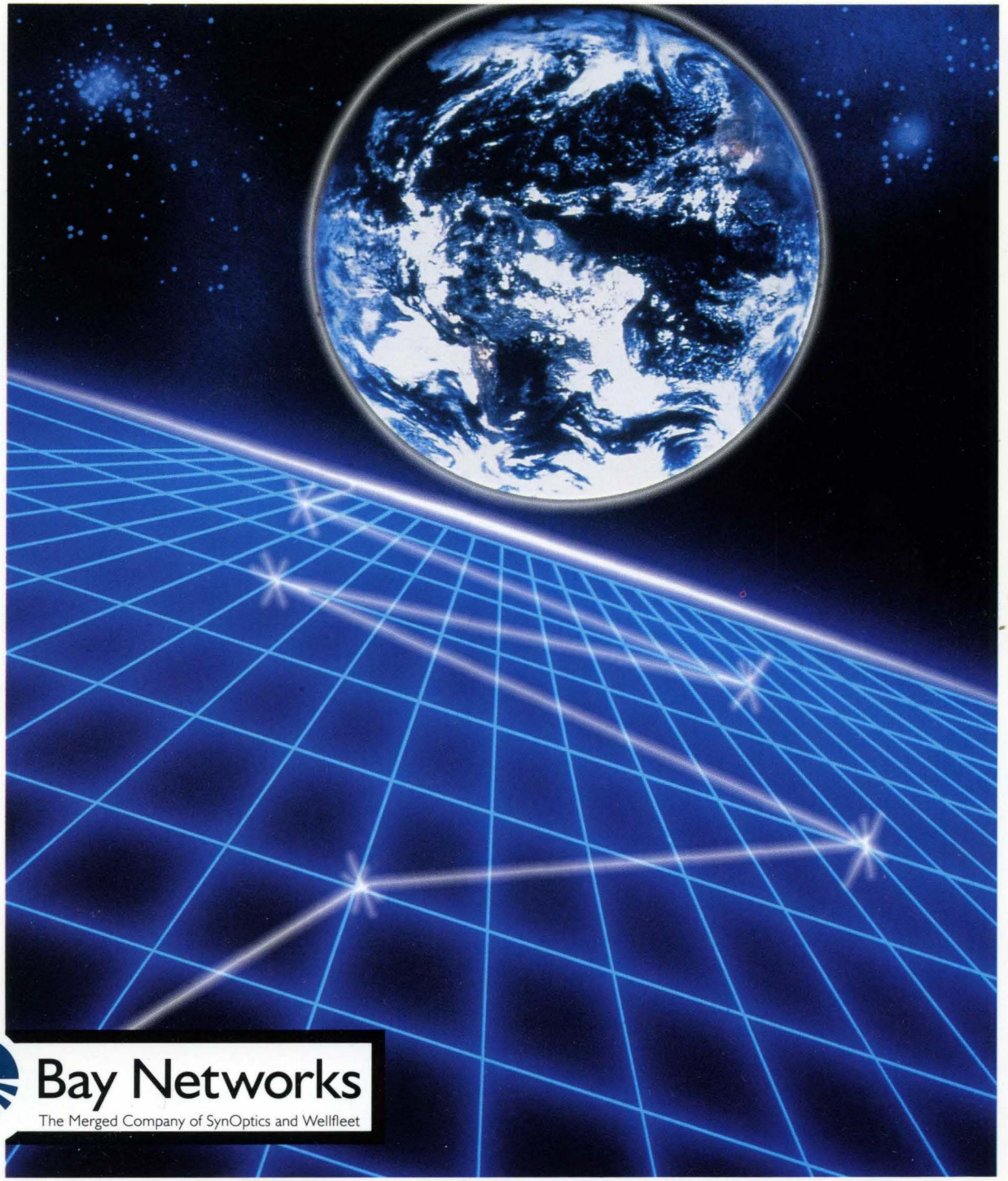

Bay Networks

The Merged Company of SynOptics and Wellfleet

Customizing SMDS Services

Part No. 110058 A

Customizing SMDS Services

Router Software Version 8.10
Site Manager Software Version 2.10

Part No. 110058 Rev. A
February 1995

Bay Networks

The Merged Company of SynOptics and Wellfleet

Bay Networks, Inc., 8 Federal Street, Billerica, MA 01821

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About This Guide

If you are responsible for configuring and managing Wellfleet® routers, you need to read this guide. We assume that you have experience with LANs and WANs, SMDS, and general network management tasks. We also assumes that you have already configured at least one SMDS interface on the router using Site Manager.

This guide describes Switched Multimegabit Data Service (SMDS) and provides instructions for using Site Manager to configure SMDS parameters for your network.

Refer to this guide for

- An overview of Switched Multimegabit Data Service (Chapter 1)
- Information about our implementation of SMDS (Chapter 2)
- Descriptions of SMDS parameters and instructions for editing those parameters (Chapter 3)

For information and instructions about the following topics, see *Configuring Wellfleet Routers*.

- Initially configuring and saving a WAN interface
- Retrieving a configuration file
- Rebooting the router with a configuration file

Before You Begin

Before using this guide, you must complete the following procedures:

- Create and save a configuration file that contains at least one SMDS interface.
- Retrieve the configuration file in local, remote, or dynamic mode.

Refer to *Configuring Wellfleet Routers* for instructions.

How to Get Help

For additional information or advice, contact the Bay Networks Help Desk in your area:

United States	1-800-2LAN-WAN
Valbonne, France	(33) 92-966-968
Sydney, Australia	(61) 2-903-5800
Tokyo, Japan	(81) 3-328-0052

Conventions

arrow character (→)	Separates menu and option names in instructions. Example: Protocols→AppleTalk identifies the AppleTalk option in the Protocols menu.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
`screen text`	Indicates data that appears on the screen. Example: `Set Trap Monitor Filters`
quotation marks (" ")	Indicate the title of a chapter or section in a book.
vertical line (|)	Indicates that you enter only one of the parts of the command. The vertical line separates choices. Do not type the vertical line when entering the command. Example: If the command syntax is **show at routes | nets**, you enter either **show at routes** or **show at nets**, but not both.

Acronyms

ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
CRC	cyclic redundancy check
DSU/CSU	Digital Service Unit/Channel Service Unit
DS1	Digital Service, Level 1
DS3	Digital Service, Level 3
DXI	Data Exchange Interface
HSSI	High Speed Serial Interface
IEEE	Institute of Electrical and Electronic Engineers
IP	Internet Protocol
IPX	Internet Packet Exchange
LAN	local area network
LMI	Local Management Interface
MAC	media access control
MAN	metropolitan area network
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First
PDU	protocol data unit
PVCs	permanent virtual circuits
RIP	Routing Information Protocol
SIP	SMDS Interface Protocol
SMDS	Switched Multimegabit Data Services
SNMP	Simple Network Management Protocol
WAN	wide area network
XNS	Xerox Network System

Chapter 1
SMDS Overview

Switched Multimegabit Data Service (SMDS) is a public, high-speed, packet-switched network service that enables you to connect local area networks (LANs) across wide area networks (WANs). See Figure 1-1.

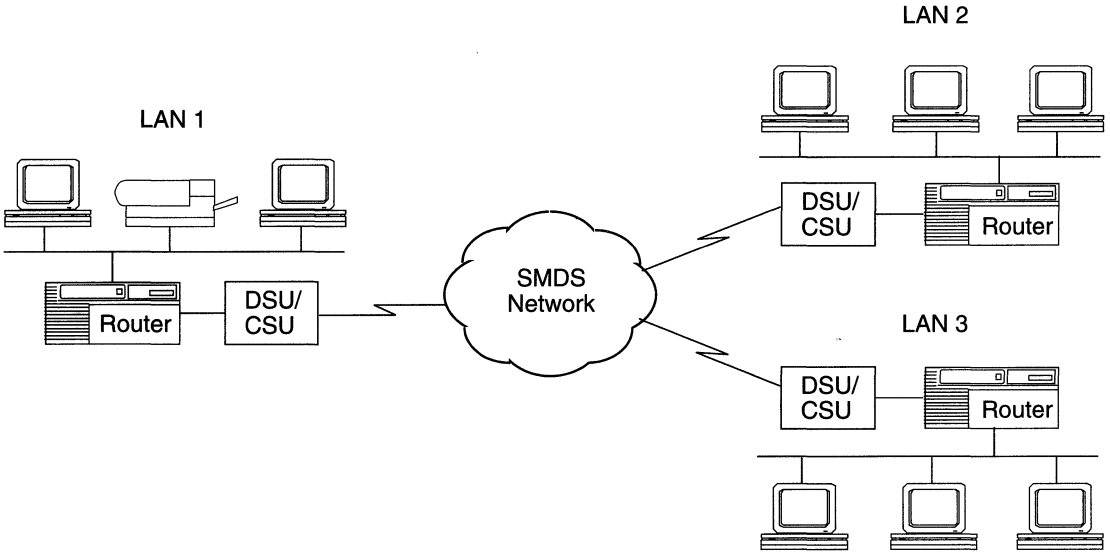


Figure 1-1. SMDS Sample Network

SMDS is a combination of Asynchronous Transfer Mode (ATM) cell relay technology and IEEE Standard 802.6, the link control protocol standard that controls cell transmission. Similar to ATM technology, SMDS divides data into fixed 53-byte cells. The use of cell technology makes SMDS well-suited for traffic that consumes high bandwidth for short periods of time.

SMDS currently offers six network access speeds (or classes): 1.2 Mb/s, 4 Mb/s,10 Mb/s, 16 Mb/s, 25 Mb/s, and 34 Mb/s. SMDS also offers low speed SMDS classes, which operate at fractional T1/E1 speeds (56 Kb/s up to 64 Kb/s). Within the SMDS fabric, T3 trunks link the network switches together.

How SMDS Sends LAN Data Over WANs

SMDS allows you to communicate beyond your premises across a metropolitan or wide area network.

LAN data is typically connectionless data. This means that it has addressing information in each frame so there is no need for a prior connection between the originating and destination devices. WAN data is typically connection-oriented data. This means that it needs a virtual circuit between the two connection points prior to sending data.

SMDS provides connectionless data transfer across a wide area network without establishing a logical end-to-end connection.

SMDS Interface Protocol

The SMDS Interface Protocol (SIP) defines SMDS addressing, formatting, framing, and error detection requirements.

The SIP has three levels that are similar to, but do not match, the protocol layers that make up the OSI protocol model.

- Level 1 specifies the physical connectivity that enables transmission.

- Level 2 specifies the segmentation of Level 3 Protocol Data Units (PDUs) into short fixed-length SMDS cells, referred to as Level 2 PDUs.
- Level 3 specifies the addressing, formatting, and encapsulation of packet data, referred to as Level 3 PDUs.

Figure 1-2 illustrates the SIP protocol stack.

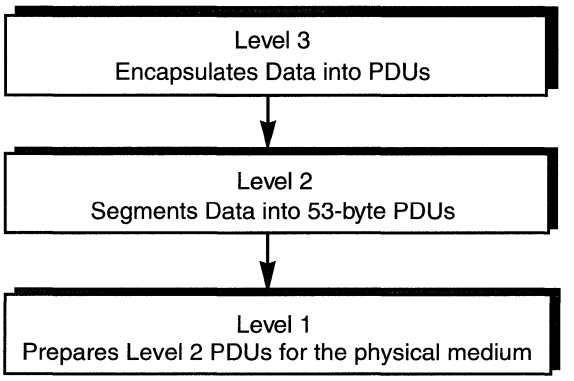


Figure 1-2. SMDS Interface Protocol Stack

SIP specifies that the SMDS source and destination addresses reside in the Level 3 PDU header (Figure 1-3). Each header contains a MAC-level address in an E.164 address format. E.164 formats are 64-bits long and provide both individual and multicast addresses. Network switches use the address information in the header to route the PDU to its destination.

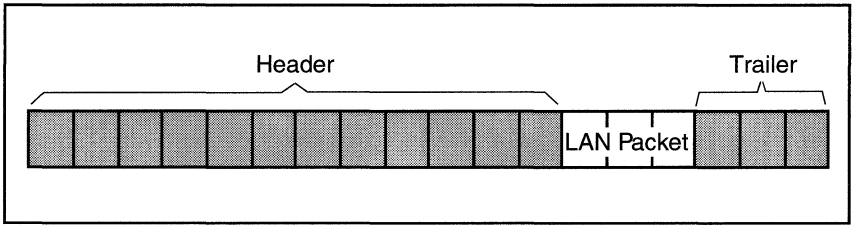


Figure 1-3. SMDS Level 3 PDU

One or more SMDS devices can provide the functionality of the three SIP levels, as described in the next section.

Data Exchange Interface Protocol

For SMDS high-speed access classes, that is, speeds from 1.2 Mb/s to 34 Mb/s, the SMDS Interest Group (SIG) wanted to simplify the integration of SMDS into existing network equipment, and to hasten SMDS into the market. To do this, they divided the functions defined by the SIP levels between devices that handle local network packets (for example, your router) and devices that interface with the digital services provided by common carriers (a DSU/CSU).

The Data Exchange Interface (DXI) protocol defines this division of tasks and describes the router and DSU/CSU relationship. Refer to the next section, "Dividing PDU Assembly between the Router and the DSU/CSU."

For low speed SMDS (56 Kb/s to 64 Kb/s), the DXI is extended out to the SMDS network. In this case, you do not need a special SMDS DSU/CSU.

Dividing PDU Assembly between the Router and the DSU/CSU

SMDS PDU assembly begins when the router's SMDS service receives a network-generated packet. The router takes the entire packet and encapsulates it within a 36-byte header (containing addressing, length, and control information) and a 4-byte trailer (containing a CRC value), thereby creating an SMDS Level 3 PDU (Figure 1-4).

The router next prepares the Level 3 PDU for transmission to the DSU/CSU by encapsulating it within a DXI header and trailer that provide control information. Upon receiving the DXI packet, the DSU/CSU strips the DXI header/trailer and segments the Level 3 PDU into fixed-length (44-byte) units called cells. The DSU/CSU encapsulates these cells within a 7-byte header and 2-byte trailer to form Level 2 PDUs.

Finally, the DSU/CSU inserts an additional four bytes of framing information between each Level 2 PDU and transmits the framed cells across a DS1 or DS3 connection to the SMDS network.

Figure 1-4 shows the assembly of SMDS cells as specified by the DXI.

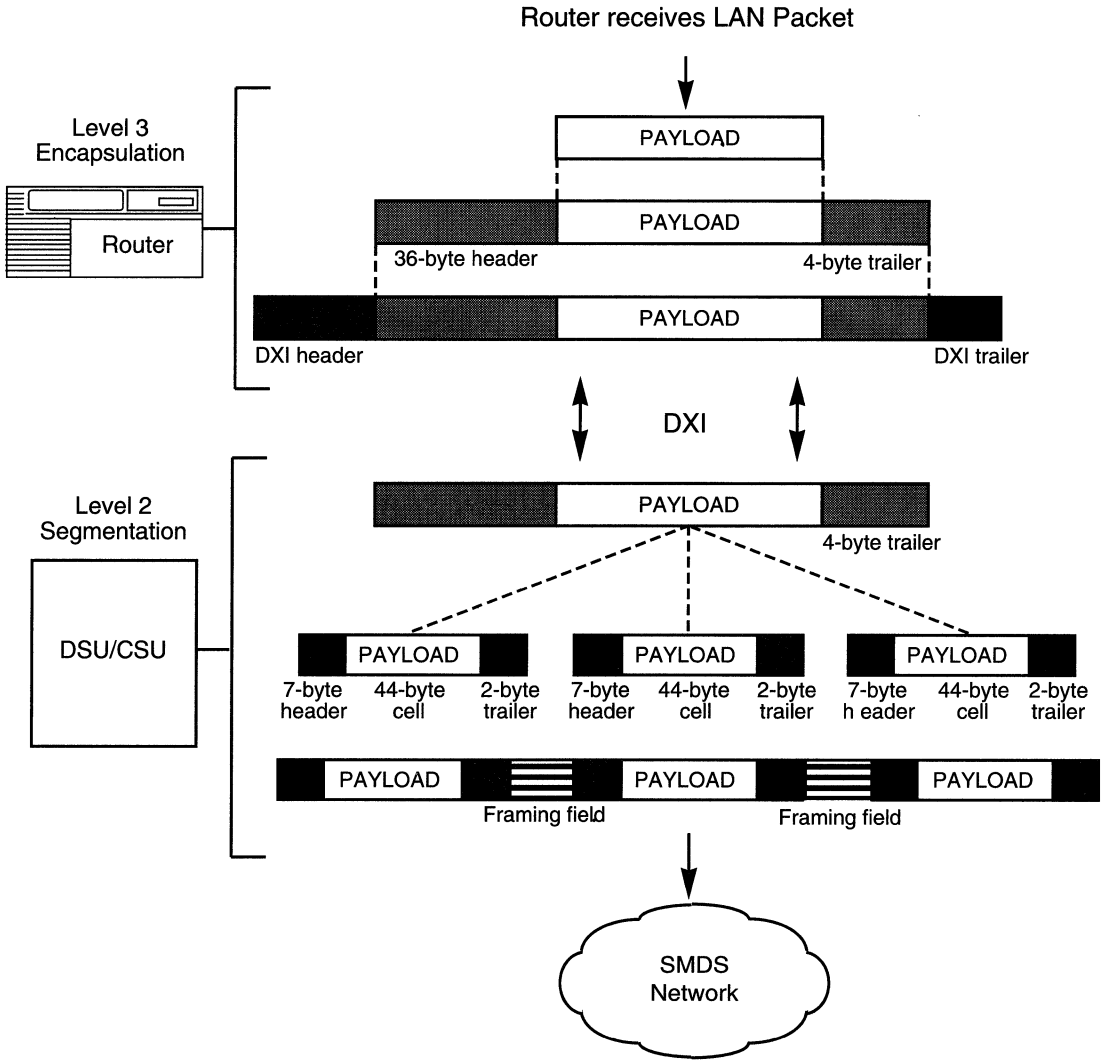


Figure 1-4. DXI Packet Assembly

For More Information about SMDS

The following documents provide technical detail on SMDS and DXI protocol design and implementation.

Baker, F. and Kolb, C. *Definitions of Managed Objects for the DS1 Interface Type*. RFC 1232, Network Information Center (NIC), SRI International, Menlo Park, California, May 1991.

Cox, T. and Tesink, K. *Definitions of Managed Objects for the DS3 Interface Type*. RFC 1233, Network Information Center (NIC), SRI International, Menlo Park, California, May 1991.

Bellcore. *Generic System Requirements in Support of Switched Multi-Megabit Data Service*. Technical Reference TR-TSV-000772, Issue 1, May 1991.

Bellcore. *Local Access System Generic Requirements, Objectives, and Interfaces in Support of Switched Multi-Megabit Data Service*. Technical Reference TR-TSV-000773, Issue 1, June 1991.

Bellcore. *Generic Requirements for SMDS Customer Network Management Service*. Technical Advisory TA-TSV-001062, Issue 2, February 1992.

Piscitello, D. and Lawrence, J. *The Transmission of IP Datagrams over the SMDS Service*. RFC 1209, Network Information Center (NIC), SRI International, Menlo Park, California, March 1991.

SMDS Interest Group. *SMDS Data Exchange Interface Protocol* (Revision 3.2). Technical Specification SIG-TS-001/1991, October 1991.

SMDS Interest Group. *SMDS DXI Local Management Interface*. Technical Specification SIG-TS-002/1992, May 1992.

The following publications provide a less technical introduction to SMDS service.

Davidson, R. and Muller, N. *The Guide to SONET: Planning, Installing & Maintaining Broadband Networks*. Telecom Library, Inc., 1991.

Goldstein, F. *ISDN in Perspective*. Reading, Massachusetts: Addison-Wesley Publishing Company, 1992.

Chapter 2
Implementation Notes

This chapter provides information about the Bay Networks implementation of SMDS.

To implement high speed SMDS, you need a Wellfleet router and an SMDS DSU/CSU that provides DS1- or DS3-based access to the switched SMDS network. A synchronous or high-speed serial interface (HSSI) physically connects the router and the DSU/CSU (Figure 2-1).

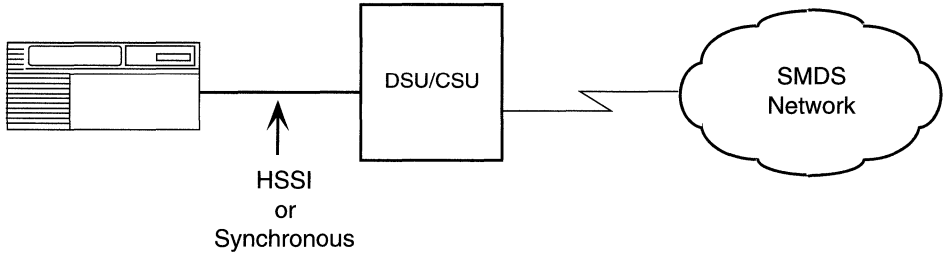


Figure 2-1. Access to SMDS Network via a Router and DSU/CSU

The router also supports low-speed SMDS through the subscriber-to-network interface (SNI) and DXI specifications standardized by the SMDS Interest Group. If you are running low-speed SMDS, you can extend the DXI to the SMDS network, thereby eliminating the need for a special SMDS DSU/CSU. Instead, an MCT1 or MCE1 link module physically connects the router and the network (Figure 2-2).

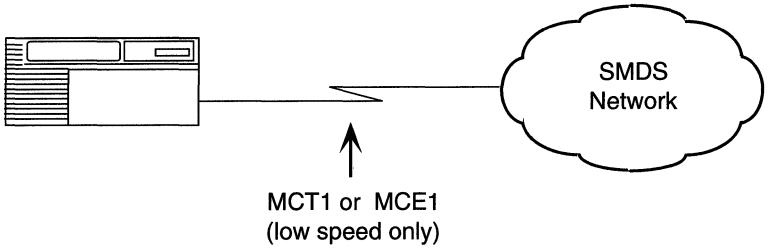


Figure 2-2. Low Speed Access to SMDS Network

Another low-speed SMDS option is to use a low-speed DSU/CSU to connect to the network. In this case, a V.35 cable physically connects the router to the DSU/CSU (Figure 2-3).

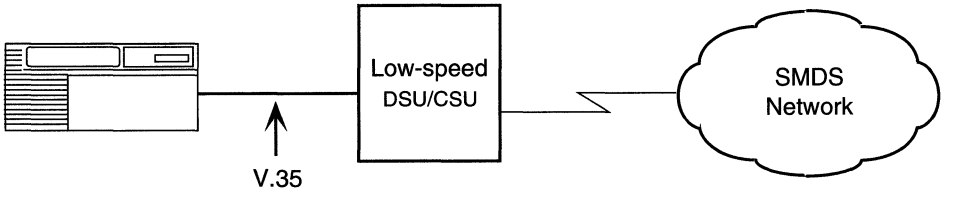


Figure 2-3. Low Speed Access to SMDS Network via a Low-Speed DSU

Requirements for the Router and the DSU/CSU

The next sections detail configuration requirements for the router and DSU/CSU to implement high speed SMDS.

DXI Protocol Requirements

Version 3.2 of the DXI protocol manages the data exchange between the router and the DSU/CSU. Because the router does not support earlier DXI versions, the DSU/CSU must support DXI Version 3.2. DXI Version 3.2 provides an optional *heartbeat poll* mechanism to periodically verify the router and DSU/CSU connection.

Be sure to enable heartbeat polling on the DSU/CSU.

The DXI provides support for both 16-bit and 32-bit CRCs; therefore, you must make sure that the CRC values for both the router and the DSU/CSU match. This means that if you set the router to 16-bit CRCs, set the DSU/CSU to 16-bit CRCs. If necessary, you can modify the CRC values (16-bit or 32-bit) for both synchronous and HSSI connections.

Local Management Interface

The Local Management Interface (LMI) protocol works in conjunction with the DXI to facilitate the exchange of management information between the router and the DSU/CSU. The LMI uses a subset of the Simple Network Management Protocol (SNMP) to provide for router management queries, DSU/CSU responses to queries, and DSU/CSU-generated asynchronous trap events.

Before enabling the LMI, ensure that the DSU/CSU supports this feature and that you enable it on the DSU/CSU.

Protocols Supported by SMDS

SMDS service can operate with the following protocols:

- AppleTalk
- Bridge (including Spanning Tree)
- DECnet
- Internet Protocol (IP), including Address Resolution Protocol (ARP) support
- Internet Packet Exchange (IPX)
- Source Routing with Wellfleet 8101 encapsulation.
- VINES
- Xerox Network System (XNS)

Note: SMDS does not support OSI.

Protocol Prioritization

When you configure your router, you can prioritize the traffic sent across a synchronous line interface using a process called *protocol prioritization*. Being able to prioritize traffic is important time-sensitive applications.

For example, a user at Router A participating in a Telnet session with Router B requires a more immediate response than a user at Router A performing a file transfer with Router B.

When you select SMDS on a circuit, the router automatically enables protocol prioritization because SMDS data, specifically heartbeat poll and LMI messages to the DSU/CSU, must have priority over other data. Level 3 PDUs do not require prioritization.

Although protocol prioritization is set automatically, you still need to configure priorities and filters. For more information about protocol prioritization, see *Configuring Filter Options for Wellfleet Routers*.

Multinet

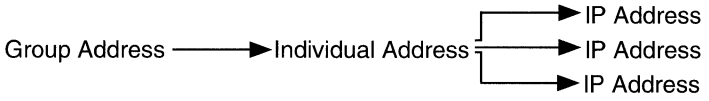
Multinet is a feature of the Internet Protocol (IP) that enables you to configure one SMDS individual address along with one SMDS group address for a single subscriber-to-network interface (SNI) and then associate multiple logical IP subnetworks with these single SMDS addresses.

A second variation of a multinet configuration allows you to have multiple SDMS individual addresses along with a single SMDS group address by configuring an individual address per IP host address for the same group address. For information about IP, refer to *Customizing IP Services.*

Figure 2-4 offers a conceptual drawing of the two types of multinet configurations.

Type 1

Single group and individual addresses, multiple IP address



Type 2

Single group address, multiple individual and IP address

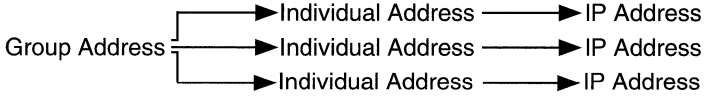


Figure 2-4. Multinetting SMDS and IP Addresses

An SMDS group address is one address that instructs an SMDS switch to broadcast information from the router to multiple destination nodes. SMDS individual addresses within the SMDS group identify these nodes. Like an SMDS individual address, the group address is a media access layer (MAC) address in an E.164 format. E.164 addresses are 64-bit address, which for SMDS, are similar to phone numbers.

The advantage of a multinet configuration is that it allows you to support many IP networks over one SMDS line by allowing many hosts on a single logical IP subnetwork. A multinet network is economical because you do not have to purchase as many SMDS group address from your SMDS provider as you might with other configurations.

Figure 2-5 on the next page shows a sample multinet configuration.

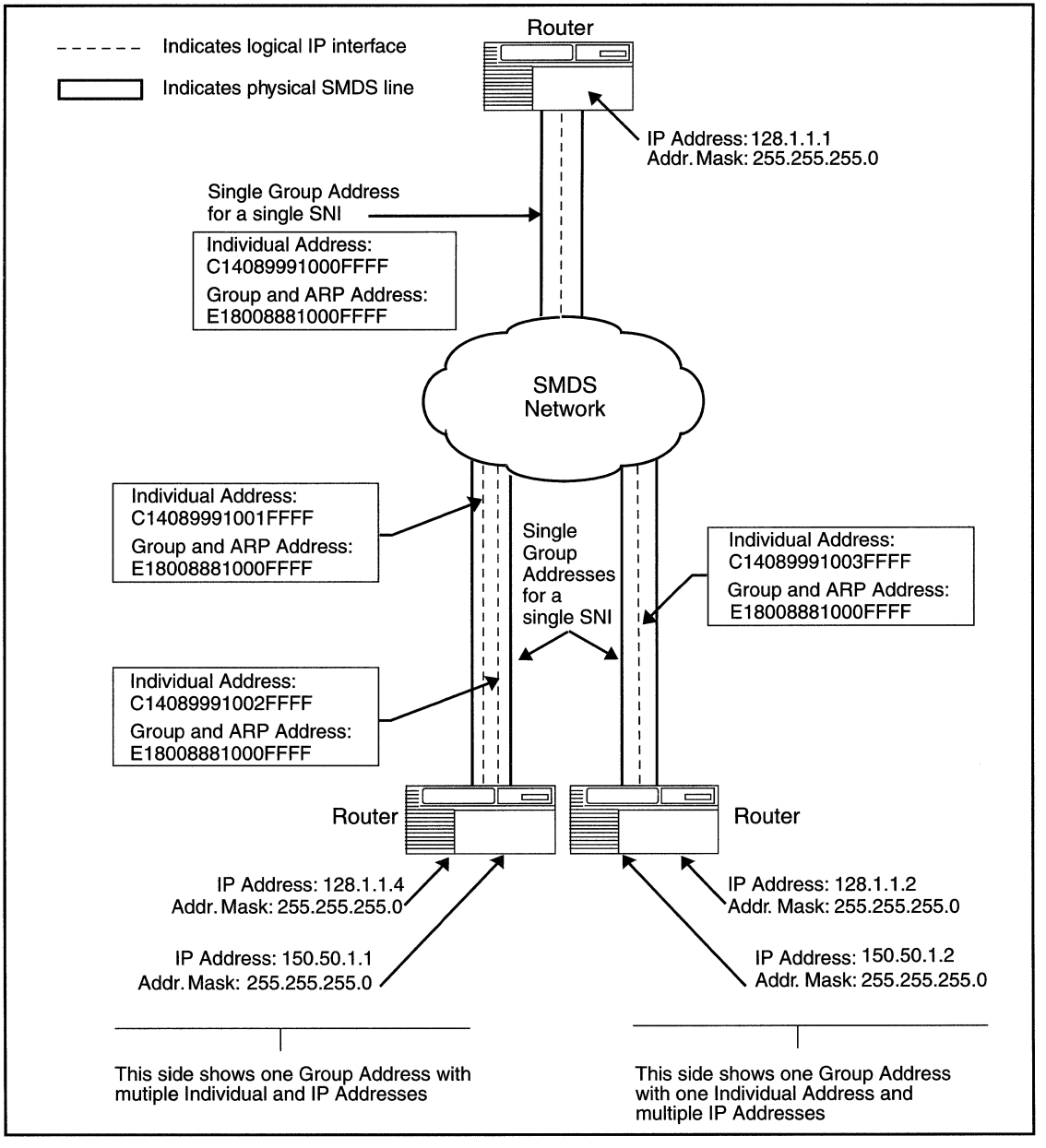


Figure 2-5. Multinet Configuration

To configure multinet:

1. In your SMDS configuration parameters, enter addresses in the Group Address, ARP Address, and Individual Address parameters described in Chapter 3 of this book.
2. In your IP interface configuration, enter the same addresses that you just entered in the SMDS parameters in the previous step. The equivalent IP parameters are: SMDS Group Address, SMDS ARP Req Address, and MAC address. Refer to *Configuring IP Services* for information about IP these parameters.
3. Add a new IP interface with a unique IP address, which includes a network/subnet and host address.
4. Enter the same SMDS Group, ARP address, and Individual Address that you entered in Step 2 for this new IP interface.

Note: You may also configure many individual addresses for an SMDS group address, but ensure that each individual address within a group is unique.

Multigroup

Multigroup is a feature of the Internet Protocol (IP) that enables you to configure multiple SMDS group addresses on the same subscriber-to-network interface (SNI), which is the access interface to the SMDS network. The router implements multigroup according to RFC 1209. For information about IP, refer to *Customizing IP Services.*

Figure 2-6 shows a conceptual drawing of a multigroup configuration.

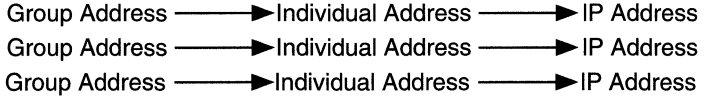


Figure 2-6. Multigrouping SMDS and IP Addresses

An SMDS group address is one address that instructs an SMDS switch to broadcast information from the router to multiple destination nodes. SMDS individual addresses within the SMDS group identify these nodes. Like an SMDS individual address, the group address is a media access layer (MAC) address in an E.164 format. E.164 addresses are 64-bit address, which for SMDS, are similar to phone numbers.

Once you configure an SMDS group address, you can then assign this group address to at least one IP subnetwork. An IP address identifies the subnetwork.

By associating or *pairing* a different SMDS group address with each IP address, you achieve multigrouping. The advantage of a multigroup configuration is that it enables you to use one SMDS physical line (SNI) to connect many nodes located on different subnetworks. It also allows you to limit broadcast and multicast traffic, such as Routing Information Protocol (RIP) updates, Address Resolution Protocol (ARP) updates, and Open Shortest Path First (OSFP) messages, to their respective SMDS groups.

A Sample Multigroup Configuration

Figure 2-7 illustrates a multigroup configuration.

In this figure, two separate subnetworks share the same SNI. The routers in these networks use RIP updates to communicate network information. The routers broadcast RIP updates to each node on the network. Because each RIP network shares an SNI, the only way to prevent RIP updates from interfering with one another is to isolate these subnetworks by associating each one with a different SMDS group address.

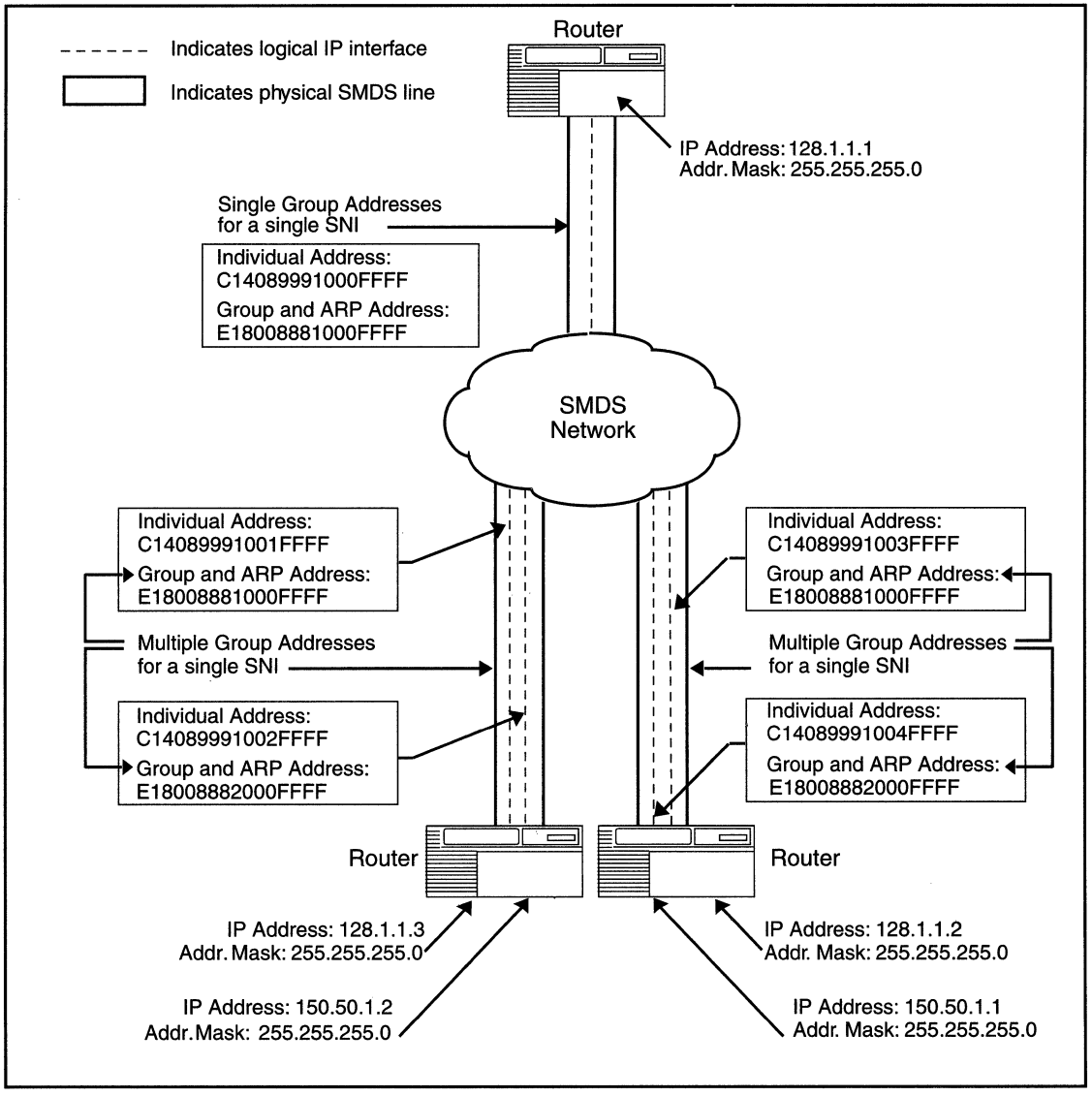


Figure 2-7. Multigroup Configuration

To configure multigroup, follow these steps:

1. In your SMDS configuration parameters, enter addresses in the Group Address, ARP Address, and Individual Address parameters described in Chapter 3 of this book.
2. In your IP interface configuration, enter the same addresses that you just entered in the SMDS parameters in the previous step. The equivalent IP parameters are SMDS Group Address, SMDS ARP Req Address, and MAC address. Refer to *Customizing IP Services* for information about IP these parameters.
3. Add a new IP interface with a unique IP subnetwork address. This address should include a network/subnet and host address.
4. Enter a new SMDS Group, ARP address, and Individual Address for this new IP interface. The IP interface parameters override these same parameters in the SMDS configuration for this and subsequent IP interfaces.

Configuring Synchronous Lines for SMDS

If you enable SMDS on a circuit, note that Site Manager automatically sets the following synchronous line parameters as follows:

Parameter	Value
BOFL	Disable
Promiscuous	Enable
Service	Transparent
WAN Protocol	SMDS

For more information on these parameters, refer to *Configuring Wellfleet Routers.*

Chapter 3
Editing SMDS Parameters

This chapter describes how to edit SMDS parameters for the SMDS interfaces on your router.

Note: You must have already configured at least one SMDS interface on the router in order to edit SMDS parameters. If you have *not* yet configured an SMDS interface, or want to add additional SMDS interfaces, see *Configuring Wellfleet Routers*.

Access all SMDS parameters from the Configuration Manager window shown in Figure 3-1 (refer to *Configuring Wellfleet Routers* for instructions on accessing this window).

For each SMDS parameter, this chapter provides information about default settings, valid parameter options, the parameter function, instructions for setting the parameter, and the Management Information Base (MIB) object ID.

The Technician Interface allows you to modify parameters by issuing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, refer to *Using Technician Interface Software*.

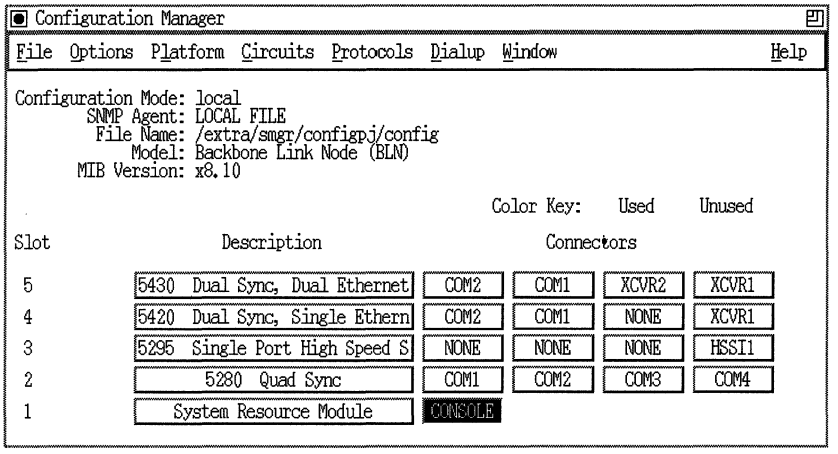


Figure 3-1. Configuration Manager Window

Editing SMDS Interface Parameters

Edit SMDS interface parameters from the SMDS Interface Parameters window (Figure 3-2). To access this window, use the following procedure.

1. Select the Protocols→SMDS→Interfaces option from the Configuration Manager window shown in Figure 3-1. Site Manager displays the SMDS Interface List window (Figure 3-2).

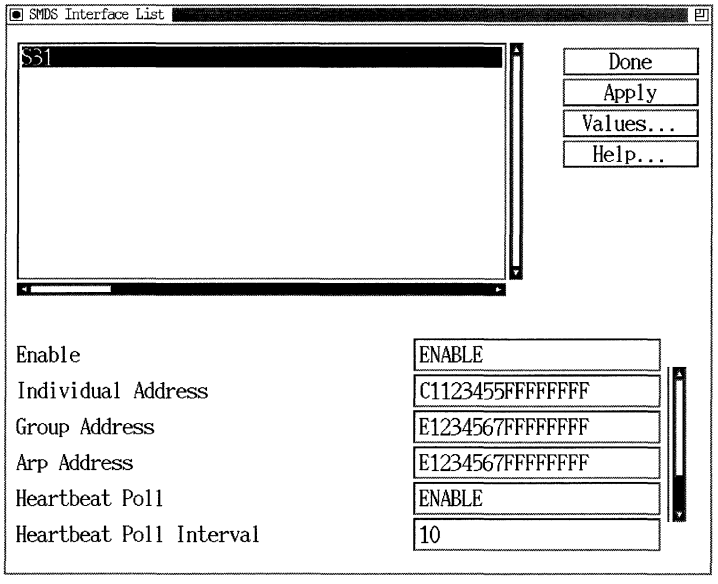


Figure 3-2. SMDS Interface List Window

2. Select the interface you want to edit from the scroll box in the SMDS Interface List window, and then set the parameters, referring to the parameter descriptions following these procedures.
3. Click on the Apply button to save your changes when you are finished. Repeat this step for each SMDS interface you want to edit.
4. Click on the Done button when you finish your configuration. Site Manager returns you to the Configuration Manager window (Figure 3-1).

SMDS Interface Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters on the SMDS Interface List window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables SMDS service on this interface.
Instructions:	Set to Disable if you want to temporarily disable SMDS service on this interface, rather than delete it. Set this parameter to Enable if you want to re-enable SMDS service.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.2

Parameter:	**Individual Address**
Default:	None
Options:	A complete SMDS E.164 address specified by the SMDS subscription agreement that you have with your SMDS provider.
Function:	Provides a MAC-layer address.
Instructions:	Enter the complete SMDS E.164 address, for example, C15082348734FFFF. To configure this parameter for a multinet or multigroup configuration, refer to Chapter 2 for instructions.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.5

Parameter:	**Group Address**
Default:	None
Options:	A complete SMDS E.164 address specified by the SMDS subscription agreement that you have with your SMDS provider.
Function:	Provides a MAC-layer multicast address for this SMDS interface.
Instructions:	Enter the complete SMDS E.164 group address, for example, E16175552876FFFF. To configure this parameter for a multinet or multigroup configuration, refer to Chapter 2 for instructions.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.6

Parameter:	**ARP Address**
Default:	None
Options:	A complete SMDS E.164 address specified by the SMDS subscription agreement that you have with your SMDS provider.
Function:	Provides an address resolution multicast address.
Instructions:	Enter the complete SMDS E.164 address, for example, E16175552876FFFF. To configure this parameter for a multinet or multigroup configuration, refer to Chapter 2 for instructions.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.7

Parameter:	**Heartbeat Poll**
Default:	Disable
Options:	Enable | Disable
Function:	Enables or disables DXI heartbeat polling. DXI Version 3.2 provides a heartbeat polling mechanism, which verifies the integrity of the router/DSU connection. To implement heartbeat polling, the router transmits a constant stream of keep-alive messages to the DSU. The DSU, in turn, sends an acknowledgment to the router.
Instructions:	Set to Enable to enable heartbeat polling. Set to Disable if the DSU/CSU in your network does not support heartbeat polling.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.8

Parameter:	**Heartbeat Poll Interval**
Default:	10
Options:	6 to 1023 seconds
Function:	Specifies the time interval between each heartbeat poll message that the router transmits. If you disable heartbeat polling, this parameter is nonfunctional.
Instructions:	Set to the number of seconds between the transmission of heartbeat poll messages. Be sure to set the Heartbeat Poll Interval parameter to a value greater than 5 seconds, the length of the heartbeat poll acknowledgment timer. We recommend that you accept the default value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.9

Parameter:	**Heartbeat Poll Down Count**
Default:	3
Options:	1 to 1023 messages
Function:	Specifies the number of heartbeat poll messages that the router will send without acknowledgment from the DSU before it declares the router/DSU connection down. If you disable heartbeat polling, this parameter is nonfunctional.
Instructions:	Set to the number of unacknowledged heartbeat poll messages that the router will tolerate before taking the router/DSU connection down. We recommend you accept the default.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.10

Parameter:	**LMI Network Mgmt**
Default:	Disable
Options:	Enable | Disable
Function:	Enables or disables LMI network management. LMI works with DXI Version 3.2. LMI is an SNMP-like protocol that enables the exchange of management information between the router and the DSU/CSU.
Instructions:	Set to Enable to enable the LMI protocol. Set to Disable if the DSU/CSU in your network does not support the LMI.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.3.1.11

Deleting SMDS from the Router

To delete SMDS service from all router circuits, complete the following steps:

1. From the Configuration Manager window (Figure 3-1), select Protocols→SMDS→Delete SMDS. A window pops up and prompts

   ```
   Do you REALLY want to delete SMDS?
   ```

2. Click on the OK button. Site Manager returns you to the Configuration Manager window. SMDS is no longer configured on the router.

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