

Configuring SMDS

The Switched Multimegabit Data Service (SMDS) is a wide-area networking service offered by some Regional Bell Operating Companies (RBOCs) and by 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 *Communication Server 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 CSU/DSU (Channel Service Unit/Digital Service Unit) 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.

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.

And finally, 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.

A group address (also defined as a multicast address) is entered in the Cisco SMDS configuration software using the standard E prefix, as follows: the E1 prefix specifies North American addresses; the E0 prefix specify European addresses.

Our software expects the addresses to be entered in E.164 format. The E.164 format is 64 bits. The first four bits are address type code, followed by four bits of country code, followed by 10 BCD digits, with the final 16 bits all ones.

An example of an E.164 address follows:

```
C14155561313FFFF
```

Note The full E.164 address is not required. We support the first 12 digits and force the last 4 digits to 0xF. The trailing Fs are not needed. They are not displayed, and it is not necessary to type them when entering an address.

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
```

The following is an example of a group address:

```
E180.0999.9999
```

For additional technical references about SMDS, see Appendix A, "References and Recommended Readings" in the *Communication Server Command Reference*.

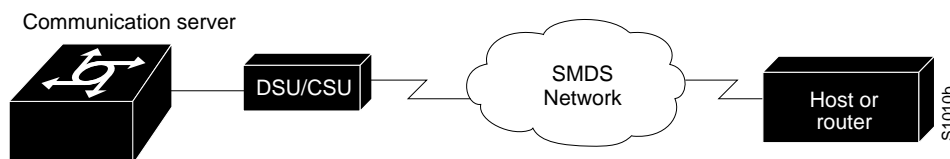
SMDS Hardware Requirements

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

- A CSC-MCI or CSC-SCI serial interface controller card
 - 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.
- RS-449 or V.35 applique (chassis-based systems) or RS-449 transition cable (IGS)
- The SDSU device
- The packet-switched software option with the system software

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

Figure 1-1 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. All of these tasks are outlined in the list that follows:

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

See the *Communication Server Command Reference* publication for information about the commands listed in the tasks.

Enable SMDS on the Interface

You must perform the following tasks to enable SMDS:

- Set SMDS encapsulation
- Specify the SMDS address
- Establish address mapping
- Provide a map to a multicast address
- Enable address resolution protocol (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

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 is 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**
- ARP—**arp**
- Novell IPX—**novell** or **ipx**

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

Enable Address Resolution Protocol (ARP)

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

Task	Command
Enable ARP and dynamic routing.	smds enable-arp
Enable ARP and a static routing table	arp <i>IP-address SMDS-address</i> smds

An SMDS network can be thought of in much the same way as an X.25 cloud. The premises equipment, in this case a Cisco 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 "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 <i>SMDS-address</i> <i>[IP-address mask]</i>

Customize Your SMDS Network

Perform the following tasks, 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

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

Table 1-1 Protocol Families and Types of Multicasts Needed

Protocol Family	Multicasts Needed
IP	IP, ARP
Novell	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.

Novell

For Novell, the multicast address must be configured.

For Novell, 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 Novell multicast address.

Configure Multiple Logical IP Subnets

Multiple logical IP subnet (MultiLIS) is 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 IP subnets and to support routing of packets from one network to the next without using intervening communication servers. When enabled, the communication server will perform routing between the subnets configured using secondary IP addresses on an SMDS interface. Each supported subnet has a secondary IP address and multicast IP 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. to configure multiple logical IP subnets, perform the following task in interface configuration mode:

Task	Command
Configure MultiLIS.	smds multicast ip <i>SMDS-address</i> <i>[IP-address IP-mask]</i>

For an example of how to configure MultiLIS, see the section “Example of Configuring a MultiLIS Network” 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 re-enable 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. See the *Communication Server Command Reference* publication for more information about DXI 3.2.

Configure Pseudo-broadcasting

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

To configure pseudo-broadcasting, perform the following task in interface configuration mode:

Task	Command
Configure pseudo-broadcasting.	smds static-map ip protocol-type protocol-address broadcast

Pseudo-broadcasting can degrade performance. For an example of how to configure pseudo-broadcasting, see the section “Example of Configuring Pseudobroadcasting” later in this chapter.

Monitor the SMDS Connections

To monitor SMDS connections, perform 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

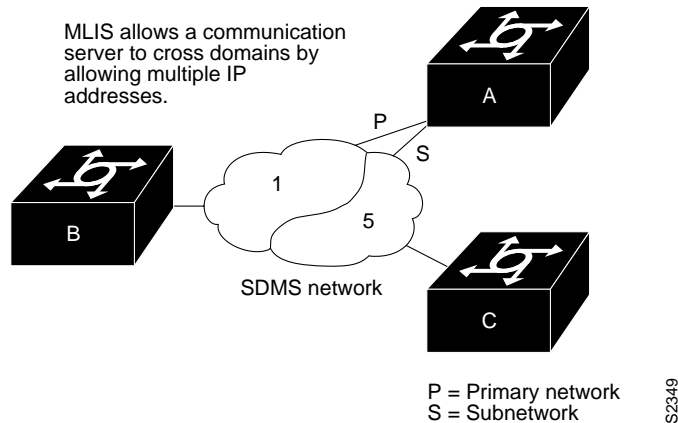
Following are some typical configuration file examples you can use as models for your network configurations:

- Example of Configuring a MultiLIS Network
- Example of Configuring Pseudobroadcasting

Example of Configuring a MultiLIS Network

In the following example, Communication Servers A, B, and C are connected to an SMDS cloud (see Figure 1-2).

Figure 1-2 Multiple Logical IP Subnet Configuration



Communication Server A can communicate with Communication Servers B and C directly. Communication Server B can communicate to Communication Server A directly, and to Communication Server C via Communication Server A. Communication Server C can talk to Communication Server A directly and to Communication Server B via 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 when the MultiLIS proposal was made and deemed not to be a critical one. It is also a nonstandard configuration.

Configuration for Communication Server A

```
interface serial 0
smds address c120.1111.2222
ip address 131.108.1.30 255.255.255.0
ip address 131.108.5.30 255.255.255.0 secondary
smds multicast ip e180.0999.9999
smds multicast ip e180.0333.3333 131.108.5.0 255.255.255.0
```

Configuration for Communication Server C

```
interface serial 4
smds address c120.9999.8888
ip address 131.108.5.20 255.255.255.0
ip address 131.108.1.20 255.255.255.0 secondary
smds multicast ip e180.0333.3333
smds multicast ip e180.0999.9999 131.108.1.0 255.255.255.0
```

Configuration for Communication Server B

```
interface serial 2
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
```


Example of Configuring Pseudobroadcasting

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 E.164 for the return reply if it is the target of the ARP request. IGRP broadcast updates follow the same rules. Pseudobroadcasting can degrade performance.

Configuration for Communication Server A

```
interface s 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 s 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 s 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
```

