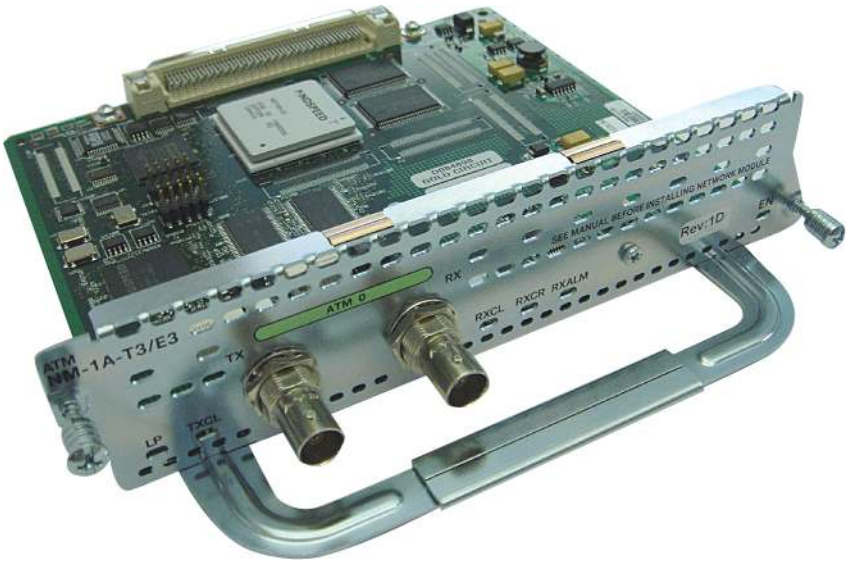
T3/E3 ATM Network Modules for Cisco 2800, 3800 and 3900 Integrated Services Routers

The new Cisco T3/E3 ATM Network Module (NM-1A-T3/E3) is now available for the Cisco ISR 2800, 3800 and 3900 Series Routers that provide ATM WAN connectivity for enterprise regional and branch office connectivity. This combined T3/E3 ATM network module provides an ATM connection of either 44 Mbps for DS3/T3, or 34 Mbps for E3 using standard 75-ohm BNC connectors. Support is provided for ATM Forum compliant framing standard AAL5, as well as ATM Traffic Management support for Unspecified Bit Rate (UBR), UBR+ (For SVC's only), Variable Bit Rate real-time (VBR-rt), Variable Bit Rate non-real time (VBR-nrt), Constant Bit Rate (CBR), and Available Bit Rate (ABR) classes of traffic.

The T3/E3 ATM network modules provide a cost-effective solution that can be deployed in the Cisco 2800,3800, and 3900 ISR's as Service Provider Managed customer premise equipment (CPE) or by Enterprise customers for T3/E3 and Fractional T3/E3 connectivity to medium-to-large size branch and smaller regional office locations for consolidating multiservice data, voice and video services over a single ATM link.

Figure 1. T3/E3 ATM Network Module



The following key features are supported:

- ATM Classes of Service support for: Unspecified Bit Rate (UBR), UBR+ (SVC's only), Variable Bit Rate real-time (VBR-rt), Variable Bit Rate non-real time (VBR-nrt), Constant Bit Rate (CBR), and Available Bit Rate (ABR)
- RFC 1483 and RFC 1577 support
- 1024 maximum simultaneous Virtual Connections (VCs)
- 8 bits of VPI (VPI range 0-255), 16 bits of VCI (VCI range 0-65535)
- Permanent Virtual Circuits (PVCs) and Switched Virtual Circuits (SVCs)
- PLCP and HEC cell delineation support
- Operations and Management (F4,F5 OAM) cell support
- LANE support
- ILMI 1.0 support
- IETF PPP over ATM support
- Multiprotocol Label Swapping (MPLS) VPN support
- MPOA Client and Server
- Next Hop Routing Protocol (NHRP)
- On-line Insertion and Removal (OIR) on 3845
- Permanent Virtual Path (PVPs) support
- FRF.5/8 Interworking
- ITU-T G.703 Compliant
- ATM Traffic Management 4.1 compliant
- ATM Forum UNI 3.1/4.0 PVC compliant
- ATM Forum UNI 4.0 SVC compliant

Table 1 shows minimum Cisco IOS release and feature sets requirement for the product.

Table 1. Cisco IOS Support and Orderability Matrix for DS3/E3 ATM Network Modules

Product	IOS S/W Version Required	IOS Feature Sets or Licenses Required	Maximum supported
Cisco 2800 Series (2811, 2821, 2851)	12.4(15)T	All Cisco IOS12.4(15)T and above "SP Services" feature sets	1
Cisco 3825	12.4(15)T	All Cisco 12.4(15)T and above "SP Services" feature sets	1
Cisco 3845	12.4(15)T	All Cisco 12.4(15)T and above "SP Services" feature sets	2[1]
Cisco 3925	15.0(1)M	Data License	1[2]
Cisco 3945	15.0(1)M	Data License	2[2]

[1] Maximum recommended modules does not imply will meet performance at wire rate
[2] Support for the DS3/E3 ATM network module in the 3925, and 3945 will be via the network module adapter card (SM-NM-ADPTR)

Advanced Traffic Management

Advanced traffic management mechanisms in the DS3/E3 ATM network modules architecture allow for the support of bursty, client/server traffic, while supporting applications that require guaranteed or best-effort service. The ATM DS3/E3 supports all the ATM service classes, including UBR, UBR+, VBR-rt, VBR-nrt, and ABR. Supporting these ATM service classes allows the DS3/E3 network modules to concurrently support various network applications on the same ATM interface. VBR-rt is intended for applications that require guaranteed services, and ABR and UBR are intended for applications that need only “best-effort” service.

The ABR support includes the Explicit Rate (ER), Relative Rate (RR), and Explicit Forward Congestion Indicator (EFCI) modes. ABR was defined specifically to minimize cell loss and maximize good put through the ATM network. Explicit Rate ABR is typically deployed in ATM WAN switches, and is used in products such as Cisco’s 8400/IGX and 8800/MGX ATM switches. Relative Rate ABR is more effectively deployed in the campus and is supported by the Cisco Lightstream 1010, and 8500 series ATM switches. EFCI is typically used for backward compatibility with legacy ATM switches that support neither Explicit nor Relative Rate. Please refer to Table 2 for ATM Service Class Definitions.

Table 2. ATM Service Class Definitions

ATM Service Classes	Typical Use
VBR-nrt-non-real time Variable Bit Rate	Used for all applications that require a level of Service guarantee through the ATM.
VBR-rt-real-time Variable Bit Rate	Used for connections that transmit at a rate varying with time and that can be described as bursty, often requiring large amounts of bandwidth when active. Intended for applications that require tightly constrained delay and delay variation such as compressed VoIP and video conferencing.
ABR-Available Bit Rate	Used to maximize bandwidth utilization on the ATM link through the use of congestion feedback notification.
UBR-Unspecified Bit Rate	Most legacy data applications using fair best-effort service.
CBR-Constant Bit Rate	Provides guaranteed bandwidth for data applications such as SNA traffic.

Per-VC Traffic Shaping

Traffic shaping is a function typically provided on ATM edge devices to ensure that bursty traffic conforms to a predetermined Service Level Agreement (SLA). More specifically, traffic shaping ensures that traffic from one VC 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 will discard all traffic that exceeds the predetermined contract at the ingress of the switch.

The ATM DS3/E3 supports traffic shaping in hardware which eliminates performance degradation when shaping is enabled. Providing traffic shaping on a per-VC basis in done by the software using IP-to-ATM CoS mapping feature and allows total flexibly and control over every VC configured.

For each ATM service class, the ATM DS3/E3 supports highly configurable parameters: 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 VC, as needed for a specific application. Table 3 lists ATM Class of Service Traffic Shaping Parameters supported on the product.

Table 3. ATM Class of Service Traffic Shaping Parameters

VBR -rt and nrt Parameters	ABR Parameters	UBR Parameters
PCR (kbps)	PCR (kbps)	PCR (kbps)
SCR (kbps)	MCR (kbps	
MBS (cells)		

The ATM DS3/E3 hardware “shapes” the VC to the specific parameters using a wheel-based scheduling algorithm to ensure fairness across the ATM interface. In the event that two cells compete for the same time slot, the VCs are prioritized in the following order (starting with highest priority): 1) CBR; 2)rt-VBR; 3)nrt-VBR; 3) ABR; and 4) UBR. OAM cells and signaling has the priority higher than any of the service classes. Prioritizing the VCs in this manner ensures that the high priority and guaranteed traffic have precedence over the best-effort traffic.

To provide further flexibility, the ATM DS3/E3 allows each of these parameters to be set over a wide range of small increments. Please refer to Table 4 for the Traffic Shaping Granularity supported on this module.

Table 4. Traffic Shaping Granularity

Parameter	Range	Increments
PCR	64 kbps to line rate	64 kbps
SCR	64 kbps to line rate	64 kbps
MBS	• <32 up to 4 Mbps • <200 up to line rate	One cell

Note: Although configuration to line rate is allowed, line rate is only reached with large packet sizes.

Extended Virtual Connections Capabilities

The ATM DS3/E3 supports up to 1024 Virtual Connections (VC) and up to 256 Virtual Path (VP). Any combinations of VC and VP can be supported up to a maximum number of 1024 VC/VP combinations. These VCs can be either Permanent Virtual Connections (PVC) which are created manually or Switched Virtual Connections (SVC) created through point-to-point and point-to-multipoint UNI signaling. Table 5 provides Interface Specification details. Table 6 provides LED Indicator description.

Table 5. Interface Specifications

Interface	Rate	Connector Type	Wavelength	Maximum Distance
DS3	44.736 Mbps	BNC	Coaxial	450 ft.
E3	34.368 Mbps	BNC	Coaxial	1250 ft.

Note: The DS-3 version provides adaptive equalization for 0-450 ft. of cable and provides loopback capability. The E3 version provides adaptive equalization for 0-1250 ft. of cable and also provides loopback capabilities. The DS-3 version also has the ability to support line build-out for cable lengths of less than 50 ft. or greater than 50 ft., as required.

Table 6. LED Indicators

ATM NM LED	Port Status	Function
Enable	Green	Indicates the ATM NM is successfully inserted and has established communications to the PCI bus. It is ready to accept CLI commands
RCLK	Green	Indicates that a receive clock has been detected
FERF	Yellow	The framer has detected a Far End Receive Failure
OOF	Yellow	The framer has detected an Out of Frame occurrence
AIS	Yellow	The framer has detected an Alarm Indication Signal

System Requirements

- A maximum of one NM-1A-T3/E3 Network Module is supported on the Cisco 2811,2821,2851 and 3845. Two are supported on the Cisco 3845. Line rate performance is not guaranteed for maximum NM-1A-T3/E3 Network Module support on the platforms.
- Operates in conjunction with all currently available Cisco 3800 network modules and WAN interface cards (WICs) and with all currently available Cisco 3900 Network Modules, Service Modules, Internal Services Modules, EHWICs, HWICs, WICs and VICs.
- No slot placement restrictions
- Support for the DS3/E3 ATM network module in the 3925, and 3945 will be via the network module adapter card (SM-NM-ADPTR).

Network Management

Supported MIBs include:

- Synchronous Optical Network (SONET) MIB
- MIB II
- AToM MIB (FRC 1695)
- ILMI MIB
- CISCO-BUS MIB
- CISCO-LECS-MIB
- CISCO-LES-MIB
- LAN Emulation (LANE) MIB
- Cisco-AAL5-MIB
- DS3/E3 CISCO-ATM-IF-PHYS-MIB

Product Compliance Standards

The DS-3 and E3 ATM network modules are to receive all the agency approvals necessary for unlimited international availability. The following regulatory approvals are supported:

Environmental

Table 7. DS3/E3 ATM Physical Specifications

Product Specifications	Descriptions
Dimensions (H x W x D)	1.55 x 7.10 x 7.2 in
Weight	2 lbs. Maximum
Environmental Conditions	• Operating temp. 41-131℉ (+5 -+55℃) • Non-operating temp. -13-158℉ (-25-70℃)
Relative Humidity	0 to 90%, noncondensing
EMI	Class B EMI
Cabling	75 Ohm BNC type connector
LEDs	Enabled, RX cells, RX carrier, RX Alarm

Safety Regulatory Approvals

- UL 1950 3rd edition/CSA C22.2, no. 950
- C1950 (Canada)
- AS/NZS 3260 (Australia/New Zealand)
- EN60950 (Europe)
- IEC 950 (National Deviations)

Emission Regulatory Approvals

- FCC Part 15J Class A (US/Canada)
- VCCI Class 2 (Japan)
- AS/NZS 3548 (Australia/New Zealand)
- EN55022 (CISPR 22) Class B (Europe)

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Printed in USA C78-418067-01 10/09