2.29-kbps increments for OC-3c/STM-1, 0.674-kbps increments for DS3, and 0.515-kbps increments for E3
MBS	1 to 65535	One cell

High-Performance Architecture

The Cisco ATM Port Adapter is based on advanced dual segmentation and reassembly (SAR) architecture. One SAR processor is dedicated for transmission and one for reception. Each SAR supports AAL5 ATM adaptation for high-performance data applications. Many of the Cisco ATM

Port Adapter advanced traffic management features mentioned previously are a direct result of this SAR design.

The Cisco ATM Port Adapter also includes a large amount of buffer memory locally on the port adapter, a feature unique to the Cisco ATM Port Adapter. This buffer memory is partitioned on a per-virtual circuit and per-virtual path basis, providing better overall performance and the ability to absorb large bursts of traffic. This design ensures that bursty traffic from one virtual circuit does not prevent another virtual circuit from being serviced, an issue that could be crucial for any service provider ATM network.

Advanced Bandwidth Management Feature

Advanced bandwidth management mechanisms in the ATM network module architecture allow for the support of bursty client/server traffic while supporting applications that require guaranteed or best-effort service. The Cisco ATM Port Adapter bandwidth management capabilities exceed those of existing older ATM interfaces in midrange routers.

This new feature provides the ability to keep track of the bandwidth used by a virtual circuit or virtual path on a per-interface basis. It prevents the oversubscription of the ATM link and is configurable by the user.

The total bandwidth allocated on the interface is tracked by aggregating the values specified for sustained cell rate for each virtual circuit. Whenever a new virtual circuit is requested, the requested rate is checked against the available rate to ensure that the available bandwidth is not exceeded. This check can be disabled if link-over subscription is desired.

ATM Layer Connection Management

OAM cells are used for ATM layer end-to-end link management messages. This ensures that the remote end of the connection is alive and functioning. Support is provided for both OAM F4 and F5 flows. During segmentation, the OAM cells have the highest priority, and they are transmitted ahead of other queued data. During reassembly, the OAM traffic is routed to a global OAM receive buffer pool of 512 64-byte buffers.

MPLS

The MPLS feature classes that are supported include basic MPLS, MPLS traffic engineering, MPLS VPN, and MPLS CoS.

IP to CoS Features

The Cisco ATM Port Adapter supports the Cisco IOS Software IP QoS-to-ATM CoS (IP-to-ATM CoS) feature. This implements a solution for coarse-grained mapping of quality-of-service (QoS) characteristics between IP and ATM. These features ensure consistent QoS between IP and ATM interworked networks. IP/ATM networks can now offer different service classes across the entire WAN, not just the routed portion. Critical applications can be given higher classes of service during periods of high network usage and congestion. Great QoS flexibility becomes available for more important traffic and user types.

Per-virtual circuit QoS features enable you to apply advanced queuing and bandwidth management functionality such as Class-Based Weighted Fair Queuing (CBWFQ), Weighted Random Early Detection (WRED), or low-latency queuing (LLQ) to an individual virtual circuit. Also

supported is IP-to-ATM CoS mapping using the virtual-circuit bundling feature that allows you to divide traffic on different virtual circuits depending on the desired CoS.

ATM-to-Frame Relay Interworking

The ATM-to-Frame Relay service interworking function allows communication between a Frame Relay end user and an ATM end user. It is based on the FRF.8 implementation agreement, which specifies that a Frame Relay end station may communicate with an ATM end station provided that there is a router performing the specifications given in FRF.8 in the software between the two end stations.

http://www.cisco.com/en/US/tech/tk39/tsd_technology_support_category_home.html

QoS for Low-Speed Virtual Circuits

LFI over ATM-to-Frame Relay Interworking Virtual Circuit

This feature enables delay-sensitive real-time packets and packets that are not real-time data to share the same link by fragmenting the long data packets into a sequence of smaller data packets (fragments). The fragments are interleaved with the real-time packets. On the receiving side of the link, the fragments are reassembled and the packet reconstructed. This method of link fragmenting and interleaving (LFI) helps guarantee the appropriate QoS for the real-time traffic.

http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fqos_c/fqcprt6/qcflfifr.htm

Real-Time Performance/Voice - Multiservice Integration

CBR and VBR-rt classes; QoS such as LFI and IP-to-ATM CoS; VoATM with VoIP over AAL2 (VoAAL2); VoIP over ATM (VoATM)

Cisco IOS ATM Internetworking Services

Cisco IOS ATM services included in the Cisco ATM Port Adapter, with specific features based on your Cisco IOS image, follow:

- Multiprotocol encapsulation with support for Logical Link Control/Subnetwork Access Protocol (LLC/SNAP) encapsulation and virtual-circuit multiplexing (IETF RFC 2684 [updated RFC 1483])
- Classical IP and ARP over ATM; client and ARP server (IETF RFCs 1577, 1755, and 1626)
- Multiprotocol routing over ATM for IP, Novell Internetwork Packet Exchange (IPX), DECnet, AppleTalk Phases 1 and 2, Connectionless Network Service (CLNS), Xerox Network Systems (XNS), and Banyan VINES via IETF RFC 2684/1483
- Point-to-Point Protocol (PPP) encapsulation for the aggregation of asymmetric DSL (ADSL) subscribers' CPE using PVC and SVC (RFCs 2364 and 2516)
- ATM Forum LANE, including LAN emulation client (LEC), broadcast and unknown server (BUS), LAN Emulation Server (LES), and LAN Emulation Configuration Server (LECS) (available with Cisco IOS 12.1(6)E on the OC-12/STM-4 version)

ATM Services

- ATM Forum UNI 3.0/3.1/4.0 signaling for point-to-point and point-to-multipoint SVCs
- ATM Forum ILMI for address prefix acquisition and ATM service address registration

- ATM network service access point (NSAP) E.164 address support F4 (virtual path) and F5 (virtual connection) OAM cell segment and end to-end flows, remote defect indication (RDI), and alarm indication signal (AIS)

Network Management

The Cisco ATM Port Adapter supports the following Management Information Bases (MIBs), depending on the Cisco IOS release deployed:

- MIB II
- Synchronous Optical Network (SONET) MIB
- AToM MIB
- ATM ILMI MIB
- LANE MIB
- DS3/E3 MIB

Supported Interface Types

Table 5 gives the interface types that the Cisco ATM Port Adapter supports.

Table 5. Interface Types That Cisco ATM Port Adapter Supports

Interface	Rate	Connector Type	Cable Type	Wavelength	Maximum Distance
DS3	44.736 Mbps	BNC	Coaxial 75 ohm	-	450 ft
E3	34.368 Mbps	BNC	Coaxial 75 ohm	-	1250 ft
OC-3c/STM-1 multimode	155.52 Mbps	SC	62.5-/125-micron multimode fiber	1270 to 1380 nm	2 km
OC-3c/STM-1 single-mode intermediate reach	155.52 Mbps	SC	9-micron single-mode fiber	1260 to 1360 nm	15 km
OC-3c/STM-1 single-mode long reach	155.52 Mbps	SC	9-micron single-mode fiber	1260 to 1360 nm	45 km

Power Parameters for Optical Interfaces

Table 6 lists the power parameters for the Cisco ATM Port Adapter Optical Interfaces.

Table 6. Power Parameters for Cisco ATM Port Adapter Optical Interfaces

Interface	Transmit Power (Minimum)	Transmit Power (Maximum)	Receive Power (Minimum)	Receive Power (Maximum)	Power Budget
OC-3c/STM-1 Multimode	-20 dBm	-14 dBm	-30 dBm	-14 dBm	9 dB
OC-3c/STM-1 Single-Mode Intermediate Reach	-15 dBm	-8 dBm	-28 dBm	-8 dBm	15 dB
OC-3c/STM-1 Single-Mode Long Reach	-5 dBm	0 dBm	-35 dBm	-0 dBm	29 dB

Regulatory Compliance

Safety

- UL 1950 (3rd Ed.)

- CSA C22.2 No. 950-95
- EN60950 (1992 including Amendments 1-4 and 11)
- CE Marking
- IEC 950 (2nd Ed. including Amendments 1-4)
- AS/NZS3260 (1993 including Amendments 1-4)
- EMI
- FCC Part 15 Class A
- ICES-003 Class A
- VCCI Class B
- EN55022 Class B
- CISPR22 Class B
- CE Marking
- AS/NZS3548 Class B
- FDA Class 1 laser

Product Compliance Standards

- Environmental
- Operating temperature: 10 to 40℃
- CE Marking
- IEC 950 (2nd Ed. including Amendments 1-4)
- AS/NZS3260 (1993 including Amendments 1-4)

EMI

- FCC Part 15 Class A
- ICES-003 Class A
- VCCI Class B
- EN55022 Class B
- CISPR22 Class B

CE Marking

- AS/NZS3548 Class B
- FDA Class 1 laser

Product Compliance Standards

Environmental

Operating temperature: 10 to 40℃

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