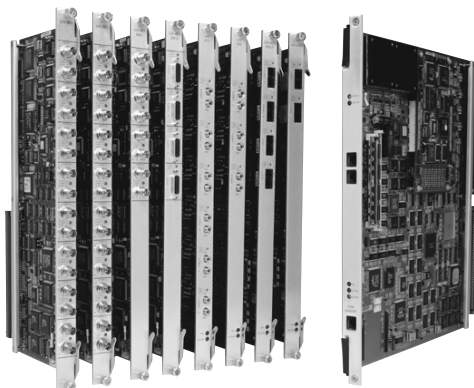


Universal Switching Module (UXM-E)

THE UNIVERSAL SWITCHING MODULE (UXM-E) FOR THE CISCO IGX 8410, IGX 8420, AND IGX 8430 WIDE-AREA SWITCHES PROVIDES STANDARDS-BASED, FULL-FEATURED ATM INTERFACES THAT MEET CURRENT AND FUTURE WIDE-AREA NETWORKING ATM REQUIREMENTS. THE UXM-E LEVERAGES INDUSTRY-LEADING TECHNOLOGY WITH STRATM TECHNOLOGY; A SET OF CUSTOM ASICs TO DELIVER HIGH-PERFORMANCE, HIGH-DENSITY ATM SOLUTIONS FOR WIDE-AREA NETWORKS. WITH THE UXM-E, CISCO OFFERS A SOLUTION FOR BUILDING WIDE-AREA ATM NETWORKS THAT IS UNIQUE IN THIS CLASS OF SWITCHES.



Key Features

Next-Generation Technology for Performance and Scale

The UXM-E uses a 64-bit RISC processor along with the Stratm ASICs to support the following functions:

- Trunks (IGX-to-IGX/BPX/MGX) and ports (IGX-to-CPE) interfaces on the same card
- ATM Forum, ITU-T, and ANSI standards-based UNIs and NNIs with flexible port densities:
 - Two or four OC-3/STM-1 ports per module
 - Three or six T3 ports per module
 - Three or six E3 ports per module
 - Four or eight T1 ports per module
 - Four or eight E1 ports per module
- IMA (Inverse Multiplexing over ATM)
- Virtual Switch Interface (VSI) to support an attached Label Switch Controller (LSC) for MPLS
- Virtual path connections (VPCs) and virtual channel connections (VCCs)
- 310 Mbps (OC-6) sustained throughput per card
- Integrated Local Management Interface (ILMI) per ATM Forum UNI 3.1
- Standards-based dual leaky bucket policing
- Traffic shaping
- Per-virtual circuit queuing
- Large dynamically-assigned buffers (64,000 cells ingress and 64,000 cells egress per module)
- Per-virtual circuit rate scheduling
- Standards-based implementation of available bit rate (ABR)
 - Explicit Forward Congestion Indication (EFCI) marking
 - Explicit rate (ER) marking
 - Virtual source/virtual destination (VS/VD)
- 8000 connections per module

- Standards-based ATM layer fault management per TA-NWT-1248-OAM (F4 and F5), AIS, and RDI
- Alarm and fault detection per GR-253-CORE (section 6), TA-NWT-1248, for PHY and ATM layer
- Statistics collection with support elements of RFC 1695 MIB via platform software
- Simple Network Management Protocol (SNMP) configuration and access via platform software
- Redundancy with hot standby switchover

ATM User Services

The UXM-E enables the interconnection of routers, campus switches, and other devices to wide-area switches using ATM UNIs. It provides a standards-based ATM interface on the IGX 8400 series switch to connect to any vendor's equipment. The following VPCs and VCCs are supported on the UXM-E. All these connections may traverse any UXM-E trunk interface.

- Constant bit rate (CBR)
- Variable bit rate-Real Time (VBR-RT)
- Variable bit-rate-Non Real Time (VBR-NRT)
- Unspecified bit rate (UBR)
- Available bit rate (ABR)

ATM Trunking Services

The UXM-E provides standards-based ATM interfaces on the IGX 8400 series switch to interconnect Cisco wide-area switches using leased lines or foreign (public/private) ATM networks. These ATM trunks can be used to transport ATM, Frame Relay, voice, or circuit data services between IGX switches as well as interconnection between IGX switches and Cisco BPX[®] 8600 series switches. Using UXM-Es, IGX switches can be interconnected via leased-line trunks at various rates, including OC-3/STM-1, T3, E3, NxT1, and NxE1 (with $1 \leq N \leq 8$).

Inverse Multiplexing over ATM

In order to bridge the large gap between T1 and T3 and between E1 and E3, the UXM-E supports inverse multiplexing over ATM for NxT1 or NxE1 trunking between IGX switches. This capability also provides some resiliency in the network by providing 1:N redundancy in the IMA group. This functionality offers the following capabilities:

- Multiple IMA groups per UXM-E card; up to eight groups per eight-port card. All links in a group must use the same clock.
- Each IMA group on a UXM-E may contain as few as one T1 or E1 link.
- Differential delays of up to 250 ms for T1 and 209 ms for E1 across the constituent T1s or E1s of an IMA group

- The administrator may specify the number of "retained links" for each IMA group. This represents the number of unfailed links necessary for the IMA group to remain in service.
- If a link within an IMA trunk fails, the IMA group dynamically re-calculates the available trunk bandwidth. If the remaining bandwidth is insufficient to support all the connections on the trunk, all the connections are rerouted and fewer connections are allowed to use the trunk.

Virtual Trunking

With the UXM-E, IGX switches can easily be interconnected via foreign (public or private) ATM networks using virtual path trunking over VPCs. The UXM-E supports multiple virtual trunks per physical interface, up to a maximum of 15 virtual trunks per module.

When using a foreign ATM network as a virtual trunk, all the "networking" features are preserved, as are the traffic management capabilities. This allows enterprise customers to utilize public ATM services, where available, and benefit from the lower cost of ATM services compared to dedicated leased lines.

Traffic Management

Cisco's commitment to traffic management for ATM is unprecedented in the industry today. UXM-E modules contain the following capabilities that enable efficient traffic management in an IGX 8400 series network:

- Per-virtual circuit ingress queuing and scheduling
- Per-virtual circuit egress traffic shaping
- Large, dynamically-assigned buffers (64,000 cells ingress and 64,000 cells egress per module)
- Dynamic buffer management with threshold scaling
- Up to 16 classes of service, including the standard ATM classes (CBR, VBR-RT, VBR-NRT, UBR, and ABR) with the following configurable parameters:
 - Maximum queue depth (MQD)
 - Cell loss priority (CLP) high and low thresholds
 - EFCI threshold
- Support for Cisco's ForeSight[®]

This enables the IGX 8400 series to ensure that guaranteed QoS levels are met under any network condition.

Description	OC-3/STM-1 Single-Mode Fiber (IR)	OC-3/STM-1 Single-Mode Fiber (XLR)	OC-3/STM-1 Multi-Mode Fiber	STM-1 Electrical	T3	E3	T1	E1
ATM Cell Rate Per Port	353,207 cps	353,207 cps	353,207 cps	353,207 cps	96,000 cps	80,000 cps	3,622 cps	4,830 cps
Note:	Minimum length before attenuator is required to prevent saturation: 15 km. Recommended attenuator: Neptec MA30-SC-U/SC-U-C3-02.							

ATM Layer	
ATM Layer Management Protocol	ILMI or None
Standards	ATM Forum UNI 3.1, TM 4.0 ITU-T I.150, I.361, I.371, I.432, I.610
Valid VPI Range	NNI: 1–4095 UNI: 1-255
Valid VCI Range for User Traffic	VCC: 0–65,535 VPC: 32–65,535
Frame to ATM Interworking	Network Interworking (FRF.5) Service Interworking (FRF.8)
Connection Types Supported	CBR: Constant Bit Rate RT-VBR: Real-time Variable Bit Rate NRT-VBR: Non-Real-time Variable Bit Rate UBR: Unspecified Bit Rate ABRSTD: Available Bit Rate using TM4.0 Traffic Management ABRFST: Available Bit Rate using ForeSight Traffic Management ATFR: ATM-to-Frame Relay Network Interworking (FRF.5) ATFST: ATM-to-Frame Relay Network Interworking (FRF.5) with ForeSight Traffic Management ATFT: ATM-to-Frame Relay Transparent Service Interworking (FRF.8) ATFTFST: ATM-to-Frame Relay Transparent Service Interworking (FRF.8) with ForeSight Traffic Management ATFX: ATM-to-Frame Relay Translational Service Interworking (FRF.8) ATFXFST: ATM-to-Frame Relay Translational Service Interworking (FRF.8) with ForeSight Traffic Management

Connection Parameters Supported

Name	Units	Description	CBR	RT-VBR	NRT-VBR	UBR	ABRSTD	ABRST	AFRR	ATTEST	ATFT	ATFTEST	ATFX	ATFTEST
PCR(0+1)	Cells/second	Peak Cell Rate for cells with CLP=0 or CLP=1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
% Util	Percentage	Percent Utilization	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
MCR	Cells/second	Minimum Cell Rate					Y	Y	Y	Y		Y		Y
CDVT(0+1)	Microseconds	Cell Delay Variation Tolerance for cells with CLP=0 or CLP=1	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
AAL5 FBTC	Enable/Disable	AAL5 Frame-Based Traffic Control		Y	Y	Y	Y	Y						
VSVD	Enable/Disable	Virtual Source/Virtual Destination					Y							
FCES	Enable/Disable	Flow Control of External Segments					Y	Y		Y		Y		Y
SCR	Cells/sec.	Sustained Cell Rate		Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
MBS	Cells	Maximum Burst Size		Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
Policing	1 - 5	Type of ingress cell policing to be applied. See the Table below for a description of each policing mode.	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
VC Qdepth	Cells	Depth of the ingress queue (VC_Q) dedicated to the VC	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
CLP Hi	Percentage of VC Qdepth	Upper VC_Q threshold above which arriving cells with CLP=1 are discarded.	Y	Y	Y		Y	Y		Y		Y		Y
CLP Lo	Percentage of VC Qdepth	Lower VC_Q threshold below which arriving cells with CLP=1 are accepted again after CLP Hi threshold was previously reached.	Y	Y	Y									
CLP Lo/EPD	Percentage of VC Qdepth	VC_Q threshold used as the "CLP Lo" parameter (as above) and as the Early Packet Discard threshold					Y	Y		Y		Y		Y
CLP Setting	Enable/Disable	Tag (i.e., set CLP=1) all PCR compliant cells				Y								
EFCI	Percentage of VC Qdepth	Threshold of VC Qdepth above which new cells have their Explicit Forward Congestion Indication bit set					Y	Y	Y	Y	Y	Y	Y	Y
ICR	Cells/second	Initial Cell Rate					Y	Y		Y		Y		Y
ADTF	Milliseconds	Allowed Cell Rate Decrease Time Factor					Y	Y		Y		Y		Y
Trm	Milliseconds	Minimum time between RM cells generated					Y	Y		Y		Y		Y
RIF	ABR: power of 2 ForeSight: Percentage	Rate Increase Factor					Y	Y		Y		Y		Y
RDF	ABR: power of 2 ForeSight: Percentage	Rate Decrease Factor					Y	Y		Y		Y		Y
IBS	Cells	Initial Burst Size							Y	Y	Y	Y	Y	Y
Nrm	Cells	Maximum number of data cells between RM cells generated					Y							
Trunk cell routing restrict	Yes/No	Yes: Force this connection to use only ATM trunks in the network. No: Allow this connection to use FastPacket trunks in the network.	Y		Y	Y	Y	Y						

Policing Modes

Type	ATM Forum TM 4.0 Designation	PCR Flow Policing in First Leaky Bucket		SCR Flow Policing in Second Leaky Bucket	
		Cells Policed	CLP Tagging of Non-Compliant Cells	Cells Policed	CLP Tagging of Non-Compliant Cells
1	VBR.1	All (CLP=0 and CLP=1)	No	All (CLP=0 and CLP=1)	No
2	VBR.2	All (CLP=0 and CLP=1)	No	CLP=0 only	No
3	VBR.3	All (CLP=0 and CLP=1)	No	CLP=0 only	Yes
4	CBR.1	All (CLP=0 and CLP=1)	No	None	N/A
5		None	N/A	None	N/A

Physical/Electrical Specifications

Dimensions	Front card: 15.25 x 16.25 inches Back card: 6.5 x 16.25 inches
Weight	Front card: 8 lb (3.6 kg) Back card: 4 lb (1.8 kg)
Input Voltage	-48 VDC
Power Consumption	54W
Electrical and Safety Standards	FCC Part 15 Bellcore GR1089-CORE IEC 801-2, 801-3, 801-4, 801-5, 825-1 (Class 1) EN 55022, UL 1950, 60950



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