Xedge 6000 Version 6.1.0

Software Installation & Release Notes

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Documentation

Revision History: GDC P/N 032R901-V610

Issue	Date	Release Description
1	November 2003	Initial Release of Xedge Switch System Software Version 6.1.0
2	April 2004	Add file sizes to Table 1; Add software files and upgrade guidelines.
3	May 2007	Format update with minor corrections/clarifications.
4	February 2008	Minor corrections and updates.

Related Publications

Description	Part Number
Xedge 6000 Switch Application Guide	032R300-V610
Xedge 6000 Switch Technical Reference Guide	032R310-V610
Xedge 6000 Switch Software Ver 6.1.0 Configuration Guide Xedge 6000 Switch Software Ver 6.1.0 Release Notes	032R400-V610 032R901-V610
Xedge 6000 Switch Chassis Installation Guide (all models)	032R410-000
Xedge 6000 Switch Hardware Installation Manual	032R440-V610
Xedge 6000 Switch Diagnostics Guide	032R500-V610
ProSphere NMS User Manual (AEM, GFM, SPM, MV/S) ProSphere Routing Manager Installation and Operation Manual (RTM, INM, ADM)	032R610-VREV 032R600-VREV 032R605-VREV 032R606-VREV

-REV is the hardware revision (**-000**, **-001**, etc.)
-VREV is the software version (**-V510, V610, v620, V710,** etc.)
In addition to the publications listed above, always read Release Notes supplied with your products.

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Section 1 - Xedge Switch System Software Version 6.1.0

1.0 Overview

These release notes provide information relevant to this version of the GDC Xedge6000 Switch (formerly GDC APEX), updating the information in the Xedge Switch user manuals and guides. If you require detailed operating instructions, please refer to those documents, listed in the front inside cover of this document.

For information on new features and improvements for Xedge Version 6.1.X switch software, consult the Patch Notes that accompany your product, or contact your your authorized field service representative.

For the latest updates to all Xedge user manuals and release notes go to: **`http://www.gdc.com`**.

2.0 Changes and Improvements Since Last Release

The following hardware/software functionality is supported by release Version 610:

- Select Route - Preemptive Routing for SPVCs
- ISG - IP Services Gateway - Support for RIP2, Proxy ARP, Next Tunnel - Direct Flows to Tunnels using TOS field.

2.1 Select Route

This new feature gives SPVCs another level of prioritization for routing purposes. The additional level of prioritization, independent of Service Category, provides SPVCs the ability to perform preemptive routing. When there is not enough bandwidth to route all SPVCs over a physical link, SPVCs of higher priority can bump SPVCs of lower priority.

2.2 ISG - IP Services Gateway

Version 6.1 is the full release of ISG, where 6.0 ISG was a Controlled Release. ISG is an IP router with a 10/100 Ethernet port and connects up 256 IP tunnels. The router will route between Ethernet and/or Tunnels. Tunnel encapsulation is RFC 1483 - VC Based Multiplexing. New features to ISG above version 6.0.0 include RIP2 routing over tunnels, Proxy ARP, and ability to direct Flows to tunnels using the TOS field of the packet header.

3.0 Slot Controller Firmware Requirements

The table below lists only the assemblies where a minimum Xedge firmware boot EPROM revision level is required to support Version 6.1.0.

Table 1: Firmware Requirements

Part No.	Front Panel ID	IC	Minimum Boot PROM Part No.	Upgrade Kit
032M020-001	ETH	ICU8	032Z080-612C	N/A
032M020-001	ETH	ICU1	032Z080-609C	N/A
032M016-003	CE	IC93	032Z044-602E	032K018-001
032M016-003	CE	IC92	032Z044-601E	032K018-001
032M017-003	VE	IC93	032Z044-618E	032K023-001
032M017-003	VE	IC92	032Z044-617E	032K023-001
032M024, 025, 026, 027-001	ACP	IC71 U71	032Z091-602B 032Z110-602	N/A
032M024, 025, 026, 027-002				
032M028, 029, 030, 031-001	ACS	IC70 U70	032Z092-601B 032Z111-601	N/A
032M028, 029, 030, 031-002				
032M021-001 032M022-001	FRC CHFRC	IC1	032Z080-609B	N/A
032M021-001 032M022-001	FRC CHFRC	IC8	032Z080-612B	N/A
032M021-001 032M022-001	FRC CHFRC	IC41	032Z080-615-	N/A
032M032-001	SCE	IC89	032Z093-601A	N/A
032M033, 034, 035, 036-011	VSM	IC66	032Z200-601A-	N/A
032P025-001	ECC ECC	XU1 XU2	032Z025-606A 032Z025-607A	N/A
032P026-001	ECC2 ECC3	XU1 XU2	032Z026-301 032Z026-302	N/A

4.0 Unsupported Hardware/Software

This software release does not support the following Xedge6000 Switch hardware/software:

- MS/QED Adaptation Slot Controller, P/N 032M009-003. The MS/QED slot controller is replaced by the ETH Ethernet to ATM Adaptation slot controller, P/N 032M020-001.
- VH320, NTSC/PAL H.320 Video line interface module, P/N 032M078-001.
- VJLIM, NTSC/PAL JPEG Video line interface module, P/N 032M015-001 and 032M019-001.
- NMS 3000 Manager is not supported in software version 6.1.0 and later.

Note: *Disregard any remaining references to the MS/QED slot controller, the VJLIM, and the VH320 LIM in the Xedge6000 Switch manual set.*

Note: *Refer to Section 11.0 Technical Reference later in this document for additional information on supported features and capabilities as compared with previous releases.*

5.0 Supported Hardware

The table below lists supported Xedge6000 Slot Controllers and LIMS supported in Xedge Switch Version 6.1.0, and their required software files. Refer to this list during software installations and upgrades to ensure the correct files are downloaded from the supplied CD..

Table 2: Xedge Version 6.1.0 Supported Hardware

Product Description	Label	Required Files	Part Number
ATM Controller PDH 4K/4K	ACP (-001 only)	`mpro1.cod` `ac_lca.bin`	032M024-001
ATM Controller PDH 16K/16K			032M025-001
ATM Controller PDH 16K/64K			032M026-001
ATM Controller PDH 64K/64K			032M027-001
ATM Controller PDH 4K/4K w/logical multicast	ACP (-002 only)	`mpro1.cod`	032M024-002
ATM Controller PDH 16K/16K w/logical multicast			032M025-002
ATM Controller PDH 16K/64K w/logical multicast			032M026-002
ATM Controller PDH 64K/64K w/logical multicast			032M027-002
ATM Controller SDH/SONET 4K/4K	ACS (-001 only)	`mpro1.cod` `ac_lca.bin`	032M028-001
ATM Controller SDH/SONET 16K/16K			032M029-001
ATM Controller SDH/SONET 16K/64K			032M030-001
ATM Controller SDH/SONET 64K/64K			032M031-001

Table 2: Xedge Version 6.1.0 Supported Hardware (Continued)

Product Description	Label	Required Files	Part Number
ATM Controller SDH/SONET 4K/4K w/logical multicast	ACS (-002 only)	**mpro1.cod**	032M028-002
ATM Controller SDH/SONET 16K/16K w/logical multicast			032M029-002
ATM Controller SDH/SONET 16K/64K w/logical multicast			032M030-002
ATM Controller SDH/SONET 64K/64K w/logical multicast			032M031-002
MS/QED Adaptation Controller	MS/QED	**slave.cod**	032M009-003
Ethernet to ATM Adaptation Controller	ETH	**slave.cod** **eth.bin**	032M020-001
Frame Relay Adaptation Controller	FRC	**slave.cod** **frdoc.bin**	032M021-001
Channelized Frame Controller	CHFRC	**slave.cod** **cfdoc.bin**	032M022-001
Circuit Emulation Controller	CE	**slave.cod** **ce_lca.bin**	032M016-003
Structured Circuit Emulation Controller	SCE	**mpro1.cod** **scelca.bin**	032M032-001
Voice Service Module: 48, 60, 96 and 120 Channels	VSM	**mpro1.cod** **vsm.bin**	032M033-001 032M034-001 032M035-001 032M036-001
Enhanced Cell Controller with 155 Series LIM (with APS support)	ECC	**mpro2.cod** **eccpga.cod**	032P025-001
Enhanced Cell Controller with 155 Series LIM (with APS support)	ECC2	**mpro2.cod** **ecc.cod**	032P026-001
OC-3 LIM		**oc3.cod**	
Legacy Circuit Emulation 16 Link LIM	LCE-16	**lce.cod**	032P187-001
DX-1 16 link Inverse Multiplexing for ATM LIM	DSX1-IMA	**e1ds1.cod**	032P153-003
E1 16 link Inverse Multiplexing for ATM LIM	E1-IMA	**e1ds1.cod**	032P153-013
T1 BITS Node Timing Module	NTM-DS1	**ntm_t1.bin**	032P062-001
E1 BITS Node Timing Module	NTM-E1	**ntm_e1.bin**	032P089-001

6.0 Xedge Switch Version 6.1.0 Software Files

The table below lists the Xedge6000 Switch Version 6.1.0 software files provided on the Xedge Switch Software CD-ROM.

Table 3: Xedge Version 6.1.0 Software Files

Directory	File Name	File Name / Description	Version	File Size
\	README			
\dir1\cod	smc.cod	System Software for SMC, ISG1	610	966918
\dir1\cod	eccpga.cod	System Software for ECC PLD	522	80402
\dir1\cod	lce.cod	System Software for LCE-16	512	224274
\dir1\cod	mpro1.cod	System Software for ACP, ACS, SCE, VSM	610	849659
\dir1\cod	mpro2.cod	System Software for ECC	610	1139232
\dir1\cod	mpro1isdn.cod	Q.SIG System Software for ACP, ACS,VSM	610i	1028420
\dir1\cod	mpro2isdn.cod	Q.SIG System Software for ECC	610i	1139280
\dir1\cod	oc3.cod	System Software for E-Series LIMs	oc3_522	96837
\dir1\cod	slave.cod	System Software	610	631828
\dir1\cod	e1ds1.cod	System Software for IMA LIMs	610	83643
\dir2\bin	ac_lca.bin	Software for ACP/ACS (-001 controllers only)	522	185982
\dir2\bin	ce_lca.bin	Software for CE	522	124000
\dir2\bin	cfdoc.bin	Frame Relay Module for CHFRC	610	305378
\dir2\bin	eth.bin	Software for ETH	522P2	381002
\dir2\bin	frdoc.bin	Frame Relay Module for FRC	610	334486
\dir2\bin	ntm_e1.bin	Software for NTM-E1	500	35732
\dir2\bin	ntm_t1.bin	Software for NTM-DS1	500	41539
\dir2\bin	scelca.bin	Software for SCE	522	147742
\dir2\bin	vsm.bin	Software for VSM	610	238338
\dir2\mib	apex.mib		610	
\dir2\mib	apexCommon.mib		522	
\dir2\mib	apexSlot0.mib		610	
\dir2\mib	apexVc.mib		610	
\dir2\mib	atm.asn		522	
\dir2\mib	atmPort.mib		522	
\dir2\mib	aal5.mib		522	
\dir2\mib	billing.mib		522	

Table 3: Xedge Version 6.1.0 Software Files (Continued)

Directory	File Name	File Name / Description	Version	File Size
\dir2\mib	cac.mib		522	
\dir2\mib	diag.asn		522	
\dir2\mib	dlsplim.mib		522	
\dir2\mib	elim.mib		522	
\dir2\mib	elimds1.mib		610	
\dir2\mib	elime1.mib		522	
\dir2\mib	elimaps.mib		522	
\dir2\mib	elimcommon.mib		610	
\dir2\mib	elimsonet.mib		522	
\dir2\mib	entity.asn		610	
\dir2\mib	ether.asn		522	
\dir2\mib	frac.asn		610	
\dir2\mib	frame.mib		522	
\dir2\mib	hdls.mib		522	
\dir2\mib	ima.mib		610	
\dir2\mib	lim_mpg.asn		522	
\dir2\mib	oam.mib		522	
\dir2\mib	pdh.mib		522	
\dir2\mib	plpp.mib		522	
\dir2\mib	qaal2.mib		522	
\dir2\mib	qedoc.mib		522	
\dir2\mib	sce.mib		522	
\dir2\mib	slotstats.mib		522	
\dir2\mib	sonet.mib		522	
\dir2\mib	vpcTermination.mib		610	
\dir2\mib	vsm.mib		522	

Note: *Xedge Version 6.1.0 software and hardware manuals (in Acrobat Reader PDF format) are located on the V610 software CD under the following directory:* **\docs\Xedge_docs**

7.0 Software Upgrade Procedure

The software installation upgrade is intended for a workstation using an Ethernet LAN. The preferred method for transferring files onto slot 0 controllers is TFTP via LAN, and then slot 0 to the other slot controllers, as described in this section.

The blank Slot Controller/LIM Log sheet below should be copied for use during software updates. Installing Xedge software involves four processes, performed in order:

- Optimize space on the target devices.
- Transferring Files to Slot0 Using a Workstation Via Ethernet (LAN)
- Transferring Files From Slot0 to Other Slot Controllers
- (Optional) Special Software Files.

Table 4: Slot Controller/LIM Log Sheet

Slot Number	Slot Controller / LIM Installed	Software Files Required	Sent ✔
Slot-0 Main			
Slot-o Standby			
Slot 1			
Slot 2			
Slot 3			
Slot 4			
Slot 5			
Slot 6			
Slot 7			
Slot 8			
Slot 9			
Slot 10			
Slot 11			
Slot 12			
Slot 13			
Slot 14			
Slot 15			
NTM Primary			
NTM Secondary			

Note: *Depending on your configuration and switch type, some slot positions may be unused. You do not have to log information for the Switch Fabric modules.*

7.1 Preparing to Install Software

Before you begin, you will need an accurate list of the types of slot controllers, NTMs and LIMs in your node, their slot locations, and the software files required for each. To simplify this process, you will use the following tables in this section:

Table 2: Xedge Version 6.1.0 Supported Hardware

Table 3: Xedge Version 6.1.0 Software Files

Table 4: Slot Controller/LIM Log Sheet

1. Make a copy of the Slot Controller/LIM Log Sheet (Table 5:).
2. In the “Slot Controller Installed” column, write the abbreviated front panel product name of each slot controller, NTM or LIM (i.e., ACS, NTM, LCE-16, etc.).
3. Use the V6.1.0 Software File List (*Table 3:*) to find the software files required for each Slot Controller, NTM or LIM in your node. Write the file names in the “Software Files Required” column of the log sheet.
4. Create a new directory on your hard drive (**`C:\Xedge`**) to receive the files.
5. Insert the Xedge CD in the CDROM drive and copy the files to the newly created directory.
6. After reviewing the Special Considerations and guidelines below, proceed to *Section 7.2 Optimize Flash Space*.

Special Considerations

- IMPORTANT! If prompted with the option to “Boot run time code” do not select that option.
- IMPORTANT! You must optimize flash file space for each slot controller before upgrading software.
- IMPORTANT! You must transfer the slave.cod file for a redundant Slot-0 individually, not via broadcast mode.
- IMPORTANT! The **`ac_lca.bi`**n file is only required on the older version of the ACP/ACS Cell Controllers (-001). Do not transfer that file to the newer ACP/ACS Cell Controllers (-002); the file will be automatically erased on warm restart. The version number is displayed in the upper right corner of the Root Menu.

Guidelines for V5.X to V6.X Upgrade

- Upgrading Version 5 nodes populated with IMA LIMS to Version 6.x software requires SMC or ECC in Slot 0. To maintain Slot 0 redundancy, ETHs must be replaced by SMCs.
- Upgrading Version 5.2.2 switches to Version 6.x software requires ECC/IMAs to be manually reconfigured. All other configuration files from all other Slot Controllers carry forward.
- Upgrading any switch running software prior to Version 5.2.2 release requires all configuration files on all slot controllers to be manually reconfigured. Old **`config.cfg`** files do not carry forward to Version 6.x.

7.2 Optimize Flash Space

This procedure optimizes flash file space for each slot controller. Before performing a software upgrade, you must backup all hosts, **`config.cfg`**, **`def.rtb`**, **`dtl.bin`**, **`alr_cls.txt`**, **`users.cfg`** and any customized files.

1. From the Root Menu select: **`Events`**, **`Clear event table`**, **`Yes`** and **`eXit`**.
2. From the Root Menu select: **`File system`**.
3. Select: **`Erase files`**.
4. Erase all the **`.bin`** (binary) and **`.cod`** (compressed) files. In this case, you are in Slot0. Later in this procedure, you repeat this step for all other slot controllers.
5. Select: **`checK media`**.
6. Type: **`Y`**.
7. Select: **`Garbage collect`** and wait for the Select option prompt.
8. Select: **`media Info`** and then verify the following:
   - **`Dirty files`** data is 0.
   - **`Media free`** data is large enough to accommodate the new software files.
9. If connected to the redundant Slot0, clear the telnet connection with (**`Ctrl-T`**).
10. For each non-Slot0 controller, Telnet to that particular slot and repeat *Step 1.* through *Step 8.*

Note: *As necessary, refer to Table 2: and Table 3: in these release notes for which software files you must load and the file sizes.*

11. You can now transfer the software files to Slot0 using a workstation via Ethernet (LAN), as described in the procedure below.

7.3 Transferring Files to Slot0 Via Workstation on Ethernet (LAN)

1. Configure the Xedge6000 Node for Ethernet.
2. Set the Xedge6000 Node Authentication Table to allow SNMP access from the workstation.
3. Bring up a second xterm window by left-clicking on the background field of the display.
4. At the prompt, type **`/usr/openwin/bin/filemgr&`** *[Enter]*
5. The File Manager window is displayed. Insert the Xedge6000 software CD-ROM into the CD-ROM drive. The CD-ROM directories will be displayed, for example:

   `dir1 dir2 dir3 docs` *(etc.)*

Note: *As necessary, refer to Table 2: and Table 3: in these release notes for which software files you must load and the file sizes.*

6. Change the working directory to the directory containing the file to be downloaded:

   `cd /cdrom/cdrom0/dir1`

7. At the prompt type: **`tftp`** then press the Enter key.
8. At the tftp prompt enter the following commands:
   `connect IP_ADDRESS` *[Enter]*
   `mode binary` *[Enter]*
   `rexmt 1` *[Enter]*
   `timeout 120` *[Enter]*
   `trace on` *[Enter] (optional for when user wants to see progress)*
   `put filename` *[Enter]*
9. Repeat the **`tftp put`** for each of the files to be downloaded.
10. You can now transfer the software files from Slot0 to other controllers, as described in the procedure below.

7.4 Transferring Files From Slot0 to Other Slot Controllers

1. If necessary, **`eXit`** to the Root Menu.
2. Verify all the required **`.cod a`**nd **`.bin`** files have been transferred to Slot0 as described in the previous procedure.
3. Select: **`File system`**
4. Type: **`Directory`**
5. Verify that the required files have been transferred to Slot0.

Note: *As necessary, refer to Table 2: and Table 3: in these release notes for which software files you must load and the file sizes.*

6. Type: **`eXit`** until the File Operations screen is displayed.
7. Select: **`TFTP`**
8. Select: **`Broadcast file`**
9. Type: **`slave.cod`**

Note: *If all 15 TFTP process slots (0-14) are used, wait until the transfer is complete. Otherwise, continue to the next step.*

10. For each slot controller, send the associated **`.bin`** files to the associated slot. In the following steps, substitute the actual file name for *[filename]* and the actual slot number without spaces for *[slotnumber]*. If you have Slot0 Standby, instead of typing slotnumber, you must type **`redund`** to TFTP the files to Slot0 Standby.
11. Type: *[filename]*
    Press: Enter
    Example: **`eth.bin`**
12. Type: *[slotnumber]* or **`redund`**
    Press: Enter
    Example: **`slot10`**
    Example: **`redund`**

13. When finished **`eXit`** back to the Root Menu.
14. Wait for File transfer: to toggle from Active to **`Inactive`**.
    Wait for Slot0 Redund: available to toggle from No to **`Yes`**.
15. Check Event table for any TFTP failures and resend files as required.
16. Select: **`Warmstart`**
17. Select: **`Force slave.cod`**
18. Select: Yes
19. Wait for the User name prompt, then type (lowercase): **`root`**
    Press: Enter
20. Type (uppercase): **`MANAGER`**
21. Select: **`Manage configuration`**
22. Select: **`(9, 3) Physical layout`**
23. Verify that all slot controllers are Active and the software version is correct.

Note: *When downloading software to an NTM, it must be configured to provision timing in the switch as described in Chapter 18, Xedge V.6.1.0 Configuration Guide (032R400-V610).*

8.0 Installing New Slot Controllers

This section describes the required procedures when installing new slot controllers into an existing node. New slot controllers are shipped from the factory without software. With no software installed, your system will boot to the Boot Menu screen, not the Root Menu screen. Slot controllers can be installed using hot-swap methods.

1. At the Boot Menu select Warm start. Note that the Slot Controller front panel LEDs will sequence from top to bottom. Existing system software automatically downloads **`slave.cod`**, **`mpro1.cod`** and **`mpro2.cod`** files to the new controller. Other required **`.cod`** and **`.bin`** files must be manually loaded, as described in *Section 7.0*.
2. After a few minutes, the new Slot-0 Controller will boot its full-feature code. When finished, the screen will prompt for a Username.
3. Type (lowercase) **`root`** and then press Enter.
4. Type (uppercase) **`MANAGER`** and then press Enter.

Note: *Slot controllers are configured by the factory for nonSlot-0 operation. For nonSlot-0 operation, no hardware (switch/jumpers) changes are required. For Slot-0 switch settings, check all jumper and switch settings as described in the Hardware Installation Guide (032R440-V610) before installing the controller.*

8.1 CHFRC, FRC, CE Slot Controllers

1. Install the slot controller into the desired slot in the switch node. Diagnostics are performed upon power-up and software is automatically downloaded. The front panel LEDs indicate the status of the controller.
2. After the software transfer is complete, the module will boot “full-feature” on its own. The Root Menu of Slot0 shows the controllers status. A successful boot shows the controller as Active on the screen.
3. Once the module is reporting Active, load the correct **`.bin`** file as described in *Section 7.0*.

8.2 ACP/ACS SCE and VSM Adaptation Controllers

Wait until after upgrading to Version 6.1 before installing ACP/ACS, SCE and VSM adaptation controllers. Install the slot controller into the desired slot in the switch node. Use the Software Installation section of the Xedge6000 Software Configuration Guide (032R400-V610) to load the mpro1.cod compressed file to Slot0. Once the slot controller boots, it will automatically download the mpro1.cod file from Slot0. For the SCE and the VSM adaptation controllers, once the slot controller is reporting Active, load the scelca.bin (SCE) and/or vsm.bin (VSM) file(s) as specified in the Software Installation section of the Xedge6000 Software Configuration Guide (032R400-V610).

ACP/ACS OAM Hardware/Software Requirements

- The Version 6.1.0 software release and the new ACx hardware (DOC HW Version 6J or greater) provides the full OAM upgrade.
- The older ACS and ACP modules (version -001) require the **`ac_lca.bin`** file to be loaded. The newer ACS and ACP modules (-002) do not require the **`ac_lca.bin`** file; if loaded, this file will be erased when the slot is warm-started.

Note: *To distinguish a -001 from a -002, look at the upper right hand corner of the root menu. A -001 displays the current software level while a -002 displays the current software level and the REV of the boot PROM.*

- The new ACS and ACP hardware does not change OAM functionality with pre-Version 6.1.0 software.
- The Version 6.1.0 software release with pre-6J ACx hardware results in a limited OAM upgrade. This hardware/software combination does not maintain the sequence integrity for performance monitoring cells which pass through the switch.

9.0 Operational Guidelines

Follow the guidelines in this section for optimal performance of the Xedge Switch system, slot controllers and LIMs. Contact your authorized field representative if you have any further questions.

9.1 System Guidelines

- When using multiple signaling channels, CAC for switched connections is done on logical SAPs and physical SAPs while CAC for PVCs is done on physical SAPs only. This is equivalent to having a separate bandwidth table for PVCs and SPVCs.
- Do not use the Debug option available in the Diagnostics/Inject_cell/OAM screen. This is supplied as a SERVICE SUPPORT TOOL ONLY.
- Should an ECC slot controller reboot, full recovery of all configured connections may take an average of 5 minutes per 1,000 connections configured.
- Do not use a VPI value over 255 with ACP or ACS cell controllers.
- By design, an A-Series Slot0 controller will always perform a force warm start, even when a normal warm start is invoked. Non A-Series slot controllers warm-start when a warm-start is invoked.
- During normal operation of the Switch, a minimum of one slot controller must be installed for each power supply unit operating (i.e., a Xedge6000 shelf with four power supplies operating, must have at least four slot controllers). Having too many power supply units installed for the number of slot controllers may cause invalid power supply events and TRAPs.
- After changing the link type (in the PVC Resources) from NNI to UNI, the target slot controller must be warm-started. Changing the link type from UNI to NNI does not require a warm-start.
- The ETH adaptation controller traffic shaping is for the Peak Cell Rate only. Traffic shaping on the Sustained Cell Rate has not been implemented.
- When using the ETH adaptation controller, full, line-rate performance on all frame sizes may not be consistent with multiple ports and Tunnels. As multiple Tunnels are utilized, the overall performance is degraded. When using multiple shaping rates or Spanning Tree, similar conditions may exist.
- Do not perform nested Telnet sessions as they will result in degraded Telnet performance.
- When the screen menu prompts you to type esc to abort, you may have to press Escape two or more times.
- The auxiliary port on the Xedge6160 (MAC1) chassis is not supported.
- The filtering database on a bridge does not consistently report the source mac address from the sending device. An invalid entry is reported. This occurs when sending 64- and 128-byte frames across 4 bridges at the same time.
- The operation of the ECC cell controller does not allow a network address to be used as the address of the node. For example, a node address of 192.1.1.0 is no longer valid as in previous releases.

9.1.1 E-Series OAM Performance Monitoring (PM)

For proper operation of PM functionality, you must set the connection type (Manage configuration, OAM Configuration/Status, OAM VC Port Config/Status Table, connection type) and the Performance Mon (Manage configuration, OAM Configuration/Status, OAM VC Port Config/Status Table, Performance Mon:) so that the flow type and connection type are the same.

For example:

If the connection type is set to segment endpoint, the PM source must be set to **`act_source_seg_manual`** *and the PM sink must be set to* **`act_sink_seg_manual`**.

If the connection type is set to end-to-end endpoint, the PM source must be set to **`act_source_ee_manual`** and the PM sink must be set to **`act_sink_ee_manual`**.

Note: *Cell-based Continuity check and Performance Monitoring are currently not operational. Only the manual selections are operational.*

9.2 Audio/Video Delays

The following end-to-end worst case delays are found when operating two codecs in a single ATM node.

Table 5: Intra-Node End-to-End Worst Case Delay

Mode	NTSC Delay	PAL Delay	Notes
I	90 ms	100 ms	Use of Layer 2 audio is not recommended as lip-synch cannot be attained.
IP	170 ms	180 ms	Add one frame of delay when using SIF or Half CCIR601 (33 ms NTSC, 40 ms PAL)
IBP	200 ms	210 ms	Add one frame of delay when using SIF or Half CCIR601 (33 ms NTSC, 40 ms PAL)
IBBP	230 ms	240 ms	Add one frame of delay when using SIF or Half CCIR601 (33 ms NTSC, 40 ms PAL)

9.3 Configuration Guidelines

- The slot controller names have been changed in the MIB in Version 6.1.0. This affects how they are displayed via telnet.
- Ensure resources are available when configuring PVCs. Services which require more resources than are available will not activate. No error messages are generated in this case.
- Do not enable statistics collection if 1000 or more connections are established; modules will reboot.
- Do not configure a PVC or SPVC with all the following parameters set to 0: SSlot, Slink, SVPI, SVCI, DSlot, DLink, DVPI, and DVCI. The system uses this setting internally.

- For A-series slot controllers, approximately 480 cps of bandwidth must be reserved for switch management on NNI links where the Management Overlay Network (MOLN) is to operate. E-series slot controllers automatically reserves 3,567 cps at a link for MOLN.
- SPVC VCI starts are fixed at 0. The VCI start of 32 that is displayed on the screen is intended as a reminder that VCIs below 32 are reserved and should be used with caution.
- A new option has been added to the SVC Resource Table, Auto SAP OFF with the default set to No. If set to Yes, the software automatically turns off this SAP when there is a signaling failure between the end-to-end signaling entities.

Note: *If you enable the Auto SAP Off option, i.e., by selecting Yes, you will need to manually turn on the SAP after a failed trunk is restored.*

- When configuring the FRC adaptation controller, always use Link-0 in the PVC Configuration/Status table.
- When configuring VSM timeslots for transporting Nx64k data, AAL1 is mandatory. When transporting 64k data, AAL1 is recommended. AAL2 can be used for 64k data, however, bit errors may occur if more than 90 64-K channels are configured with CAS, and CAS bits are changing at a high frequency.
- Regarding VSM echo cancellation, putting in tandem the echo cancellers can cause degradation of voice quality. A voice circuit that traverses more than one echo canceller, inside or outside the VSM adaptation controller, can experience degraded signal quality. The limitation is avoided by enabling the echo canceller only at the final end points of the connection.

Note: *Refer to ITU-T Specification G.168 regarding Digital Network Cancellers.*

- When configuring ATM multicast on the VSM, a timeslot on the source end of a unidirectional PVC/SPVC must have the conditioning towards the ATM side set to None. Otherwise, the VSM interprets a lack of cells as an event requiring conditioning, and conditions the ATM ingress cell stream.

Note: *The* ***`Conditioning status`*** *reported for the bundle associated with the timeslot will indicate* ***`Yes`*** *when the configuration is actually implemented. This occurs on both the SCE and the VSM.*

- Ensure all bundles are active before saving the config.cfg file. If not, upon reboot, the bundles do not return to the running state.
- The VSM adaptation controller does not support AAL2 multicast with CAS.
- Do not change the VP Start range for a link to 0 without deleting all the circuits over the link. If you change the VP Start range on an NNI to 0, it changes the link type to a UNI, it re-initializes the VC routing RAM, and then kills every circuit on the link. The only work-around is to change the VP range back again and warm-start the slot controller.

- The Xedge6645 (DV2) chassis has contacts for two external user status inputs. The alarm handler allows these inputs and their SNMP Traps to be either enabled or disabled. The inputs can be defined as active-open or active-closed, and the alr_cls.txt file allows them to generate Critical, Major, or Minor alarm types. Although the SMM in the Xedge6280 (IMX) chassis still generates alarms correctly, the Xedge6645Slot0 (DV2) chassis now ignores the input status. If configured to active-open or active-closed, a contact closure has no effect.

9.4 File System Guidelines

- During a TFTP, a copy of the original file being overwritten is maintained in flash while the new file is being transferred. The new file has the **`>~`** characters preceding the file name (e.g., **`>~lave.cod`**). When the file transfer is successful, the original files are marked dirty and the new file is renamed to exclude the **`>~`** characters.
- If the file transfer is unsuccessful, the old file is maintained and the new file is marked **`dirty`**. In the case of an aborted TFTP, run check Media followed by Garbage collect to release orphan sectors caused by the abort.
- After a broadcast of code from Slot0, some slot controllers may still have the original slave.cod and also have a file called **`>~lave.cod`**. Delete the **`>~lave.cod`** file and perform a TFTP of the new **`slave.cod`** to the slot controller.
- Managing the file system is essential for ensuring sufficient room for loading new files (i.e., for **`slave.cod`**). Because the transfer process maintains the old file until the new one is completely received, you must maintain enough room in flash to accommodate the new file. Remove all unnecessary files from flash.
- If the system reports insufficient file space, perform **`check Media`** followed by **`Garbage collect`** to recover any orphaned sectors of the flash EPROM.
- To improve TFTP reliability with a SUN workstation, type **`?`** at the TFTP prompt, then set the SUN workstation retransmit timer to 1 second (**`re 1`** <*cr*>) and maximum time-out to 120 seconds (**`ti 120`** <*cr*>).
- The DLIM Type options are in upper and lower case alpha characters in the software configuration Physical Layout screen. The character entered for the DLIM type is case sensitive.
- When upgrading the redundant Slot0 controller, the slot controller should be prepared by removing the old files and performing a **`Garbage collect`**. To prevent the in-service controller from attempting to replace these files before this preparation is complete, the **`AUTO TRANSFER`** feature should be disabled first. Once the old files are removed and the Garbage collect is complete, enabling **`AUTO TRANSFER`** allows the new code to be automatically transferred to the out-of-service controller.
- Intermittently, files may get corrupted during broadcast. If after a broadcast the slot does not come out of boot, compare the original file size to the file size on the affected slot controller.

9.5 Redundancy Guidelines

- Inserting any slot controller other than an ETH/SMC into the Redundant Slot0 shelf position can result in damage to the ETH/SMC adaptation controller in Slot0.
- When configuring Slot0 redundancy, install the slot controller with its thumbwheel switch set to **`0`** (main) in the main Slot0 slot (just left of the switch fabric). Install the slot controller with its thumbwheel switch set to **`4`** (standby) in the standby Slot0 slot. After installation, the main Slot0 controller loads its MAC address on the standby Slot0 controller so that communications with the NMS is maintained after a redundancy switchover.
- If using an ETH in slot0, when exiting the OOS redundant Slot0 controller, the prompt will appear to save changed configuration (y/n). Reply **`NO`**. If a save is done to the **`config.cfg`** file while the slot controller is out of service, the **`config.cfg`** file may be corrupted. Only make changes to the **`config.cfg`** file of the inservice slot controller and allow the auto update feature to update the **`config.cfg`** file on the out-of-service slot controller. The SMC will not allow a config change in OOS controller.
- Transfer of the switch fabric between Main and Standby is accomplished by the management processor via use of “health-check” cells. If the processor fails to get a “health-check” response for 6 seconds, it assumes that the switch fabric has failed (or has been removed). It takes another 1 second for the processor to initiate the switchover (including 250ms for the transfer to take place) for a total of approximately 7 seconds (a “health-check” period).
- When redundancy is available, any configuration changes made and saved to the **`config.cfg`** file will update the redundant Slot-0 Controller automatically. As the file transfers, the Root Menu will show **`File transfer = Active`** and the redundant controller LEDs will show a TFTP in progress. All module front panel LEDs will illuminate, and then illuminate one at a time, from top to bottom. This sequence repeats until the TFTP transfer is complete.

10.0 Known Limitations

10.1 Configuration

- When running full-feature system software, do not use the Load option in the Manage configuration menu to manually load configuration files as this is an unsupported function and may cause the slot controller to reboot.
- When setting the time and date, always supply the leading zero for the hour setting. Otherwise, the tens digit of the minutes setting is cleared.
- The Broadcast of the Authentication Table is not consistent. Verify that the table is properly sent to a target slot controller by viewing its Authentication Table.
- Security Issue; No more than 6 entries with traps enabled should be entered in the authentication table. Exceeding this limit may seriously impact the user's ability to access the Slot0 mib.

10.2 Signaling

10.2.1 Q.SIG (Optional Feature)

- With an ACP or ACS slot controller in Slot0, there is a limit of 300 possible connections maximum. When Max Pt-Mpt Trees is increased to 15 with 10 leaves per tree, the Max Pt-Pt Connections drops to 150.
- With an ACP or ACS slot controller in non-Slot0, there is a limit of 500 possible connections maximum. When Max Pt-Mpt Trees is increased to 25 with 8leaves per tree, the Max Pt-Pt Connections drops to 300.

10.2.2 ILMI

- If using SNMP authentication, set the IP Address to 0.0.0.0 and the community string to ILMI for the ILMI entry (this is not necessary if ILMI support is turned off). Beginning with Xedge6000 Switch Version 4.1.1, you can turn ILMI support on or off.

10.2.3 SVC

- Calls with a valid status = U3 are released inappropriately.
- AAL 1E test cases fail because the outgoing setup adds an additional byte to the incoming setup.

10.2.4 SVC/SPVC

- SVCs do not reroute in Xedge6000 if Explicit DTLs are used.
- The Display Route feature displays only information for SVCs/SPVCs that use DTL style routing.

10.3 Switch Operations

10.3.1 System

- Unexpected traffic on the management VC (0/5) causes the ECC to lockup in Fault.

10.3.2 OAM Performance Monitoring

Connection Count vs. PM Source Count

If different slot controllers are used across the switch fabric, then the limit of 64 PM sources is reached. If slot N/link 0 is used on the egress and slot N/link 1 is used on the ingress, the following takes place:

1. When a PM source is established on slot N/link 0, the user cells coming into slot N/Link 1 are counted as they enter the ingress connection of the switch.
2. For every *b* user cells, where *b* is the number of cells in the specified block size, a PM Forward monitoring (FM) cell is generated. The user cells and FM cells are sent out through the egress connection on slot N/link 0 downstream to a remote PM sink connection.
3. The remote PM sink calculates PM statistics and returns the results in Backward Reporting (*br*) cells upstream towards the PM source.
4. These *br* cells are collected by the PM source slot N/link 0 ingress connection and are routed up to the slot N management processor.

Therefore, when a single slot controller is used on both sides of the switch fabric joining connections, each PM source established uses both connections. In this case, a limit of 32 PM sources is reached involving 64 connections.

10.4 Network Timing

10.4.1 NTM Software

- With a two-line reference (OC-3), a primary line fault causes a major alarm which should be only a minor alarm.

10.4.2 SNMP

- The LIM fault trap is displayed in the events table, but is not transmitted from the switch.

10.4.3 Tunnels

- When a **`config.cfg`** update is processed from the NMS/SPM, the ethernet tunnel table, mapping table, logical table, physical table, and stat table mibs are all corrupted. Therefore, calls can be generated from the SPM and the same results follow after the updated **`config.cfg`** file.

10.5 Traffic Management

10.5.1 MOLN

- When MOLN is changed to a new VPI/VCI the user must do a restart on the slot controller for the resource change.
- When a link type is configured as NNI, MOLN is assumed to be required. In certain cases, the user may want to allow proprietary signalling messages between nodes, but not management traffic. This can be accomplished by configuring the MOLN VC to use a different VPI / VCI on each end of the link.

10.5.2 Policing

- The Policing disable option in the SVC Resource Table should apply to all connection types (PVCs, SPVCs and SVCs) at any NNI link. Currently this only applies to signaled connections.

10.6 Switch Fabric Modules

10.6.1 XH

- With a full Xedge6645 (NPX) shelf configured and one XH installed, bit errors are observed.

10.7 Slot Controller Modules

10.7.1 ISG

- Interoperability with Cisco’s ATM interface works with AAL5MUX/IP option selected only.

10.7.2 CE

- During the narrow band and wide band phases of acquisition, the cell FIFO is allowed to exceed the maximum, causing a 10-second time period when bit errors may be observed.
- When the CE adaptation controller is the root of a multicast tree, adding or restarting a PVC causes data loss on other circuits associated with the root.
- AIS is not generated for starvation and overflow conditions.
- After initial power up the CE may report a Minor, AAL Fault alarm. This can be cleared by warmstarting the CE controller.

10.7.3 CHFRC

- When AMI is selected, use inverted data to avoid errored frames because of the number of 0s in the data.
- In the channel config display Overbooking = none means 100% utilization. Overbooking enables over utilization of the channel.

- Link status does not indicate the actual status of the physical link. The front panel LED display and Slot0 root menu link status indicate only that a given link is enabled, i.e., active, and does not reflect the state of the physical link.
- Only the last cell of a sequence supports CLP=1-to-DE=1 mapping. This mapping occurs only if the last cell belonging to a frame has the CLP bit set.

10.7.4 FRC

- Error messages and random characters appear in MIB 24 and 25 fields.

10.7.5 ACP/ACS

- Given the ACP, when a single header error is injected in two consecutive cell headers, the ACP properly corrects the first single bit error and discards the second errored cell. However, the HCS Error count, under the PLCP Config/Stats, does not increment its count by 1 when the 2nd errored cell is discarded. When one or more cells containing multiple header bit errors are detected, the ACP properly discards all cells and the HCS Error count is incremented accurately.

10.7.6 VSM

- R2 signaling is not supported when Compression Type is set to CS ACELP G729A 8K.
- It is important to apply the Admin Status, Reconfigure for configuration changes to take effect reliably. Unless the reconfigure update is applied, results of the configuration and the validation performed on the configuration are unpredictable.
- The FAX detection feature (of FAX bypass) does not comply with the ITU G165/168 standard for disabling the echo canceller.

10.8 Line Interface Modules

10.8.1 General

- Terminate all configured LIM ports with the appropriate impedance when a link cable is disconnected to prevent the generation of link-up and link-down alarms.

10.8.2 E3-2C LIM

- When an AIS condition exists on the link, a loss of frame is displayed in the Alarm Handler.

10.8.3 HSSI LIM

- The HSSI-DCE LIM does not respond to remote LB diagnostics.

10.8.4 OC-3c/STM-1 Series

- Secondary Line fault causes Primary ref status to change when using a STM1 Dual.

11.0 Technical Reference

This section provides brief technical specifications, capabilities and supported features for this release of the Xedge Switch modules.

11.1 Xedge Modules Capabilities and Characteristics

CE Slot Controller (Part No. 032M016-003)

- Constant Bit Rate (AAL1) circuit emulation.
- Supports from 2.4 Kbps up to 4 x DS1/E1 or 2 x T3/E3 ports
- Adaptive clock recovery
- Synchronous timing, loop timing, and Synchronous Residual Time Stamping (as specified in ITU I.363 and ANSI DS1.630 for DS1 and E1)
- Uses DS1-2CS/4CS, DS3-2C, E1-2CS/4CS, E3-2C, and SI-2C/4C LIMs.

SCE Slot Controller (Part No. 032M032-001)

- Constant Bit Rate (AAL1) circuit emulation for structured DS1 or E1 services
- Provides up to 4 x DS1 or E1 ports with support for Channel Associated Signaling.
- Uses DS1-2CS/4CS, E1-2CS/4CS LIMs

ECC2 Slot Controller (Part No. 032P025-001/032P026-001)

- Supports the following physical interface types:
  2 x OC-3c/STM-1, DSX1-IMA, E1-IMA
- Conforms to ITU-T I.610 - OAM Principles for Broadband Networks.
- Conforms to ATM Forum specifications as follows:
  User-Network Interface Version 3.1
  Traffic Management Specification Version 4.0
  Signaling Specification UNI Version 4.0
  ILMI Specification Version 4.0

ACP/ACP2 Slot Controller

- ATM PDH Controller available with four different ingress/egress cell buffer sizes: 4K/4K, 16K/16K, 16K/64K, or 64K/64K
- Provides advanced modular buffering for up to 256,000 cells per controller.
- The ACP supports the current DS1-2C/2CS, DS3-2C, E1-2C/2CS, E3-2C, SI-2C/4C, HSSI-DTE and LCE-16 LIMs.

ACS/ACS2 Slot Controller

- ATM SDH/SONET Controller available with four different ingress/egress cell buffer sizes: 4K/4K, 16K/16K, 16K/64K, or 64K/64K.
- Provides advanced modular buffering for up to 256,000 cells per controller.
- The ACS supports the current OC-3c/STM-1 LIMs but not the new OC-3c/STM-1 LIMs available with Xedge System Release, Version 6.1.0.

Channelized Frame Controller (032M022-001)

- Provides four, channelized frame-to-ATM interface ports for structured DS1 and E1 services.
- Supports four simultaneous DS1 or E1 ports at full bandwidth with optional DS1-2C/2CS, DS1-4C/4CS, E1-2C/2CS, and E1-4C/4CS, interfaces.
- For Frame Relay operation, the maximum throughput for the slot controller per port is as follows:

Frame Size	Circuit Rate	Frames/Sec	Actual Rate
39-byte	1.536 Mbps	3596	1.122 Mbps
64-byte	1.536 Mbps	2834	1.451 Mbps
512-byte	1.536 Mbps	372	1.524 Mbps
4096-byte	1.536 Mbps	47	1.535 Mbps
39-byte	1.984 Mbps	4519	1.410 Mbps
64-byte	1.984 Mbps	3611	1.849 Mbps
512-byte	1.984 Mbps	479	1.964 Mbps
4096-byte	1.984 Mbps	60	1.535 Mbps

Frame-to-ATM Controller (032M021-001)

- Provides two frame relay, HDLC frame transport, or FUNI with DS1-2C, E1-2C, DS1-2CS, E1-2CS, SI-2C and HSSI-DCE port interfaces.
- Supports an aggregate throughput above 75 Mbps.
- For Frame Relay operation, the maximum throughput for the slot controller for both ports is as follows:

Frame Size	Circuit Rate	Frames/Sec	Actual Rate
39-byte	10 Mbps	17700	
64-byte	18 Mbps	17700	
512-byte	73 Mbps	8980	
4096-byte	75.2 Mbps	1150	

ETH Slot Controller (032M020-001)

- Provides redundant Slot0 operation.
- Provides four-port ethernet/802.3 bridging with RFC 1483 encapsulation enabled and the following throughput:

1 input port to 1 output port over 1 tunnel	Circuit Rate
1518-byte frames	807 pps
1024-byte frames	1190 pps
64-byte frames	13390 pps

4 input ports to 1 output port over 4 tunnels	Circuit Rate
1518-byte frames	3192 pps
1024-byte frames	4656 pps
64-byte frames	21860 pps

VSM Slot Controllers (032P200-001, 032M033-011, 032M034-011, 032M035-011, and 032M036-011

- Variable Bit Rate (AAL2, per ITU-T I.363.2) and Constant Bit Rate (AAL1, per ITU-T I.363.1) circuit emulation for structured DS1 or E1 services on a per channel basis.
- Provides up to 4 x DS1 or E1 ports with support for Channel Associated Signaling.
- The 032P200-001 supports Nx64K data (AAL1) and 64K PCM voice (AAL2) with CAS and idle channel removal.
- The 032Mxxx-001 controllers support Nx64K data (AAL1), and the following AAL2 features: 64K PCM or 32K ADPCM, idle channel removal, silence suppression, 8K CS-ACELP (per ITU-T G.729a), FAX/modem detection with automatic shift to 64K PCM or 32K ADPCM, FAX/modem detection bypass without CAS (idle code), TLP attenuation, CBR traffic shaping, cross companding types, and echo cancellation (per ITU-T G.156 and G.168).

STM Slot Controller (032P105-001)

- Used in the Standby Slot0 position in non-redundant configured NPX and DV2 systems to monitor and condition the system clock signals.

SMC Slot Controller

- Provides extended slot 0 oriented features.
- Carries ethernet user traffic over ATM tunnels via an embedded the 10/100baseT port on the controller.
- Provides Slot0 redundancy for Xedge 6280, 6640 and 6645 shelves.
- Can manage up to 6000 PVC/PVP in a Xedge shelf, and can manage more than 4 ports per controller in the shelf (i.e., IMA).

11.2 Feature Compatibility with Previous Versions

Table 6: Feature Comparison compares module features based on the Xedge software version. Dashes indicate unsupported features; CR indicates a controller release.

Table 6: Feature Comparison

Feature	4.4.1	5.0.0	5.1.1	5.1.2	5.2.1	5.2.2	6.0.0	6.1.0
SLOT CONTROLLERS								
SMC	--	--	--	--	--	--	YES	YES
ISG1	--	--	--	--	--	--	CR	YES
ACP & ACS	YES	YES	YES	YES	YES	YES	YES	YES
ACP2 & ACS2	--	--	YES	YES	YES	YES	YES	YES
CE	YES	YES	YES	YES	YES	YES	YES	YES
CHFRC	YES	YES	YES	YES	YES	YES	YES	YES
HPG, HS	YES	--	--	--	--	--	--	--
ECC2	--	YES	YES	YES	YES	YES	YES	YES
FRC	YES	YES	YES	YES	YES	YES	YES	YES
MS/QED	YES	YES	YES	YES	--	--	--	--
ETH	YES	YES	YES	YES	YES	YES	YES	YES
SCE	YES	YES	YES	YES	YES	YES	YES	YES
VE	YES	YES	YES	YES	YES	YES	YES	YES
VSM	YES	YES	YES	YES	YES	YES	YES	YES
STM	YES	YES	YES	YES	YES	YES	YES	YES
LINE INTERFACE MODULES								
DSX1/E1-IMA LIMs (4 ATM ports)	--	--	--	--	YES	YES	--	--
DSX1/E1-IMA LIMs (16 ATM ports)	--	--	--	--	--	--	YES	YES
LCE-16	--	--	YES	YES	YES	YES	YES	YES
DS1/DS3 LIM Timing	YES	YES	YES	YES	YES	YES	YES	YES
E1/E3 LIMs	YES	YES	YES	YES	YES	YES	YES	YES
HSSI LIM (DTE)	YES	YES	YES	YES	YES	YES	YES	YES
HSSI LIM (DCE)	YES	YES	YES	YES	YES	YES	YES	YES
OC-3c/STM-1 LIM Timing	YES	YES	YES	YES	YES	YES	YES	YES
OC-3c/STM-1	--	YES	YES	YES	YES	YES	YES	YES
STM-1 Electrical	--	YES	YES	YES	YES	YES	YES	YES
Serial I/O LIM	YES	YES	YES	YES	YES	YES	YES	YES

Table 6: Feature Comparison (Continued)

Feature	4.4.1	5.0.0	5.1.1	5.1.2	5.2.1	5.2.2	6.0.0	6.1.0
DELIM STM-1 LIM	YES	YES	YES	YES	YES	YES	YES	YES
VJLIM LIM (NTSC, PAL)	YES	YES	YES	YES	--	--	--	--
VH320 LIM (NTSC/PAL)	YES	YES	YES	YES	--	--	--	--
MPG2V (MPEG-2)	YES	YES	YES	YES	YES	YES	--	--
NODE TIMING MODULES								
Node Timing Module (DS1)	YES	YES	YES	YES	YES	YES	YES	YES
Node Timing Module (E1)	YES	YES	YES	YES	YES	YES	YES	YES
SWITCH FABRIC MODULES								
XH Switch Fabric	YES	YES	YES	YES	YES	YES	YES	YES
XS Switch Fabric	--	YES	YES	YES	YES	YES	YES	YES
XM Switch Fabric	YES	YES	YES	YES	YES	YES	YES	YES
CM Multiplexer	YES	YES	YES	YES	YES	YES	YES	YES
FEATURE SUPPORT								
PNNI Routing	--	--	--	--	--	--	--	--
ISG1 Next Tunnel	YES	--	--	--	--	--	--	YES
ISG1 RIP2	--	--	--	--	--	--	--	YES
ISG1 Proxy ARP	--	--	--	--	--	--	--	YES
IMA MIN/MAX	--	--	--	--	--	--	--	--
Select Route	--	--	--	--	--	--	--	YES
PVC Table Entries	1000	1000	1000	1000	1000	1000	6000	6000
ECC Differentiated UBR for MTS	--	--	--	--	--	--	YES	YES
IP Routing	--	--	--	--	--	--	YES	YES
Q.SIG	--	--	--	YES	--	YES	YES	YES
VP Queues with the ECC	--	--	--	--	YES	YES	YES	YES
Billing	YES	YES	YES	YES	YES	YES	YES	YES
VSM Logical Multicast	--	--	YES	YES	YES	YES	YES	YES
VSM2 with FAX Relay	--	--	--	--	YES	YES	YES	YES
MTS 1.0	--	--	YES	YES	YES	YES	YES	YES
CE PVC Multicast	YES	YES	YES	YES	YES	YES	YES	YES
DTL	YES	YES	YES	YES	YES	YES	YES	YES
ECC Automatic Protection Switching	--	YES	YES	YES	YES	YES	YES	YES

Table 6: Feature Comparison (Continued)

Feature	4.4.1	5.0.0	5.1.1	5.1.2	5.2.1	5.2.2	6.0.0	6.1.0
External Alarm	YES	YES	YES	YES	YES	YES	YES	YES
ILMI Address Registration	YES	YES	YES	YES	YES	YES	YES	YES
Link Alarms	YES	YES	YES	YES	YES	YES	YES	YES
Maximum IP Routing Table	200	200	200	200	200	200	512	512
OAM F4/F5 flows	YES	YES	YES	YES	YES	YES	YES	YES
RFC 1483 (Encapsulation)	YES	YES	YES	YES	YES	YES	YES	YES
SCE/VSM PVC SPVC Multicast	YES	YES	YES	YES	YES	YES	YES	YES
Slot0 Redundancy	YES	YES	YES	YES	YES	YES	YES	YES
System Timing	YES	YES	YES	YES	YES	YES	YES	YES
UNI 3.1 SVC Point-To-Point	YES	YES	YES	YES	YES	YES	YES	YES
UNI 3.1 IISP	YES	YES	YES	YES	YES	YES	YES	YES
UNI 3.1 MSC Point-To-Point	YES	YES	YES	YES	YES	YES	YES	YES
UNI 3.1/4.0 Point to Multipoint	YES	YES	YES	YES	YES	YES	YES	YES
UNI 4.0 Signaling Point-To-Point	--	YES	YES	YES	YES	YES	YES	YES
VJLIM Capped Variable Bit Rate	YES	YES	YES	YES	--	--	--	--
Video PVC Multicast (VJLIM)	YES	YES	YES	YES	--	--	--	--
Video SPVC Multicast (VJLIM)	YES	YES	YES	YES	--	--	--	--
Video PVC Multicast (MPG2V)	YES	YES	YES	YES	YES	YES	--	--
Video SPVC Multicast (MPG2V)	YES	YES	YES	YES	YES	YES	--	--
Logical Multicast	--	--	YES	YES	YES	YES	YES	YES

Note: *In the table above, CR designates a controlled release.*


General DataComm