

Xedge MSPX Platform

MultiService Packet Exchange for Converged Networks

Forward-looking network planners not only support new and legacy services, but are also migrating towards transport technologies such as MPLS that converge Layer 2 and Layer 3 switching of “any-to-any” services. GDC’s MultiService Packet Exchange platform (MSPx) can interconnect remote enterprise sites with emerging Ethernet/IP and legacy services across an MPLS, Ethernet, IP, VLAN, or ATM WAN.

MSPx enables Metro Ethernet Forum compliant Ethernet services on the same cost-effective and reliable platform that offers native services such as TDM, Frame Relay, IP and ATM. This convergence allows graceful, incremental migration and mediation between legacy circuits and new packet-based services. Users can access a rich variety of standards-compliant service modules and interfaces with advanced packet technology that reliably and securely satisfies user demand for quality of service. *Figure 1* shows MSPx technology integrating multiservice and Ethernet UNI with IP, MPLS, VLAN ATM or Ethernet Transport.

FEATURES & BENEFITS

- Enables Metro Ethernet Forum compliant Ethernet services.
- Offers circuit emulation services over MPLS, IP, Ethernet, VLAN or ATM.
- Supports pseudowire emulation (PWE) of legacy TDM, IP, and ATM as well as Ethernet services.
- QoS for prioritization of services and bandwidth management
- Gigabit routing with OSPF, BGP, L2TP, UDP
- Simplified network management, Provisioning Manager (SPM), an application of GDC’s ProSphere NMS.

ANY SERVICE, ANY TRANSPORT

At the heart of the MSPx platform is the Packet Cell Switch (PCx), Packet Circuit Emulation (PCE), and other modules facilitating multiservice convergence.

PCx enables Metro Ethernet Forum compliant E-Line services over an MPLS, Ethernet, IP, VLAN, MPLS or ATM backbone. It also supports transport of legacy TDM, ATM, IP, VLAN and Ethernet service packets using pseudowires. A variety plug-in interfaces also support diverse services.

The PCe controller serves as a convergence gateway for the efficient transport of TDM-Ethernet over a packet-switched network.

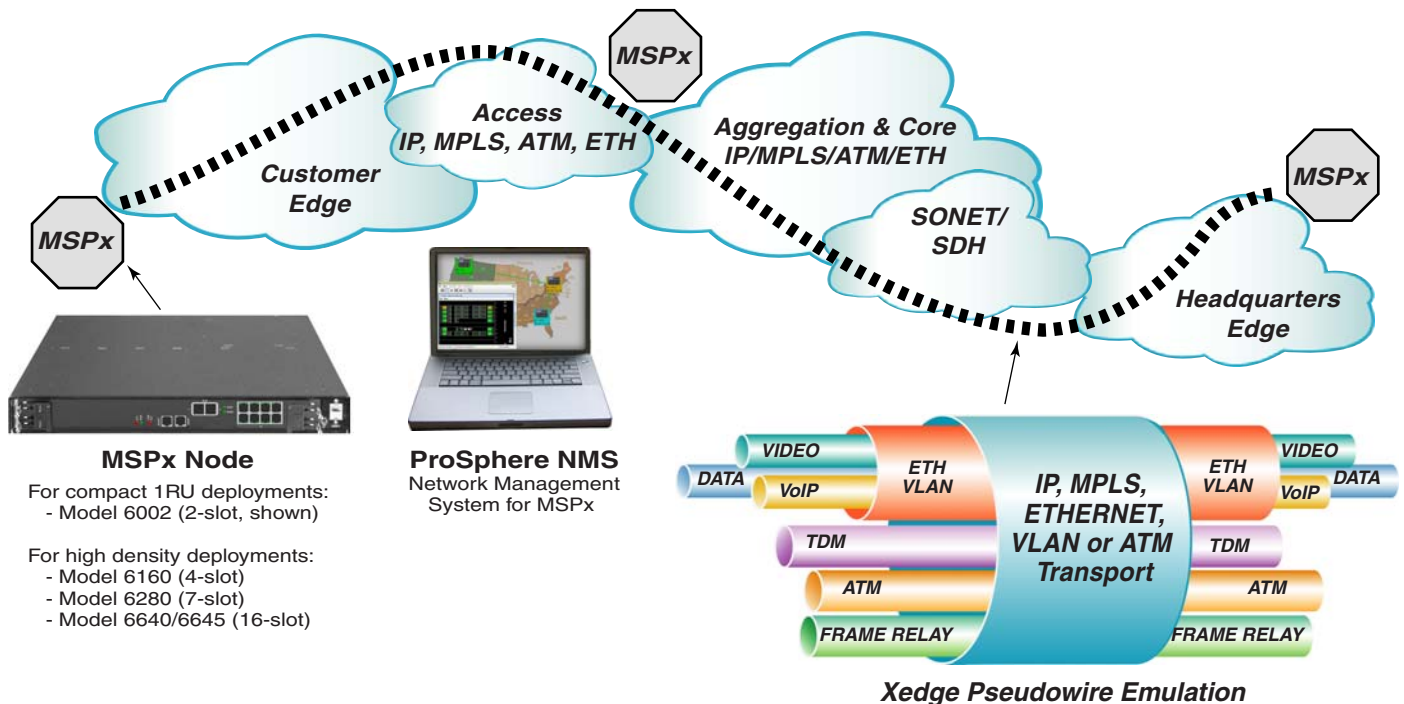


Figure 1: Xedge MSPX: Any Service, Any Transport

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*Figure 2: MSPx Packet Cell Switch and LIMs
in a Model 6002 Chassis*

Ethernet Services

GDC's MSPx allows network managers to implement comprehensive Ethernet services through the WAN to interconnect their remote sites for the transport of data, voice, and video.

MSPx offers Ethernet packet forwarding at wireline speeds. This is accomplished via the PCx and PCe slot controller modules. Each module has two Gigabit Ethernet ports, and eight additional Fast Ethernet ports. These high speed Ethernet solutions offer alternative facilities for transport, a high degree of QoS, and flexible tools for setting up an Ethernet service. The PCX-2 engine offers linespeed layer 2 and layer 3.

Layer 2 - Layer 3 Support

The MSPx platform supports layer 2 and layer 3 routing services with OSPF/RIP integration. This added flexibility lets operators construct segmented IP services.

All MSPx transport technologies also provide flow-sensitive QoS for varied traffic profiles.

Analog/Digital Voice Services

MSPx supports analog and digital voice services, providing E&M, FXS, FXO modules, as well as circuit emulation and packetized voice communications.

Features include:

- Up to 12 voice ports via interface plug-in cards: 8-port E&M; FXS and/or FXO in 4-port increments
- 16 port DS1/E1 high density circuit emulation/services
- Simultaneous Support: AAL1/CBR and AAL2/VBR_rt
- Supports n x m x 64 Kbps in AAL1 or IP circuit emulation mode
- ITU-T I.363.1, I.363.2; ITU-T G.726, ITU-T G.729A
- Silence Suppression and Echo Cancellation
- Idle Channel/Circuit Removal Intelligent FAX/Modem auto-bypass
- Dynamic voice switching across the MSPx network using QSIG signalling.

High and Low Density Solutions

Modular design allows the MSPx to support the diverse high-speed services features. Slot controllers and their LIMs plug into two adjacent slots of the MSPx AC- or DC-powered shelves.

Figure 2 shows a controller/LIM application deployed in the 1RU 6002 2-slot shelf. This compact solution is ideal for remote deployments that support IP/Ethernet access across the WAN.

Figure 7 shows controller/LIM applications in the Model 6160 (4 slots), Model 6280 (7 slots) and the 16-slot Model 6640/6645 chassis intended for sites that require higher density deployments.

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PCx Transport Connections

In the MSPx network, Packet Cell Switch (PCx) enables a variety of inter-switch connections, including MPLS, IP, Ethernet and ATM. In MPLS Service applications, the PCx uses Fast and Gigabit Ethernet to connect to MPLS backbones, providing multiservice pseudowires (PWE) over MPLS.

In Metro Ethernet Network applications, PCx serves as the access/edge switch. The PCx or the PCE provides multi-service PWE over Ethernet.

PCx can also serve as the edge switch for the ATM backbone, providing legacy transport over ATM using diverse interfaces.

Figure 3 shows three PCx and PCE applications that support “any service-any transport” and circuit emulation over ATM, Ethernet, IP and MPLS.

PCE Circuit Emulation Services

The Packet Circuit Emulation module (PCE) allows bit-transparent TDM circuit emulation over Ethernet. The PCE also provides resilient clock recovery of TDM data over Ethernet and supports Serial, DS1/E1, DS3/E3 and high density PDH interfaces.

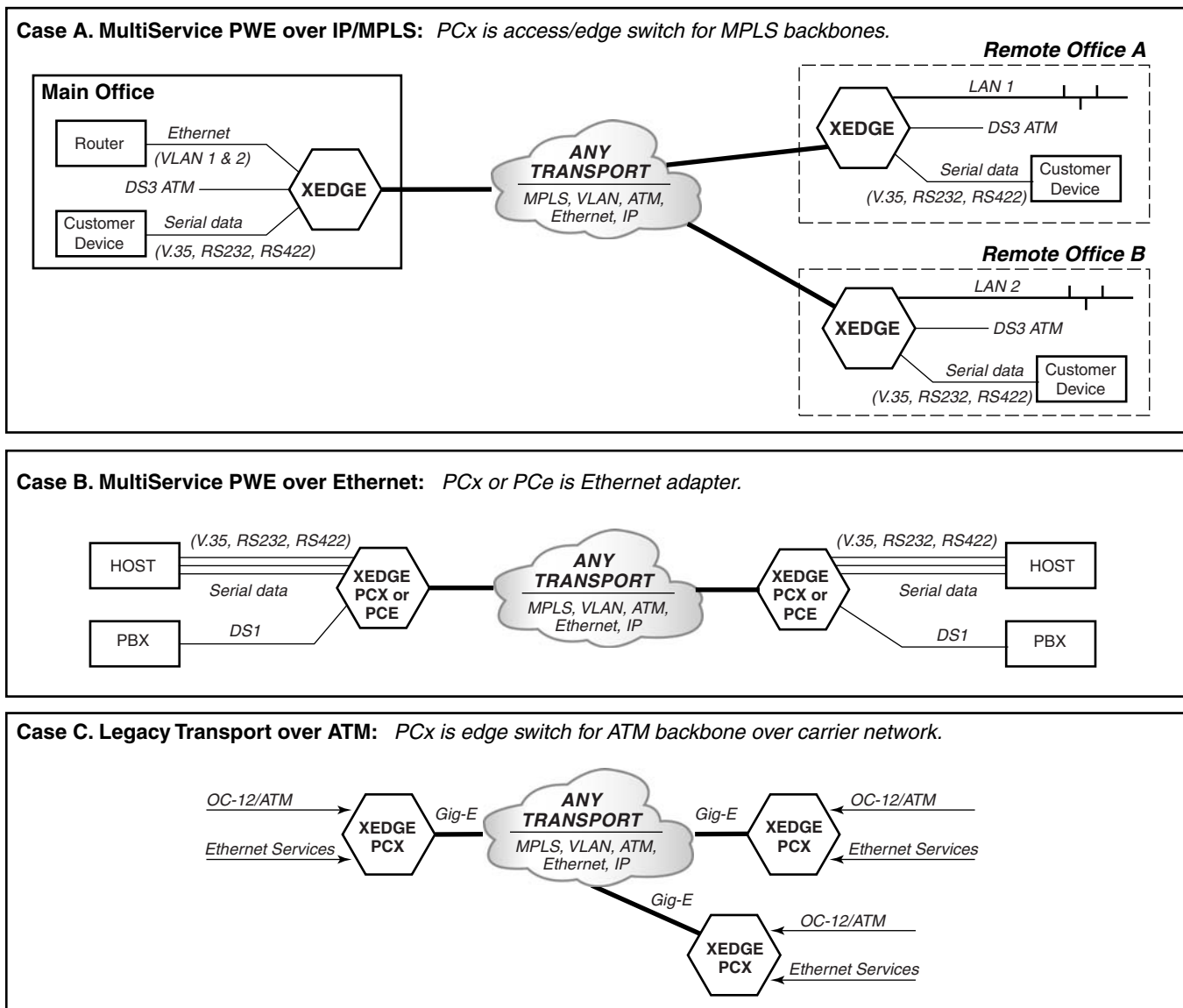
High Speed IP Routing

The PCX has a built-in network processor capable of gigabit routing. The ISG2 os also capable of routing at lower bit rates (up to 30 Mbps).

High Density PDH

The MSPx supports high density DS1 and E1 for circuit emulation services (SAtOP, CESoP or AAL1) and also bonded DS1 and E1 for multi-link point-to-point protocol (ML-PPP).

Figure 3: Case Studies



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ProSphere Network Management

GDC's intuitive ProSphere Network Management System (NMS) integrates multi-service technologies into application solutions. ProSphere can make diverse applications easy to manage and cost effective to deploy. Integrated network management is important to customers who can easily be overwhelmed by the diversity of protocols and operational requirements of multi-service networking.

Using SNMP and JAVA, ProSphere provides global visibility for network alarms and performance indications, allowing preemptive action before problems occur. ProSphere employs GUI displays and comprehensive statistical tools that simplify the implementation of complex service plans.

ProSphere's SPM application automates service provisioning. End users can easily apply traffic management priorities with time saving menu driven operational tools. [Table 1](#) lists all of the ProSphere NMS components.

Table 1: ProSphere NMS Components

ProSphere GFM Global Fault Manager	Extensive event, alarm, and fault management with easy to use GUI
ProSphere Element Manager	Configuration management and an object-oriented GUI
ProSphere XPM Performance Monitor	Polls Xedge devices for statistical data useful in defining trends
ProSphere SPM Service Provisioning Manager	Point-and-click service configuration

QoS for Critical Applications

Real time delay sensitive applications such as voice, video, or mission critical data over an Ethernet/IP enabled wide area multiple technology infrastructure can be risky for planners. The WAN is typically hybrid in nature, in that the infrastructure used in the WAN consists of multiple technologies that combine legacy and emerging access, edge, and core platforms as well as public network interdependencies. Many planners of the emerging WAN in the enterprise need a platform that is standards-based, technology-agnostic and with flexibility to support the interworking of legacy and new services that constitute the hybrid WAN.

A key benefit of MSPx solutions is its flexible traffic management architecture. The platform is flexible enough to support legacy infrastructures that are bandwidth constrained as well as assign priorities to delay-sensitive flows using MPLS tunnels. Most importantly, the design of the Xedge platform eliminates the guess-work in provisioning of prioritized connections and quality guarantees.

With the MPLS-, ATM-, IP- and Ethernet-based transport of the MSPx system, users can have a standards-based means of supporting converged layer 2 or layer 3 services, while getting the results they want, transparently.

Optimizing bandwidth utilization is a key feature of the MSPx platform. MSPx provides comprehensive quality of service capabilities that give network operators maximum flexibility in managing bandwidth and prioritizing traffic to suit the organization's mission and application needs.

Figure 4: ProSphere Statistics

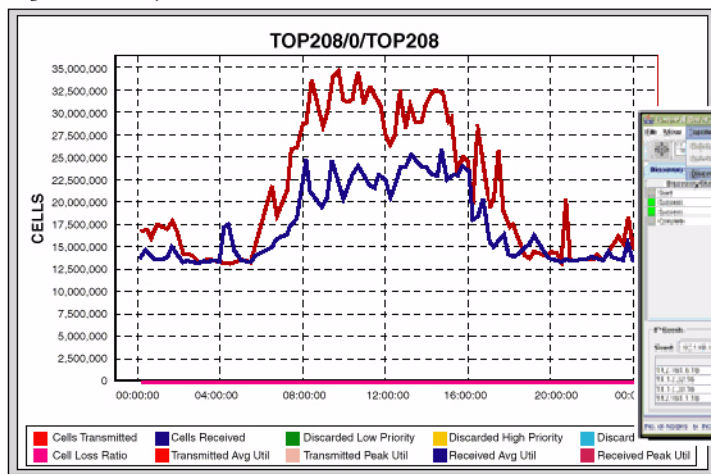
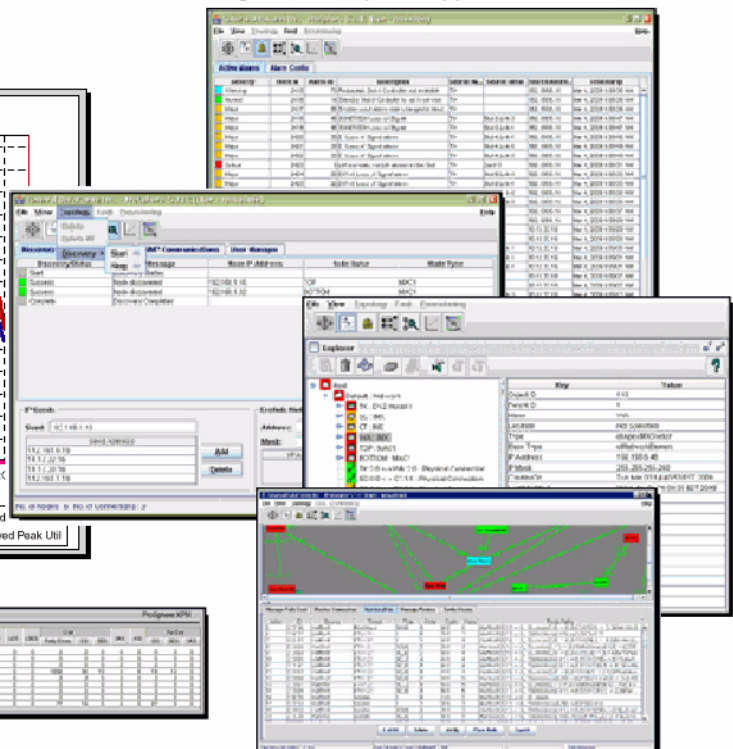


Figure 5: ProSphere Application Screens



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The MSPx System Advantage

Network planners need to manage the migration of Ethernet/IP LAN services and disparate circuit and packet services, and applications across the WAN. The MSPx platform has all the advantages of transporting packet services and native TDM, Frame Relay or ATM services with efficient cost-effective management of application services, service priorities and bandwidth. This migration strategy means:

- Customers can protect the investments in their communication networks and do not need a “forklift upgrade” to implement new technologies.
- Customers can benefit through the deployment of proven multiple services and new Ethernet/IP services over the existing scalable MSPx platform.
- Customers can upgrade their current networks to new generation technologies, including higher capacity switching and higher speed interfaces (OCn/STMn and Gigabit Ethernet ports).

Figure 6 shows the PCx supporting one or two LIMs in a variety of interfaces, such as: OC-3/STM-1, OC-12/STM-4, DS1/E1, DS3/E3, IMA, HSSI, analog voice (FXS, FXO, E&M), and serial (X.21/V.11, RS-449, V.35, RS530A).

The PCe (not shown) also supports one or two LIMs for DS1/E1, DS3/E3 or serial interfaces.

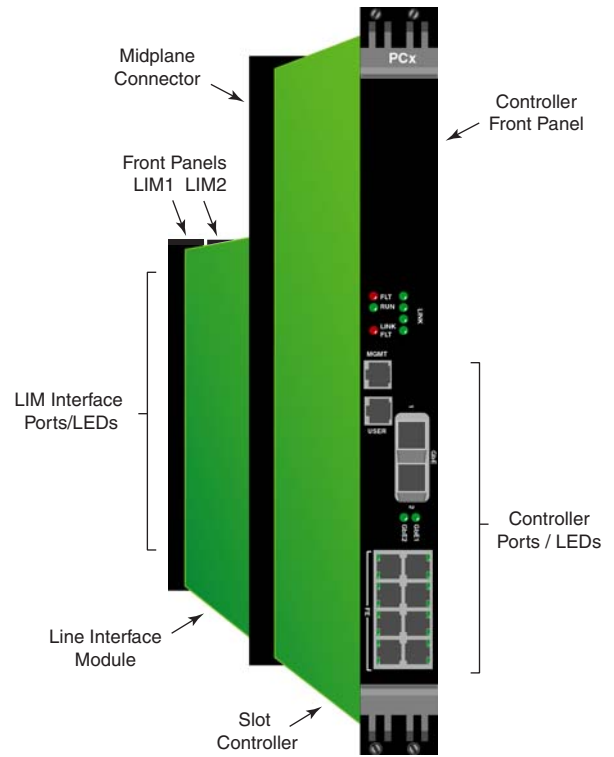


Figure 6: PCx Module with plug-in Line Interface Options



Figure 7: Flexible, Modular MSPx Packaging for Low/High Density Deployments

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MultiService Packet Exchange System Specifications

Physical & Environmental Characteristics

		Xedge 6645 Shelf	Xedge 6640 Shelf	Xedge 6280 Shelf	Xedge 6160 Shelf	Xedge 6002 Shelf
Dimensions:	Height	666 mm (26.2 in)	666 mm (26.2 in)	222.5 mm (8.75 in)	112 mm (4.4 in)	440.9 mm (1.74 in)
	Width	482.61mm (19 in)	482.61 mm (19 in)	482.61 mm (19 in)	482.61 mm (19 in)	482.61 mm (19 in)
	Depth	422 mm (16.6 in)	422 mm (16.6 in)	488.95 mm (19.25 in)	476 mm (18.75 in)	482.61 mm (19 in)
I/O Slots		16	16	7	4	2
Switch Fabric		1 or 2 XH Modules	1 or 2 XH Modules	1 XS Module	1 XM Module	--
Local Mgmt Intfc		2 Chassis Rear Panel Ports	2 Chassis Rear Panel Ports	2 SMM Ports	2 SMM Ports	1 Chassis Front Panel Port
Power	DC	-48VDC	--	-48VDC	-48VDC	--
	AC	--	100/120VAC, 50/60Hz 220/240VAC, 50/60Hz	100/120VAC, 50/60Hz 220/240VAC, 50/60Hz	100/120VAC, 50/60Hz 220/240VAC, 50/60Hz	100/120VAC, 50/60Hz 220/240VAC, 50/60Hz
Max Consumption		1300W (with 2 PSUs)	1300W (with 2 PSUs)	750W (with 2 PSUs)	350W (with 1 PSU)	150W
Temperature		Operating: 0 to 50 deg. C (32 to 122 deg. F); Storage: -40 to 70 deg. C (-40 to 150 deg. F)				
Relative Humidity		Up to 95% without condensation				

Fault Tolerance Options

- Redundant switch fabric and nodal control module (in Xedge 6640/6645 and Xedge 6280 shelves)
- Load sharing power supplies with environmental monitoring and optional 1 for N redundancy;
- Dual power feeds

Switch Fabric Options

In higher density switches, (Models 6640, 6645, 6280 or 6160), the Switch Fabric modules plug into one or two dedicated slots at the front of the chassis, labeled SF Main and SF Standby. In these switches, the Switch Fabric is responsible for transporting cells simultaneously to 16 slot controllers in the switch, at 400 Mbit/s throughput in each direction. Model 6002 has no provision for switch fabric modules since it is designed for packet controllers with integral switch fabric sufficient for that 1RU shelf.

- XM Switch Fabric (1.6 Gbps) supports up to 4 slot controllers.
- XS Switch Fabric (2.8 Gbps) supports up to 7 slot controllers.
- XH Switch Fabric (6.4 Gbps) supports up to 16 slot controllers.

Traffic Management Capabilities

- VLAN P-Bits to MPLS EXP Bits Mapping
- Spatial/logical multicast support
- Comprehensive traffic-shaping techniques including: classical, VP queueing, logical VPs and Multi-Tier Shaping (MTS) algorithm; ATM Forum TM 4.1
- Flow sensitive MPLS/Pseudowires Management
- 802.1 P,Q; 802.3X Ethernet; MEF Compliant
- IP Class of Service (CoS) and IP Quality of Service (QoS)

MSPx Slot Controller Modules

ISG2 Slot Controller

PCX2 Slot Controller

PCL Slot Controller

PCE Slot Controller

Physical Link Interface Modules (LIMs)

DSX1 or E1 LIM with voice support (4 links)

T1/E1 MultiProtocol LIM (16 ports)

Legacy Circuit Emulation LIM (16 links)

T1/E1 High Density Cross Connect LIM (28 T1s/32 E1s)

OC-3c/STM-1 LIM (short, interm, long reach)

E1 Inverse Multiplexing LIM for ATM (8 or 16 links)

OC-12/STM-4 LIM (8 ports)

Adaptive Serial I/O LIMs (ASIO, ASIO-HSSI)

DS3 or E3 LIM (2 ports)

Analog Voice LIM (FXS, FXO, E&M)

DSX1 Inverse Multiplexing LIM for ATM (8 or 16 links)

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Xedge MSPx System Specifications (continued)

Ethernet/IP Services Specification

Parameter	Description / Details	
Ports	GE Ports (PCx)	2 Gigabit Ethernet plus 8 fast Ethernet per module
	GE Ports (PCe)	2 Gigabit Ethernet plus 8 fast Ethernet per module
	Electrical Ports - RJ-45	10Base-T, 100Base-TX, 1000Base-T auto-negotiated
	Optical Ports - SPF	1000Base-SX and 1000Base-LX
Speeds	10/100/1000 Mbps	
Ingress Rate Limiting	Configurable in Increments of 0.5 Mbps	
Ingress Classifiers	IP ToS	Type of Service
	User Priority	VLAN User Priority tag
	VLAN Bridge Group	VLAN ID
	Input Interface	Port number
Ethernet - MPLS QoS Mapping	VLAN P-Bits to MPLS EXP Bits	
	VLAN P-Bits to MPLS Pseudowire	
Service Class to ATM Mapping	Voice	802.1p VO & NC(1) to ATM CBR
	Video	802.1p VI to ATM VBR-rt
	Guaranteed Bandwidth	802.1p CL & EE to ATM VBR-nrt
	Best Effort	802.1p BE & BK to ATM UBR
VLAN ID Range	0 to 4095	
Maximum Frame Sizes	1536 to 9046 bytes	
Layer 2 Switching	Ethernet	Switching and Bridging
	VLAN	Virtual LANs
	Priority	User Priority tagged frames
MAC Addresses	8192	
MPLS Signaling	RSVP-TE, CSPF	
Pseudowire Emulation	RFC 3916, RFC 4448, RFC 4717	
Layer 3 Routing	OSPF, RIPII	
IP ToS / IP CoS	IP Type of Service / IP Class of Service	
Timing over Ethernet	Conforms to IEEE 1588 PTP as an IEEE 1588 Client over Ethernet	
IPV4, IPV6 Addressing	GDC ProSphere and Xedge conform to RFC 1884 IPV6 addressing schemes.	

Other Services

Voice Service	ADPCM-32K, CS-ACELP-8K, echo cancellation, silence suppression, fax relay, Q.SIG, and DS1 / E1 interfaces, Analog E&M, FXS, FXO
Circuit Emulation	Unstructured (CES 2.0 compliant), DS1/E1/DS3/E3 interfaces; Structured (CES 2.0 compliant), DS1/E1 interfaces; SAToP / CESoPSN Services
Frame Relay	Unstructured/structured, DS1/E1 interfaces; High speed unstructured DS1/E1/HSSI interfaces
Cell Relay	UNI 3.1/4.0 compliant, PNNI compliant and TM 4.0 compliant for: PVCs/ SVCs/ SPVCs PVPs/ SVPs/ SPVPs, OC-3c/ STM-1/ DS3 / E3/ DS1/ E1/ HSSI and Serial interfaces
Ethernet ELINE	Metro Ethernet Forum ELINE Service
Ethernet VLAN	VLAN Switching 802.1Q
IP Pseudowire	TDMoIP

Certifications & Approvals

US DoD UCAPL	The Xedge 6000 System for MSPx applications has undergone special interoperability testing and certification by the Joint Interoperability Test Command (JITC) and is a US Department of Defense (DoD) Unified Capabilities (UC) approved product. Ref: DISA website/APL/GDC/TN: 1027301.
USDA RUS Accepted	USDA - Rural Utilities Service - Telecom Program - Community Connect Program