

Configuring SMDS

The Switched Multimegabit Data Service (SMDS) is a wide-area networking service offered by some Regional Bell Operating Companies (RBOCs) and MCI. This chapter describes the configuration tasks for the SMDS packet-switched software. For a complete description of the commands mentioned in this chapter, refer to the “SMDS Commands” chapter in the *Access and Communication Servers Command Reference* publication. For historical background and a technical overview of SMDS, see the *Internetworking Technology Overview* publication.

Cisco’s Implementation of SMDS

Cisco’s implementation of the SMDS protocol is based on cell relay technology as defined in the Bellcore Technical advisories, which are based on the IEEE 802.6 standard. We provide an interface to an SMDS network using DS-1 or DS-3 high-speed transmission facilities. Connection to the network is made through a device called an SDSU—an SMDS Channel Service Unit/Digital Service Unit (CSU/DSU) developed jointly by Cisco Systems and Kentrox. The SDSU attaches to a Cisco communication server through an RS-449 connection. On the other side, the SDSU terminates the line.

Cisco’s implementation of SMDS supports the IP and Novell IPX internetworking protocols.

IP routing is fully dynamic; that is, the routing tables are determined and updated dynamically. Routing of the other supported protocols requires that you establish a static routing table of SMDS neighbors in a user group. Once this is set up, all interconnected communication servers provide dynamic routing.

Cisco’s SMDS implementation includes multiple logical IP subnet (MultiLIS) support as defined by RFC 1209. This RFC describes routing IP over an SMDS cloud where each connection is considered a host on one specific private network and points to cases where traffic must transit from network to network.

Cisco’s implementation of SMDS also provides the Data Exchange Interface (DXI) Version 3.2 with heartbeat. The heartbeat mechanism periodically generates a heartbeat poll frame.

When a multicast address is not available to a destination, *pseudobroadcasting* can be enabled to broadcast packets to those destinations using a unicast address.

SMDS Addresses

All addresses for SMDS service are assigned by the service provider and can be assigned to individuals and groups.

Addresses are entered in the Cisco SMDS configuration software using an E prefix for Multicast addresses and a C prefix for Unicast addresses.

Our software expects the addresses to be entered in E.164 format, which is 64 bits (15-digit addressing). The first 4 bits are the address type and the remaining 60 bits are the address. If the first 4 bits are 1100 (0xC), the address is a unicast SMDS address, which is the address of an individual SMDS host. If the first 4 bits are 1110 (0xE), the address is a multicast SMDS address, which is used when broadcasting a packet to multiple end points. The 60 bits of the address are in binary-coded decimal (BCD) format. Each 4 bits of the address field presents a single telephone number digit, allowing for up to 15 digits. At a minimum, you must specify at least 11 digits (44 bits). Unused bits at the end of this field are filled with ones.

An example of an E.164 address follows:

```
C14155561313FFFF
```

Note Previous versions of our software supported 48-bit SMDS addresses. If, when using the current version of the software, you write the configuration to NVRAM, the full 64-bit SMDS address is written. Previous versions of the software will no longer be able to read the new SMDS configuration from NVRAM. However, the current version of the software can read previous versions of the configuration in NVRAM.

The addresses can be entered with periods in a manner similar to Ethernet-style notation, or simply as a string of digits.

The following is an example of an individual address entered in Ethernet-style notation:

```
C141.5555.1212.FFFF
```

The following is an example of a group address:

```
E180.0999.9999.FFFF
```

For additional technical references about SMDS, refer to the appendix “References and Recommended Readings” in the *Access and Communication Servers Command Reference* publication.

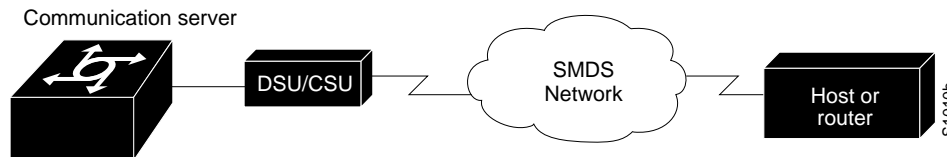
SMDS Hardware Requirements

You need the following hardware, equipment, and special software to configure SMDS:

- A CSC-MCI or CSC-SCI serial interface controller card or HSSI interface (ASM-CS)
 - To operate on CSC-SCI or CSC-MCI cards, SMDS requires that the appropriate microcode version be installed. Version numbers are 1.2 (or later) for CSC-SCI and 1.7 (or later) for CSC-MCI.
- EIA/TIA-449 or V.35 applique (chassis-based systems) or EIA/TIA-449 transition cable (IGS)
- The packet-switched software option with the system software
- The SDSU device

Figure 10-1 illustrates the connections between the different components.

Figure 10-1 Typical SMDS Configuration



SMDS Configuration Task List

Before you can begin the configuration tasks, you must have already obtained your SMDS addresses from your service provider. You need two types of addresses:

- The group address for broadcasts
- The SMDS hardware (individual) address for each communication server that will interface directly into the SMDS network (that is, customer premises equipment).

There are basic steps that you must perform to enable SMDS. In addition, you can customize SMDS for your particular network needs and monitor SMDS connections. Perform the tasks in the following sections:

- Enable SMDS on the Interface
- Customize Your SMDS Network
- Monitor the SMDS Connection

See the end of this chapter for configuration examples.

Enable SMDS on the Interface

You must perform the tasks in the following sections to enable SMDS:

- Set SMDS Encapsulation
- Specify the SMDS Address
- Establish Address Mapping
- Provide a Map to a Multicast Address
- Enable ARP
- Enable Broadcast ARP Messages

Set SMDS Encapsulation

To set SMDS encapsulation at the interface level, perform the following task in interface configuration mode:

Task	Command
Enable SMDS on the interface.	encapsulation smds

For examples of enabling SMDS encapsulation, see any of the examples in the section “SMDS Configuration Examples” later in this chapter.

Specify the SMDS Address

To specify the SMDS individual address for a particular interface, perform the following task in interface configuration mode:

Task	Command
Enter an individual address provided by the SMDS service provider.	smds address <i>smds-address</i>

For examples of specifying the SMDS address, see any of the examples in the section “SMDS Configuration Examples” later in this chapter.

Establish Address Mapping

Routing tables are configured dynamically when IP and CLNS routing are configured. For any other protocol, you must configure a static map between an individual SMDS address and a higher-level protocol address. To establish address mapping, perform the following task in interface configuration mode:

Task	Command
Define static entries for those communication servers that are SMDS remote peers.	smds static-map <i>protocol-type protocol-address smds-address</i> [broadcast]

The supported protocols and the keywords to enable them are as follows:

- IP—**ip**
- Novell IPX—**ipx**

For examples of establishing address mapping, see any of the examples in the section “SMDS Configuration Examples” later in this chapter.

Provide a Map to a Multicast Address

You can map an SMDS group address to a broadcast or multicast address used by higher-level protocols. If you use this feature, the **broadcast** keyword does not need to be specified in the **smds static map** command, and the communication server will not need to replicate each broadcast address. To map to a multicast address, perform the following task in interface configuration mode:

Task	Command
Map an SMDS group address to a multicast address used by higher-level protocols.	smds multicast <i>protocol-type smds-address</i>

The protocols supported and the keywords to enable them are as follows:

- IP—**ip**
- Novell IPX—**ipx**

For examples of mapping to a multicast, see any of the examples in the section “SMDS Configuration Examples” later in this chapter.

Enable ARP

When you enable the Address Resolution Protocol (ARP), you can choose to enable either a dynamic ARP cache or one built statically. To enable ARP, perform one of the following tasks in interface configuration mode:

Task	Command
Enable ARP and dynamic routing.	smds enable-arp
Enable ARP and a static routing table.	arp ip-address smds-address smds

An SMDS network can be thought of in much the same way as an X.25 cloud. The premises equipment (in this case our communication server) represents the edge of the cloud. The service provider enables communication across the cloud. However, proper configuration is needed for communication to occur. This configuration will differ between protocol families.

One major difference between protocol families is dynamic versus static routing among the communication servers (called remote peers) on the periphery of the cloud. For IP, routing across the SMDS cloud is fully dynamic. No action on the user's part is needed to map higher-level protocol addresses to SMDS addresses. Both IP and ARP can be configured and a dynamic ARP routing table enabled. See the section "Configure Specific Protocols" later in this chapter for more information.

Enable Broadcast ARP Messages

When an ARP server is present in the network, you can enable broadcast ARP messages that are sent to all ARP SMDS addresses or to all IP SMDS multicast addresses when ARP addresses are not present. To enable broadcast ARP messages, perform the following task in interface configuration mode:

Task	Command
Enable broadcast ARP messages.	smds multicast arp smds-address [ip-address mask]

Customize Your SMDS Network

Perform the tasks in the following sections, as appropriate, for your network:

- Configure Specific Protocols
- Configure Multiple Logical IP Subnets
- Reenable the Data Exchange Interface Version 3.2 with Heartbeat Support
- Configure Pseudobroadcasting
- Enable IP Fast Switching

Configure Specific Protocols

Some protocol families are dynamically routed. For IP and CLNS, routing is fully dynamic, and no action on your part is needed to map higher-level protocol addresses to SMDS addresses. But for the other supported protocols, you must make a static entry for each communication server to communicate with all other peer communication servers. The static entries only need to be made for those communication servers that are SMDS remote peers. Nothing additional needs to be done to assure communication with other nodes behind the peer communication servers.

Table 10-1 lists protocol families and the multicasts that are needed.

Table 10-1 Protocol Families and Types of Multicasts Needed

Protocol Family	Multicasts Needed
IP	IP
Novell IPX	NOVELL

ARP and IP

For both IP and ARP, the multicast address must be configured and ARP must be enabled. ARP multicast is required for only ARP servers; the IP multicast is used for ARPs and routing updates.

IPX

For IPX, the multicast address must be configured.

For IPX, RIP routing packets, SAP packets, NetBIOS Name Lookups, directed broadcasts, and traffic to the helper addresses (if that helper address is a broadcast address) will be sent to the SMDS IPX multicast address.

For IPX configurations, a static map entry must be made for each remote peer.

Configure Multiple Logical IP Subnets

Multiple logical IP subnets (MultiLIS) are supported as defined by RFC 1209. This RFC describes routing IP over an SMDS cloud where each connection is considered a host on one specific private network and points to cases where traffic must transit from network to network.

The MultiLIS solution allows a single SMDS interface to be treated as multiple logical IP subnets and to support routing of packets from one network to the next without using intervening routers or communication servers. When MultiLIS is enabled, the router or communication server performs routing between the subnets using IP addresses on an SMDS interface. Each supported subnet has an IP address, a unicast SMDS E.164 address, and a multicast SMDS E.164 address configured on the SMDS interface. Broadcast packets are duplicated and transmitted to all IP networks on the specified SMDS interface and use the associated multicast SMDS address for the network.

Only routers or communications servers that require knowledge of multiple IP networks need to be configured with multipoint subinterfaces that correspond to different networks.

To configure a communication server to have multipoint subinterfaces for multiple logical IP subnets, perform the following tasks in interface configuration mode:

Task	Command
Step 1 Define a logical subinterface for each IP network.	interface serial <i>interface.subinterface</i> multipoint ¹
Step 2 Configure the subinterface as an IP network.	ip address <i>ip-address mask</i> ²
Step 3 Assign a unicast SMDS E.164 address to the subinterface.	smds addr <i>smds-address</i>
Step 4 Assign a multicast SMDS E.164 address to each protocol supported on the subinterface.	smds multicast <i>protocol smds-address</i>
Step 5 Enable ARP on the subinterface, as required by the protocol.	smds enable-arp

1. This command is documented in the “Interface Configuration Commands” chapter of the *Access and Communication Servers Command Reference* publication.
2. This command is documented in the “IP Commands” chapter of the *Access and Communication Servers Command Reference* publication.

For an example of how to configure MultiLIS, see the section “Configuring a MultiLIS Network Example” later in this chapter.

Reenable the Data Exchange Interface Version 3.2 with Heartbeat Support

By default, SMDS provides the Data Exchange Interface (DXI) Version 3.2 heartbeat process as specified in the SIG-TS-001/1991 standard. If you find you must reenable the DXI heartbeat, perform the following task in interface configuration mode:

Task	Command
Configure DXI 3.2.	smds dxi

The DXI mechanism encapsulates SMDS packets in a DXI frame before they are transmitted. The heartbeat mechanism automatically generates a heartbeat poll frame every 10 seconds. The Interim Local Management Interface (ILMI) is not supported. Refer to the *Access and Communication Servers Command Reference* publication for more information about DXI 3.2.

Note If you are running back-to-back serial lines, disable keepalive on SMDS interfaces; otherwise, DXI will declare the link down.

Configure Pseudobroadcasting

Some hosts do not support multicast E.164 addresses. This is a problem in IP where frequent broadcast packets are sent, because routing updates are generally broadcast. IP and ARP depend on the use of multicast addresses to determine a route to a destination IP address. A mechanism was needed to artificially support the use of broadcast where multicast E.164 addresses do not exist; the result is that a multicast address is not available to a destination, pseudobroadcasting can be enabled to broadcast packets to those destinations using a unicast address.

To configure pseudobroadcasting, perform the following task in interface configuration mode:

Task	Command
Configure pseudobroadcasting.	smds static-map <i>protocol-type protocol-address</i> <i>smds-address</i> [broadcast]

For an example of how to configure pseudobroadcasting, see the section “Configuring Pseudobroadcasting Example” later in this chapter.

Enable IP Fast Switching

SMDS fast switching of IP packets provides faster packet transfer on serial links with speeds above 56 kbps. Use fast switching if you use high-speed, packet-switched, datagram-based WAN technologies such as Frame Relay offered by service providers.

By default, SMDS fast switching is enabled.

To reenable fast switching, perform the following tasks in interface configuration mode:

Task	Command
Step 1 Set SMDS encapsulation.	encapsulation smds
Step 2 Enable the interface for fast switching.	ip route-cache¹

1. This command is documented in the “IP Commands” chapter in the *Access and Communication Servers Command Reference* publication.

Monitor the SMDS Connection

To monitor the SMDS connection, perform one or more of the following tasks in EXEC mode:

Task	Command
Monitor ARP activity.	show arp
Display the individual addresses and the interface with which they are associated.	show smds addresses
Display all SMDS addresses that are mapped to higher-level protocol addresses.	show smds map
Display packet traffic activity.	show smds traffic

SMDS Configuration Examples

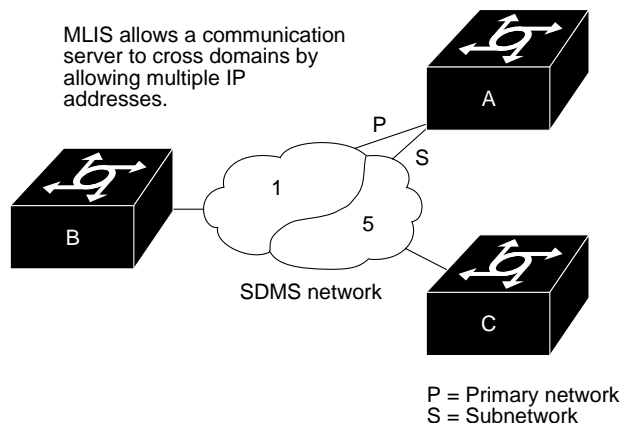
The following section provides typical configuration file examples you can use as models for your network configurations:

- Configuring a MultiLIS Network Example
- Configuring Pseudobroadcasting Example

Configuring a MultiLIS Network Example

In the following example, Communication Servers A, B, and C are connected to an SMDS cloud (see Figure 10-2).

Figure 10-2 Multiple Logical IP Subnet Configuration



Communication server A knows about two IP networks and can communicate with communication servers B and C directly.

Communication server B can communicate with communication server A directly, and with communication server C through communication server A.

Communication server C can talk to communication server A directly and to communication server B through communication server A.

Notice that a packet destined to communication server B from communication server C must make two hops on the cloud through the same interface on communication server A. This issue was considered at the time the MultiLIS proposal was made, but was not deemed critical. It is also a nonstandard configuration.

Configuration for Communication Server A

```
interface serial 0
encapsulation smds
smds address c120.1111.2222
ip address 131.108.1.30 255.255.255.0
smds multicast ip e180.0999.9999
smds enable-arp
!
interface serial 1
encapsulation smds
smds address c111.2222.2222.2222
ip address 1.1.1.3 255.0.0.0
smds multicast ip e180.0999.9999
smds enable-arp
```

Configuration for Communication Server B

```
interface serial 0
encapsulation smds
smds address c120.1234.5678
ip address 131.108.1.10 255.255.255.0
smds multicast ip e180.0999.9999 255.255.255.0
smds enable-arp
```

Configuration for Communication Server C

```
interface serial 1
encapsulation smds
smds address c120.9999.8888
ip address 131.108.5.20 255.255.255.0
smds multicast ip e180.0333.3333
smds enable-arp
```

Configuring Pseudobroadcasting Example

In the following example, an ARP broadcast from communication server A is sent to multicast address E180.0999.9999 to communication server B and to unicast address C120.1234.5678 to communication server C. The reply from communication server C uses the unicast address C120.1111.2222.E164 for the return reply if it is the target of the ARP request. IGRP and Enhanced IGRP broadcast updates follow the same rules.

Configuration for Communication Server A

```
interface serial 0
encapsulation smds
smds address c120.1111.2222
ip address 131.108.1.30 255.255.255.0
smds multicast ip e180.0999.9999
smds static-map ip 131.108.1.10 c120.1234.5678 broadcast
smds enable-arp
```

Configuration for Communication Server B

```
interface serial 4
smds address c120.9999.8888
ip address 131.108.1.20
smds multicast ip e180.0999.9999
smds enable-arp
```

Configuration for Communication Server C

```
interface serial 2
smds address c120.1234.5678
ip address 131.108.1.10
smds static-map ip 131.108.1.30 c120.1111.2222 broadcast
smds enable-arp
```