Digital Switching Systems

DMS-250

ISDN Reference Manual

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DMS-250

ISDN Reference Manual

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- MAUUI Over Release Message for NCAUUI (AX1408)
- PRI Connected Number Transport (AX1414)
- MAUUI In First Call Clearing Message Before Connect (A60006311)

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About this document

This document serves as the primary rate interface (PRI) applications handbook for DMS-250 switch telecommunications managers and coordinators. It describes the applications engineered for the PRI connection between a DMS-250 switch and a private branch exchange (PBX).

When to use this document

This document provides references, procedures, and detailed information about the following features:

- ISDN hardware
- ISDN messaging
- customer-deliverables

Intended audience

This document provides references, procedures, and detailed information about ISDN hardware, messaging, PRI applications, and customer-deliverable features. This document describes the DMS-250 switch hardware configuration and available software features; it is a reference manual for operating company personnel using the ISUP DMS-250 switch.

How this book is organized

This document contains the following chapters, followed by a list of terms.

- Chapter 1, "Introduction," describes channels supported by PRI, defines PRI applications, and gives an overview of the protocol for open systems interconnection (OSI) and ISDN layers.

- Chapter 2, "DS-1 configurations," provides an overview of how a DMS-250 switch connects a DS-1 trunk to a single-line PBX; describes the hardware configuration for the DS-1, commissioning details, and performance and maintenance details. Included is an overview of digital trunk controller versions and integrated trunk access.

- Chapter 3, "D-channel handler," describes hardware configuration, installation, and verification procedures. Also included information about troubleshooting, test equipment, and PRI D-channel backup facility.

- Chapter 4, "Message structure and functions," defines the purpose of each of the mandatory information elements and other information elements of messages; describes messages supported for PRI call processing and their role in call processing. Included are detailed definitions of Q.931 and Q.932 messages' information elements

- Chapter 5, "Call control procedures," describes the call control procedures used to set up and take down PRI calls, including user or network parameters.

- Chapter 6, "PRI interworking," lists the interworking of PRI to various agents, and describes enhanced digital recorded announcements and PRI to ISUP interworking.

- Chapter 7, "Feature interaction," describes the services and features supported on the PRI interface, including RLP/ATP and Fraud Call Interrupt.

- Chapter 8, "Dialable Wideband Service," describes how Dialable Wideband Service works, including hardware, translation and routing, and datafilling.

- Chapter 9, "Datafill and subscription parameters," provides information on database correlation and describes interdependencies of tables and datafill order; describes subscription parameter relationships, including facility, service, and integrated access parameters.

- Chapter 10, "Service verification," outlines the verification of the various services and describes steps that guarantee services function properly and steps to isolate problems.

- Chapter 11, "Engineering recommendations," provides recommendations to simplify the configuration and engineering of the ISDN digital trunk controller PRI.

- Chapter 12, "DS-1 to DS-30 channel mapping," provides tables that show mapping of the DS-1 channel to the DS-30.

- Chapter 13, "ETSI PRI," describes the differences between North American PRI and European PRI functionality.

- Chapter 14, "NCAUUI" (Non Call Associated User to User Information), describes the service that provides PRI users at the same switch with user–to–user communication.

- Chapter 15, "NCAUUI (Two switch scenario)," provides a two switch scenario of the activated NCAUUI feature.

- Chapter 16, "PRI Connected Number Transport," describes the flow of PRI Connected Number Transport across the network.

- Chapter 17, "PRI Progress Indicator Transport," outlines the purpose of the progress indicator and maps its location in relation to the originating switch.

- Chapter 18, "MAUUI Over Release Message for NCAUUI," describes a single switch scenario for MAUUI TSC clearing for NCAUUI.

- Chapter 19, "MAUUI in First Call Clearing Message Before Connect," provides details on transporting the UUI information element from the terminating to the originating agent.

Intended audience

This document provides references, procedures, and detailed information about ISDN, and customer-deliverable features. Specifically, this document describes how to apply PRI to a network—the DMS-250 switch hardware configuration and available software features. This document is a reference manual for operating company personnel using the ISUP DMS-250 switch.

Applicability of this document

This document is written for a DMS-250 office with software release MWC18. More than one version of this document may exist. To determine whether you have the latest version of this document, check the release information in *DMS-250 Master Index of Publications*.

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increments each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the *next* software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increments each time the document is revised, but rereleased in the *same* software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *DMS-100 Family Guide to Nortel Publications*, 297-1001-001.

This document is written for all DMS-250 Family offices. More than one version of this document may exist. To determine whether you have the latest version of this document and how documentation for your product is organized, check the release information in *DMS-100 Family Guide to Nortel Publications*, 297-1001-001.

References in this document

DMS-250 Master Index of Publications is referred to in this document.

- *DMS-250 Network Control System Reference Manual*, NTP 297-2521-138

- *DMS-100 Trunks Maintenance Guide,* NTP 297-1001-595

- *Integrated Services Digital Network Product Guide*, NTP 297-2401-010

- *Integrated Services Digital Network Basic Rate Interface Maintenance Guide,* NTP 297-2401-501

- *DMS-250 Billing Records Reference Manual,* NTP 297-2521-119

- *DMS-250 Common Channel Signaling 7 Reference Manual*, NTP 297-2521-137

- *DMS-250 Operational Measurements Reference Manual,* NTP 297-2521-814

- *DMS-250 Commands Reference Manual,* NTP 297-2521-819

- *DMS-250 Logs Reference Manual*, NTP 297-2521-840

- *DMS-250 Data Schema Reference Manual,* NTP 297-2521-851

- *DMS-100 Network Management System Reference Manual,* NTP 297-1001-453

- *DMS-100 Bit Error Rate Performance Testing,* NTP 297-1001-533

- *DMS-250 Master Index of Publications,* NTP 297-2521-001

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION Information needed to perform a task

> **ATTENTION**
> If the unused DS-3 ports are not deprovisioned before a DS-1/VT
> Mapper is installed, the DS-1 traffic will not be carried through the
> DS-1/VT Mapper, even though the DS-1/VT Mapper is properly
> provisioned.

DANGER   Possibility of personal injury

> **DANGER**
> **Risk of electrocution**
> Do not open the front panel of the inverter unless fuses
> F1, F2, and F3 have been removed. The inverter contains
> high-voltage lines. Until the fuses are removed, the
> high-voltage lines are active, and you risk being
> electrocuted.

WARNING   Possibility of equipment damage

> **WARNING**
> **Damage to the backplane connector pins**
> Align the card before seating it, to avoid bending the
> backplane connector pins. Use light thumb pressure to
> align the card with the connectors. Next, use the levers on
> the card to seat the card into the connectors.

CAUTION   Possibility of service interruption or degradation

> **CAUTION**
> **Possible loss of service**
> Before continuing, confirm that you are removing the card
> from the inactive unit of the peripheral module.
> Subscriber service will be lost if you remove a card from
> the active unit.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the
following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

>BSY

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

>BSY CTRL

Variables

Variables are shown in lowercase letters:

>BSY CTRL ctrl_no

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different type:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

The following excerpt from a procedure shows the command syntax used in this document:

1   Manually busy the CTRL on the inactive plane by typing

>BSY CTRL ctrl_no
and pressing the Enter key.

where

ctrl_no   is the number of the CTRL (0 or 1)

Example of a MAP response:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

Introduction

ISDN is a digital communications network that provides users with multiple services through a single access point, and integrates voice, data, video, and messaging across the network. ISDN provides a variety of circuit-switched and packet-switched features.

An ISDN switch offers customers two methods of accessing the voice and data networks: basic rate interface (BRI) for line service, and primary rate interface (PRI) for trunk service. Both interfaces consist of time-division multiplexed, bidirectional channels known as Bearer (B), and Data (D) channels.

Primary rate interface

PRI is an internationally standardized architecture for the interface between a customer's equipment and public network switches or other PBXs. PRI provides the interface within a corporate network for basic call and network business services. PRI allows PBXs, interexchange carriers, host computers, and subtending server computers to be connected to the ISDN switch over digital trunks.

PRI is a common channel signaling system consisting of:

- B-channels—bearing voice or data at a transmission rate of 64 kbit/s

- at least one D-channel—bearing out-of-band signaling with a transmission rate of 56 or 64 kbit/s (two D-channels may be used for redundancy purposes)

PRI is transmitted over a DS-1 trunk. The DS-1 is a collection of 24 imbedded DS-0 channels.

Each DS-0 can be used as one of the following:

- PRI B-channel
- PRI D-channel
- provisioned channel

Any of the 24 DS-0 channels in a DS-1 trunk can be a D-channel, but convention designates the DS-0 in the 24th position as the D-channel.

Q.931 signaling protocol

The standardized, all-digital characteristics of PRI support Q.931. PRI combined with Q.931 makes up a common channel signaling system using a protocol that fits into the OSI model. Q.931 is a message-oriented, out-of-band signaling protocol that is capable of providing telephony, data, and supplementary services. Q.931 defines the content of messages used to control calls over ISDN interfaces.

Protocol overview

A set of protocols governs the format, timing, and sequencing between two network terminal stations. Figure 1-1 is a simplified view of the role that protocol plays.

Figure 1-1
Protocol view
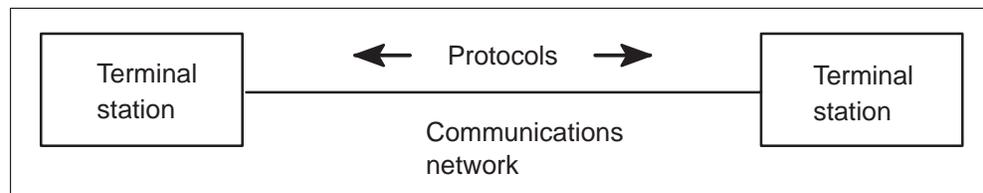
The architecture used for ISDN protocol consists of four modular levels, based on the seven-layer open systems interconnection (OSI) reference model. (This model, developed by the International Standards Organization in 1983, was adopted by CCITT.) The OSI defines consistent languages and communication boundaries for protocols so that systems conforming to its rules are "open" to each other. Figure 1-2 illustrates the hierarchy of functional levels defined within the OSI reference model. Each successive layer represents a higher level of system supervision.

OSI protocol layers

Each of the seven OSI layers uses a series of services provided by the layer below it. Each layer builds on those services to perform communication functions and furnish a series of services to the layer above it. This layered approach splits the complex communication requirements of a wide variety of systems into a series of derivative blocks. Although connected, each block exists independent of the others.

Figure 1-2
OSI seven-layered reference model
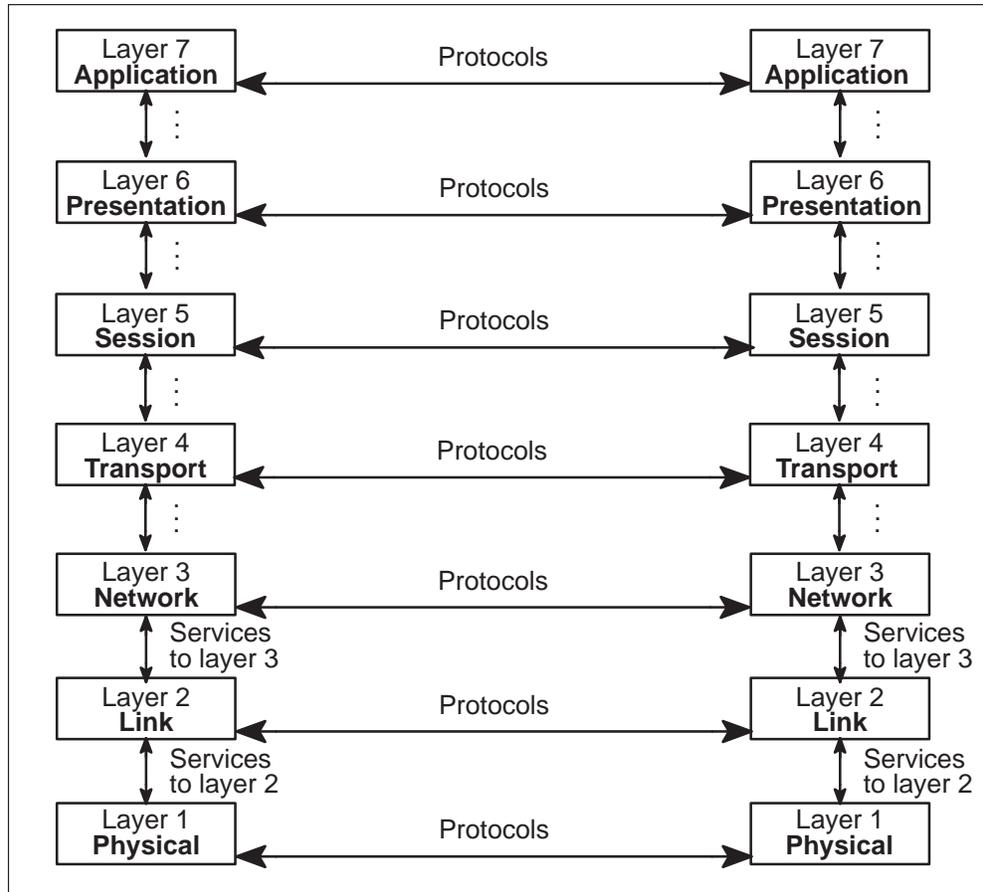
The following list describes the seven OSI layers and their associated functions:

- *Layer 1, Physical*—Maintains, connects, and disconnects the circuits that form the communication facility. Layer 1 handles the electrical, mechanical, and functional control of a data interface.

- *Layer 2, Link*—Provides services related to the reliable interchange of data across the data link established by the physical layer. This layer manages the establishment, maintenance, and release of data link connections. Layer 2 controls the flow of data while supervising error recovery and link flow control.

- *Layer 3, Network*—Provides services related to moving data through a network. Layer 3 provides and manages logical channel connections between end points of a network.

- *Layer 4, Transport*—Transfers data between sessions transparently. Layer 4 handles communication between the two end systems and enhances, where necessary, the quality of services provided by layer 3.

- *Layer 5, Session*—Responsible for administration services, control of data exchange, and delimiting and synchronizing data operation dialogue services. Layer 5 handles the structure of dialogue between devices.

- *Layer 6, Presentation*—Interprets data and is responsible for format and code transformation. Handles the representation of information as bit patterns.

- *Layer 7, Application*—Contains the protocols specific to the application or reason for communicating. Layer 7 is concerned with the application process and management functions.

Note: Layers 4 through 7 govern the transmission of signaling information between two terminals on an ISDN loop.

ISDN protocol layers

Layers 1 through 3 govern connection, set up, and transmission of information between terminals on loops, packet-switched, and circuit-switched networks. As shown in Figure 1-3, the protocols in layers 1 through 3 can be thought of as a series of pipes. Only message information intended for that layer or any higher layer can pass through the pipes.

Data transfer on a B-channel between two ISDN terminals involves layer 2 and higher protocols. Layer 2 and higher protocols are transparent to the telecommunications network. Layer 4 provides transparent transfer of data between network entities.

Figure 1-3
Layers 1 through 3 of the ISDN protocol
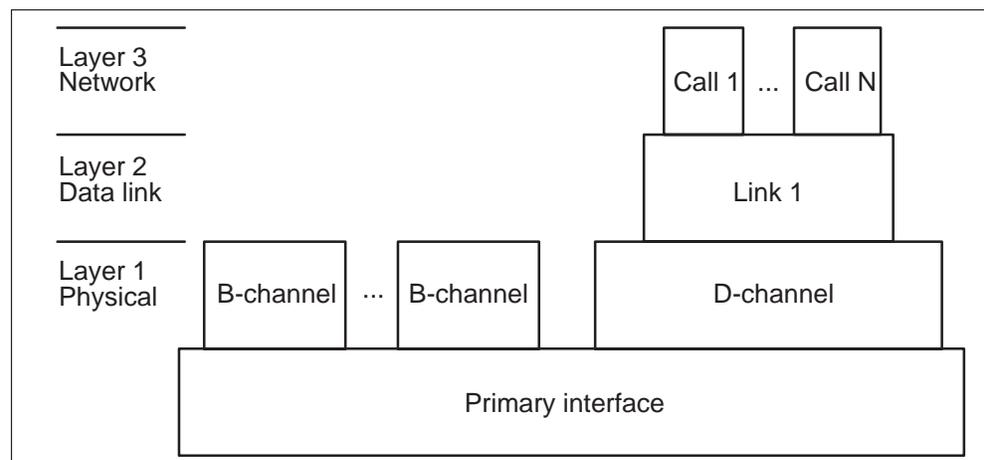
The layers function in the following manner:

- Layer 1 (physical) provides the physical pipe for primary access; this layer contains multiple B-channels and one D-channel.

- Layer 2 (link) provides pipes on the D-channel in the form of logical data links. These links join terminals on the loop to points that provide access to packet-switched service or circuit-switched service.

- Layer 3 (network) provides protocols that are used to establish, maintain, and clear one or more calls in a logical link pipe. For the PRI, one data link exists between the terminal and the network, and between multiple calls at layer 3.

- Layer 4 (application) provides protocols for transport, session, presentation, and application functions. Figure 1-4 shows the ISDN layer 1, 2, and 3 protocols used by the B- and D-channels.

Figure 1-4
B- and D- channel protocols
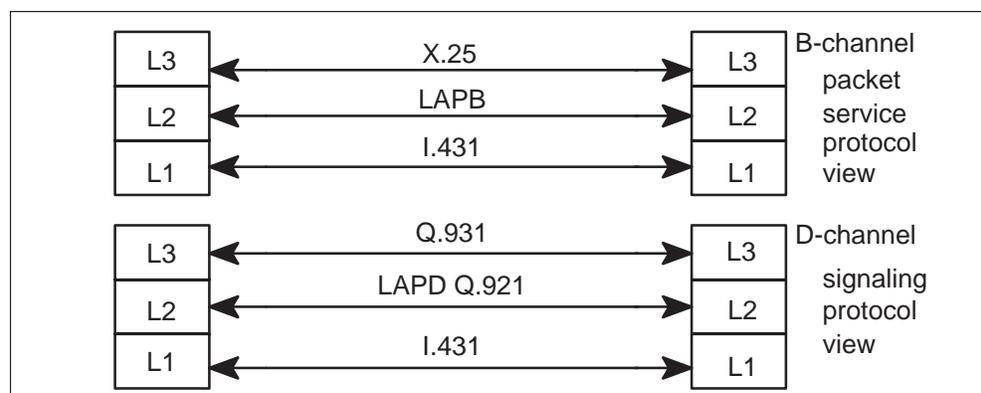
Layer 1 (physical) protocol

The physical layer protocol is described in CCITT recommendation I.431.

Layer 2 (link) protocols

There are two types of link access procedures:

- *Link access procedure on the B-channel (LAPB) protocol*—used to carry packet-switched data, speech, and circuit-switched data on B-channels (defined in CCITT recommendation Q.921)

- *Link access procedure on the D-channel (LAPD)/Q.921 protocol*—used to carry multiple signaling and data message streams that interleave on the same D-channel, each of which forms a logical link (defined in CCITT recommendations I.440, Q.920, Q.441, and Q.921). There are two types of logical links:

  — broadcast—used for line (not trunk) implementation of ISDN

— point-to-point—DMS-250 switches use only point-to-point links

Layer 3 (network) protocols

Layer 3 (described in CCITT recommendations I.450, Q.920, I.451, and Q.931) provides the means to use the D-channel for establishing, maintaining, and completing calls on a logical link created by the link layer. The type of channel and information carried determines which protocol is used.

D-channel

On the D-channel, two types of protocols are used:

- LAPD (a packet-switching protocol based on X.25)—used for low-speed packet data on basic rate interface D-channels; not used for the PRI D-channel

- Q.931—a call-control protocol used for call control messages, including:

  — setup and teardown of calls and features between the network and PBX

  — address (directory number) displays and progress indicators at the PBX and the network ends

  — B-channel control from the network side

  — the support of basic error-handling procedures and reinitialization on recoverable errors

B-channel

Different types of protocols are used on B-channels. The X.25 network layer protocol is used only for transmission of packet-switched data. Speech and circuit-switched data on a B-channel do not require a network layer protocol.

Layer 4 (application) protocols

Layer 4 protocols provide transparent data transfer and application-level messages.

DS-1 configuration

This chapter gives an overview of how an MWC DMS-250 switch connects a DS-1 trunk to a single-line private branch exchange (PBX).

Introduction

The ISDN digital trunk controller (DTCI) is an enhanced version of the existing digital trunk controller (DTC) peripheral interface.

The following contingencies apply to the DTCI:

- The DTCI and the DTC share the same hardware configuration. However, the DTCI must be equipped with an ISDN signaling preprocessor (ISP) card. The ISP also goes through a warm switch of activity (SWACT), along with the other processors that are resident on the DTCI.

- The DTCI and DTC both accommodate up to 20 DS-1s.

- The DTCI supports the warm SWACT capability.

- The DTCI supports PRI and non-PRI (AB-bit) trunk provisioning. This type of access arrangement is called integrated trunk access. Integrated trunk access means that a single DS-1 can be provisioned with both PRI and non-PRI trunk types by altering tables LTCINV and TRKSGRP.

- The DTCI does not support:

    — the special tone receiver card

    — CCS7 ISUP trunks

Hardware configuration

The printed circuit board hardware for the DS-1 trunks resides on the ISDN digital trunk controller (DTCI) shelf, as shown in Figure 2-1.

Figure 2-1
DTCI shelf configuration (front view)

DS1	DS1	DS1	DS1	DS1	Filler	Filler	Filler	Filler	Filler	Filler	Up	Filler	ETS	UTR*	EISP	Filler	MI	Filler	CSM	FM	DS30	Filler	Filler	PCONV
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
DS1	DS1	DS1	DS1	DS1	Filler	Filler	Filler	Filler	Filler	Filler	Up	Filler	ETS	UTR*	EISP	Filler	MI	Filler	CSM	FM	DS30	Filler	Filler	PCONV

* Optional

The 25 card slots in the DTCI shelf are split into upper and lower sections. This allows each populated slot to have one online module and one standby module. The DTCI supports up to 10 NT6X50AB (or NT6X50AA) DS-1 cards (slots 1 through 5, upper and lower). DS-1 cards are equivalent to 20 DS-1 trunks. It is recommended that the DTCI be equipped with NT6X50AB type DS-1 cards. This is because DS-1 cards can support 56 kbit/s and 64 kbit/s (clear and restricted) data rates.

Table 2-1 describes the printed circuit boards on the DTCI shelf.

Table 2-1
DTCI shelf description

Slot	Abbreviation	NT_PEC	Description
01–05	DS1	6X50AB	DS-1 interface. Up to five DS-1 cards on each unit are supported. A minimum of one card is required.
06–11	Filler	0X50AA	Filler face plate
12	UP	MX77AA	Unified processor
13	Filler	0X50AA	Filler panel
14	ETS	AX78AA	Enhanced time switch
—continued—			

Table 2-1
DTCI shelf description (continued)

Slot	Abbreviation	NT_PEC	Description
15	UTR	6X92BB	Universal tone receiver
16	EISP	BX01AB	ISDN signaling processor
17	Filler	0X50AA	Filler panel
18	MI	6X69AC	Message interface
19front	Filler	0X50AA	Filler face plate
19rear		MX71AA	XPM plus terminator board
20	CSM	6X42AA	Channel supervision message card
21	FM	6X41AA	Formatter
22front	DS30	6X40FA	DS-30 Interface (16-port). If this card is provisioned, slot 23 is not used.
22rear		6X40GA	ENET fiber interface card
23–24	Filler	0X50AA	Filler face plate
25	PCONV	2X70AE	Power converter
—end—			

Commissioning

The frame formats, channel ordering sequence, line coding, network customer terminating equipment and cross-connect point, and test equipment requirements are described in the following subsections.

Frame formats

The DS-1 basic frame format consists of one byte per channel, (24 eight-bit bytes) and one framing bit (F-bit), for a total of 193 bits per frame.

- The bit rate is 1.544 Mbit/s.

- The sampling rate for each channel is 8000 Hz.

- The 24 bytes are identified as time slots 1 through 24 (numbered consecutively from the F-bit).

- A pattern is placed in the F-bit to identify the location of the signaling frame.

- A superframe format (SF) consists of 12 DS-1 frames.

- Bit error rate (BER) monitoring is accomplished using two indicators: bipolar violation (BPV) and cyclic redundancy check (CRC).

— BPV is an indication of a coding error in the received bit stream. BPV indicates local span performance.

— CRC, applicable only with extended superframe format (ESF), is an indication of one or more bit errors in a block of bits from the received bit stream. CRC indicates performance on an end-to-end span.

- Channel framing identifies the location of time slot one. The signaling frame identifies those frames in which two signaling states, A and B, are transmitted on a time-shared basis. Table 2-2 shows the assignment of the F-bit, A-bit, and B-bit; the most significant bit is defined as bit one and the least significant bit as bit eight.

Table 2-2
Superframe format bit assignments

Frame number	F-bit terminal framing	F-bit signaling framing	PCM coding bits	Signaling bit	Signal channel
1	1		1–8		
2		0	1–8		
3	0		1–8		
4		0	1–8		
5	1		1–8		
6		1	1–7	8	A
7	0		1–8		
8		1	1–8		
9	1		1–8		
10		1	1–8		
11	0		1–8		
12		0	1–8	8	8
—end—					

- The superframe format is consistent with channel bank formats D2, D3, and D4. The signaling bit is time-shared to identify the channel and the signaling frame. The framing pattern is the repeated sequence 100011011100. The superframe format is supported on both types of DS-1 cards (6X50AA and 6X50AB).

- The extended superframe format consists of 24 frames and is supported only on DS-1 card 6X50AB.

The 8-kbit/s F-bit channel is divided into three separate channels:

- Framing pattern sequence (FPS)—a 2-kbit/s channel. Beginning with frame four (extended superframe format bit 579), the framing bit of every fourth frame forms the following:

  — FPS 001011 (determines the mainframe)

  — superframe format

  — robbed bit signaling synchronization

  The superframe format and extended superframe format are datafilled under the frame format field in table CARRMTC.

- facility data link—a 4-kbit/s channel. The 6X50AB uses FDL to convey remote alarm information or to transmit all ones, as selected in service change.

- cyclic redundancy check—a 2-kbit/s channel. CRC carries the CRC-6 code. CRC indicates one or more bit errors in a block, or bits from the received bit stream. CRC is used as an end-to-end bit error rate indicator.

Channel ordering sequence

The channel ordering sequence is shown in Table 2-3.

Table 2-3
Channel ordering sequence

Time slot	D3/D4/ESF	D2
1	1	12
2	2	13
3	3	1
4	4	17
5	5	5
6	6	21
7	7	9
8	8	15
9	9	3
—continued—		

Table 2-3
Channel ordering sequence (continued)

Time slot	D3/D4/ESF	D2
10	10	19
11	11	13
12	12	23
13	13	11
14	14	14
15	15	2
16	16	18
17	17	6
18	18	22
19	19	10
20	20	16
21	21	4
22	22	20
23	23	8
24	24	24
—end—		

Line coding

Line coding for a DS-1 is bipolar alternate mark inversion (AMI)/2B1Q. The 6X50AA DS-1 card supports zero code suppression (ZCS) line coding, and the 6X50AB DS-1 card supports bipolar eight zero substitution (B8ZS) or ZCS, with the following conditions:

- ZCS coding format requires that the B-channels be used in the 64 kbit/s restricted mode.

- The B8ZS coding format provides a 64 kbit/s clear channel.

General requirements for DS-1 zerio code supression are as follows:

- a maximum of 15 consecutive zero binary bits

- a minimum average of 12.5% density of one binary bit over any 192 consecutive bits

To meet the maximum and minimum requirements, DS-1 uses the following schemes:

- ZCS or AMI/2B1Q coding is used for the 64 kbit/s restricted mode.

- B8ZS is used for the 64 kbit/s unrestricted mode.

ZCS or AMI/2B1Q coding for 64 kbit/s restricted

When all eight pulse code modulation bits in a channel are zero and the eighth bit is not a signaling bit of state one, the seventh bit is substituted by a one. This means ZCS is done on a per-byte basis. Note that seventh-bit substitution should not be invoked when digital data is being transmitted because this causes data corruption.

B8ZS for 64 kbit/s unrestricted

When eight consecutive zeroes appear on a channel and the last one transmitted is positive, they are substituted with the following pattern:

- original eight bits: 0 0 0 0 0 0 0 0

- substituted word: 0 0 0 +1 –1 0 –1 +1

If the last one was negative (so the substituted word is 0 0 0 –1 +1 0 +1 –1), the polarity is reversed.

BPVs occur in the fifth and seventh bit positions of the inserted code. Therefore, B8ZS coding is used only when the receiving end is capable of recognizing that these are not BPVs or bit errors.

Network customer terminating equipment and cross-connect point

Network customer terminating equipment (NCTE) is generally located in the central office repeater bay, such as the LD-1 shown in Figure 2-2. Also shown is a DMS-250 switch, customer premises equipment (CPE), and digital signal cross connect-1 (DSX-1) cross-connect point. In the United States, NCTE is part of CPE; in Canada, it is part of the public network.

Figure 2-2
NCTE block diagram

LD-1—the demarcation point between CPE and the public network
DSX-1—the standard signal quality reference point
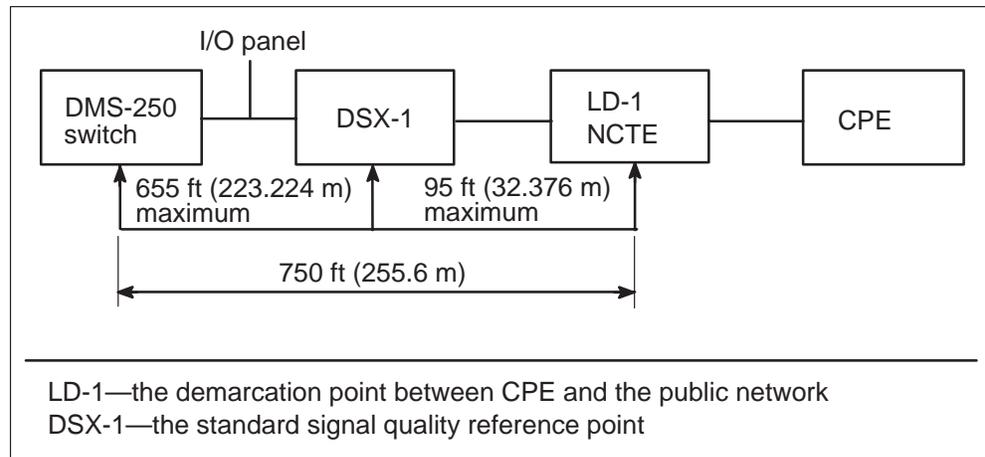
Cabling distance

The following conditions apply to the cabling distance from the front panel of the DMS-250 switch to the LD-1:

- Cabling distance is limited to approximately 750 feet (255.6 m) on shielded 22-gauge cable (NT-ABAY, WECO-ABAM, or equivalent).

- Cabling consists of approximately 655 feet (223.2 m) of the same cable to a DSX-1.

The following conditions apply to the cabling distance from the DSX-1 to the LD-1:

- Cabling may vary within a 95-feet (32.4 m) range, depending on the manufacturer of the NCTE and whether the NCTE is equipped with a transmit equalizer.

- Reduce the cabling distance to the LD-1 or DSX-1 by about 27 feet (9.2 m) when measured from the input/output (I/O) filter assembly, PN P0643763, located at the bulkhead (I/O panel) of the DMS-250 switch cabinet.

Switch settings for distance

Table 2-4 lists the DMS-250 switch settings based on distance.

Table 2-4
DMS-250 switch settings

Distance to cross-connect	Switches closed
0 to 298 ft (0 to 101.6 m)	SW1
298 to 449 ft (101.6 m to 153.0 m)	SW2, SW5, SW7
449 to 656 ft (153.0 m to 223.6 m)	SW3, SW6, SW8
Note: SW4 is not used.	
—end—	

Test equipment requirements

The following describes useful equipment for commissioning a DS-1 trunk.

DS-1 line simulator

A DS-1 line simulator/monitor can be used to verify the integrity of the DS-1 trunks between a DMS-250 switch and a PBX. The line simulator can perform the following tasks:

- monitor a single path without being part of the primary path

- be included in the path between the two systems and operate in either a transparent mode or provide its own stimulus to the trunk

- monitor the status of the trunk

- monitor the information in the channels

- simulate information in a given channel or an idle code in all channels

- simulate the alarms

Error counter

An error counter detects BPVs or no-signal periods for DS-1 trunks. The fault detection and isolation procedures are performed using a Thor portable test package. This test package consists of one of each of the following items:

- Thor TTT2028 Mini Error Counter with an operation instruction card

- test cable equipped with a bantam plug at one end and minihooks at the other end

- loopback plug with pin 3 shorted to pin 1 and pin 11 shorted to pin 9 (of a 15-pin D-connector)

Performance and maintenance

The carrier level of the DMS-250 switch MAP terminal contains alarms and display fields that are indicators of the DS-1 trunk performance. To access the carrier level of the MAP terminal, enter the following command:

>MAPCI;MTC;TRKS;CARRIER

All performance data parameters have user-defined alarm points associated with them on a per-carrier basis. In some cases, two alarm points are appropriate, specifying a maintenance level and an out-of-service level.

Performance group alarms

Default values to performance group alarms are adequate for normal maintenance procedures.

Carrier group alarms

The carrier group alarms also have user-defined alarm points associated with them (on a per-carrier basis). These alarm points signify the filter period used to time the alarm. Two filter periods are required: one to define entry into the alarm, and one to define the exit from the alarm.

The carrier options for the nth posted circuit can be displayed by using the DispOpt command. Card code, options, and alarm thresholds are displayed with this command. A carrier can be looped towards the near (l) or far (r) end by using the Loop n <l/r/c> command. The loop is cleared using the (c) option.

Alarms

The following is a listing of alarms applicable to the DS-1 trunk. All alarm settings mentioned are default settings and can be altered in table CARRMTC.

- remote carrier group alarm (RCGA)—yellow alarm

- local carrier group alarm (LCGA)—red alarm

- alarm indication signal

- DATA—data not downloaded correctly to XPM

- SCAN—scan path enable failure

RCGA—yellow alarm

The remote carrier group alarm indicates a remote alarm detection in the receive path.

When a remote alarm is detected in the receive path, the alarm is verified through a filtering process. The filtering process meets requirements as defined by Bell Publications 43801 (United States) and CS03 (Canada).

The filtering process operates as follows:

- When the remote alarm mode is entered, a counter integrates the detected remote alarm from the digital carrier in increments of 10 ms.

- For each time period with a detected remote alarm, the counter increments by one. When a detected remote alarm is no longer present, the counter decrements by 16.

- A remote alarm is considered significant when the counter reaches 34 (340 ms of continuous remote alarm). When the alarm is significant, the counter no longer increments.

- When the remote alarm mode is exited, the counter decrements until it reaches zero (this takes approximately 30 ms when the remote alarm is absent).

- If any frame alarm is present, processing of the yellow alarm is temporarily suspended and the contents of the yellow alarm counter remain unchanged.

LCGA—red alarm

The local carrier group alarm indicates a local alarm in the transmit path. If the switch determines that a DS-1 trunk should be removed from service it generates a local alarm. As part of this operation, the DS-1 trunk transmits a remote alarm pattern to inform the far end of its local alarm condition.

When the DS-1 trunk sends a remote alarm, it sends alarm patterns as follows:

- When the DS-1 trunk is commanded to enter the local alarm mode, a remote alarm pattern is transmitted. This pattern transmission is delayed for 2.5 ± 0.5 s after the receipt of the message from a DMS-250 switch.

- When the DS-1 trunk is commanded to exit the local alarm mode, it stops sending the remote alarm pattern. There is a 10.5 ± 0.5 s delay after the receipt of the message from the DMS-250 switch. The DS-1 trunk informs the DMS-250 switch when the remote alarm pattern ends.

Display fields

The display fields applicable to DS-1 trunks are as follows:

- frame slip
- frame loss
- approximated BER

- errored seconds (ES)

- severe errored seconds (SES)

- unavailable seconds (UAS)

- states

Frame slip

A frame slip occurs when the transmit clock and receive clock on the DS-1 trunk are not synchronized. When this occurs, a frame must be inserted or deleted. A counter is used to track the total number of frame slips. To prevent frame slips, the clock is synchronized to the external clock.

Frame loss

The DS-1 frame format consists of a frame bit followed by 24 eight-bit words that represent the 24 channels. If two-out-of-four to two-out-of-five framing bits are received erroneously, receive framing is considered lost. This means the receiving side cannot determine which data belongs to which channel.

Frame loss is significant after 3 seconds; then the trunk is taken out of service. The trunk is restored to service automatically when frame synchronization is received continuously for 15 seconds.

BER monitoring

The BER is monitored using two indicators:

- *BPV*—In a bipolar pulse stream, pulses alternate in polarity. If two pulses of the same polarity are received in succession, it is called a bipolar violation (BPV). Each BPV implies that a data transmission error has occurred. A count is maintained, in increments of 1024, for the number of occurrences per day. There are four classes of BPV rates:

  — class 1: 10^{-3} error rate (10,240 BPVs in 6.6 s)

  — class 2: 10^{-4} error rate (10,240 BPVs in 65.96 s)

  — class 3: 10^{-5} error rate (10,240 BPVs in 659.6 s)

  — class 4: 10^{-6} error rate (10,240 BPVs in 6596 s)

- *CRC*—(applicable only with extended superframe format) an indication of one or more bit errors (in a block of bits) from the received bit stream. The cyclic redundancy check indicates performance on an end-to-end span; BPV indicates performance on only the local span. With extended superframe format, BPVs and CRCs are reported. If framing is not extended superframe format, only BPVs are reported.

ES, SES, and UAS

The quality of service on a given DS-1 trunk is reflected in the ES, SES, and UAS data parameters.

States

DS-1 trunk states are as follows:

- INSV—in-service

- MANB—manual busy

- SYSB-T—system busy

- UNEQ—unequipped (trunks are offline)

Maintenance and error thresholds are datafilled in table CARRMTC (refer to the *DMS-250 Data Schema Reference Manual*).

TRAVER enhancements

Translation verification (TRAVER) is a tool that simulates a call from a user-specified origination to a user-specified destination. TRAVER displays the contents of all translation and routing tables used; it can also display each element of the route list with digits outpulsed, if any. This helps in verifying and correcting datafill.

TRAVER reflects the additional translation tables accessed by PRA250 and ISA. The additional translation tables needed for PRA250 do not affect translations for PRA250 trunks.

Originations on PRA250 trunks

The TRAVER command line accepts data needed to make originations on PRI trunks. The TRAVER command line format is

>TRAVER <ORIG> |<NPI>| <DIGITS> |<OPT>| <TRACE>

The fields NPI and OPT are used for calls originating on a PRI trunk. These fields do not affect any other type of trunk agency. The OPT field contains the following information:

- network-specific facilities (mandatory)

- bearer capability (optional)

With this information (usually contained in the Q.931 SETUP message), TRAVER is able to follow the path that the translations would follow for PRI on the DMS-250 switch.

For more information on the TRAVER command, refer to *DMS-250 Commands Reference Manual*.

Datafill trace

The following shows an example TRAVER call trace. The first three tables
are

- TRKGRP—provides the LTID (in this case, ISDN 45) that TRAVER
  uses to perform further translation of a routed call

- LTCALLS—(indexed by ISDN 45 and the call type from the command
  line) provides the appropriate CALLATTR index or RTEREF

- CALLATTR—(indexed by the CALLATTR field in table LTCALLS—in
  this case, 4) provides information needed to translate the call

```
>TRAVER TR L2DPR62CL 2339910000 PRISM T
STS USED FOR TRAVER IS: 815
TABLE TRKGRP
L2DPR64CL PRA250 0 NPDGP  NCIT N 0 ASEQ N NIL 0 N 814
     0 (ISDN 45)
TABLE LTCALLS
ISDN 45 PRISM XLAIEC 4 $ $
TABLE CALLATTR
4 444 MWCP 0 NSCR ZEROM 814 Y 10 8140000 NIL
TABLE STDPRTCT
MWCP   (1) (0)
   – SUBTABLE STDPRT
   – 23 29 CT OFFNET 10 10 0
   – SUBTABLE AMAPRT
   – KEY NOT FOUND
   – DEFAULT VALUE IS: NONE N
TABLE HNPACONT
815 20 0 (8) (1) (0)
–SUBTABLE HNPACODE
–233 234 FRTE 3
–   3 S D D2AIMTISUP
–EXIT TABLE RTEREF
EXIT TABLE HNPACONT

+++SUCCESSFULL CALL TRACE
```

D-channel handler

Introduction

PRI differs from other common channel signaling protocols; it does not use external assistance (such as MSB7 or LIU7) to cope with the call control messages. All signaling functions transport from the external peripheral module up to the computing module by means of the ISDN signaling processor (ISP).

Hardware configuration

The D-channel handler (DCH) consists of two processors:

- master processor (MP)—performs high-level processing for the D-channel such as link access procedure on the D-channel (LAPD)

- ISDN signaling preprocessor—used by the ISDN digital trunk controller (DTCI) for D-channel signaling; supports up to 32 D-channels on a single DTCI

    — eliminates the need to provision signaling terminal cards for D-channel signaling

    — controls the transmission and reception of high-level data link control (HDLC) frames

Functionality

The DTCI master processor communicates with the ISP through shared memory. Figure 3-1 illustrates the relationship between the D-channel handler environment and the various ISDN layers.

Figure 3-1
D-channel handler and ISDN layer comparison
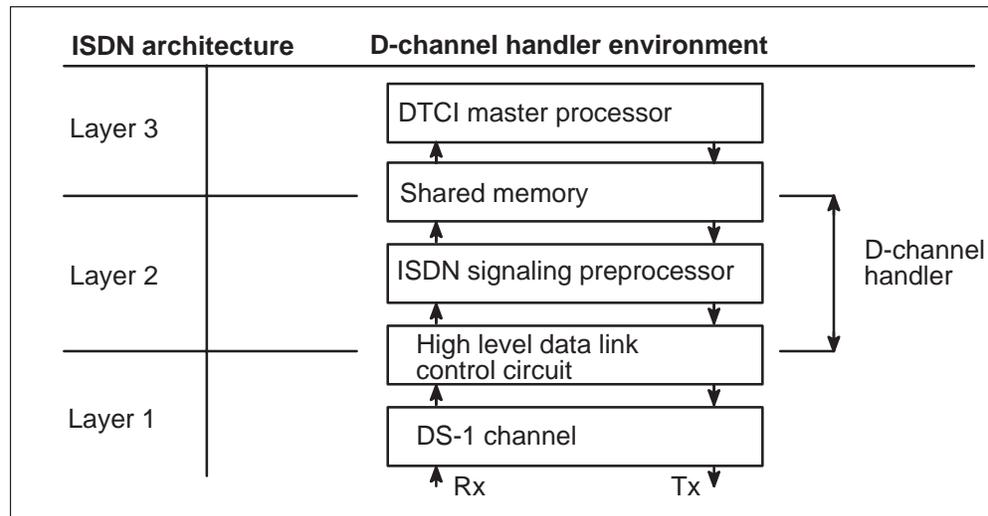
Layer 3 messages destined for the PBX are packaged into layer 2 frames by the ISP. These frames are transmitted by the high-level data link control (HDLC) circuitry (resident in the ISP) onto a DS-1 channel. The DS-1 is a 24-channel (64 kbit/s each channel) carrier that provides the medium of communication between the DMS-250 switch and the PBX.

The ISP card, located in slot 16 of the DTCI shelf, provides the capability to do ISDN-specific front-end processing for PRI applications. The ISP is essentially the layer 1 termination point for DTCI D-channels. The ISP contains a host processor (68020), HDLC circuitry, and a LAPD state machine. These entities provide layer 1 and layer 2 protocol handling for an ISDN PRI.

HDLC circuitry is used to send and receive ISDN LAPD frames. The circuitry terminates up to 32 data channels, and each channel supports up to 64 kbit/s.

The DTCI peripheral has the same configuration as a digital trunk controller (DTC), but the DTCI requires an ISP card in each unit. The special tone receiver card is not supported with a DTCI.

Installation

The PRADCH-level of the MAP terminal posts and maintains the DCH in the DTCI. To reach the PRADCH level from the command interpreter level of the MAP terminal enter the following command:

>MAPCI;MTC;TRKS;TTP;PRADCH

Loading the D-channel handler from the MAP terminal

The ISP is loaded when the DTCI is loaded.

Returning the D-channel handler to service

To return the DCH to service, perform the following steps.

1   At the PRADCH level of the MAP terminal, enter the POST GD (group D-channel) or POST D <ckt #> command to identify the DCH; use the common language location identifier to return to service (RTS).

2   Apply the RTS command to the POST DCH.

    If DCH is busy, ensure a BSY command puts the DCH in MB state before issuing the RTS command.

    DCH goes to in-service state.

Checking the D-channel handler load name

It is not necessary to check the DCH load name because the DCH is loaded when the DTCI is loaded.

Verification

Verification includes running internal continuity tests, read-only memory tests, and an external continuity test.

Running internal continuity tests

To run a continuity test:

1   Go to the PRADCH level of the MAP terminal. The full path name is:

    MAPCI;MTC;TRKS;TTP;PRADCH

2   Enter the POST GD command to identify the DCH to test.

3   Enter the CONT command with option INT to run the internal continuity test.

Running the read-only memory tests

This does not apply to the DTCI DCH.

Running the external continuity test

The external continuity test checks the end-to-end continuity of the D-channel. The test path runs from the DMS-250 switch DCH to the far-end PBX. The loopback at the far end must be set by commands at the far end.

To run the continuity test, perform the following steps.

1 Go to the PRADCH level of the MAP terminal. The full path name is:

   MAPCI;MTC;TRKS;TTP;PRADCH

2 Enter the POST command to post the DCH associated with the DS-1 to test.

3 Ensure the D-channel is looped back at the far end. To do so, use the LOOPBK SET command at the far-end switch.

4 Enter the CONT command with the external (EXT) option to run the external continuity test.

5 At the far end, remove the loopback with the LOOPBK REMOVE command.

Troubleshooting

Check the following if the DCH is in lockout (LO):

- *Baud rate (field DCHRATE)*—datafilled at the local end (in Table TRKSGRP) may not match that at the far end of the DS-1 channel.

- *NETWORK setting*—The DMS-250 switch is considered to be the network in the layer 2 protocol. This means that entry IFCLASS in Table TRKSGRP must be set to NETWORK. Other datafill may cause LO.

- *DS-1 channel configuration*—If local parameter IFCLASS in Table TRKSGRP is set to USER, verify the remote DS-1 channel configuration.

- *Appropriate card type*—The DS-1 channel may not be supervised by the appropriate NT6X50 DS-1 card type.

- *Layer 1 setup*—may be set up incorrectly. Both sides of the DS-1 channel may not be set for the same frame format (either standard or extended).

- *Frame synchronization*—The DCH does not send any messages to the far end unless it has frame synchronization with the far end. Use a protocol analyzer to verify frame synchronization.

Also refer to "Restoring service to the DCH," in Chapter 10, "Service verification."

Test equipment

A protocol analyzer can be used to monitor a DS-1 channel. Analyzers are normally used to check layer 1. However, analyzers can be used to check whether layer 2 HDLC flags are being transmitted. HDLC flags must be transmitted from both sides of the DS-1 channel when operating at a rate of 64 kbit/s. This check can be made after the DCHs are ready for service.

To monitor ISDN PRI messages on the D-channel, the protocol analyzer must have software that can monitor or decode LAPD and Q.931 messages.

PRI D-channel backup

PRI D-channel backup provides an optional backup D-channel in addition to the primary D-channel. This backup increases reliability and guarantees continuous PRI service between any switching nodes or networks using ISDN PRI.

Terminology

The terms *primary D-channel* and *D1* are used interchangeably to describe the primary D-channel for the PRI interface with a backup D-channel. The terms *secondary D-channel* and *D2* are used interchangeably to describe the secondary D-channel for the PRI interface with a backup D-channel.

The term *backup D-channel* can refer to either the D1 or D2, depending on the state of D1 and D2. For example, if D1 is in the active state, D2 is called the backup D-channel. On the other hand, if D2 is in the active state, D1 is the backup D-channel. D1 and D2 cannot be in the active state at the same time.

Backup D-channel is a logical term, but *primary D-channel* and *secondary D-channel* are terms assigned to circuits as datafilled in the trunk subgroup table.

Background

A typical PRI interface supports a configuration of 23 B-channels and one D-channel in a common DS-1 facility. This is called associated signaling of the PRI interface.

When one D-channel controls a PRI interface with more than one DS-1 facility, it is called nonassociated signaling of the PRI interface. When the nonassociated PRI interface is used, D-channel backup ensures the integrity of the interface by providing a second D-channel and a warm switch of activity (SWACT) capability.

In the DMS-250 switch product series, DTCI type XPMs are supported by D-channel backup. The ISDN access controller type XPM is not supported with D-channel backup.

Configuration for D-channel backup

When two or more DS-1 facilities are used with the PRI interface, a primary D-channel is always present on one DS-1 and is labeled D1. On a different DS-1 facility, a secondary D-channel, identified as D2, is also present. Both primary and secondary D-channels can send signaling information in LAPD

format, but only one D-channel (either primary or secondary) can be active in layer 3 at any one time. The other D-channel is active in layer 2.

Figure 3-2 shows the basic nonassociated signaling of a PRI interface that contains three DS-1 facilities. It also shows the primary D-channel (D1), and a secondary D-channel (D2).

Figure 3-2
Nonassociated PRI interface with D-channel backup
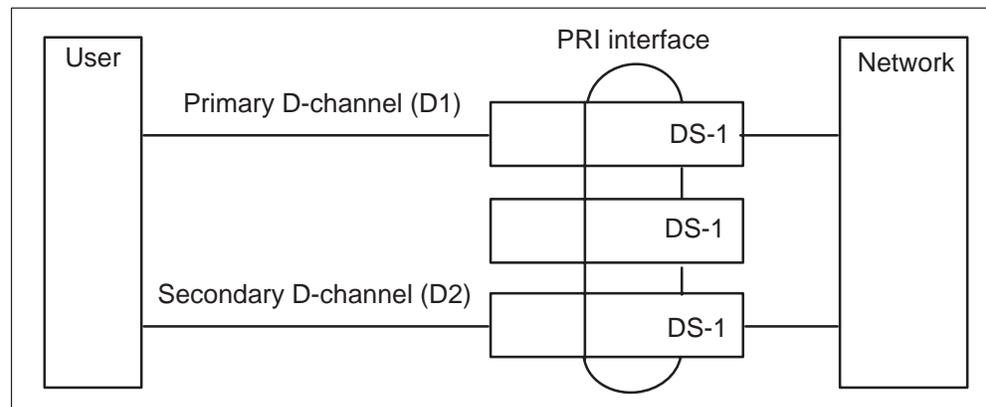
MAP commands for D-channel maintenance

PRI D-channel backup extends the existing MAP terminal PRADCH-level commands to handle the backup D-channel maintenance functions in both

- the ISDN central controller
- the ISDN multiprocessor system extended peripheral module (XPM)

The command function under PRADCH-level handles primary and secondary D-channel maintenance. The SWACT command supports the manual switch of activity of D-channels.

D-channel back-up interactions

The following features interact with the D-channel backup:

- universal tone receiver on PRI—calls in the digit receiving state are cleared
- basic PRI calls—calls not in the active state are cleared

Message structure and function

This chapter describes the signaling messages that PRI call processing supports, and their associated information elements. Also included are the purpose for each information element and the role of each message in call processing. For more information on call control procedures during call processing, see Chapter 5, "Call control procedures." For more information on datafill, see the *DMS-250 Data Schema Reference Manual*.

Message structure

Signaling messages contain information elements that hold information for call processing. An information element may be sent from the user to the network, from the network to the user, or in both directions. Information elements ignored by the DMS-250 switch are acceptable if received in a Q.931 message, but are never sent by the DMS-250 switch.

Mandatory information elements

Every message contains mandatory information elements and, if required, other information elements specific to the message. The maximum message length is 256 octets.

The three items listed below are common to all the messages and must always be present. (Other information elements are specific to a message type and may or may not be required.)

- Protocol Discriminator
- Call Reference
- Message Type

These mandatory information elements are described in the following information.

Protocol discriminator

The Protocol Discriminator information element distinguishes messages for call control and maintenance (or service) from other messages.

Call Reference

The Call Reference information element identifies the call request at the local user-network interface to which the particular message applies. The call reference does not have end-to-end significance across ISDN.

Message Type

The Message Type information element identifies the function of the message.

Other information elements

There are other information elements that may be required for specific messages. These elements are assigned code values. The code values of the information element identified for the variable length formats are assigned in ascending numerical order, according to the actual order of appearance of each information element in a message. This allows the receiving equipment to detect the presence or absence of a particular information element without scanning through the entire message. These information elements are listed as follows.

Bearer Capability

The Bearer Capability (BC) information element lets subscribers specify (on a per-call basis) the type of communication required for a call. BCs are further discussed in Chapter 7, "Feature interaction." No default BC may be assumed by the absence of this information element.

Call State

The Call State information element describes the current status of a call.

Called Party Number

The Called Party Number information element is the digits dialed to access a terminal in the public switched telephone network or the private network.

For details on how the DMS-250 switch uses the Called Party Number for routing the call, refer to "Translations and routing options" in Chapter 7, "Feature interaction."

Called Party Subaddress

The Called Party Subaddress information element allows the originating user to further identify the called user.

Calling Party Number

The Calling Party Number information element identifies the origin of a call.

For more information on how the DMS-250 switch uses the Calling Party Number, refer to "Identifying call origin—calling number delivery" in Chapter 7, "Feature interaction."

Calling Party Subaddress

The Calling Party Subaddress information element allows the originating user to further identify the calling user.

Cause

The Cause information element describes the reason for generating certain messages. It optionally provides diagnostic information if procedural errors occur. It also indicates the location of the cause originator.

For a complete list of all the possible causes generated during PRI call processing, refer to Chapter 5, "Call control procedures."

Change Status

The Change Status information element changes the current status of an interface and D-channel to one of the following states: in service, maintenance, out of service.

Channel Identification

The Channel Identification (CID) information element identifies a channel within the interface that is controlled by signaling procedures. For PRI, the CID information element identifies the B-channel on a PRI interface that is to be used for a call. If B-channel negotiation is enabled, either the originating or the terminating side can specify a B-channel and indicate whether alternatives are acceptable.

Because a PRI interface can comprise more than one DS-1 interface, the channel used for a call is identified by specifying the interface identifier (IID) of the DS-1 where the channel resides, as well as the channel number identifying the channel on that DS-1. The IID is a binary code in the range of 0 to 31 as datafilled against that DS-1 in table LTCPSINV. The channel number used to identify a particular channel on a DS-1 is a binary code in the range of 1 to 24, corresponding to the timeslot for that channel as datafilled in table TRKMEM.

The encoding of the CID information element is such that the IID field may be omitted; this means the DS-1 interface to be used is implicitly identified. When a PRI interface comprises a single DS-1, the interface must be identified either explicitly or implicitly.

When the PRI is comprised of more than one DS-1, the interface must be identified explicitly. Otherwise, the DMS-250 switch assumes that the

interface requested is the interface that contains the D-channel. If the interface that contains the D-channel does not contain B-channels, a release with cause is returned specifying channel not available.

The DMS-250 switch will always identify the DS-1 interface explicitly when table PRIPROF has the function switch "XPLCTIID" datafilled, regardless of the number of DS-1 interfaces that comprise the PRI.

Congestion Level

The Congestion Level information element indicates whether the terminating user or the network is able to receive the USER INFO message.

Connected Number

The Connected Number information element indicates which number is connected to a call. The Connected Number may be different from the Calling Party Number or Called Party Number because of changes (call redirection) during the lifetime of the call. As a subscription option, the connected number may be passed from user to user without network interpretation or interaction. The element is sent by the PBX only in response to an information request information element.

Display

The Display information element supplies display information visible to the user. Optionally, this information element may be passed from user to user without network interpretation or interaction.

Facility

The Facility information element indicates the invocation and operation of supplementary services identified by the corresponding operation value within the Facility information element. The maximum length of this element depends on the service provided.

Generic Digits

The Generic Digits information element accepts and/or delivers the Network Call Identifier (NCID) received from the originating switch, an intermediate or terminating switch, or the reoriginating switch.

Higher Layer Compatibility

The Higher Layer Compatibility information element allows the originating user to identify specific requirements requested for upper layer functionality.

Information Request

The Information Request information element allows the system to request additional information and signal completion of the information requested.

This information element is used by the PBX to request redirection information. If the information is restricted, or not available, this information element indicates what number type was requested (for example, calling number, connected number, redirecting number). Optionally, this information element may be passed from user to user without network interpretation or interaction.

Lower Layer Compatibility

The Lower Layer Compatibility information element allows the originating user to identify specific requirements requested for lower layer functionality.

More Data

The More Data information element is sent by the user to the network in a User-to-User Information (UUI) information element; it is delivered by the network to the destination user(s) in the corresponding UUI message. The presence of the More Data information element indicates to the destination user that another UUI message is to follow which contains more information belonging to the same block of data.

Network-Specific Facilities

The Network-Specific Facilities information element indicates which network facilities are being invoked at the specified network.

PRI supports the following call types from the PBX to the DMS-250 switch. (For more information on the call types listed, see Chapter 7, "Feature interaction.")

- VNET—Virtual Network (VNET) calls; VNET calls may be translated by the network control system, depending on table CALLATTR information. For more information on the network control system, see Chapter 5, "Call control."

- PRISM—calls to the public network; translated by the in-switch data tables

PRI supports the following call types from the DMS-250 switch to the PBX:

- VNET—calls that imply the call was originally translated by the NCS

- 800—calls designated as such by the CALLTYPE field in table LTCALLS under LTID

- 900—toll calls designated as such by the CALLTYPE field in table LTCALLS under LTID

- PRISM—public calls that are translated in-switch

This information element allows the subscriber to request specific route or network capabilities. The call is routed on the basis of the service selector in

preference to other information (for example, destination number, number plan identification, and so forth); checks are made to ensure that the call setup information is consistent with the network facilities requested for the call.

Notification Indicator

The Notification Indicator information element indicates or conveys information pertaining to a call.

Original Called Number

The Original Called Number information element identifies the number from which the first redirection/diversion was invoked. Optionally, this information element may be passed from user to user without network interpretation or interaction. The Original Called Number information element is Northern Telecom proprietary to support cross-product interworking and is coded as codeset 0 to accommodate inter-vendor connectivity.

Progress Indicator

The Progress Indicator information element describes an event that has occurred during the life of a call and affects the handling of a call. It is supported as a mandatory information element in the progress message and optional in the alerting message. For examples of use of this element, refer to "Termination to a non-ISDN trunk" and "Calls routed to treatment," in Chapter 5, "Call control procedures."

The following conditions describe these events:

- A call is not end-to-end ISDN—The connection from source to destination includes a per-trunk signaling trunk.

- In-band information is now available—An event occurred that must be told again to the originator of the call. When this information cannot be sent out-of-band on the D-channel, it is sent as a treatment on a B-channel.

Redirecting Number

The Redirecting Number information element is the number from which call redirection/diversion was invoked. Optionally, this information element may be passed from user to user without network interpretation or interaction.

Redirection Number

The Redirection Number information element indicates the number to which call redirection/diversion should be or has been invoked. Optionally, this information element may be passed from user to user without network interpretation or interaction.

Restart Indicator

The Restart Indicator information element identifies the class of the facility (channel or interface) for restart. The Channel Identification information element must be included with the Restart Indicator to indicate which channel is to be restarted.

Transit Network Selection

The Transit Network Selection information element requests a transit network for call routing.

User-to-User

The User-to-User information element conveys information between users. The content of this information element is fully defined by users only and has no predetermined use. The information is not interpreted by the network, but rather is carried transparently and delivered to the remote user(s).

Locking shift to codesets

The locking shift to codesets procedure uses a Q.931 information element to indicate a new active codeset is in use. The specified codeset remains active until another locking shift information element is encountered. All Q.931-defined information elements are codeset 0 (active by default).

The following codesets are defined:

- codeset 0—Q.931 information elements

- codeset 5—information elements defined for national use

- codeset 6—information elements specific to MWC; delivers proprietary information

- codeset 7—information elements specific to the end user (for example, customer premises equipment, regional Bell operating companies). Data transported in codeset 7 travels across the network without interpretation. Transport of codeset 7 information from ISDN user to ISDN user by way of a single DMS-250 is supported for all calls. Codeset 7 supports all 256 information elements (#00–#FF). Table ISDNPARM is used for all supported messages on PRI originating and terminating agencies. The messages can be datafilled as Access Transport Parameter (ATP) or Block (BLK) for Codeset 7. The MAP option is not valid for Codeset 7.

Message functions

The definitions of the Q.931 and Q.932 messages and their information elements are presented in the following tables.

Q.931 message descriptions

Table NO TAG1 lists Q.931 messages in alphabetical order. Included are each message's meaning, direction, event information, and (where applicable) the correlation of messages with traditional telephone events.

The following list depicts the messages in the order of their appearance during regular call setup.

- SETUP
- CALL PROC
- PROG
- ALERT
- CONN
- CONN ACK
- DISC
- REL
- REL COM
- NOTIFY
- REST
- REST ACK
- STATUS ENQ
- STATUS
- SERV
- SERV ACK

Table 4-1
Q.931 message descriptions

Message	Meaning	Direction	Event information
ALERT	Alerting	Sent by the called party to the network and by the network to the calling party to indicate that called party alerting has been initiated. Any additional information in this message (such as redirecting number or redirection number) is not sent to an originating ISDN user. Instead, the network ignores these information elements upon receipt.	Sent to the originator to indicate alerting of the called party; sent to PRI originators only when received from a terminating PRI agent. The terminating MSL-PBX determines when the alerting message is sent. For PRI-to-trunk calls, the B-channel cut-through occurs between call proceeding and connect.
CALL PROC	Call proceeding	The network sends this message to the originating PRI to indicate call establishment has been initiated and that it will accept no more information. Also, the terminating PRI may send this message to the network. When the network receives this information, it does not send it back to the originator. This message does not have end-to-end significance. Its significance is local within a single interface.	Sent to the originator of the call after translation and routing have been successful.
CONG CON	Congestion control	Sent by either the network or the congested called user to the sender of the USER INFO message.	Indicates the called user or network is congested and unable to receive the USER INFO message. All subsequent USER INFO messages are discarded. A STATUS message is sent to the sender of the USER INFO message with the Cause, Coding Standard, and Location.

—**continued**—

Table 4-1
Q.931 message descriptions (continued)

Message	Meaning	Direction	Event information
CONN	Connect	Sent by the called party to the network, and by the network to the calling party, to indicate call acceptance by the called party.	Generated by the terminating side of the call when the call is answered. This message is sent from the terminator to the network. The network subsequently sends a CONN message back to the originator. Billing begins at this time.
CONN ACK	Connect acknowledge	Of local significance; sent by the network to the called party (and may optionally be sent by the calling party to the network) in response to a CONN message.	After the originator receives the CONN message, it responds back to the network with a CONN ACK message. The network also responds to the terminator with a CONN ACK message.
DISC	Disconnect	Sent by either the calling party or the network as an invitation to release the channel and call reference. The channel and call reference are retained.	Generates when one member of the call hangs up. This message is equivalent to detecting an onhook signal on a PTS trunk. This is the first step in the call takedown message sequence. Billing is now complete.
FAC ACK	Facility acknowledge	Sent by either the called user or the network to the calling user.	Indicates acceptance of the user-to-user feature and ability to receive the USER INFO message.
FAC REJ	Facility reject	Sent by either the called user or the network to the calling user.	Sent when resources are not available to accept the USER INFO message or when the user-to-user feature is not supported.
—continued—			

Table 4-1
Q.931 message descriptions (continued)

Message	Meaning	Direction	Event information
NOTIFY	Notify	Sent by either PBX user to the network and by the network to the calling user to convey information across the PRI interface. Like the ALERT message, the NOTIFY message is sent to a PBX only when received from the opposite PBX. The MSL-PBX determines when the NOTIFY message is sent.	Used by the network to notify the end users of the transfer. The appropriate description "call transfer-alerting" or "call transfer-active" contained in the notification indicator information element may be sent to a user on a call with the transferring user. The NOTIFY message carrying the transfer notification is not delivered to the user that was alerting after the transfer. The message is delivered after the user answered the transferred call.
—continued—			

Table 4-1
Q.931 message descriptions (continued)

Message	Meaning	Direction	Event information
PROG	Progress	The network or the originator sends this message.	Indicates the progress of a call during call establishment (for example, when the call has left the ISDN network or to indicate the use of in-band tones. Sent to the originator any time after a CALL PROC message is sent Examples: • Call is not end-to-end ISDN. The connection from source to destination includes a PTS trunk. • In-band information is now available. An event has occurred that must be retold to the originator of the call. When this information cannot be sent out of band on the D-channel, the information is sent as a treatment on a B-channel.
REL	Release	Sent from either the calling party or the network to indicate: the equipment sending the message disconnected the channel and intends to release the call reference; and the receiving equipment should release the channel and call reference and abort any call with that call reference in the process of being set up.	Sent to the member that sent the disconnect message. This is the second step in the call takedown message sequence. A REL message is also sent for abnormal call clearing.
—continued—			

Table 4-1
Q.931 message descriptions (continued)

Message	Meaning	Direction	Event information
REL COM	Release complete	Sent from either the calling party or the network.	Indicates the equipment sending the message released the channel and call reference; the channel is available for reuse; and the receiving equipment will release the channel and call reference. This is the last message sent in any disconnect sequence. Also sent in response to a SETUP message when the requested B-channel cannot be allocated. Generates after a member receives a REL message. This is the third and final step in the call takedown message sequence.
REST	Restart	Sent from one side of the interface to the other to request the recipient to restart (return to an idle condition) the indicated channel(s) or interface.	This message is of local significance. It uses the global call reference. If no channel is identified, the restart applies to all B-channels controlled by the D-channel on which the message was sent.
REST ACK	Restart acknowledge		Sent to acknowledge receipt of the REST message. Indicates the requested restart is complete. REST ACK is of local significance. It uses the global call reference.
SERV	Service	Bidirectional; can be sent by either the calling party or the network.	Conveys PRI B-channel change of status to in-service, maintenance, or out-of-service state. Cannot be used for changing the status of the D-channel.
SERV ACK	Service acknowledge	Bidirectional; can be sent by either the calling party or the network.	Used to acknowledge changes to the status of PRI B-channels. Sent in response to a SERV message received.

—continued—

Table 4-1
Q.931 message descriptions (continued)

Message	Meaning	Direction	Event information
SETUP	Setup	Sent by either the originator or the network to initiate call establishment.	Sent to the network when a call is initiated; this message includes all digits dialed.
STATUS	Status	Sent from either the calling party or the network at any time during a call.	Sent when an unexpected message is received or to report other conditions of the call. It is also sent in response to a STATUS ENQ message.
STATUS ENQ	Status enquiry	Sent from either the calling party or the network at any time during a call.	Solicits a STATUS message from layer 3.
USER INFO	User information	Sent by either the calling party, the called party, or both.	Contains user-defined data that is sent transparently across the network (without interpretation).
—end—			

Q.931 message information elements

Table 4-2 lists the information elements for supported Q.931 messages.

Table 4-2
Q.931 message information elements

Q.931 message	Information element	Direction	Type
ALERT	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Channel identification	Both	Optional; mandatory if it is the first message in response to SETUP.
	Facility	Both	Optional
	Progress indicator	Network to user	Optional
	User to user	Both	Optional
—continued—			

Table 4-2
Q.931 message information elements (continued)

Q.931 message	Information element	Direction	Type
CALL PROC	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Channel identification	Both	Mandatory
CONG CON	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Congestion level	Both	Mandatory
CONN	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Channel identification	Both	Mandatory if it is the first message in response to SETUP; otherwise, optional.
	User to user	Both	Optional
CONN ACK	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
DISC	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Cause	Both	Optional only in the sense that if it is missing, truncated, or has invalid contents, the actions taken are the same as if a DISConnect message with cause value #31, "normal, unspecified" was received.
	User to user	Both	Optional
FAC ACK	Protocol Discriminator	Both	Mandatory

—continued—

Table 4-2
Q.931 message information elements (continued)

Q.931 message	Information element	Direction	Type
	Call Reference	Both	Mandatory
	Message Type	Both	Mandatory
	Network-Specific Facilities	Both	Optional
FAC REJ	Protocol discriminator	Both	Mandatory
	Call Reference	Both	Mandatory
	Message Type	Both	Mandatory
	Cause	Both	Mandatory
	Network-Specific Facilities	Both	Optional
NOTIFY	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Cause	Both	Optional
	Connected number	Both	Optional. The network can provide, on a subscription basis, the ability to transfer the information element between users without network interpretation or interaction.
	Progress indicator	Both	Optional; mandatory if in-band tones must be provided; otherwise, it is not included.
	Notification indicator	Both	Mandatory
—continued—			

Table 4-2
Q.931 message information elements (continued)

Q.931 message	Information element	Direction	Type
	Display	Both	Optional. Included in the user-network direction if the user has display information that should be passed to the far-end user. It is included in the network-user direction if received from the remote user. As a network option, the display information element can be passed from user to user without network interpretation or interaction.
	Information request	Both	Optional. The network can provide, on a subscription basis, the ability to transfer the information element between users without network interpretation or interaction.
	Calling party number	Both	Optional. Mandatory in the user-to-network direction if the calling party number to be used is not the default number for the interface. In the network-to-user direction, this information is made available to the called user upon subscription to the corresponding ISDN supplementary service.
	Redirecting number	Both	Optional. The network can provide, on a subscription basis, the ability to transfer the information element between users without network interpretation or interaction.
PROG	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory

—**continued**—

Table 4-2
Q.931 message information elements (continued)

Q.931 message	Information element	Direction	Type
	Cause	Both	Optional; supplied when there is in-band treatment applied to the call and there is a cause that corresponds to that in-band treatment; otherwise, cause is not included.
	Progress indicator	Both	Mandatory in the network-to-user direction. If received on an incoming ALERT message, it is treated as an unrecognized optional information element and discarded.
	User to user	Network to user	Optional
REL	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Cause	Both	Mandatory if this is the first clearing message; otherwise, cause is not included.
	User to user	Both	Optional; available only if this is the first clearing message.
REL COM	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Cause	Both	Mandatory if this is the first clearing message; otherwise, cause is not included.
	User to user	Both	Optional; available only if this is the first clearing message.
REST	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory

—continued—

Table 4-2
Q.931 message information elements (continued)

Q.931 message	Information element	Direction	Type
	Channel identification	Both	Mandatory only if a single channel or a single interface controlled by a D-channel is to be restarted. If all the channels associated with a D-channel are to be restarted, it is not included.
	Restart indicator	Both	Mandatory
REST ACK	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Channel identification	Both	Optional; mandatory if a single channel or a single interface controlled by a D-channel is to be restarted. If all the channels associated with a D-channel are to be restarted, it is not included.
	Restart indicator	Both	Mandatory
SERV	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Change status	Both	Mandatory
	Channel identification	Both	Optional; mandatory only if a single channel or a single interface controlled by a D-channel is to be restarted. If all the channels associated with a D-channel are to be restarted, it is not included.
SERV ACK	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Change status	Both	Mandatory
—continued—			

Table 4-2
Q.931 message information elements (continued)

Q.931 message	Information element	Direction	Type
	Channel identification	Both	Optional; mandatory only if a single channel or a single interface controlled by a D-channel is to be restarted. If all the channels associated with a D-channel are to be restarted, it is not included.
SETUP	Protocol Discriminator	Both	Mandatory
	Call Reference	Both	Mandatory
	Message Type	Both	Mandatory
	Bearer Capability	Both	Mandatory
	Channel Identification	Both	Mandatory
	Facility	Both	Optional
	Progress Indicator	Both	Mandatory if in-band tones are to be provided; optional otherwise.
	Network-Specific Facilities	Both	Optional; included if facilities other than public ISDN facilities are to be used for the call.
	Display	Both	Optional; network can provide, on a subscription basis, the ability to transfer the information element between users without network interpretation or interaction.
	Calling Party Number	Both	Optional
	Calling Party Subaddress	Both	Optional
	Called Party Number	Both	Mandatory
	Called Party Subaddress	Both	Optional
	Original Called Number	Both	Optional
	Lower Layer Capability	Both	Optional
	Higher Layer Capability	Both	Optional
	User-to-User	Both	Optional
	Locking shift codeset 5	Both	Optional
—continued—			

Table 4-2
Q.931 message information elements (continued)

Q.931 message	Information element	Direction	Type
	Codeset 5	Both	Optional
	Locking shift codeset 6	Both	Optional
	Codeset 6	Both	Optional
	Locking shift codeset 7	Both	Optional
	Codeset 7	Both	Optional
STATUS	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
	Cause	Both	Mandatory
	Call state	Both	Mandatory
STATUS ENQ	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
USER INFO	Protocol Discriminator	Both	Mandatory
	Call Reference	Both	Mandatory
	Message Type	Both	Mandatory
	More Data	Both	Optional
	User-to-User	Both	Mandatory
—**end**—			

Q.932 message descriptions

Table 4-3 lists the Q.932 messages in the order they appear during regular call setup. Included are each message's meaning, direction, event information, and (where applicable) the correlation of messages with traditional telephone events.

Table 4-3
Q.932 message descriptions

Message	Meaning	Direction	Event information
FACILITY	Facility	Sent by a user to a network to request the supplementary service or from the network to the user to respond to a request. This message is used by the transferring user to invoke network call transfer.	Network dependent. Refer to the appropriate network profile supplement to determine what level of message is supported and what additional information elements are used.
REGISTER	Register	Initiates a transaction	Network dependent. Refer to the appropriate network profile supplement to determine what level of message is supported and what additional information elements are used.
		—end—	

Q.932 message information elements

Table 4-4 lists the information elements for supported Q.932 messages.

Table 4-4
Q.932 message information elements

Q.932 message	Information element	Direction	Type
FACILITY	Protocol discriminator	Both	Mandatory
	Call Reference	Both	Mandatory
	Message Type	Both	Mandatory
	Facility	Both	Mandatory
REGISTER	Protocol discriminator	Both	Mandatory
	Call reference	Both	Mandatory
	Message type	Both	Mandatory
		—end—	

Congestion and Network Flow Control

There are two kinds of congestion control, user congestion and network congestion. The DMS-250 switch can flow control the transfer of User Information messages by way of a Congestion Control message. The Congestion Control message contains a Congestion level parameter that can be set to "Receiver Not Ready," indicating Congestion or "Receiver Ready," indicating Congestion Clearing.

User Congestion

Status messages are not generated during user congestion. All user information messages are discarded.

Network Flow Control

Flow control of User Information messages at the DMS-250 switch is done using the following algorithm:

- burst parameter X, initialized to office parameter UUS_BURST

- User Information message counter N, initialized to X

- the replenishment parameter Y, initialized to X/2

- the DMS-250 timer TUUS is 10 seconds

A burst capability of sending N User Information messages will be available to each access/egress agent. The value of N is decremented by one for each User Information message sent by the user and incremented by Y at regular interval of TUUS subject to the limitation that N should not exceed X. If the DMS-250 receives more than N User Information messages, within the TUUS timer setting, "network congestion" occurs. The network sends a Congestion Control message to the user with Congestion Level parameter set to "Receiver Not Ready". The Cause Parameter in the Congestion Control message is set to a value of 42, "Switching Equipment Congestion," Location "Transit," and Coding Standard "CCITT".

When network congestion clears, a Congestion Control message is sent to the user with Congestion Level parameter in the Congestion Control message set to "Receiver Ready". The Cause Parameter is set to a value of 42, "Switching Equipment Congestion", Location "Transit" and Coding Standard "CCITT". Only the user who was previously notified of congestion is sent a Congestion Control message with "Receiver Ready".

User Congestion and Network Flow Control Interaction

The DMS-250 switch considers the congestion status of both end users and itself before sending or forwarding Congestion Control messages to the end users.

An end user who is notified that the network or far end user is congested only receives one Congestion Control message with an indication of "Receive Not Ready" and an optional Cause parameter. Once a user receives a Congestion Control message for that user must have an indication of "Receiver Not Ready," the next Congestion Control message for that user must have an indication of "Receiver Ready" with the optional Cause parameter identical to the one received in the Congestion Control message with an indication of "Receiver Not Ready".

If the access DMS-250 goes into "network congestion" due to congestion flow control, the DMS-250 will send its access user a Congestion Control message with an indication of "Receiver Not Ready." If the far end user is congested, it sends a Congestion Control message with an indication of "Receiver Not Ready." The network forwards this user generated Congestion Control message across the network until it reaches the access switch that sent the first Congestion Control message with an indication of "Receiver Not Ready". If the access switch is still congested, the access switch cannot forward the user generated Congestion Control message to the near end user.

Conversely, an end user can only be notified of congestion clearing when the network and the far end user are ready to receive User Information messages. The end user can only receive one Congestion Control message with an indication of "Receiver Ready." Once a user receives a Congestion Control message with an indication "Receiver Ready", the next Congestion Control message for that user must have an indication of "Receiver Not Ready."

For example, if the access switch is in congestion and the far end user congestion clears, the far end user can send a Congestion Control message with an indication of "Receiver Ready." The network forwards the user generated Congestion Control message across the network until it reaches the access switch. The user generated Congestion Control message cannot be forwarded to the near end user because the access switch is still in congestion.

Call control procedures

Introduction

A telephone call consists of a signaling component and a voice and data component. The voice and data component contains the information transferred between callers. The signaling component contains the supervisory and address signals that switching offices use to control the setting up, monitoring, and taking down of the call.

This chapter describes the basic call control procedures used to set up and take down PRI calls. PRI calls are controlled by a sequence of signaling messages that flow across the user-network interface. For more information about the meaning of signaling messages and their role in call processing, see Chapter 4, "Message structure and functions."

DMS-250 switch functions and services

The DMS-250 switch provides the following functions and services:

- authorization of the call by collection and validation of

  — authorization codes (authcodes)—multidigit codes used to identify a subscriber, to bill a call, and to screen against unauthorized access to the MWC network

  — personal identification number (PIN) digits—a unique number along with an access code used to activate a service

  — supplementary codes or account codes (optional)—multidigit codes that allow charge back of calls to projects, departments, or accounts

- translation and call screening

- user tones and announcements

- routing of calls to their destination

- call detail records for billing purposes

Switch network parameter

In any PRI connection, one end functions as the user and the other end as the network. The IFCLASS parameter in table TRKSGRP specifies whether the

DMS-250 switch functions as a user or a network. For the DMS-250 switch, this parameter should be set to network.

Figure 5-1 shows a call traveling from nodes 1 through 6 as it proceeds through the various nodes by means of PRI. At node 3 (call incoming on a PRI) is an originating exchange. At node 4 (call outgoing on a PRI) is a terminating exchange (the call terminates out of the switch). The user and network functions are also shown.

Figure 5-1
Originating and terminating exchanges, network and user functions
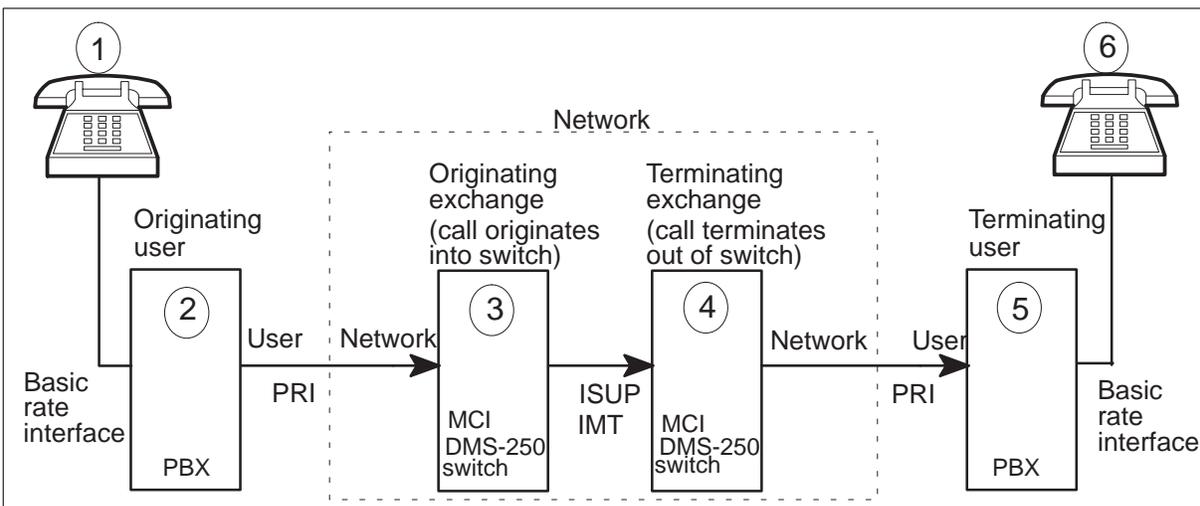
The various states (or status) of a call (communicated by signaling messages) are perceived by the network, the user, or both. Unless specifically qualified, all call states are considered common. The differences between the functionality of a user and network are as follows:

- Response

  — User—When a Q.931 SETUP message is sent by the user side of the interface, it expects a Q.931 CALL PROC message in response.

  — Network—The network side of the interface may receive a CALL PROC, ALERT, or CONN message in response.

- CONN_SENT—user side

  The user interface has one extra Q.931 call state, CONN_SENT. CONN_SENT is entered when a CONN message is sent to the network. Timer T313 is started on the user side and is cancelled on receipt of a Q.931 CONN ACK message. The active state is then entered. When a network interface transfers a Q.931 CONN message, the network state is set directly to active (no timer is started).

- CONN ACK

  — User—Sending a CONN ACK message is not mandatory for the user in response to a CONN.

  — Network—CONN ACK is mandatory for the network in response to a CONN message.

For call control procedures, there are only a few differences between the network side and the user side. The following information focuses on the DMS-250 switch as the network; any differences are stated.

If the D-channel data link fails, start timer T309. If the timer expires, clear the network connection and release the B-channel and call reference.

Call establishment at the originating exchange

Call establishment at the originating exchange means a PRI call comes into the DMS-250 switch (node 3 in Figure 5-2).

Figure 5-2
Originating exchange
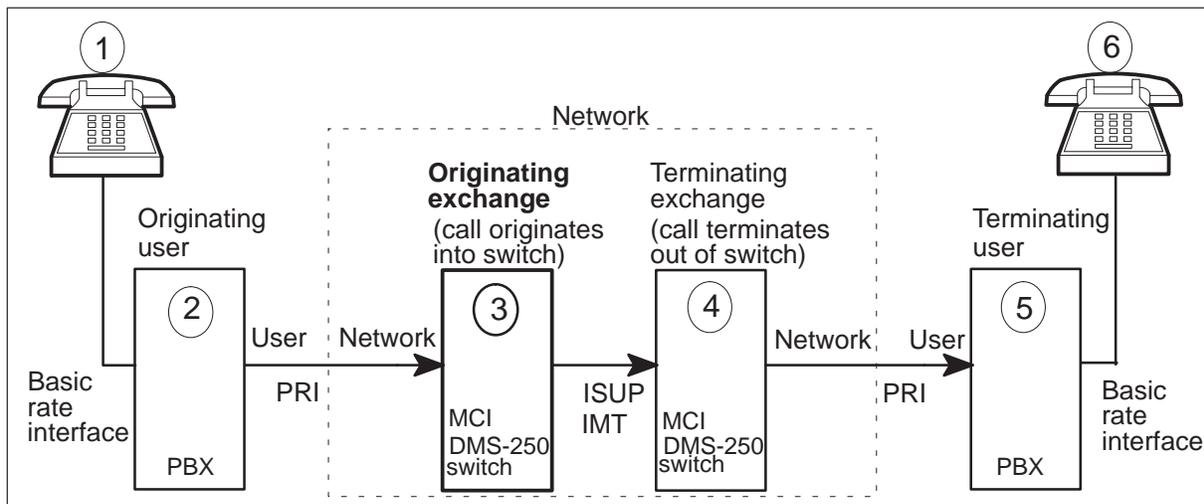
User call request

The user requests the call. When a PRI call is received into the switch, it routes the call based on the call's SETUP message and the switch datafill. The SETUP message contains most of the data required to set up the call. The process of routing requires these main steps:

- analyzing the SETUP message

- determining the call type

- determining the routing characteristic of the call (including called party number and bearer capability)

- routing the call

Call types supported

The following call types are supported by the DMS-250 switch:

- calls coming into the switch—Virtual Network (VNET) and PRISM

- calls going out of the switch—VNET, service access code (SAC) calls (for example, 8xx and 900), and PRISM

For more information about these call types, see Chapter 7, "Feature interaction."

Network control system

The network control system (NCS) is a centralized, remote system of databases (called database access points or DAPs) owned and operated by MWC. NCS provides the DMS-250 switch with call verification and call translation information for the following calls:

- VNET

- SAC

- Calling card

The DMS-250 makes various requests of the NCS for its services and waits for the NCS to respond. The information the NCS returns to the switch is used for:

- call translation

- account/supplementary code validation

- card number validation

- routing

- billing and/or retranslation

- specialized or customized treatments

Call authorization

Basic authorization identifies the subscriber, prevents unauthorized access to the network, and enables the call to be billed to the subscriber.

Authorization code

The switch retrieves the address from the incoming SETUP message to authorize the call. The authorization code is retrieved from table

CALLATTR and verified. For more information, refer to Chapter 7, "Feature interaction."

Supplementary or account code

If the incoming message needs supplementary code (or suppcode) collection or account code collection, the call is not blocked. The suppcode/account code is retrieved from table MLTATTR. (The index to this table is obtained from table LTCALLS.) For more information, refer to Chapter 7, "Feature interaction."

Call translation

Before the DMS-250 switch can route a call, the switch must perform translation. Translation occurs when the DMS-250 switch access the information in a message signal and processes the information according to datafill tables.

To begin translation, the DMS-250 switch accesses the SETUP message. This message is composed primarily of information elements. Each information element provides a part of the setup data. The switch checks the called party number and the call type in the SETUP message (or the numbering plan indicator if no call type is available) to determine how to translate the call.

Translation analyzes the information collected by using the trunk group tables. Information in the trunk group tables indexes one of the translation tables. Each translation table in turn indexes another until the call is fully translated and can be routed.

Translation example

Figure 5-3 highlights some of the main information the DMS-250 switch uses to translate and route a call. Values that map into another table are circled.

Figure 5-3
Translation example for PRISM call

Called party number—9963131   Call type—PRISM

```
                    TABLE TRKGRP
                    D2MPRI PRI250 0 NPDGP NCIT N 0 +

                      ASEQ N NIL 0 N 814 (ISDN 900)
```

The name of the PRI trunk on
the DMS-250 switch that is
between the switch and the PBX

The logical terminal identifier;
indexes into Table LTCALLS

```
                    TABLE LTCALLS
                    ISDN 900 PRISM XLAIEC  600  $ $
```

The call attributes index for
PRISM calls on ISDN 900

```
                    TABLE CALLATTR
                    600 MCI PRAX  6  NSCR NON NIL 216 814 N 10 8140000  NOVNET
                    NO-DNIS
```

Specifies the pretranslator
used for the call

The authcode

```
                    TABLE AUTHCODM
                    8140000 VALID  Y  0  UNRESTRICT  904  444  $  $  Y
```

The serving translations
scheme used to translate
the call

```
                    TABLE STDPRTCT
                    POS PRAX
                       SUBTABLE STDPRT
                          996 996 CT ONNET 7 7 0

                    TABLE HNPACONT
                    POS 904
                       SUBTABLE HNPACODE
                         996 996 LRTE 15
                       SUBTABLE RTEREF
                         15 S D D2SPRI $
```

The name of the PRI trunk on the DMS-250 switch
between the switch and the terminating PBX

The sequence of the example call in Figure 5-3 is described as follows. Information from the example is shown in italics.

Table TRKGRP
The call comes into the switch over *D2MPRI*. *D2MPRI* is a PRA250 trunk mapped against the *ISDN 900* logical terminal identifier (LTID). The LTID (*ISDN 900*) indexes into table LTCALLS.

Table LTCALLS
Table LTCALLS provides initial translations for calls that can be routed over the trunk group's LTID. Table LTCALLS includes:

- the trunk group's LTID—defined in table LTDEF
- the call type

    — conveyed between switches by the Q.931 SETUP message

    — determines the translations that will be used to route an incoming call

- the initial translations route for the call

In the example, after table LTCALLS is indexed by LTID and CALLTYPE, it supplies the necessary information to begin translation of the called party number. The call type is *PRISM*. As shown in Figure 5-3, the LTCALLS tuple associated with *ISDN 900* and call type *PRISM* is the interexchange carrier translation information (XLAIEC). The XLAIEC refinement provides a call attributes index (CALLATTR); this index references into table CALLATTR. In the example, the CALLATTR index is *600*.

Table CALLATTR
Table CALLATTR contains various translations information used in translating and screening DMS-250 switch calls.

In this example, table CALLATTR contains *PRAX* in the field PRETRANSLATOR NAME and *8140000* in the field AUTHCODE. This authcode is used in the same manner as authcodes filed against non-PRI trunk groups. (For more information, see "Filed hotline numbers" in Chapter 7, "Feature interaction.") The authcode acts as an index into table AUTHCODM.

Table AUTHCODM
Table AUTHCODM provides additional translations information, mainly the serving translation scheme used later (in the example: *904*).

The AUTHCODE field provides a means to bill calls originating on the PRI and is captured in the call detail record accordingly. Also, the AUTHCODE provides a way to indicate optional account code digits are required for calls originating on that call attribute.

Table STDPRTCT

The pretranslator name (*PRAX* in Figure 5-3) is used to index into table STDPRTCT to locate the pretranslator subtable to use for the call. The pretranslator *PRAX* contains an entry for the dialed digits and, in this case, marks the call as call type *ONNET*. On the DMS-250 switch, ONNET calls are considered to be private. Marking the call type as ONNET or OFFNET changes the numbering plan indicator on the outgoing side of the call to either PRIVATE or E.164, respectively.

Table HNPACONT

The serving translation scheme (*904*) obtained from AUTHCODM is for translations through table HNPACONT. At this point, translations proceed normally and terminate the call to the trunk group *D2SPRI*. Because the pretranslator marked the call as *ONNET*, the outgoing numbering plan indicator of the called party number is marked as PRIVATE.

B-channel allocation and negotiation

When a call is initiated and SETUP message is sent over the PRI interface to the network, the network attempts to allocate the B-channel requested in the incoming SETUP message. If this is successful, the network attempts to route the call based on the called party number information element (in the SETUP message).

B-channel negotiation occurs when the two ends of a PRI interface negotiate the B-channel to be used for a call. The B-channel requested in the SETUP message maps one-to-one with a particular trunk member in the PRI trunk group. The network selects that channel (if it is available to make the connection) and marks it busy; that particular B-channel is no longer available for other calls.

B-channel negotiation happens at two points:

- B-channel selection at the *originating interfac*e (the interface where the user customer premise equipment originates the call)

- B-channel selection at the *destination interface* (the interface where the network originates the call)

Two different methods are available for B-channel selection in the SETUP message common to originating and terminating interfaces. These are:

- requiring a specific channel, with no acceptable alternative

- preferring a specific channel, but accepting an alternative

However, if the B-channel requested in the SETUP message is not available to make the connection, the DMS-250 switch processes the call according to

the BCHNEG setting in table TRKSGRP. This parameter establishes B-channel negotiation.

If B-channel negotiation is disabled, the switch drops the connection if the B-channel requested in the SETUP message is not available.

Datafill for enabled B-channel

Enabled B-channel negotiation occurs if the BCHNEG parameter is set to Y (yes). To complete the connection, the switch selects any other B-channel associated with the D-channel. This is the preferred setting for the BCHNEG parameter.

If B-channel negotiation is enabled (BCHNEG = Y), the following settings apply:

- Set BCHGLARE parameter in table TRKSGRP to STAND.

  No other value is allowed for this parameter when BCHNEG = Y. If an attempt is made to datafill the value of YIELD, the input value is ignored and STAND is substituted.

- Set the following office parameters in the table OFCENG (values shown are recommended):

  NO_OF_FTR_CONTROL_BLKS = 125
  NO_OF_SMALL_FTR_DATA_BLKS = 1 (not used, but must not be 0)
  NO_OF_MEDIUM_FTR_DATA_BLKS = 125
  NO_OF_LARGE_FTR_DATA_BLKS = 1 (not used, but must not be 0)

Datafill for disabled B-channel

Disabled B-channel negotiation occurs if the BCHNEG parameter is set to N (no).

Call proceeding and termination

After successful translation of the called party number, the network chooses an outgoing route and proceeds to terminate the call. When the outgoing channel (PRI or non-ISDN) is successfully allocated, a CALL PROC message is sent over the originating PRI interface. This message contains the originating channel identification allocated by the network. Next, the voice path between the originating and terminating interfaces is established so that ringing is passed in-band by the terminating office.

In the event that an outgoing route cannot be successfully allocated, a CALL PROC message may be sent to the originating PRI interface as described in "Call routed to treatment" in this chapter.

Call establishment at the terminating exchange

Call establishment at the terminating exchange occurs when a PRI call goes out from the DMS-250 switch (node 4 in Figure 5-4) when the switch is the network.

In any PRI connection, one end of the interface functions as the user and the other functions as the network. The switch can function as the user or network in a PRI connection, but is ideally configured as the network.

Figure 5-4
Originating exchange
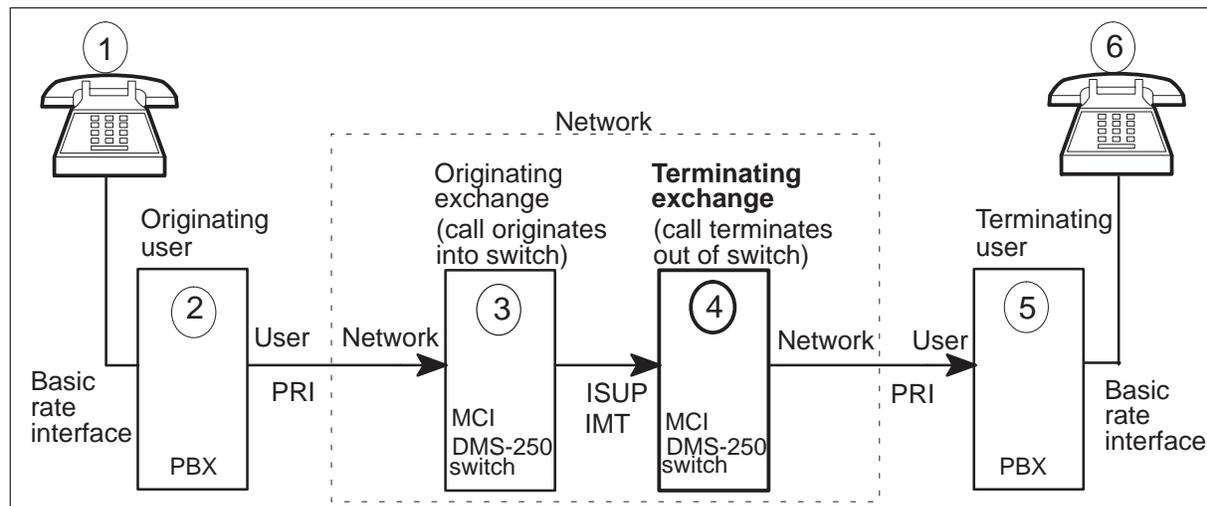
Network call request with SETUP message

The network indicates the arrival of a call to a user by sending a SETUP message across the terminating PRI interface. The SETUP message contains information about the call regarding where it should be routed.

Selection of PRI B-channel for termination

The DMS-250 switch performs the following to select a PRI B-channel to make an outgoing call.

PRI B-channel allocated

When a route is determined and the trunk group selected (within the route verified as a PRI-type), the call is treated as a PRI termination. This is described as follows.

To select a B-channel, the next idle member in the trunk group is chosen according to the SELSEQ field in table TRKGRP. The outgoing PRI trunk member is marked busy and the B-channel is allocated (made unavailable to other calls). (The selected trunk member is in effect the B-channel.) This

B-channel is reserved and the Q.931 SETUP message is built. All digits must be present before sending the SETUP message. The allocated B-channel is specified in the channel identifier information element of the outgoing SETUP message. The SETUP message is sent to the terminating PRI interface and the B-channel is cut through.

PRI B-channel busy—If all B-channels in the PRI are busy, the call is routed to the next trunk group in the route list. If no trunk members are available, route advancement occurs until there are no more choices in the route list. Then the call is routed to an all circuits busy treatment.

Datafill for B-channel allocation—Datafill in table TRKGRP controls the allocation of trunk members in either ascending or descending sequential order. These settings result in one end of the interface selecting trunk members in ascending sequential order, and the other in descending sequential order. By datafilling opposite ends of a PRI connection in this way, glare is minimized. (For more information about glare, see "B-channel glare" in this chapter.

Non-ISDN originator

If the originator is a non-ISDN trunk, the progress indicator information element (containing the value "Call is not end-to-end ISDN") is included in the outgoing SETUP message.

Terminations and user responses

The following discusses various terminations and user responses.

Terminating to a PRI

When terminating to a PRI, the network may receive a CALL PROC, ALERT, or CONN message as the first response to an outgoing SETUP message.

- CALL PROC—When terminating to a PRI, the user receives this message.

- ALERT—If the network receives this message from the terminating PRI interface, the network sends an ALERT message over the originating PRI interface.

- CONN—If the network receives this message from the terminating PRI interface, the network sends a CONN message to the originating PRI interface and a CONN ACK to the terminating PRI. The originator may also respond with CONN ACK. (The user always receives a CONN ACK in response to a CONN sent to the network.)

Figure 5-5 shows the message sequence between the network and the two users on a PRI-to-PRI call.

Figure 5-5
Q.931 message sequence for PRI-to-PRI call setup

Note: Dashed lines indicate optional messages.
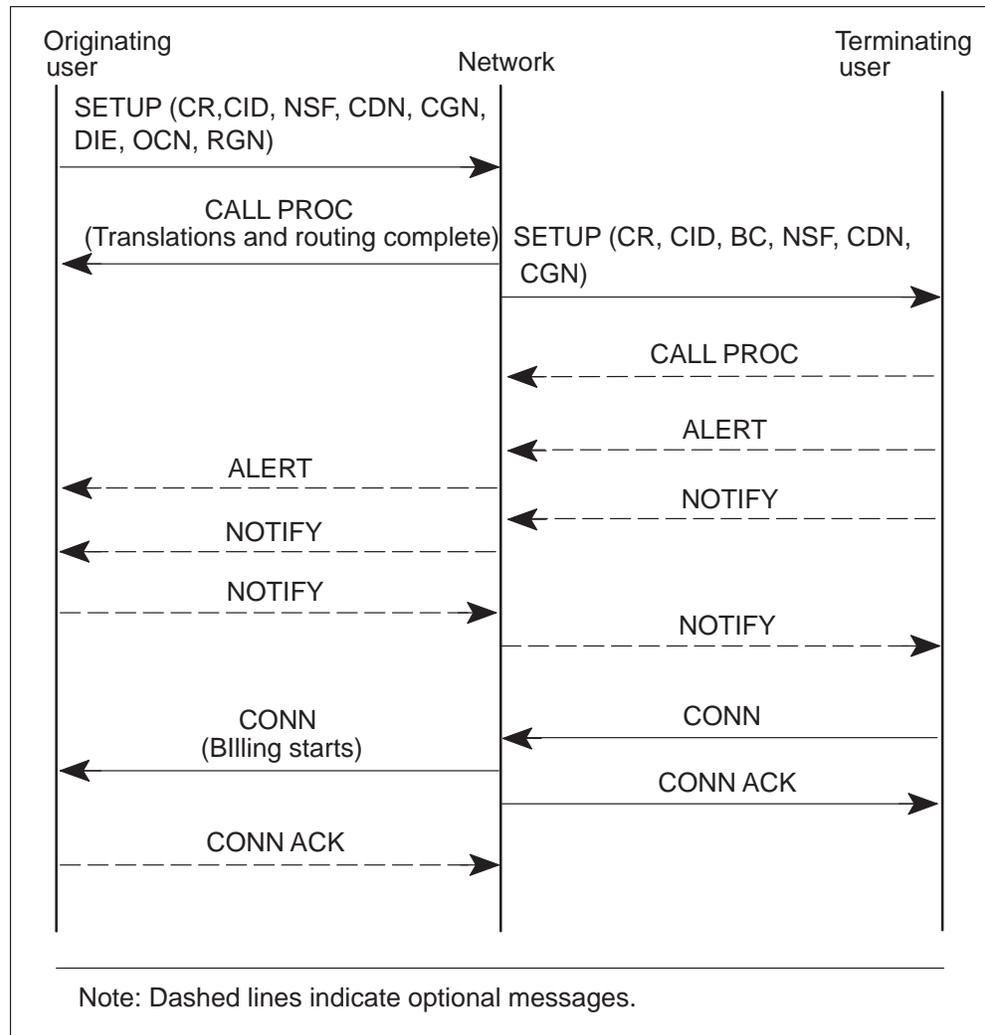
Termination translation to a PRI is achieved by datafilling the following translation tables with the PRI trunk common language location identifier (CLLI) as the route choice:

- standard translation—tables HNPACONT, FNPACONT, CTRTE, CCTR

- VNET translation—tables VPNTRMRT, VPNIMTRT

After a PRI is selected from the route choice of the above tables, a setup message is outpulsed on the terminating PRI. The calling party number, if available, is optionally delivered to the terminating PBX.

Termination to a PBX

When calls terminate to the PBX, it is sometimes necessary to identify information that is uniquely related to the call type so the call can satisfy translations requirements unique to the PBX.

VNET service identifier

VNET calls must be identified with additional information so that the call can be controlled correctly by the PBX.

The specific information required by the PBX is provided by the integrated services access (ISA) route selector. ISA route selector is datafilled in the appropriate routing tables (HNPACONT, RTEREF or OFRT). The ISA route selector specifies (on a call-by-call basis) information related to the call type and to information associated with the particular type of call. For VNET, 800, 900, and TIE (trunk connection between two PBXs) calls, the extra information required is the service identifier. The service identifier is datafilled in a subfield of the ISA route selector. This subfield is the FACNUM field and must be datafilled to match the service route of the SL-1. (Refer to the PBX coordinator to determine the service route appropriate for VNET calls.)

The following example shows the use of the ISA route selector to provide the service identifier for VNET calls. The service identifier of 5 is used to send to the SL-1 PBX. There can be only one SID per call type.

```
TABLE OFRT
20 ISA  N  N  N  VNET  5   D2SPRI
```

Termination to a non-ISDN trunk

When a call terminates from a PRI to non-ISDN trunk, the following conditions apply to the messages listed.

- *PROG message*—This message is sent after the CALL PROC message is sent to the originating PRI. PROG contains a progress indicator information element with the value "Call is not end-to-end ISDN" (as shown in Figure 5-6).

  If the DMS-250 switch is forced to reselect another non-ISDN trunk after terminating to a non-ISDN trunk, a second progress message is sent. If the call reselects a PRI trunk group, the call remains "not end-to-end ISDN" and no additional messages are sent.

- *ALERT message*—This message is not sent. This is because there is no way of knowing whether alerting is actually taking place on the called station when calling out over a per trunk signaling trunk.

- *CONN message*—If the network receives an indication from the outgoing trunk that the far end has answered, a CONN message is sent out over the originating PRI interface. The originator responds with CONN ACK. (The user receives a CONN ACK in response to a CONN sent to the network.)

Figure 5-6 shows the message sequence between the network and the originating PRI interface when the terminator is a non-ISDN trunk.

Figure 5-6
Q.931 message sequence for PRI-to-non-ISDN trunk call setup

Note: Dashed lines indicate optional messages.
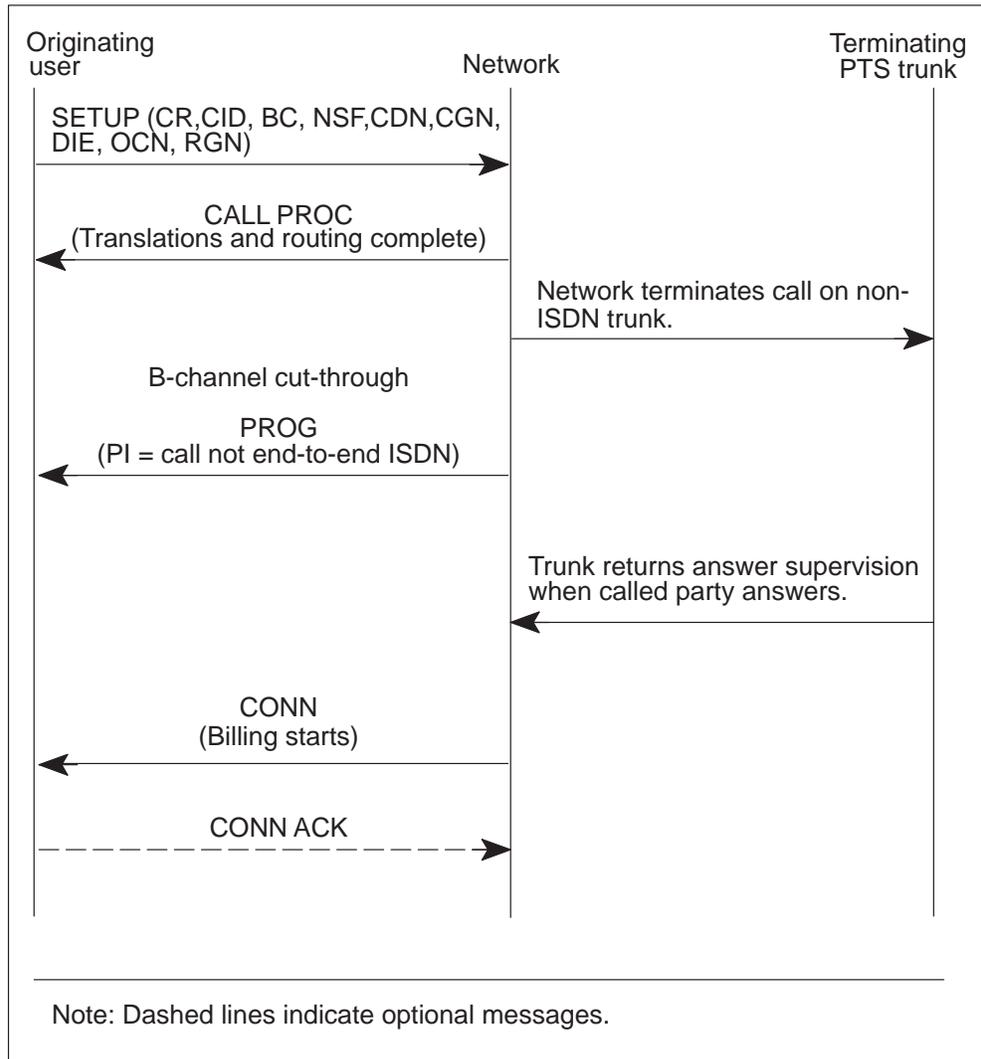
Termination to a PTS trunk

Figure 5-7 shows termination to a PTS trunk, a PRI call that requires in-band DTMF digit collection. The PBX ensures that the subscriber is capable of providing DTMF digits.

Figure 5-7
Digit collection PRI-to-trunk

Note: Dashed lines indicate optional messages.
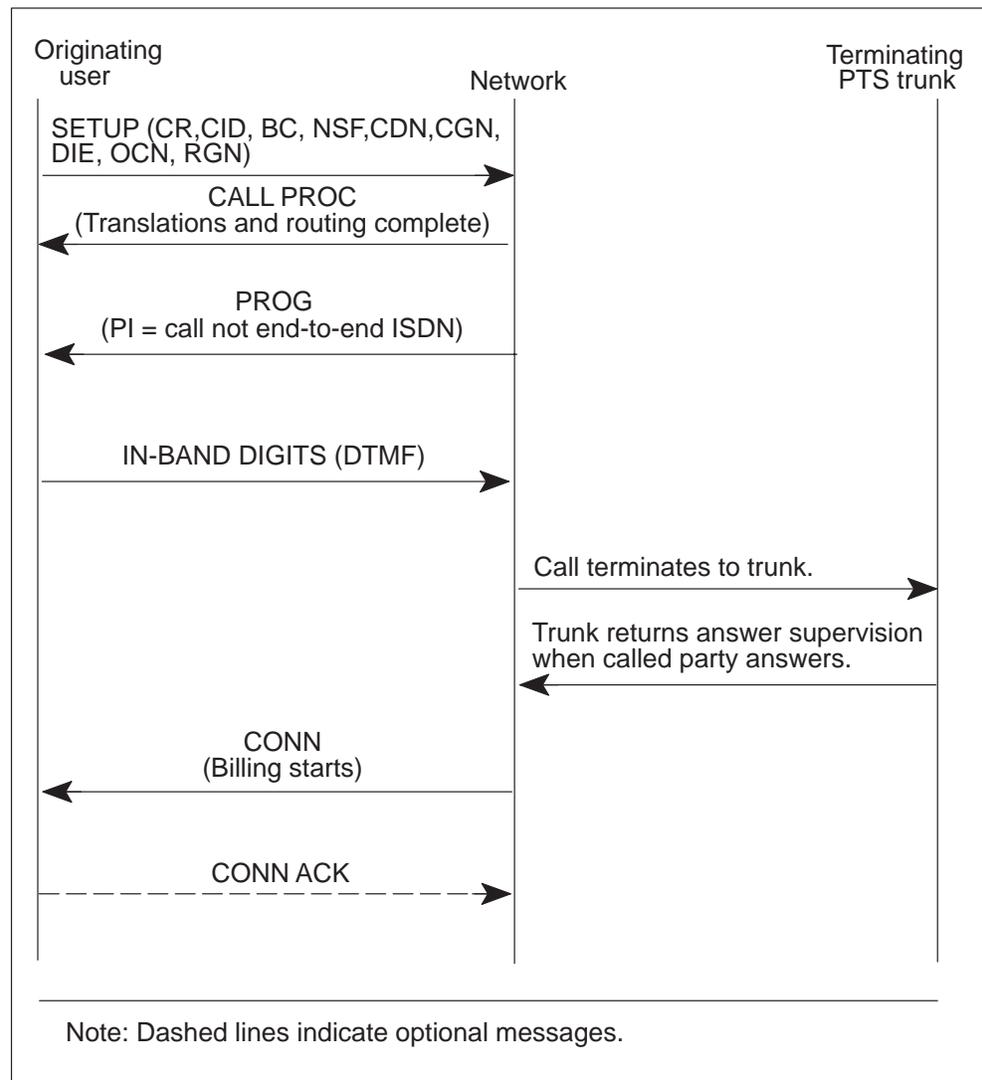
Audio tone detectors

Audio tone detectors (ATD) provide a means for the DMS-250 switch to detect an answer on a circuit that does not support supervisory signals for hardware answer. Audio signals generated from the called party determine when the called party has answered.

While PRI agencies do not support the use of ATDs to monitor answer on PRI-terminated calls, they may connect to an agency that does support ATDs. In this case, the PRI reports an answer when the ATD indicates that an answer is received from the called party.

Figure 7-8 shows the relationship between an originating PRI and a PTS off-network access line (ONAL) that indicates software answer with an ATD.

Figure 7-8
Audio tone detection

Note: Dashed lines indicate optional messages.
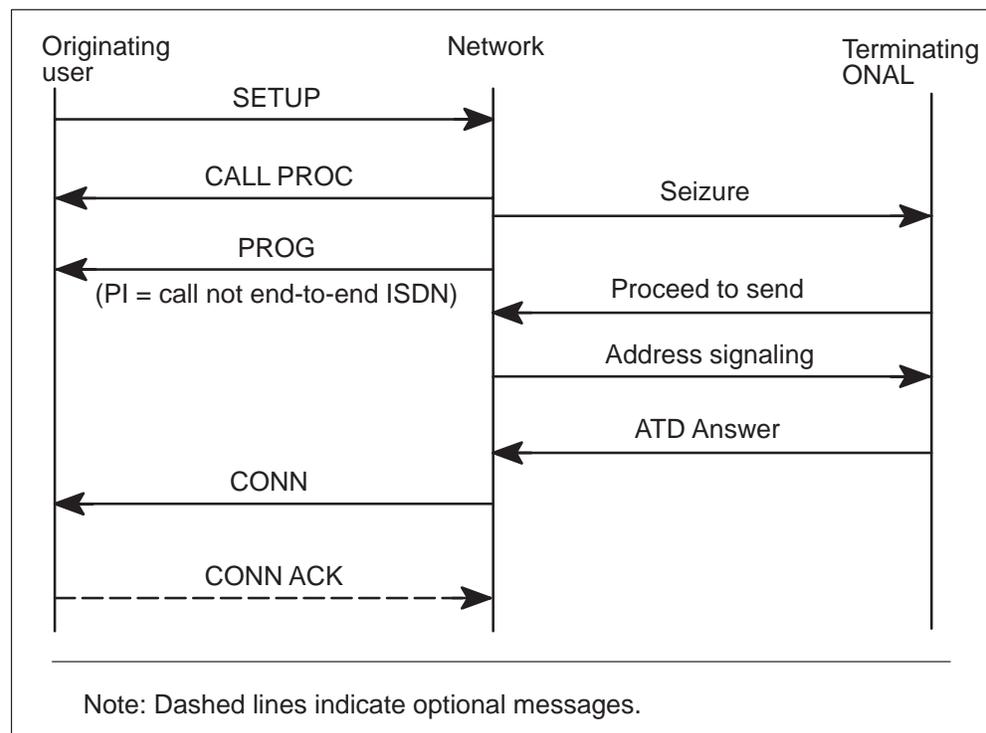
Termination to Enhanced Voice Services ARU

An EVS switch has a PRI interface to an audio response unit (ARU). EVS ARU is used for menu routing, announcements, and voice mail. (For more information on EVS ARU functionality, see Chapter 7, "Feature interaction.")

Originating, non-EVS switches perform normal translation procedures to access the network control system or in-switch routing information through table INWATXLA. If the call terminates to a EVS ARU (as shown in Figure 5-9, scenario 1), neither field (the originating trunk class or the terminating trunk class) of the billing record generated at this switch contains the value "operator service trunk." This indicates the CDR or private network record

generated at this switch is used for billing purposes by the interexchange carrier.

Figure 5-9
Billing record processing: DMS-250 switch to EVS ARU
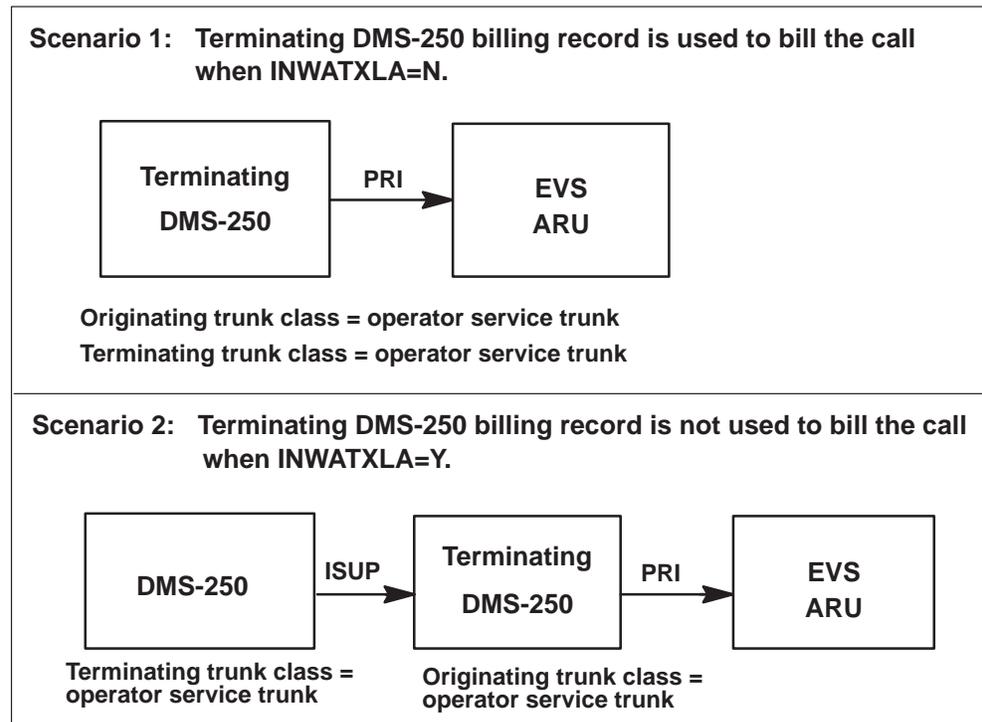
If the call does not terminate to a EVS ARU (for example, when a switch transfers the call, as shown in Figure 5-9, scenario 2), the terminating trunk class of the billing record contains the value "operating service trunk." This indicates that the CDRs or PNRs generated at the switches are not used for billing purposes.

Initial Address Message

The SS7 Initial Address Message (IAM) sent from the originating switch to the EVS switch contains the Network Specific Facilities parameter as currently implemented. This parameter indicates whether the call was a virtual network (VNET) or 800, 900, or PRISM call.

The IAM for all calls contains the Generic Digits parameter. This parameter contains the originating switch identifier and originating trunk group of the call. The IAM for 800 and 900 calls also contains the Generic Address parameter. Generic Address parameter contains the 800 or 900 number dialed.

Termination capability

EVS termination capabilities are provided for a call if one of the following occurs:

- an EVS feature code is included in the network control system feature code parameter (returned to the originating switch in the routing response message)

- the NARSCALL field of table INWATXLA is set to Y (EVS was previously called NARS—network audio response system)

If the trunk required for termination is not a dedicated PRI EVS trunk, the call will be treated as a non-EVS call.

At the EVS switch, calls destined for an EVS ARU are identified by the TRKGRP field NARSDED in the OPTIONS vector.

The standard Q.931 protocol is used for messaging between the EVS (terminating) switch and the EVS ARU. Figure 5-10 illustrates a call origination message sequence provided by this feature.

Figure 5-10
EVS call origination
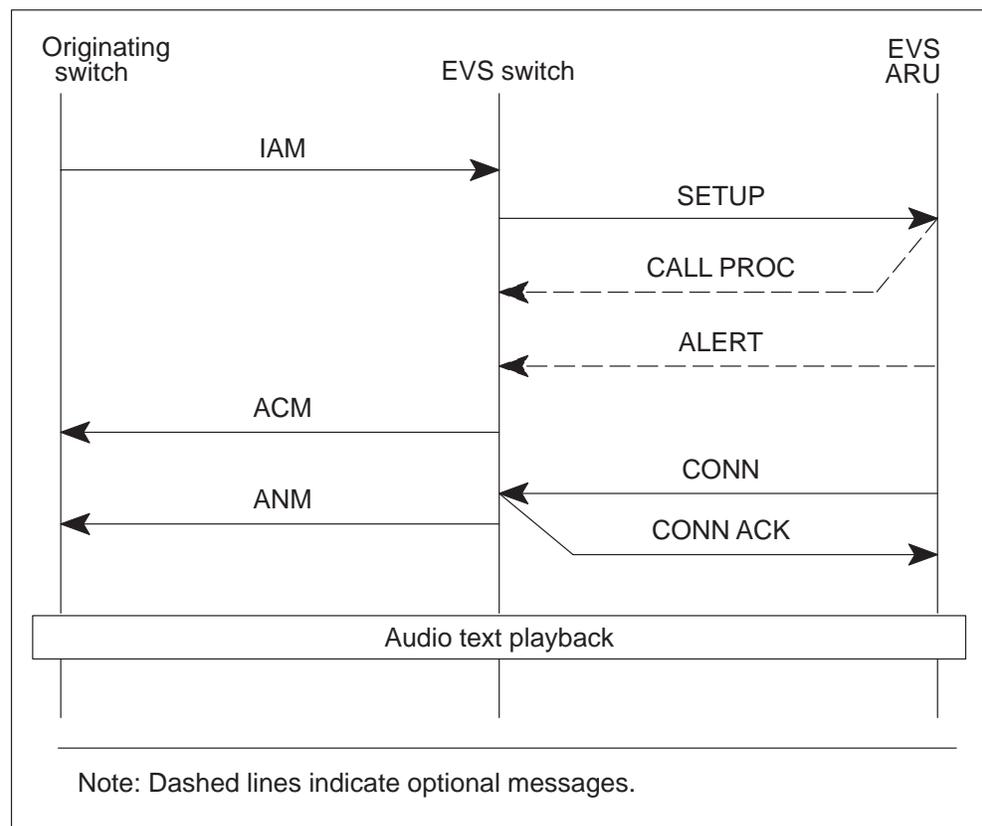
If EVS termination is required, the call setup information is sent to the EVS ARU over the ISDN D-channel in the SETUP message. The SETUP message contains

- the Generic Address information element, including the dialed number identification services

- the Generic Digits parameter, including

    — the originating trunk group

    — the originating switch identifier

- the called party number information element, including:

    — the called party number

    — the automatic number indicator

The originating switch CLLI, found in table MCLLICDR, is usually located in the originating trunk group field of the Generic Digits parameter (provided in the SETUP message). The NCS_SWITCH_ID, found in table OFCVAR, is usually located in the originating switch identifier field of the Generic Digits parameter (provided in the SETUP message).

Calls that originate on an EVS switch and are destined for an EVS ARU go through normal translation procedures to access the network control system or in-switch routing information through table INWATXLA.

After completing the EVS audio text message sequence, the EVS ARU instructs the EVS switch to transfer (extend) or to disconnect the call.

Call transfer (extension) on an EVS switch

The ability to transfer (extend) an active call from the EVS ARU to a new destination is supported for non-VNET calls, but not for VNET calls. The EVS system can instruct the DMS-250 switch to transfer a call as explained below:

- A FACILITY message containing the menu digit information collected by the EVS ARU is sent in addition to the regular sequence of call transfer messages.

- After the call is transferred, the EVS PRI portion of the call is released through the ISDN release link trunk messaging sequence.

- Calls that are transferred over ISUP IMT or PRI trunks cannot be allowed to terminate to an EVS ARU a second time. PTS IMT interworking is not supported.

When the EVS switch transfers a call from the EVS ARU to a new destination, the PRI link connecting the EVS ARU to the EVS switch is released, as shown in Figure 5-11.

Figure 5-11
Trunk release sequence of events
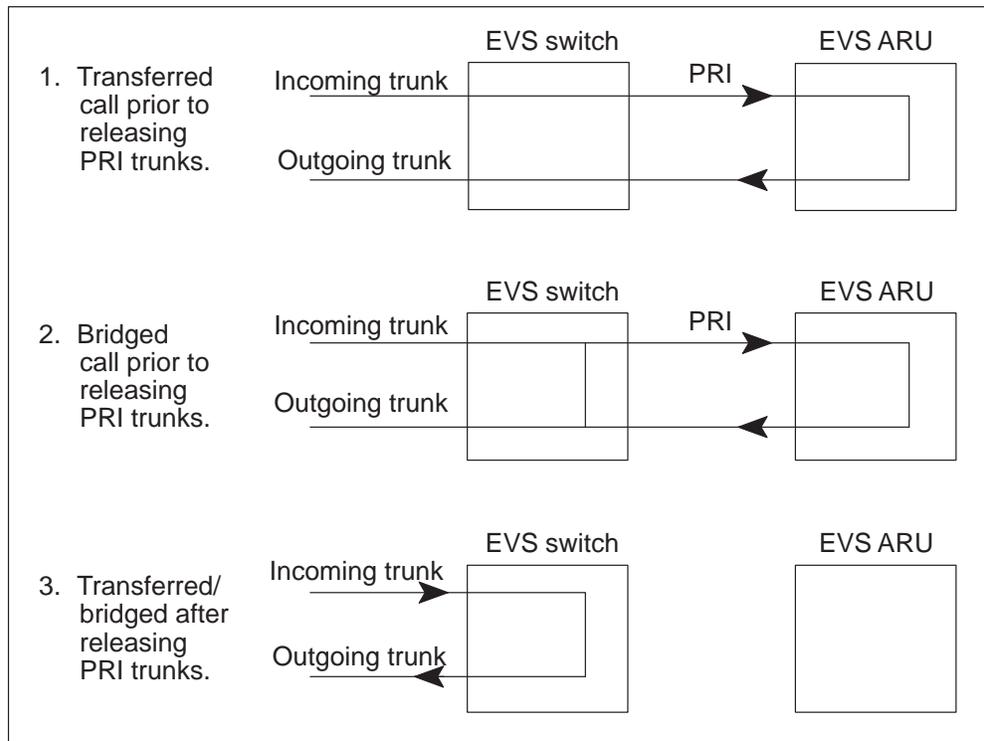
Figure 5-12 illustrates the trunk release messaging sequence and shows how calls are routed from the EVS switch into the EVS ARU over PRI trunks, then transferred to a new destination through the EVS switch.

If an answer is detected by the EVS switch, the CONN message is sent to the EVS ARU. The EVS ARU does not need to wait for the CONN message to send the FACILITY message to initiate bridging.

Figure 5-12
Trunk release messaging sequence

1. Leg 1 SETUP
2. CALL PROC
3. ALERT/PROG
4. CONN
5. CONN ACK
6. Leg 2 SETUP (FAC IE, INV 1, RLT)
7. CALL PROC
8. ALERT (FAC IE, RR1, CALLID)/PROGRESS
9. CONN
10. CONN ACK
11. FACILITY (menu digits)
12. FACILITY (FAC IE, INV 2, RLT, CALL ID)
13. FACILITY (FAC IE, RR 2, RLT)
14. DISC
15. DISC
16. REL
17. REL COM
18. REL
19. REL COM

EVS switch   EVS ARU
Incoming trunk   PRI (Leg 1)
Outgoing trunk   (Leg 2)

EVS switch   EVS ARU
Incoming trunk   PRI
Outgoing trunk

EVS switch   EVS ARU
Incoming trunk
Outgoing trunk

Legend:
FAC IE: EVS service ID (IE = information element)
INV 1:   INVOKE component with an ID of 1
RLT: Release link trunk
RR: RETURN RESULT component with the corresponding INVOKE ID of 1

Q.931 SETUP message

The leg 1 SETUP message (as shown in Figure 5-12) includes the OTG and OSID values in the Generic Digits parameter. The leg 1 SETUP message also includes the value dialed number identification services in the Generic Digits information element.

The OTG, OSID, and DNIS values are taken from the ISUP IAM message that comes from the originating switch. The Generic Digits parameter and Generic Address information element allow the EVS switch to deliver digits to the end user.

Reseller switch setup and release

A normal call setup and release using a reseller switch is shown in Figure 5-13. Supplement code (suppcode) collection requires the local formulation of an Address Completed Message (ACM) to cut through the voice path for DTMF digit collection by a universal tone receiver. The later ACM received from the far-end switch is then halted.

Suppcode collection

The suppcode is collected only if the following conditions exist:

- The tuple set for the (IMT) trunk in table TRKGRP has field ISUPIDX set to MWC2RSLR.

- The field ACCTLEN (account code length) in table TRKGRP is set within the range of 1–7 for non-VNET calls, or within the range of 1–11 for VNET calls.

- The interexchange switch sent back a locally formed ACM.

Figure 5-13
Call setup and release using a reseller switch
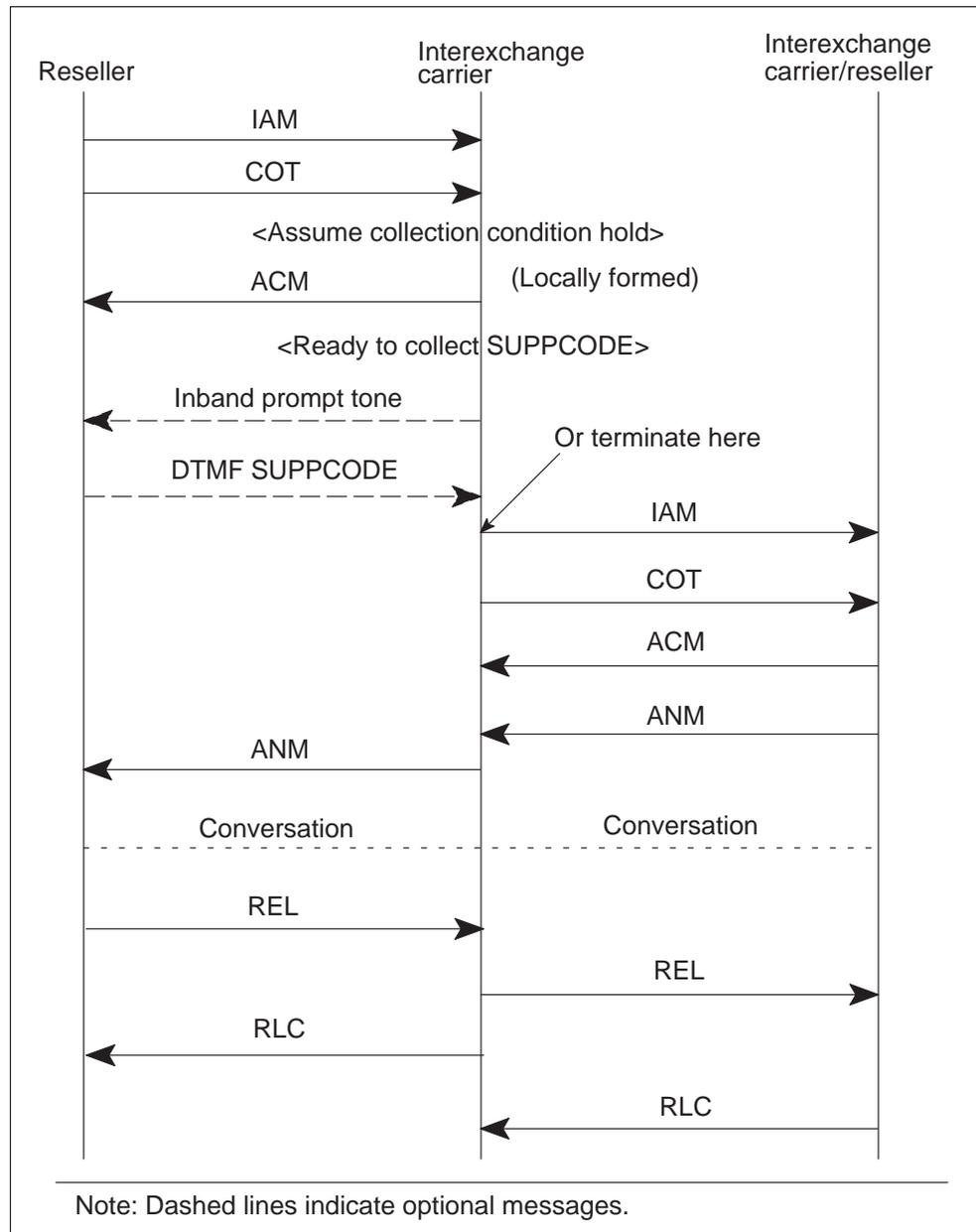
The DMS-250 switch indicates that it is ready to accept SUPPCODE digits from the reseller by sending a 400-Hz prompt tone. Any digits dialed before this prompt tone are ignored.

The collection period can timeout and cause an in-band treatment due to permanent signaling or partial dial. The periods before permanent signaling and partial dial timeouts are set in table TRKGRP in the fields PSPDSEIZ

for permanent signaling and PARTDIAL for partial dial. The DMS-250 switch ignores any digits dialed after a timeout.

The DMS-250 switch also ignores the DTMF signals * and #; these digits cannot reset the timeout periods for partial dial or permanent signaling.

After receiving the suppcode, the DMS-250 switch stores it in the parameter AUTHCC3 of the CDR for non-VNET calls and in the PNR for VNET calls.

Call takedown for normal call clearing

The procedures for call takedown when normal call clearing is initiated (by either the user or the network) are described as follows.

A normal disconnect sequence consists of three messages:

- DISC—The first message is always a DISC message, whether the user or the network initiates call clearing of an established call.
- REL—The other end of the connection responds with this message.
- REL COM—The side initiating call clearing responds with this message.

User-initiated normal call clearing

When the network receives the DISC message from the user over a PRI trunk, this is equivalent to detecting an on-hook signal on a PTS trunk. Eventually, the network idles the PRI trunk member by disconnecting the B-channel. The channel remains unavailable for any other calls.

As shown in Figure 5-14, the network responds to the DISC message by

- starting timer T308
- starting a DMS-250 switch internal lockout timer
- sending a REL message to the user

Figure 5-14
PRI-to-PRI disconnect, user initiates normal call clearing
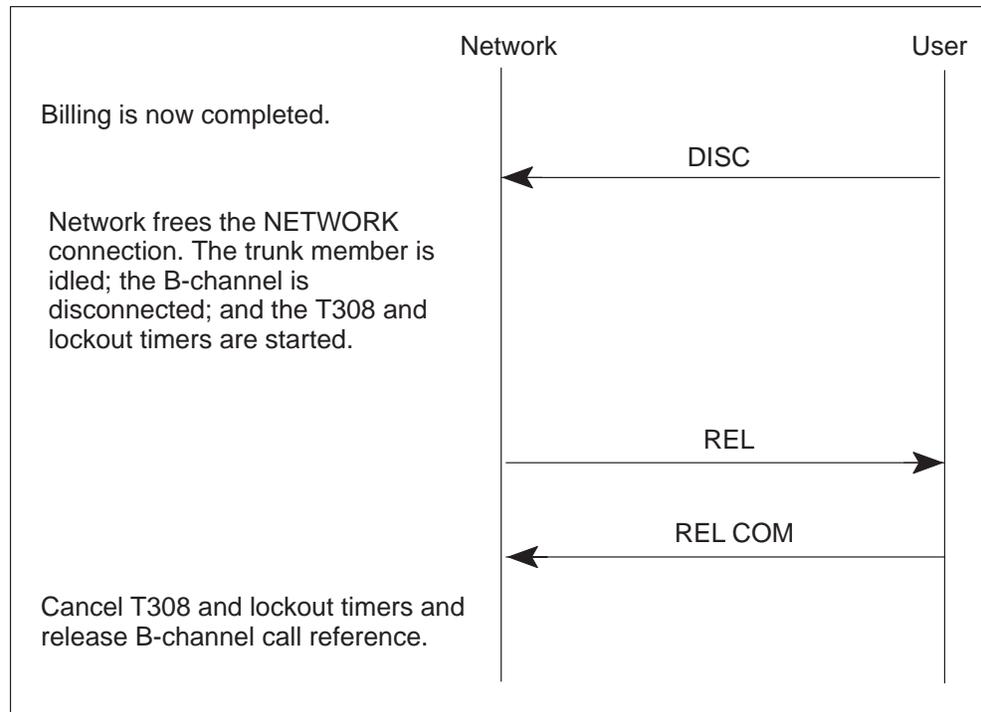
The lockout timer (trunk guard timer) is datafilled in the table TRKSGRP as TRKGRDTM. (The value is typically less than 2.5 seconds.) For information about what occurs when the lockout timer expires, see "B-channel lockout" in this chapter.

When the network receives a REL COM message from the user, the B-channel and call reference are deallocated; both are free to be allocated for other calls.

Network-initiated normal call clearing

When the network initiates call clearing, the following occurs:

- A DISC message is sent to the user.

- The network

  — disconnects the B-channel

  — deallocates the trunk member

  — starts timer T305 and the lockout timer; the B-channel is not available for other calls

After receiving a REL message from the user, the network cancels T305 and releases the B-channel and call reference. The B-channel is now available

for other calls. The network sends a REL COM message to the user, as shown in Figure 5-15.

Figure 5-15
PRI-to-PRI disconnect, network initiates normal call clearing
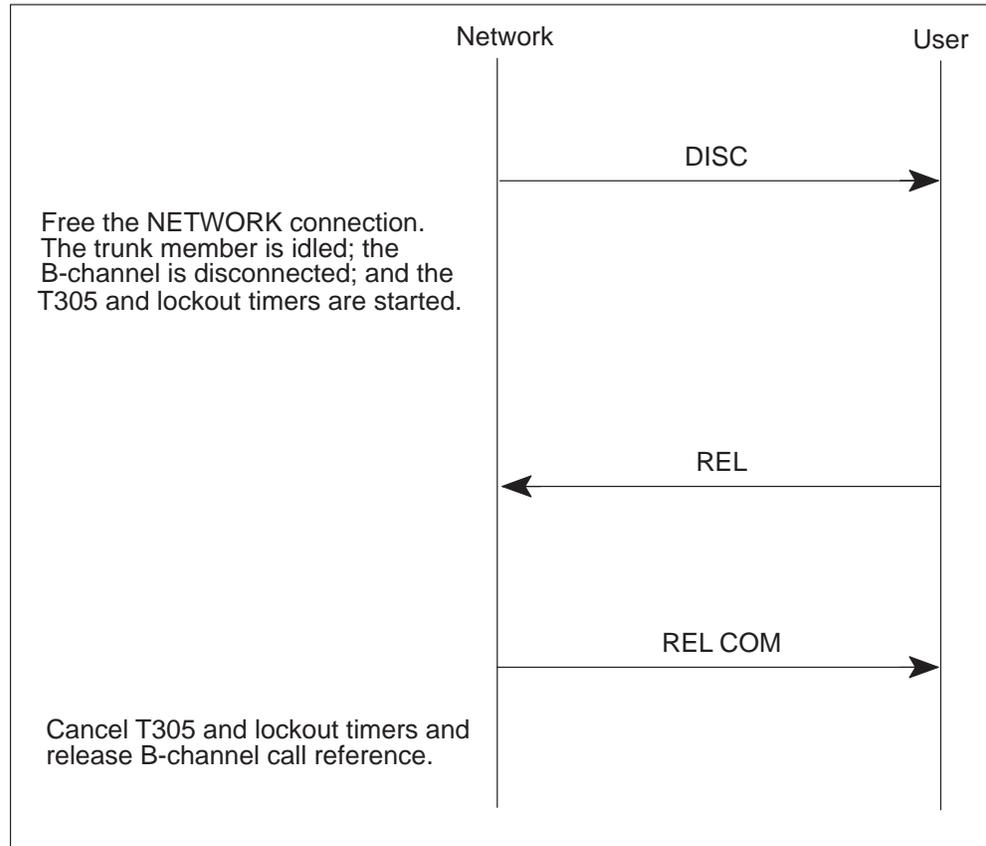
Disconnection of an EVS call

A facility message (containing the menu information collected by the EVS ARU) is sent in addition to the regular sequence of call teardown messages. Figure 5-16 illustrates a user-initiated call disconnect message sequence.

Figure 5-16
User-initiated call disconnect
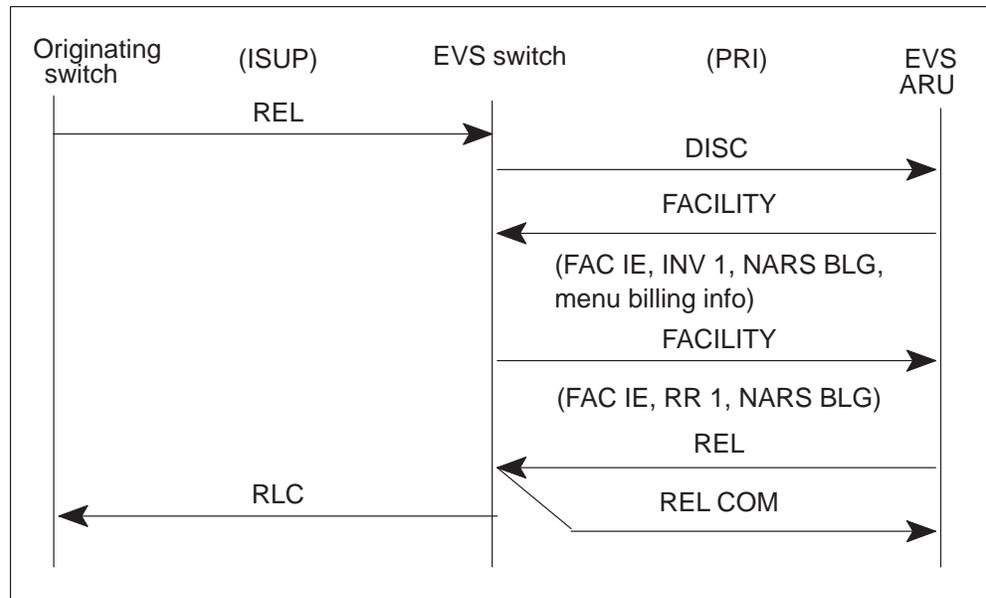
Figure 5-17 illustrates an EVS-initiated call disconnect message sequence.

Figure 5-17
EVS-initiated call disconnect
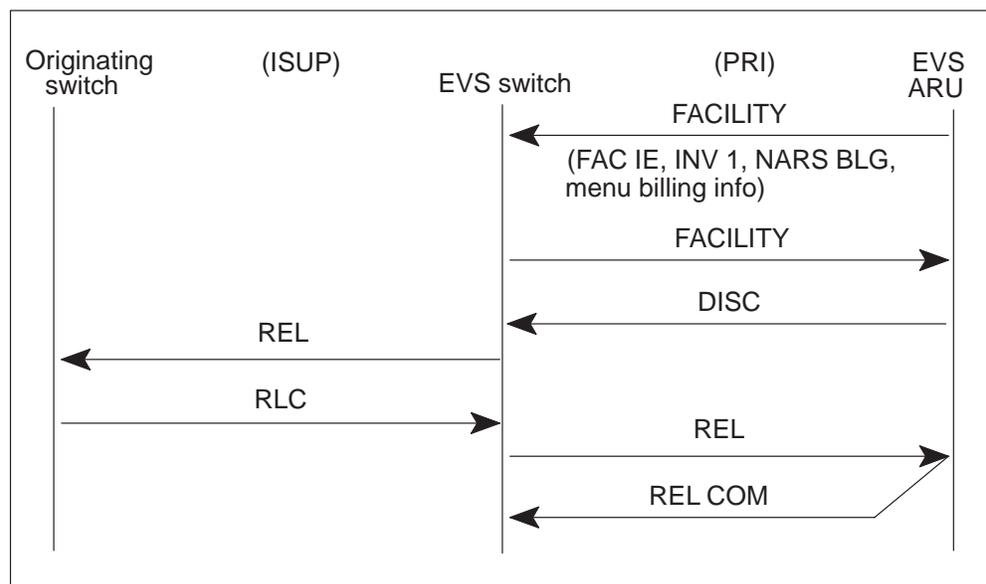
The originating and terminating PRI interfaces are deallocated and idled as shown in Figure 5-18.

Figure 5-18
DISC with cause (three-message sequence)
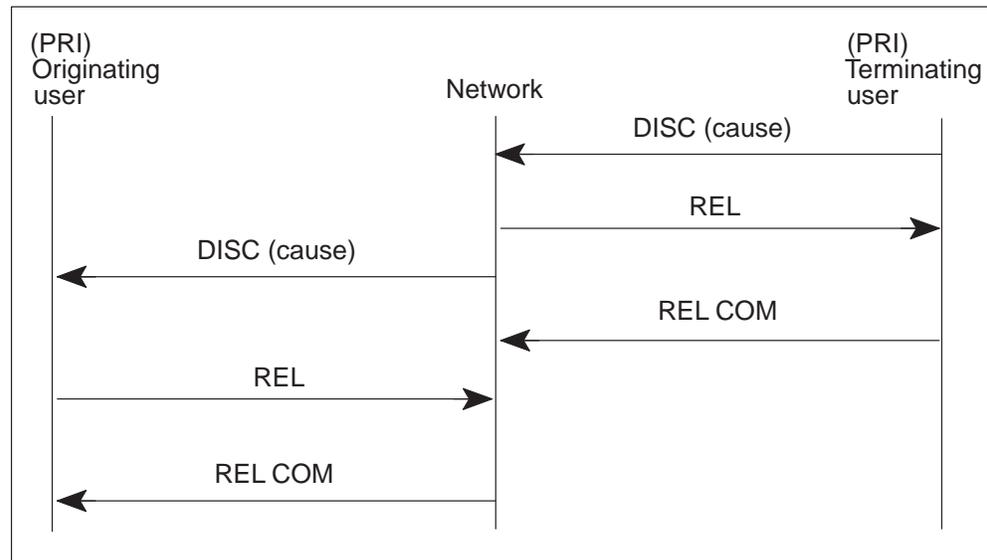
The DMS-250 switch supports a two-message release sequence when handling abnormal error conditions. This sequence involves a REL–REL COM sequence of messages. The net results are identical to the three-message release sequence (the release sequence begins with a DISC message).

In Figure 5-19, the network receives a REL message from the terminator indicating an abnormal call clearing. This REL with cause is relayed to the originating PRI as a DISC message and a REL COM message is sent to the terminator. The sequence of DISC, REL, REL COM for the originator is as in normal call clearing.

Figure 5-19
REL with cause (two-message sequence)
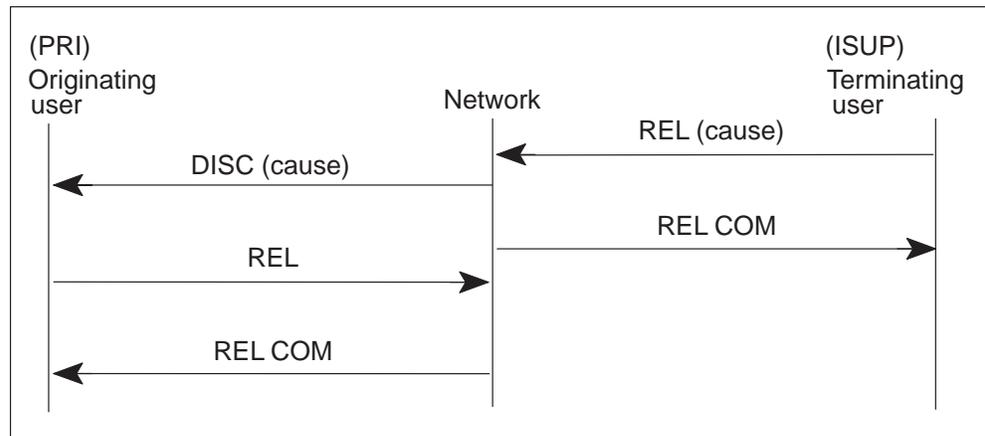
Cause and treatment handling

A treatment is an in-switch event that indicates some sort of problem with the routing or processing of a call (unless it is part of normal call completion). Treatment codes trigger a set of pre-defined announcements or tones that are audible to a user. A call terminates in a specified treatment code for one of the following reasons:

- The DMS-250 switch detects certain conditions that make it impossible to complete the call (such as all trunks busy). The switch then prescribes a treatment without reference to operating company translations.

- The translations supplied by the operating company lead the call to a specified treatment as part of a normal call completion process (for example, an announcement to the originator of the call prior to call completion).

Cause and treatment handling is used if a treatment is set in-switch by one of the following:

- through an error scenario (this includes mapping action codes from a failure response to a treatment)

- when one of the following message types are received by the DMS-250 switch (with causes not equal to 16):

  — ISUP RELease with cause

  — ISDN RELease with cause

  — ISDN DISConnect with cause

  — ISDN RELease COMplete with cause

Treatment routing

The DMS-250 switch can specify that treated calls be routed to tone, announcement, or an outgoing route using a TREAT subtable from table TMTCNTL. Because individual treatment subtables may not necessarily list all possible treatment codes, the switch may have to access several treatment control subtables until it encounters the treatment code result prescribed by the operating telephone company.

The order of precedence for determining the result of the treatment code is as follows.

1   The switch looks for the treatment code in the subtable at a position relevant to the originator of the call (for example, position PRA250 for calls originated by a PRI).

2   If treatment code is not found as described in 1, the switch looks for the treatment code in the subtable at position PRA250.

3   If treatment code is not found as described in 1 or 2, the switch looks for treatment code RODR in subtable at position OFFTREAT.

No matter what table the treatment is in, the routing result of the treatment table (the specification of the tone, announcement, or office route) is ignored for originating PRI trunks. Instead, all treatments incurred on originating PRI trunks result in a DISC or REL message with a cause value obtained through treatment-to-cause mapping.

Alternate treatments

The DMS-250 switch can also specify that all calls routed to treatment from a PRI route according to the information datafilled in the ALTERNATE subtable of TMTCNTL. This takes the place of the reference to the PRA250 subtable and precludes the possibility of referencing both subtables. Use of alternate treatments is specified using the ALTERNATE parameter in the trunk group table for the incoming PRI trunk group.

The DMS-250 switch, through table OFCOPT, offers two options for cause and treatment handling: standard or enhanced.

Standard cause and treatment handling

This mapping is fixed (hard-coded) and cannot be changed.

Datafill

Datafilling the mapping of causes to treatments (or another cause) is not available if "N" is entered in the CSE_TRMT_ENHANCEMENTS parameter of table OFCOPT.

Enhanced cause and treatment handling

This feature allows the datafill of mapping treatments-to-causes, causes-to-treatments, or causes-to-causes.

Enhanced cause and treatment handling includes the following features:

- an expanded table TMTMAP

  — used to map treatments to cause values or another treatment

  — utilized when a treatment is set in-switch and the originating trunk type is either ISUP or PRI

  — contains the same fields as the standard TMTMAP table; CAUSE and PROTOCOL are the only two fields that differ from the standard TMTMAP version

- table CSEMAP that replaces table CAUSEMAP

  — maps an incoming cause value to a treatment or another cause value

  — is utilized when a non-normal call clearing message is received on terminating ISUP or PRI trunks

  — parameters can be datafilled

  — contains the following fields: PROTOCOL, CAUSEREC, CODESTD, ROUTEADV, TMTPROC, CSE2SND, CSTD2SND, TMT, and LOG

- expanding table TRKGRP with the addition of parameter STDIDX (Protocol Standard Index)

  — STDIDX contains the following choices: Q764, TR394, TR444, A607, Q931, BUSY, ALL, NOPROP, PROT1, and PROT2.

  — The information in this parameter, coupled with the information datafilled in either table CSEMAP or table TMTMAP, determines whether to apply an in-band treatment or send a call clearing message with cause to the originating switch.

- expanded originating trunk group parameters for ISDN PRI, reseller IMT, RLT IMT, MWC ISUP IMT, and ISUP FGD

The expanded PROTOCOL field contains the following choices: Q764, TR394, TR444, A607, Q931, BUSY, ALL, PROT1, and PROT2.

Datafill

A "Y" in the CSE_TRMT_ENHANCEMENTS parameter selects the Enhanced cause and treatment handling feature.

Q.931 cause values

If a call originated by a PRI interface cannot be completed by the DMS-250 switch (for example, the terminator is busy, or no circuits are available to route the call), one of the following occurs:

- If the switch treatment maps to a Q.931 cause value—The cause value is sent to the originating PRI in a DISC message. The originating PRI trunk member is deallocated and idled. In this case, the DISC message is the first message sent after receiving the SETUP message.

- If the treatment cannot be mapped to a corresponding Q.931 cause value—The network routes the call to treatment. A CALL PROC message, followed by a PROG message, is sent to the originating PRI containing the PI "in-band tones and announcements" and cause value "unknown." In this case, the CALL PROC message is the first message sent after receiving the SETUP message, as shown in Figure 5-20.

Figure 5-20
Call routed to treatment
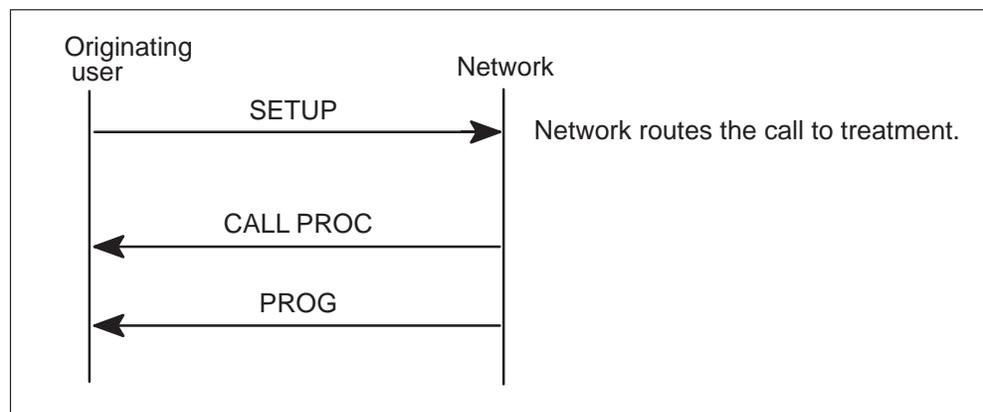
Location codes

Location codes are included in the Cause information element to indicate the location of the cause originator. Table 5-1 lists the Q.931 location codes.

Table 5-1
Location codes for the Cause information element

Code	Meaning
0	User
1	Private network serving local user
—continued—	

Table 5-1
Location codes for the Cause information element (continued)

Code	Meaning
2	Public network serving local user
3	Transit network
4	Public network serving remote user
5	Private network serving remote user
6	Local interface controlled by this signaling link
7	International network
10	Network beyond interworking point
—end—	

The office parameter LOCATION_CODE_MAPPING in table OFCOPT determines whether the location codes are mapped in the DMS-250 switch or transported as received.

Mapping of cause values to treatment

Table 5-2 lists the cause values mapped to DMS-250 switch treatments, and the corresponding treatments applied.

Table 5-2
Cause-to-treatment mapping

Cause number	Cause	Treatment
0	Unknown	Reorder (RODR)
1	Unassigned number	Vacant_code (VACT)
2	No route to specified transit network	Carr_acc_code_error (CACE)
3	No route to destination	Reorder (RODR)
6	Channel unacceptable	Reorder (RODR)
16	Normal call clearing	Reorder (RODR)
17	User busy	Busy_line (BUSY)
—continued—		

Table 5-2
Cause-to-treatment mapping (continued)

Cause number	Cause	Treatment
18	No user responding	No_terminal_responding (NTRS)
19	User alerting, no answer	Reorder (RODR)
21	Call rejected	Restricted_date_time (RSDT)
22	Number changed	Call_not_accepted (CNAC)
27	Destination out of order	Reorder (RODR)
28	Invalid number format	Partial dial (PDIL)
29	Facility rejected	Feature_action_not_acknowledged (NACK)
30	Response to status enquiry	Reorder (RODR)
31	Normal unspecified	Reorder (RODR)
34	Channel/circuit congestion	Generalized_no_circuit (GNCT)
38	Network out of order	System_failure (SYFL)
41	Temporary failure	Channel_neg_fail (CHNF)
42	Switching equipment congestion	Network_blk_hvy_traffic (NBLH)
43	Access information discarded	Reorder (RODR)
44	Requested channel not available	No_crkt (NCRT)
47	Resource unavailable, unspecified	Generalized_no_circuit (GNCT)
50	Requested facility not subscribed	Feature_not_allowed (FNAL)
52	Outgoing calls barred	Call_not_allowed (CNAD)
54	Incoming calls barred	Invalid_authorization_code (INAU)
57	Bearer Capability not authorized	Call_not_accepted (CNAC)
58	Bearer Capability not presently available	Call_not_accepted (CNAC)
63	Service or option not available	Feature_not_allowed (FNAL)

—**continued**—

Table 5-2
Cause-to-treatment mapping (continued)

Cause number	Cause	Treatment
65	Bearer Capability not implemented	BC_not_implemented (BCNI)
66	Channel type not implemented	Connection_not_possible (CONP)
69	Requested facility not implemented	Facility_not_implemented (FCNI)
70	Only res dig info BC available	Call_not_accepted (CNAC)
79	Service or option not implemented, unspecified	Feature_not_allowed (FNAL)
81	Invalid call reference value	Reorder (RODR)
82	Identified channel does not exist	Reorder (RODR)
88	Incompatible destination	Call_not_accepted (CNAC)
90	Destination missing and direct call not subscribed	Perm_signal (PSIG)
95	Invalid message unspecified	Reorder (RODR)
96	Mandatory information element missing	Reorder (RODR)
97	Message type is non-existent or not implemented	Reorder (RODR)
99	Info element is nonexistent or not implemented	Reorder (RODR)
100	Invalid information element contents	Invalid_info_element_contents (IIEC)
101	Message not compatible with call state	Reorder (RODR)
102	Recovery on timer expires	Reorder (RODR)
111	Protocol error unspecified	Reorder (RODR)
127	Interworking, unspecified	Reorder (RODR)

—end—

Mapping of treatments to cause values

More than one treatment may generate a specific cause value. Most of the
DMS-250 switch treatments map to meaningful cause values. All remaining

treatments map to the cause value *unknown* and the treatment is applied in-band.

Table 5-3 lists treatments and the corresponding cause values. For definitions of the treatments, see the *DMS-250 Customer Data Schema Reference Manual*. All treatments not listed map to the cause value *unknown* (127).

Table 5-3
Treatment-to-cause mapping

Treatment	Cause
ANI_account_status_not_allowed (ANIA)	Incoming calls barred (54)
ANI_database_failure (ADBF)	Unassigned number (1)
ANI_FGB_block (ANBB)	Incoming calls barred (54)
Busy_line (BUSY)	User busy (17)
Call_not_allowed (CNAD)	Outgoing calls barred (52)
Calling_card_invalid (CCNV)	Incoming calls barred (54)
Calling_card_timeout (CCTO)	Incomplete number (28)
DBS_communication_failure (SCFL)	Normal unspecified (31)
Facility_not_implemented (FCNI)	Facility not implemented (69)
Feature_action_NACK (NACK)	Service or option not available (63)
Feature_not_allowed (FNAL)	Service or option not available (63)
First_digit_not_zero (FDNZ)	Incomplete number (28)
Generalized_no_circuit (GNCT)	In-band tones and announcements are applied.
IDDD_prohibited	Service or option not available (63)
Inter_LATA_res (ILRS)	Incoming calls barred (54)
Invalid_account_code (INAC)	Incoming calls barred (54)
Invalid_authorization_code (INAU)	Incoming calls barred (54)
Invalid_citycode (INCC)	Incomplete number (28)
Invalid_PIN_digits (INPD)	Incoming calls barred (54)
Local_call_area_barred (LCAB)	Service or option not available (63)
—continued—	

Table 5-3
Treatment-to-cause mapping (continued)

Treatment	Cause
N00_call_blocked (N00B)	Service or option not available (63)
NCS_incoming_exclusion (NCIX)	Incoming calls barred (54)
NCS_invalid_ID_code (NCII)	Incomplete number (28)
NCS_translation_failure (NCTF)	Incomplete number (28)
No_service_circuit (NOSC)	No channel/circuit available (34)
No_software_resource (NOSR)	Resource unavailable (44)
NPA_restricted (NPAR)	Incoming calls barred (54)
Partial dial (PDIL)	Incomplete number (28)
Perm_signal (PSIG)	Destination missing and direct call not subscribed (90)
Reorder (RODR)	Unknown (0)
Service_currently_unavailable (SCUN)	Service or option not available (63)
System_failure (SYFL)	Incomplete number (28)
Temporarily_invalid (TINV)	Incomplete number (28)
Vacant_code (VACT)	Unassigned number (1)
Vacant_speed_number (VACS)	Unassigned number (1)
Vacant_country_code (VCCT)	Unassigned number (1)

—**end**—

Exception conditions

Exception conditions that occur include B-channel glare, B-channel lockout, no response to SETUP, no response after a CALL PROCeed message, and protocol violations. These are described as follows.

B-channel glare

Glare is the simultaneous seizure of a trunk at both ends. Glare occurs when the DMS-250 switch tries to select an idle PRI trunk member for termination just as a SETUP message is being received from the PBX requesting the same trunk member. When this happens, the following rules apply:

- If during processing of a termination, the switch detects an origination, the origination is either denied or allowed to proceed. This is based on the BCHGLARE parameter (can be datafilled) in table TRKSGRP. If the BCHGLARE parameter indicates that the DMS-250 switch should YIELD, the switch selects another member to complete the call.

  The DMS-250 switch network provides the ability to datafill a PRI interface so that it yields to glare conditions. However, yielding to glare conditions is discouraged because it conflicts with the Q.931 standard that states the user always yields to the DMS-250 switch network.

- If the switch attempts to route to a B-channel that has already begun to process an origination, the switch does not terminate to the B-channel regardless of BCHGLARE datafill. The terminating call selects another member to complete the call.

Response to datafill

If yielding or standing is based on BCHGLARE (BCHGLARE = STAND), the following applies:

- If BCHGLARE is datafilled as STAND, the DMS-250 switch continues processing on the terminating call.

- The switch responds to the SETUP message with a REL COM message containing CSE value 34, *no circuit/channel available* (this indicates that the requested B-channel is not available).

- The REL COM message is followed by a SETUP message that contains the call reference for the terminating call, as shown in Figure 5-21.

Figure 5-21
B-channel glare, BCHGLARE = STAND
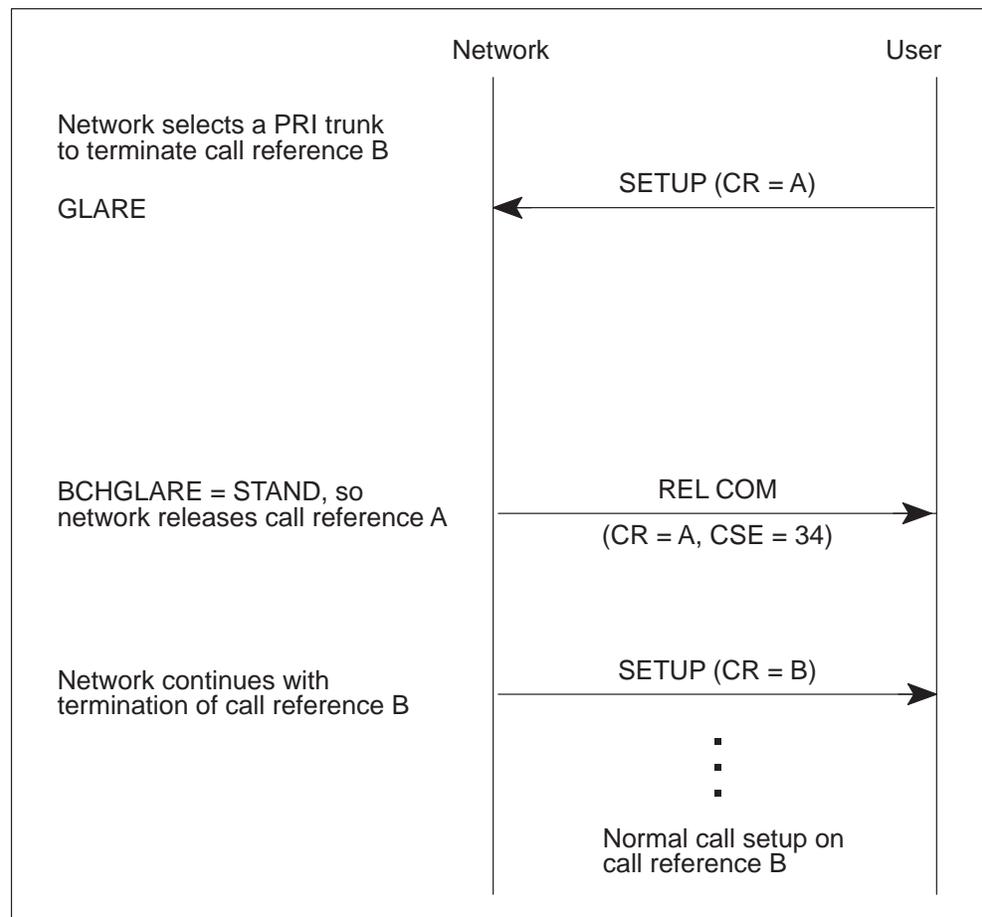
If BCHGLARE is datafilled as YIELD (BCHGLARE = YIELD), the DMS-250 switch allows the origination to proceed on the PRI trunk member and responds to the SETUP message in the same manner as for regular call setup.

The call that attempted to terminate on the PRI member tries to select a different member of that PRI trunk group. If no members are available, the call route advances to the next element in the route list. If this fails, the call is routed to treatment, as shown in Figure 5-22.

Figure 5-22
B-channel glare, BCHGLARE = YIELD

```
                                    Network                          User

Network selects a PRI trunk
on which to terminate                        SETUP (CR = A)
                                    ◄─────────────────────────────────
GLARE
                                                 ▪
                                                 ▪
                                                 ▪
                                          Normal call setup on
                                          call reference A
BCHGLARE = YIELD, so network
backs down and lets CR = A
continue with normal call setup


Reselect/route advance
```
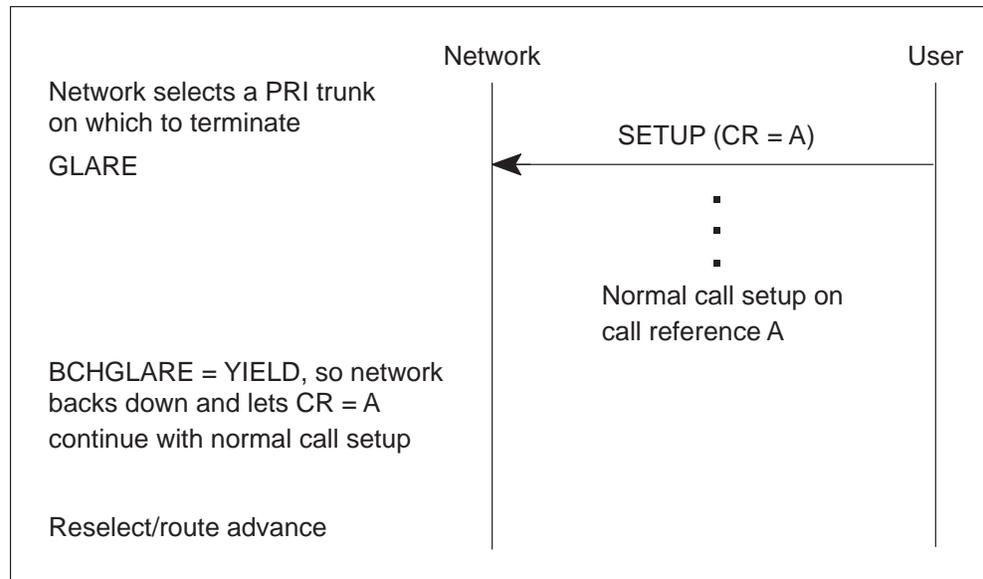
B-channel lockout

One end of the connection may not receive the expected message before
timer T308 or the DMS-250 switch lockout timer expires. The following
occurs in this case.

User-initiated call clearing

If the DMS-250 switch internal lockout timer expires before a REL COM
message is received, the network puts the trunk member in the lockout state.
If the REL COM message is received before timer T308 expires, the trunk
member is returned to idle from the lockout state.

If timer T308 expires before a REL COM message is received and after the
lockout timer has expired, a second REL message is sent and timer T308 is
restarted. If it expires a second time, the trunk member remains in the
lockout state until restart procedures are invoked on the PRI; otherwise, the
PRI trunk member is returned to idle from lockout, as shown in Figure 5-23.

Figure 5-23
User initiates call clearing, timer expires

```
                                          Network                         User
                                                         DISC
Network frees the NETWORK                        <───────────────────────
connection.  The trunk member is
idled, the B-channel is disconnected,
and the T308 and lockout timers
are started.                                             REL
                                                 ───────────────────────>
Lockout timer expires, so trunk
is put in lockout state.

T308 expires.  Start T308 again.                         REL
                                                 <───────────────────────

T308 expires.  Release call reference
but not B-channel until restart
procedure is invoked.  Trunk
remains in lockout state.
```
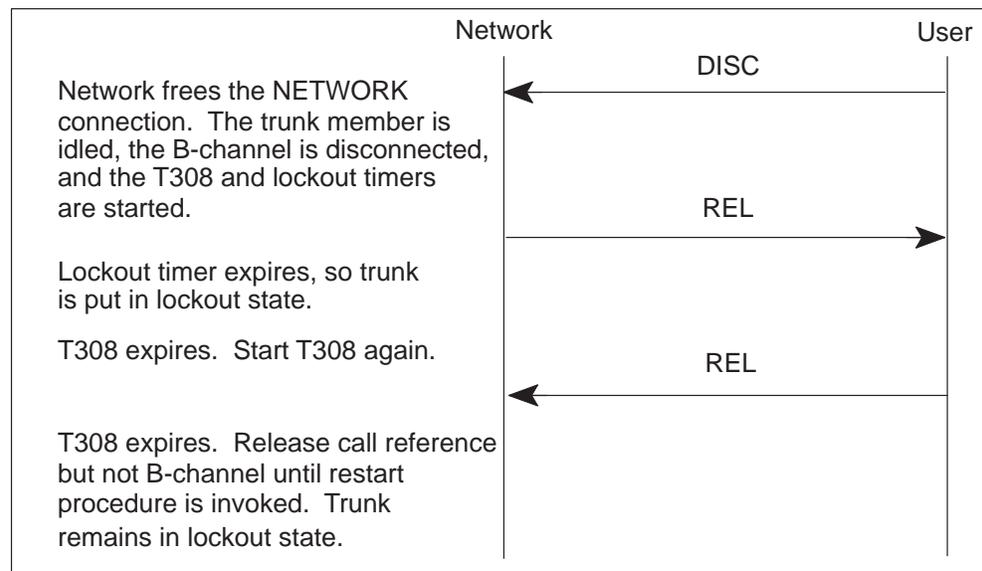
Network-initiated call clearing

Figure 5-24 shows how the network initiates call clearing.

Figure 5-24
Network initiates call clearing, timer expires

```
                                          Network                         User
                                                         DISC
Network frees the NETWORK                        <───────────────────────
connection.  The trunk member is
idled, the B-channel is disconnected,
and the T305 and lockout timers
are started.

Lockout timer expires, so trunk
is put in lockout state.

T305 expires.  Start T308.                               REL
                                                 ───────────────────────>

                                                       REL COM
                                                 <───────────────────────
Cancel T308, release the
B-channel and call reference,
and put the trunk member back
to idle state.
```
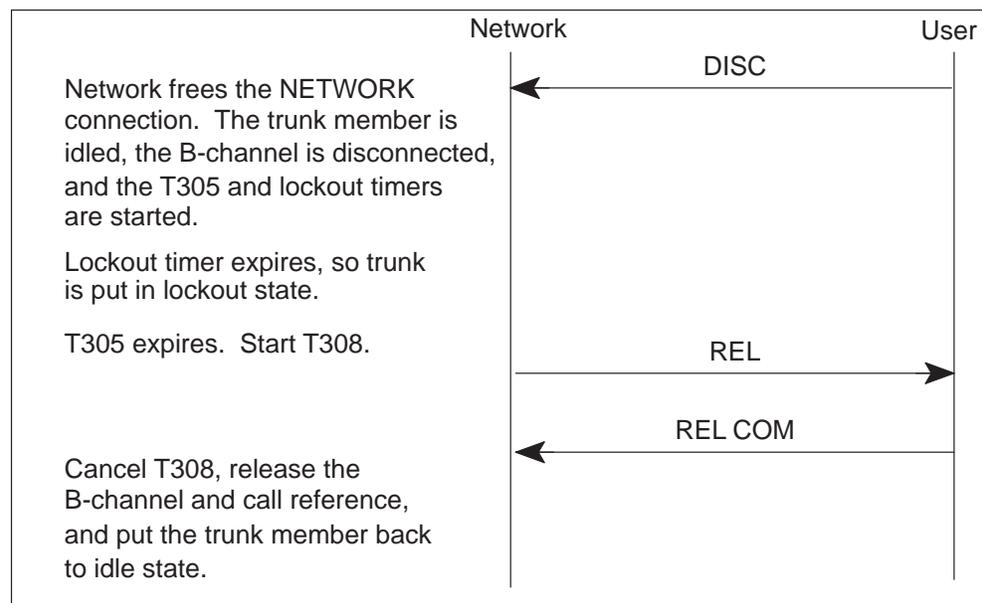
If the lockout timer expires before a REL message is received, the network puts the trunk member in lockout state. If timer T305 expires before a REL

message is received, the network sends a REL message to the user and starts timer T308 while waiting for REL COM. If the REL COM message is received before timer T308 expires, the trunk member is returned from the lockout state to idle.

If the user does not respond after a second REL message is sent from the network, the action taken is as shown in Figure 5-25.

Figure 5-25
PRI-to-PRI call setup, no response from terminator
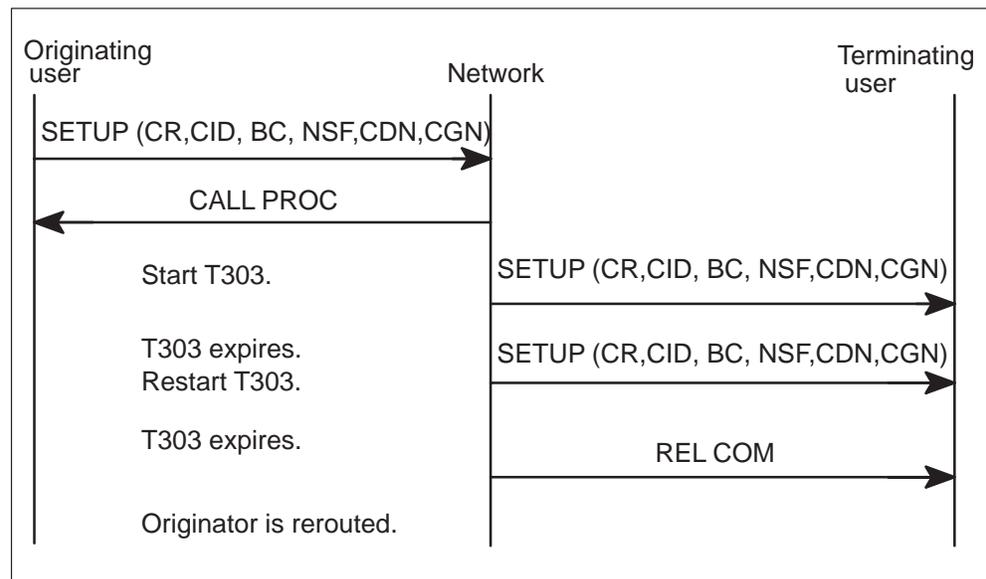
No response to SETUP message

As shown earlier in Figure 5-5, the network initiates call setup by sending a SETUP message over the PRI interface to the terminating user. At that time, the network starts timer T303 and waits for a CALL PROC, ALERT, CONN, or REL COM message before this timer expires.

If this timer does expire, the network sends the SETUP message again and restarts timer T303. If there is a response before T303 expires, call setup continues.

If T303 expires a second time, a REL COM message is sent to the terminating user. The network idles the terminating PRI trunk member and reselects or route advances the originating user to the next element in the route list, as shown in Figure 5-25.

No response after a CALL PROC message

After receiving a CALL PROC message from the terminating user, if timer T310 expires before any call progress indication is received from the terminating user, the DMS-250 switch releases the call and provides call-not-accepted treatment. Call progress indication is in the form of one of the following messages: ALERT, CALL PROC, CONN, or REL. The call control in this event is shown in Figure 5-26.

Figure 5-26
PRI-to-PRI call setup, no response after CALL PROC message

```
Originating                           Network              Terminating
user                                                       user
  |             SETUP                    |                      |
  |------------------------------------->|                      |
  |            CALL PROC                  |                      |
  |<-------------------------------------|                      |
  |                                      |                      |
  |  Start T303.                         |                      |
  |                                      |        SETUP         |
  |                                      |-------------------->  |
  |                                      |                      |
  |  Stop T303.                          |       CALL PROC      |
  |  Start T310.                         |<--------------------|
  |                                      |                      |
  |  T303 expires.                       |         REL          |
  |                                      |-------------------->  |
  |                                      |                      |
  |  Originator is rerouted.             |                      |
```
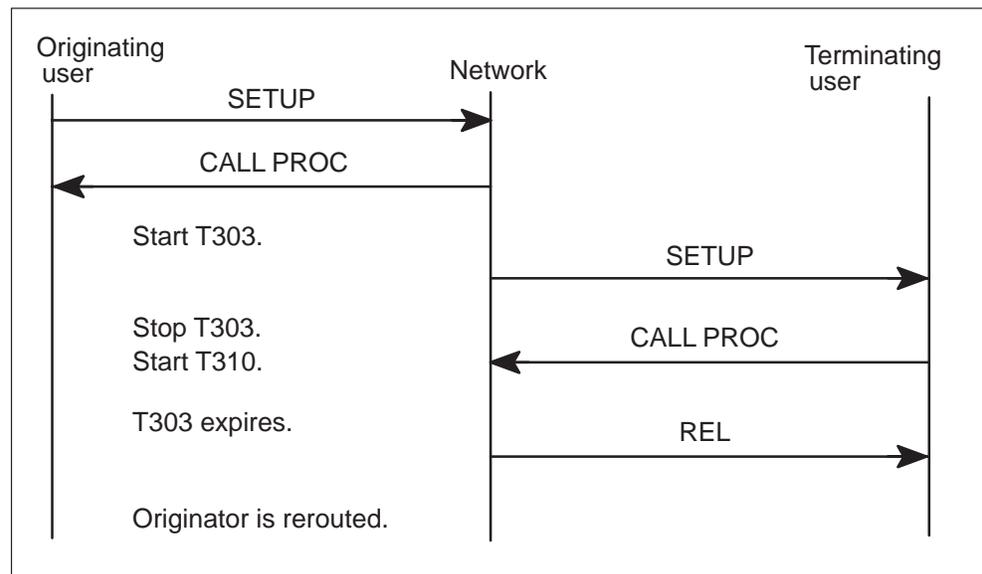
Protocol violations

If a protocol violation is detected during the termination of a call over a PRI interface, the originator responds to the network with a REL message indicating the reason for the protocol violation. Possible protocol violation cause values include the following:

- information element does not exist

- protocol error unspecified

- message type is nonexistent

- invalid information element contents

- mandatory information element is missing

- message is not compatible with state

If the DMS-250 switch receives a REL or DISC message with any of these cause values, it reselects or route advances.

PRI interworking

Agents

PRI interworks with the following agents:

- PRI
- dedicated access line (DAL) (FXO, FXS)
- DAL TIE TRUNK
- FGA
- FGB
- FGC
- FGD (PTS and SS7)
- centralized automatic message accounting (CAMA/VNET CAMA)
- ISUP intermachine trunk (IMT) (reseller standard, reseller option 1, reseller option 2, ISUP RLT)
- T100, T101, T102, T104, T105
- ATR
- FGD DAL

Originators

The following originators are supported when the call terminates to a PRI:

- PRI
- DAL (FXO, FXS)
- DAL TIE TRUNK
- FGA
- FGB
- FGC
- FGD (PTS and SS7)
- CAMA/VNET CAMA

- ISUP IMT (reseller standard, reseller option 1, reseller option 2, ISUP RLT)

- T100, T101, T101 IC, T102, T104, T105

- ATR

- FGD DAL

Enhanced digital recorded announcements

This feature supports the use of enhanced digital recorded announcement machines (EDRAM) to provide announcements to PRI interfaces. EDRAMs may be used to specify a route list or to specify an announcement to be applied to a treatment.

PRI to ISUP

Interworking between ISDN PRI and CCS7 ISUP requires message protocol mapping between the CCITT recommendations Q.931 (ISDN PRI protocol) and Q.764 (CCS7 ISUP).

The PRI/ISUP messages listed in Table 6-1 are interworked (PRI message in the second column is mapped to the ISUP message in the third column). The message and information element mapping is bidirectional.

Table 6-1
Mapping of PRI and ISUP messages

Message type	PRI message	ISUP message
Call establishment	ALERT	Address Completed Message (ACM) (see Note 1)
Call establishment	CONN	Answer Message (ANM)
Call establishment	PROG	ACM (see Note 1)
Call establishment	SETUP	Initial Address Message (IAM)

Note 1: ACM can be mapped to ALERT or PROG depending on the value of the backward call indicator (BCI). If the BCI indicates interworking with PTS trunks, ACM is mapped to a PROG message; otherwise, it is mapped to an ALERT message.

Note 2: REL can be mapped to a DISC or REL message depending on the state of the call. When an active call is cleared, REL is mapped to a DISC; otherwise, it is mapped to a REL.

—continued—

Table 6-1
Mapping of PRI and ISUP messages (continued)

Message type	PRI message	ISUP message
Call takedown	DISC	Release (REL) (Note 2)
Call takedown	REL	REL (Note 2)

Note 1: ACM can be mapped to ALERT or PROG depending on the value of the backward call indicator (BCI). If the BCI indicates interworking with PTS trunks, ACM is mapped to a PROG message; otherwise, it is mapped to an ALERT message.

Note 2: REL can be mapped to a DISC or REL message depending on the state of the call. When an active call is cleared, REL is mapped to a DISC; otherwise, it is mapped to a REL.

—end—

The following PRI/ISUP messages are not interworked because they have local significance only. Any PRI/ISUP message that is not in the following list is not interworked by this feature.

- CALL PROCeeding (PRI)
- CONNect ACKnowledge (PRI)
- RELease COMplete (PRI)
- ReLease Complete (ISUP)

The diagrams that follow illustrate the interworking between PRI and ISUP protocol messages for call establishment and takedown. The mapping of the messages used in Figures 6-1 through 6-7 are detailed in Table 6-1 given earlier in this chapter.

This list of notes applies to all of the interworking diagrams:

- The Q.931 messages CALL PROC, CONN ACK, and RLC are of local significance only and are not mapped.
- The ISUP message RLC is of local significance only and is not mapped.
- The PRI interfaces cut through pulse code modulation (PCM) in both directions upon receipt of the call proceeding message.
- The CCS7 network cuts through PCM in both directions upon propagation of the Address Complete Message.
- The terminating exchange (either ISDN or non-ISDN) provides the ringback tone.

• For active call clearing, an ISUP REL message is always mapped to a Q.931 disconnect message.

PRI-to-ISUP-to-PRI

Figure 6-1 illustrates PRI-to-ISUP-to-PRI call setup and takedown with three-stage call clearing.

Figure 6-1
PRI-to-ISUP-to-PRI with three-stage call clearing

Note: Dashed lines indicate optional messages.
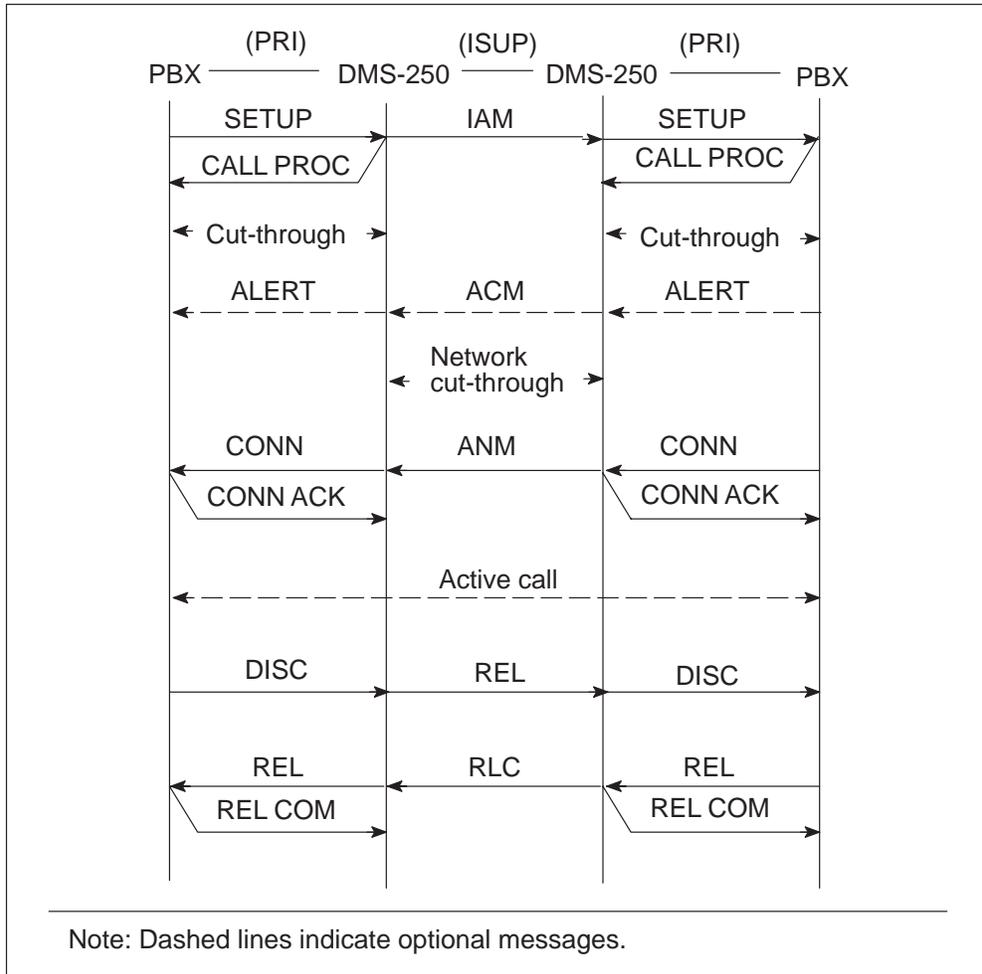
The call scenario in Figure 6-2 illustrates two-stage call clearing whereby a Q.931 REL message maps into the ISUP REL message at the interworking switch initiating call clearing (that is, the calling-access DMS-250 switch) and an ISUP REL message maps into a Q.931 DISConnect message on the other interworking switch (the called-access DMS-250 switch).

Figure 6-2
PRI-to-ISUP-to-PRI with two-stage call clearing

Note: Dashed lines indicate optional messages.
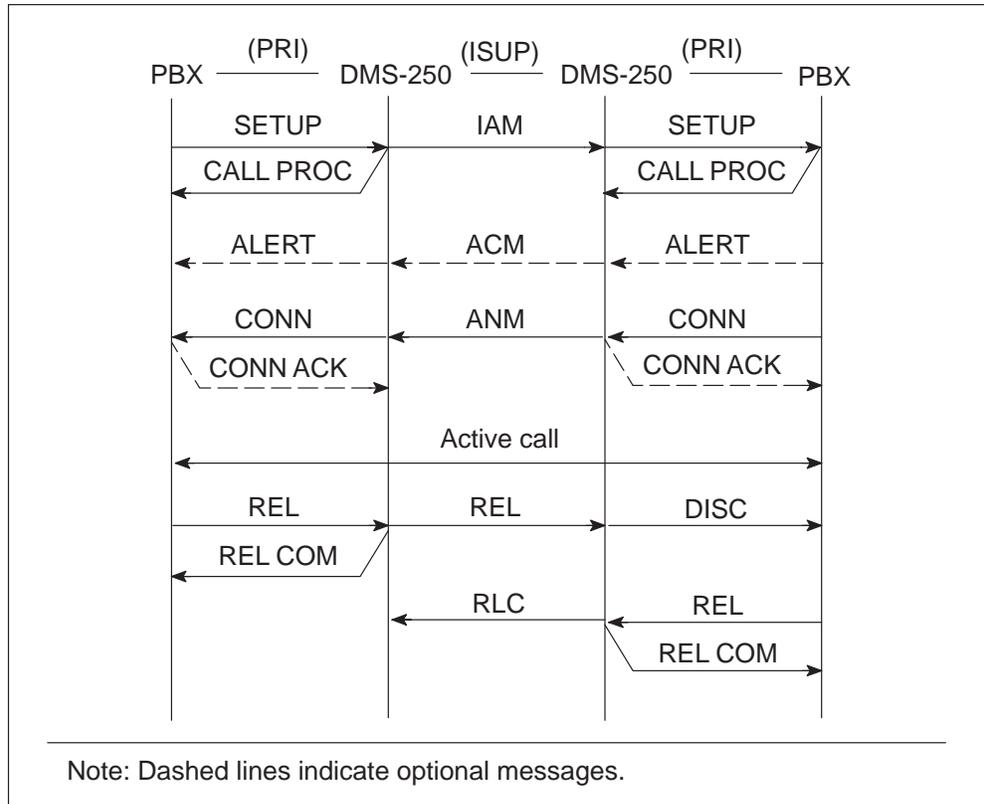
The call shown in Figure 6-3 is an example of an unsuccessful call attempt where the called PRI indicates that the user end is busy and releases the call with a Q.931 REL message. The REL message is mapped into an ISUP REL message. The ISUP REL message is mapped to Q.931 REL at the calling-access DMS-250 switch.

Figure 6-3
Unsuccessful call attempt (user busy)
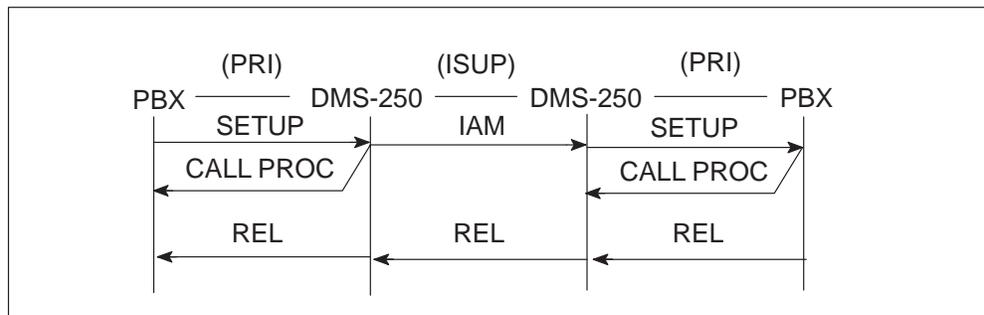
The call shown in Figure 6-4 is an example of the interworking with the in-band tone and announcement applied within the network as a result of a treatment.

Figure 6-4
PRI-to-ISUP-to-PRI call treatment

Note: Dashed lines indicate optional messages.
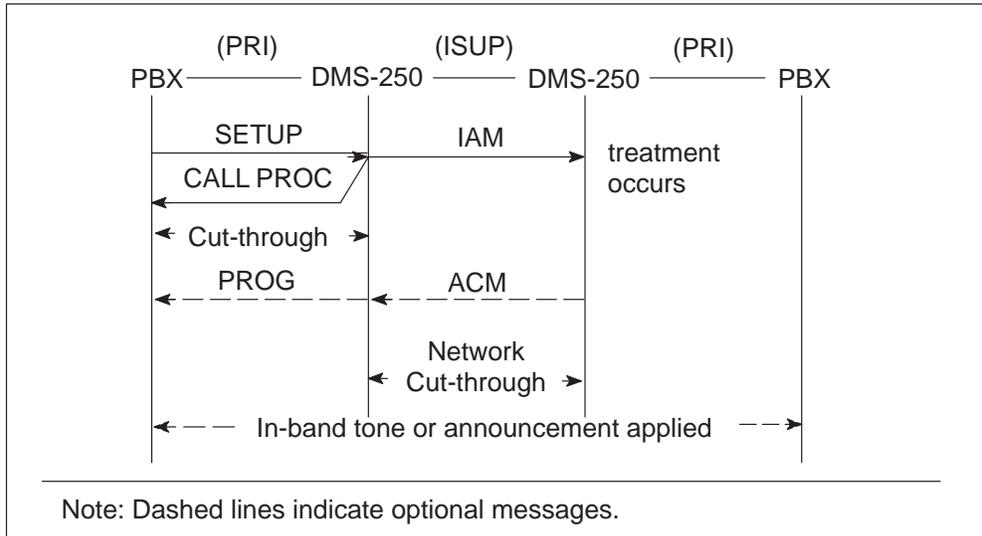
Non-ISUP trunks

The call scenario in Figure 6-5 illustrates interworking with a non-ISUP trunk within the network. Note that the ACM is mapped to a progress (instead of an alerting) message, indicating that interworking has been encountered. At the per-trunk signaling (PTS)/PRI interface, all Q.931 messages are received but ignored. Progress description in the progress indicator (PI) is set to "not end-to-end ISDN."

Figure 6-5
Interworking with a non-ISUP trunk within the network
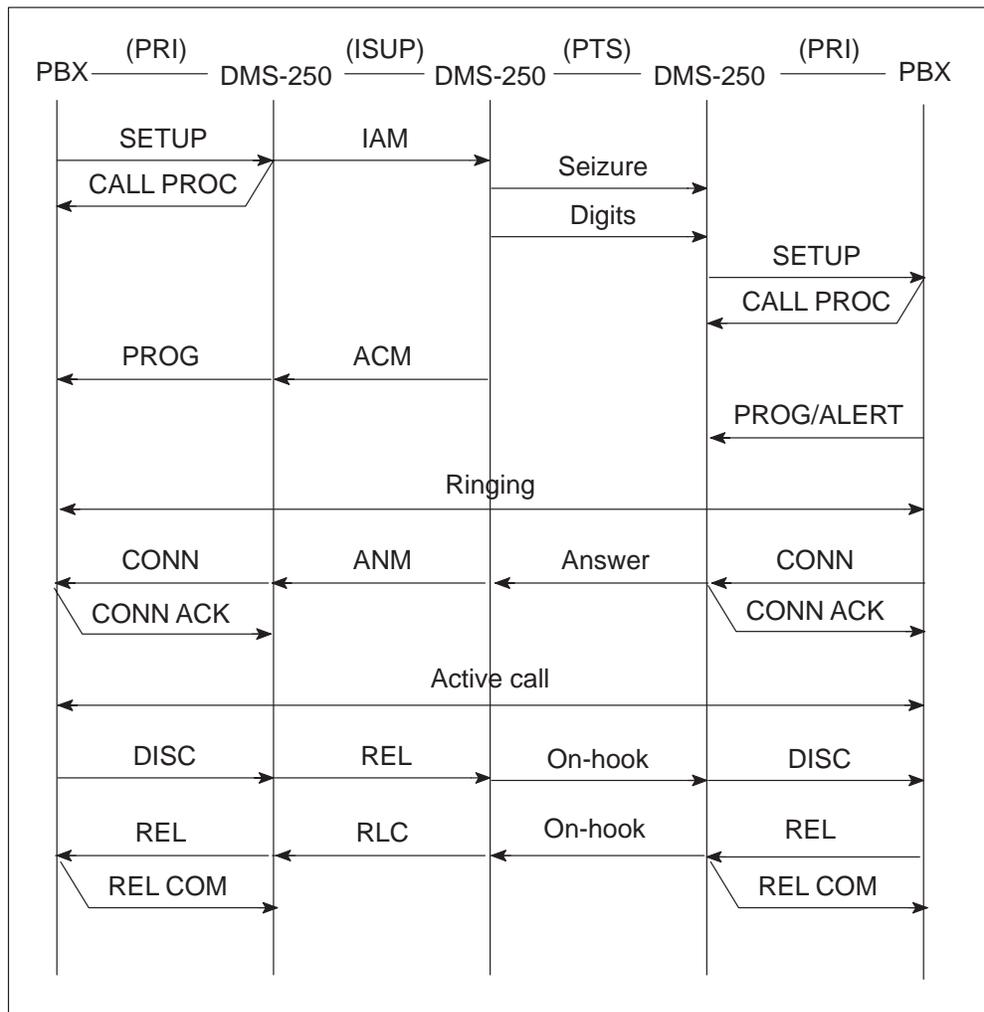
PRI-to-PTS

The call scenario in Figure 6-6 illustrates interworking between ISDN and PTS where the call is routed over a PTS trunk after leaving ISDN.

The progress message, with PI set to "not end-to-end ISDN," is sent back upon encountering the PTS trunk. The progress message is mapped into the Address Complete Message (ACM) with "interworking encountered" bits set at the called-access switch. The ACM is then mapped to a progress at the calling-access switch.

Figure 6-6
Interworking between PRI and PTS trunk—PRI-to-PTS
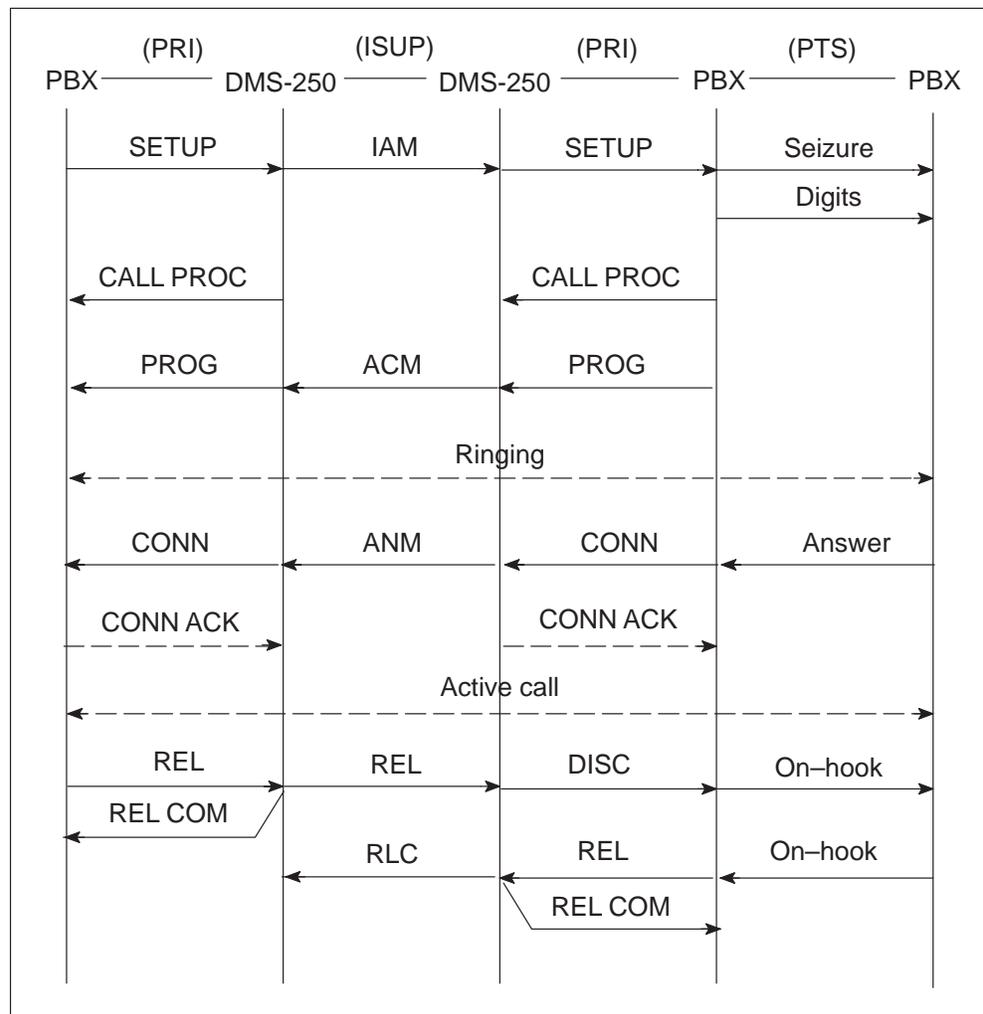
PTS to PRI

The call scenario in Figure 6-7 illustrates interworking between a PTS trunk and ISDN; the call originated on a PTS trunk and then is routed to ISDN. The forward call indicator indicates "interworking encountered."

The progress message is mapped into the ACM with the interworking bit set in the backward call indicator. Progress description in the PI is set to "not end-to-end ISDN."

Figure 6-7
Interworking between PRI and PTS trunk—PTS-to-PRI

Note: Dashed lines indicate optional messages.
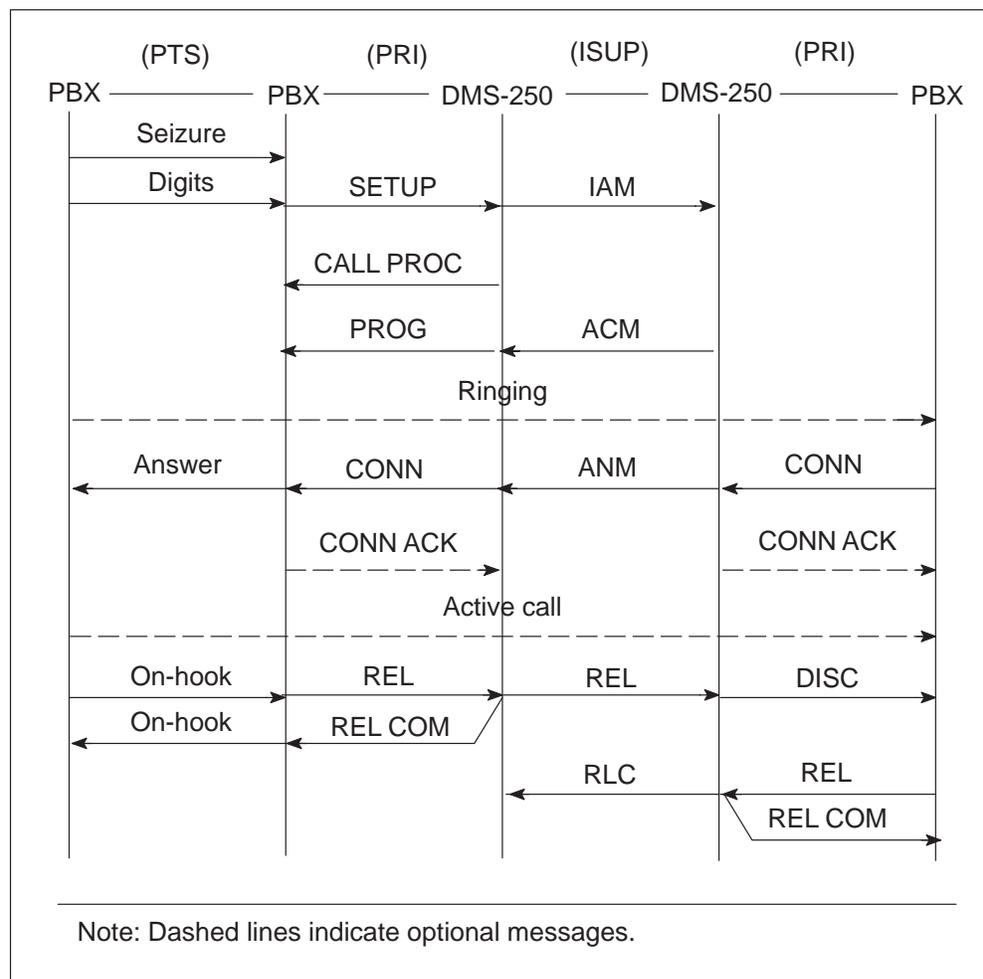
Originating Line Information (OLI)

Previously, OLI to ISDN PRI was not supported. OLI is now available by way of the Locking Shift Codeset 6 parameter. The codepoint can be set to any value in the range from 00 to 7F (hex) within the Codeset 6 parameter.

OLI delivery on PRI termination

OLI information is delivered to the ISDN PRI trunk by way of Locking Shift Codeset 6 parameter in the call SETUP message. The SETUP message for ISDN PRI is shown in table 6-2. The codepoint value in which OLI is delivered is the value that is datafilled on a per trunk basis in table CALLATTR.

Table 6-2
SETUP Message for ISDN

Information Element	Type	Length
Protocol Discriminator	M	1
Call Reference	M	2–3
Message Type	M	1
Repeat Indicator	O	1
Bearer Capability	M	4–6
Channel Identification	O	5–6
Progress indicator	O	2–4
Network Specific facilities	O	5–6
Display	O	3–16
Keypad facility	O	2–34
Signal	O	2–3
Calling Party Number	O	2–16
Calling Party Subaddress	O	2–23
Transit Network Selection	O	4–27
Low Layer Compatibility	O	2–26
High Layer Compatibility	O	2–4
User to User	O	2–131
Locking Shift to Codeset 5	O	1
Codeset 5 Parameters	O	2–*
Locking Shift to Codeset 6	O	1
Codeset 6 Parameters	O	2–*

Note: * = DTMF Delimiter

—continued—

Table 6-2
SETUP Message for ISDN (continued)

Information Element	Type	Length
Locking Shift to Codeset 7	O	1
Codeset 7 Parameters	O	2–*
Note: * = DTMF Delimiter		
—end—		

Feature interaction

Introduction

The services and features supported on PRI are listed below, and described in this chapter:

- integrated services access
- call type delivery
- bearer capability for PRI
- calling number delivery
- PRISM service
- VNET service
- SAC (800/900) service
- call authorization
- suppcode/account code collection
- PRI data calls
- network call transfer
- user to user
- network call identifier
- EVS audio response unit
- RLT/ATP
- Fraud Call Interrupt

Integrated services access

With integrated services access (ISA), any open circuit can originate or terminate any subscribed service. With this service-based architecture, calls originating over an ISA PRI facility are handled based on the call type.

Call types supported

The call types supported for calls coming into the DMS-250 switch include PRISM, TIE (trunk connection between two PBXs), VNET, SAC (800, 900), and direct termination facilities over a single PRI. Call types supported for outgoing calls on the DMS-250 switch include:

- PRISM—generic service for public calls translated in-switch; the address digits (called number) conform to the CCITT recommendation E.164 format. PRISM calls are translated directly using standard HNPA translations.

- VNET—private network calls translated by the NCS; specialized service for calls whose address digits (called number) do not conform to the E.164 format. These calls generally pertain to a private network call in which the address digits are not significant in the public numbering plan. All calls of this type invoke NCS/DAP database query.

- Service access code (SAC)/800 and 900—These calls terminate to the PBX and billed at a flat rate for an unlimited number of calls over a specific period of time.

Invalid call types

Not all combinations of call type/numbering plan indicator are valid on the DMS-250 switch. The switch applies Feature Not Allowed (FNAL) treatment to

- calls that originate on a PRI interface with call types that are not allowed

- calls that originate with a call type not datafilled in table LTCALLS

Depending on interface and service parameters, treatment-to-cause mapping may be performed for invalid call types. For more information on call treatment, see "Cause and treatment handling" in Chapter 5 "Call control procedures."

Identifying call type

Subscription parameters in ISA tables define the ISA environment for the PRI interface. Direct routing, translations, and screening are based on relationships between the PRI interface and the incoming call types. These relationships enable the DMS-250 switch to distinguish the services to be applied to each ISA call.

LTCALLS table

The LTCALLS (Logical Terminal Calls) table contains the ISA data for all call types on a PRI. Each PRI call type has a unique entry in this table and contains the following information:

- CALLATTR (call attribute index)—indexes into table CALLATTR. This index provides a means whereby a separate translations environment can be assigned to each of the ISA call types (that is, separate pretranslators and STSs for PRISM and VNET).

- ISA routing information—an alternative to interexchange routing. Individual call types can be routed directly to an outgoing trunk without first passing through translations and screening. See "Translation routing options" in this chapter for more information.

CALLATTR table

This table (accessed from table LTCALLS) specifies all of the translations and screening information necessary to process PRI calls. Figure 7-1 shows the relationship of these two ISA subscription parameter tables. Each entry in table CALLATTR is a set of translation and screening parameters for a specific logical terminal identifier (LTID) and call type.

Figure 7-1
ISA translation table relationship
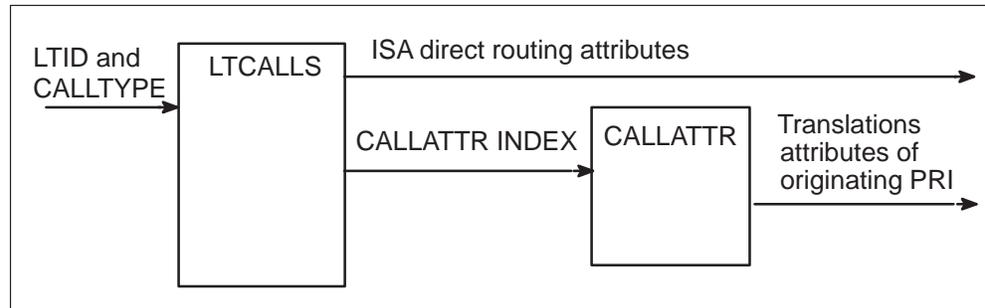
PRI origination and call type

Normally the Network-Specific Facilities (NSF) information element (or parameter) determines the originating call type. This element is in the incoming SETUP message from the originating PRI. (If no NSF information element is received, call type is determined by the NSFDFLT field in table TRKGRP.) After the originating call type is determined, call type information is passed to the terminating PRI directly in the NSF information element of the outgoing SETUP message.

PRISM

If the incoming NSF information element is set to PRISM, the call is treated as a public call type. When the NPI in the called party number information

element terminates to a PRI directly or is mapped to NATIONAL or INTERNATIONAL Nature-of-Address (NOA) parameter in the Initial Address Message (IAM) for SS7 termination, it is set to E.164 in the outgoing SETUP message. In other words, no NSF is sent.

VNET

If the NSF information element is set to VNET, a request is sent to the NCS for real-time database translation. If the NCS returns a VNET direct termination response, the NSF is set to VNET (for PRI direct termination) or mapped to VNET NOA parameter in the IAM. If the NCS returns a DDD/IDDD response, the call is treated as PRISM; the SETUP message is passed as if the call is a public call.

Unsupported NSF value

If a call originates on a DMS-250 switch and terminates to either a DMS-100 or SL-100 with an unsupported NSF value, the call proceeds after the originating DMS-250 switch receives the associated STATUS message. If a call originates on a DMS-250 switch and terminates to an SL-1 with an unsupported NSF value, the call is taken down.

The DMS-250 delivers originating PRI calls as well as originating PTS calls (as shown in Figure 7-2).

Figure 7-2
Delivery of originating PRI and originating PTS calls
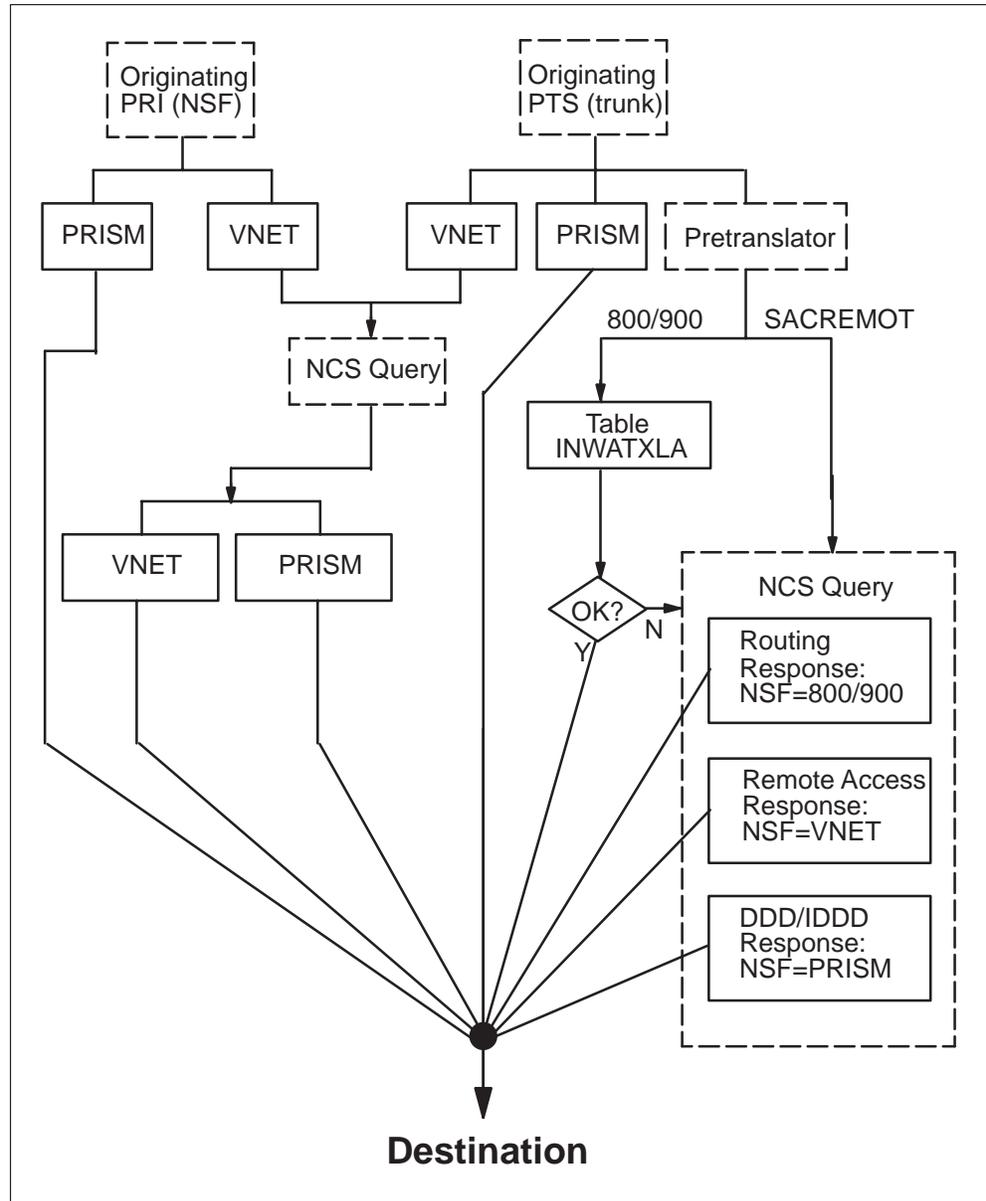
PTS origination and terminating PRI call type

The DMS-250 switch can assign the following call types for PTS trunk originations.

VNET

If the trunk group parameter VPNDED is set to YES, the PTS call is VNET. The DMS-250 delivers the call as described previously for originating PRI calls.

PRISM

If the trunk group parameter VPNDED is set to NO or the ANI database parameter VNETCUST is set to NO, the PTS call is PRISM. Then the following occurs.

SAC translated by NCS

For pretranslated SACREMOT (service access code remote) calls, the DMS-250 switch requests real-time database translation from the NCS. The following occurs for each response returned by the NCS:

- routing response—The NSF is set to 800 or 900 for PRI termination.

- remote-access response—The NSF is set to VNET for PRI termination or mapped to the 800 NOA parameter in the IAM for SS7 termination.

- DDD/IDDD response—The call is treated as public. The SETUP message is passed as if the call is a PRISM call.

SAC translated in-switch

For pretranslated 800 or 900 calls, the DMS-250 switch routes according to table INWATXLA. If the information is unavailable or insufficient to route a call, the DMS-250 switch sends a requests to the NCS for real-time database translation.

Call type mapping

When the originating call type is determined, the call type information is either

- passed to the terminating PRI directly as the NSF information element in the outgoing SETUP message

- mapped to the SS7 NOA field contained within the called party number parameter of the IAM for SS7 termination. If this occurs, the information is passed across the customer's network in the IAM and then mapped back to an NSF information element in the SETUP message for termination to the PRI trunk.

Figure 7-3 and the following tables explain call type mapping.

Figure 7-3
Integrated services access call type mapping

Note: If no NSF is received, the NSFDFLT TRKGRP parameter
is used to determine the call type.
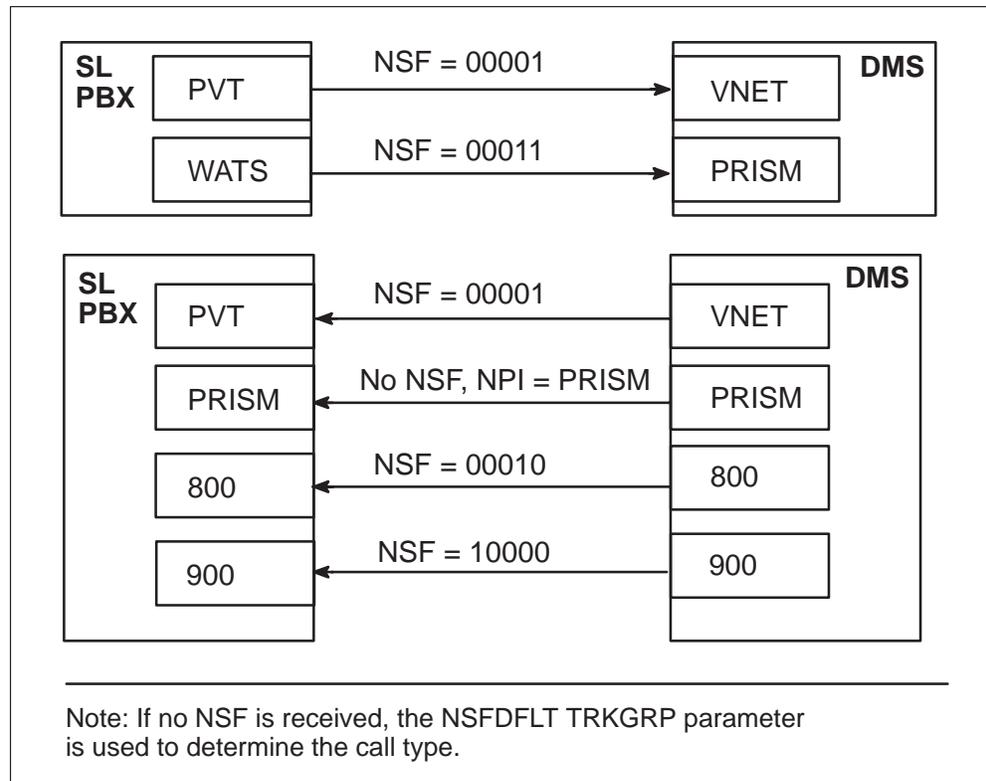
Table 7-1 lists the mapping possibilities between originating and terminating
call types.

Table 7-1
Originating and terminating call type mapping

Originating call type	Terminating call type
VNET (from PRI or PTS trunk)	VNET PRISM
PRISM (from PRI or PTS trunk)	PRISM
800 or 900 (from PTS trunk)	800 or 900
—end—	

Table 7-2 lists the mapping from PTS originations to PRI NSF.

Table 7-2
PTS origination to PRI NSF mapping

Factors for assigning NSF	NSF
Assigned if originating PTS call generates a PNR. Incoming address digits and pretranslations are not a factor.	VNET (00001)
Assigned if originating PTS is translated as either ES INWATS or SACREMOT and the call generates a CDR at the originating switch.	800 (00010) 900 (10000)
Assigned for all other call types that are not PRIVATE, 800, or 900.	PRISM (00011)
—end—	

Translation and routing options

The DMS-250 switch offers two options for processing incoming PRI calls: IEC translation and routing (XLAIEC) and direct ISA route reference routing (ISA RTEREF). The assignment of a call to either XLAIEC or ISA RTEREF is based on call type. Assignment based on call type provides the possibility of mixing the two methods over a PRI interface. For example, VNET calls can be processed with IEC translations (omit RTEREF field) and PRISM calls can be processed using ISA direct routing (RTEREF).

Figure 7-4 shows a comparison of XLAIEC and ISA RTEREF and RTEREF direct routing after authcode screening occurs.

Figure 7-4
IEC translation and routing compared to route reference routing
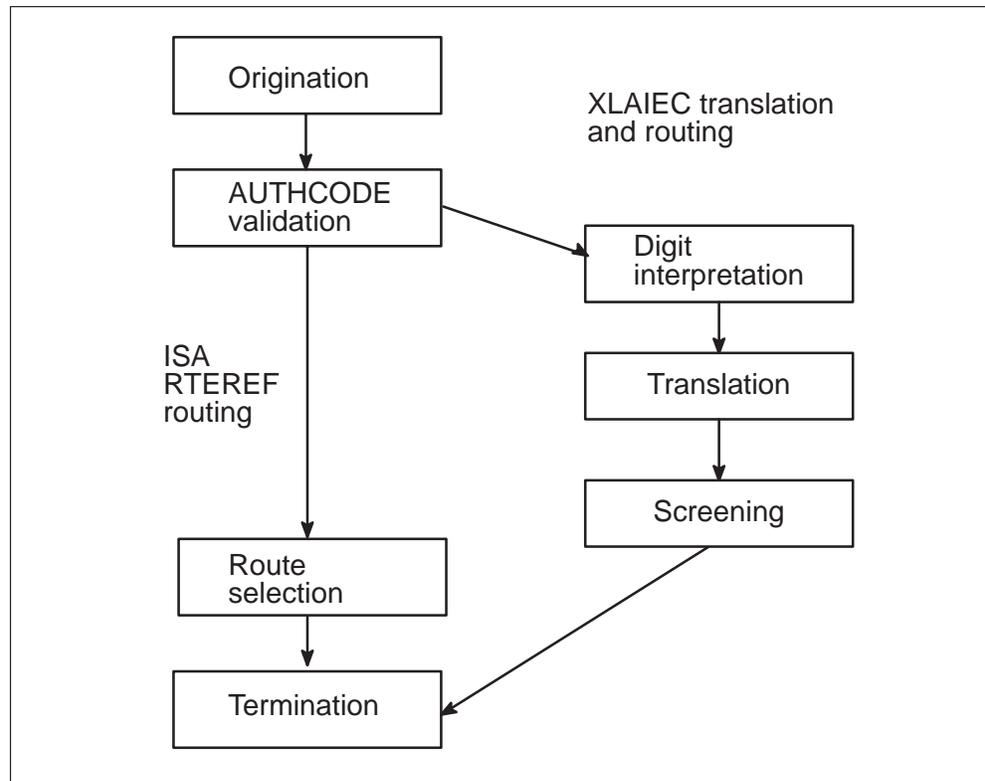
Route reference routing

RTEREF allows calls to be terminated immediately after authcode
screening, without any form of digit interpretation or translations. This
routing method provides a substantial decrease in call completion time. Use
of the RTEREF parameter essentially provides a "virtual nailed-up"
connection between the originator and the terminator. In essence, the
originator has a dedicated connection directly to the terminator. ISA
RTEREF routing allows calls to be terminated immediately after
AUTHCODE validation without the need for any form of digit interpretation
or translations.

The parameters required to invoke ISA RTEREF routing are in table
LTCALLS. Table LTCALLS contains the data for all call types on a PRI
interface. Each LTID/call type combination may have unique parameters
associated with it, providing for a multiple of unique ISA RTEREF
combinations. The LTCALLS fields required to invoke ISA RTEREF
routing are listed in Table 7-3.

Table 7-3
Table LTCALLS fields required to invoke ISA RTEREF routing

Field	Meaning	Description
LTID	Logical terminal identifier	Provides the first part of the 2-part key into LTCALLS. Each LTID is associated with a PRI interface (trunk group) and is used to index into service-related parameters for the interface.
CALLTYP	Call type	The second part of the 2-part key into LTCALLS. This field is synonymous with call type. Call type is obtained by means of the NSF information element of the incoming PRI call.
XLARTE	Translations route	Indicates the type of translations and/or routing performed on incoming calls of this LTID/call type. For ISA RTEREF routing, this field contains the value XLAIEC.
CALLATTR	Call attributes index	Provides an index into table CALLATTR. This table contains information relating to the AUTHCODE filed against this call type.
RTEREF	Route reference	Route reference to which all incoming calls of this LTID/call type are routed. This field consists of a route table name (such as OFRT) and a route reference number. The table name and route number provide a specific instance in the routing table to which all calls are routed. The presence of data in this field indicates the use of ISA direct routing.
OPTIONS		MLTIDX can be datafilled in the OPTIONS field. If MLTIDX is datafilled in the OPTIONS field, a new field to datafill an index into table MLTATTR is accessible. Table MLTATTR contains only one field for SUPPCODE/account codes used by narrowband and wideband data calls.

—end—

If a route is datafilled in the RTEREF field, the call progresses immediately to the outgoing route list without any form of translations or screening. (However, authcode validation is performed with both types of routing to ensure that the authcode (datafilled in table CALLATTR) is valid.)

The following example shows table LTCALLS with ISA direct routing (RTEREF). All TIE calls (when datafilled) originating on LTID ISDN 20 are routed directly to table OFRT, route instance 90. This routing takes place

immediately after AUTHCODE validation is performed, using the authcode datafilled against call attribute index 25.

```
LTID     CALLTYP XLARTE  CALLATTR    RTEREF      OPTIONS
ISDN20   TIE     XLAIEC  25          OFRTR90     $
```

If the optional RTEREF field is omitted (that is, a $ is entered instead of an outgoing route index such as OFRT 20), the call proceeds through the standard IEC translations and screening.

The following example shows table LTCALLS with IEC translation and routing. All PRISM calls originating on LTID ISDN 20 are translated, screened, and routed according to the IEC translations parameters. This is indicated by the absence of a value for the field RTEREF.

```
LTID     CALLTYP XLARTE  CALLATTR    RTEREF      OPTIONS
ISDN20   PRISM   XLAIEC  25          $           $
```

IEC translation and routing

XLAIEC processes calls using procedures for DMS-250 switch digit interpretation, translations, screening, and routing. (The XLARTE field should be datafilled with the value XLAIEC. This field specifies the call type will receive its translations and routing information from the IEC translations tables.)

The following IEC translations are supported:

- offnet dialing
- private network dialing (onnet dialing)
- public speed dialing
- time-restricted calling
- international dialing
- operator services dialing
- test calls
- VNET dialing

The following IEC translations are not supported:

- VNET calling card
- security digits
- credit card dialing
- reset dialing

- off-hook queuing

IEC translation steps

The following lists the steps that occur when the DMS-250 switch performs IEC translations on an originating PRI call.

1 *LTCALLS obtained*—LTCALLS is obtained from table TRKGRP.

2 *Access LTCALLS info*—Using the call type received in the incoming SETUP message and the LTID associated with the trunk group, the DMS-250 switch accesses the LTCALLS information relevant to the call. If the call type is not datafilled or is not supported, the switch applies the call not allowed (CNAD) treatment set to the call.

3 *Access call attributes*—Using the call attribute (CALLATTR) index datafilled against the LTCALLS tuple, the switch accesses the call attribute parameters related to the call in table CALLATTR. If the CALLATTR index datafilled in table LTCALLS leads to a CALLATTR tuple that is not datafilled, the switch applies vacant code (VACT) treatment to the call. Also, the switch outputs a DATABASE ACCESS TROUBLE log, indicating that the call attribute was not found.

4 *Validate authcode*—The switch validates the authcode datafilled in table CALLATTR. This provides access to STS information.

5 *Pretranslate*—Using the pretranslator name datafilled in table CALLATTR, the switch pretranslates the address digits received in the SETUP message (or supplied by the authcode HOTLINE). As specified by pretranslations, the switch performs digit processing, route selection, and call type assignment.

   If the address digits correspond to a public speed number, the switch searches for the speed digits in the corresponding database. If the digits are not found or if speeds are denied, the switch sets appropriate treatment. If the digits are found, the switch replaces the dialed digits with the DDD or private network number stored against the speed digits. The switch returns to the previous step to begin processing the new address digits.

6 *Translate*—The switch performs translations on the address digits using the STS retrieved from the authcode database. The STS provides a unique HNPA control table used to perform translations of up to ten digits.

7 *Select route*—After an outgoing route is selected, route selection proceeds to locate an available terminating agency to complete the call.

Off network dialing

A location off the network (offnet) is reached by dialing a direct distance dialed (DDD) number or an international direct distance dialed (IDDD)

number. An offnet number is different from other dialed number types; the first digit ranges from two to nine and the second digit is a zero or one (as shown in Table 7-4).

Table 7-4
Offnet dialing digits

Type of dialed number	Interpretation
10-digit direct dialed digit (DDD)	NYX-NXX-XXXX
International direct dialed digit (IDDD)	011+CC+NX...X
Note: N=2–9; Y=0 or 1; X=0–9	
—end—	

To differentiate between offnet numbers and other types of address digits, the pretranslator must be datafilled to perform 3- or 6-digit pretranslations to distinguish the NYX-NXX (or NXX) as an off-net number. The pretranslator used is determined on a per-call-type basis and is datafilled in table CALLATTR.

A pretranslator result of CT OFFNET indicates that the address digits apply to an offnet number. The pretranslator result also indicates the minimum number of digits that should be received in an incoming SETUP message. Failure to receive the minimum number of digits results in Partial Dial (PDIL) treatment.

DDD dialing
A direct distance dialing offnet number is entered directly by a subscriber or is retrieved from a speed list. (For more information on speed dialing, see "Public speed dialing" in this chapter.)

IDDD dialing
International direct distance dialing allows subscribers to place calls to locations outside of North America without operator assistance. An IDDD number consists of the international access number (011), the country code (CC) (1–3 digits), and the national significant number. Table 7-5 shows the maximum number of digits allowed.

Table 7-5
IDDD digits

International dialing format	Number of possible digits
International access number	3 digits (011)
Country code (CC)	1–3 digits
National significant number (NSN)	1–11 digits
Note: The maximum number of digits allowed for an IDDD number is 18. This includes the 011 international access number.	
—end—	

An IDDD number

- is always entered directly by the subscriber

- is part of the called party number information element of the incoming CALL SETUP message

- cannot be a speed number

When an IDDD call is identified and digits are collected, the country code digits of the IDDD number are translated by the international translation scheme. The call is then routed over an outgoing trunk to a system capable of continuing the call.

On network dialing—VNET

Users can reach a location on the network (onnet) with a 7-digit private network (VNET) number in a format shown in Table 7-6. The user may directly dial the number or dial a speed number. The speed number then accesses a speed list. (For more information on speed dialing, see "Public speed dialing" in this chapter.)

Table 7-6
Onnet dialing digits

Type of dialed number	Interpretation
7-digit private network (VNET)	NNX-XXXX or NXX-XXXX
Note: N=2–9; X=0–9	
—end—	

The onnet number is different from other dialed number types because of a pretranslations table. This table identifies 3-digit codes as numbering plan areas (NPA) or onnet office codes (NXX).

This means onnet NXXs and offnet NPAs cannot conflict within a given pretranslator. The pretranslator used is determined on a per-call-type basis and is datafilled in table CALLATTR. A pretranslator result of CT ONNET indicates that the address digits apply to an onnet number. The pretranslator result also indicates the minimum number of digits that should be received in an incoming SETUP message. Failure to receive the minimum number of digits results in PDIL treatment.

Public speed dialing—DDD/VNET

A public speed number allows the called number to be in an abbreviated form. The called number used for routing is retrieved by means of a table lookup. This table supplies a ten-digit DDD number or a seven-digit private network number.

A pretranslations table distinguishes the public speed number (in the form ZNXX) is distinguished from other forms of address digits. This table identifies four-digit codes to be public speed numbers by using the CT selector with the public speed (PUBSPD) call type. Translations occur as follows:

- *Search*—When the number dialed corresponds to a public speed number, the speed digits are searched for in the list of public speed numbers (one of which may be associated with an originating partition).

- *Successful location*—If the speed number is successfully located in the speed list, call processing replaces the digits dialed (with the digits from the speed database). IEC translations are initialized again at that point, beginning with digit interpretation and pretranslations. The speed list is stored in table SPEEDTAB.

- *Unsuccessful location*—If the speed number is not located in the speed list, vacant speed treatment is applied to the call. If public speed numbers are not allowed on the originating partition, RODR treatment is applied to the call.

- *Treatment applied*—In any case where treatment is applied to the call, cause-to-treatment mapping may be applied as described in Chapter 5, "Call control procedures."

Ten-digit routing

Ten-digit routing allows a tandem switch to terminate calls. Tandem switch termination avoids the access and egress charges that occur when the call is routed by switches owned by local exchange carriers.

Ten-digit routing on a call is done by means of indexing the call through a series of tables and subtables. The following are the subtables and tables involved in ten-digit routing:

- subtable FNPACODE (under FNPACONT) or HNPACODE (under HNPACONT)

- subtable RTEREF (under FNPACONT or HNPACONT)

- table TENDTSCR

- table TENDTSCR

Figure 7-5 represents an example call as it is routed through these tables. The numbers next to the arrows correspond to the numbered steps at the bottom of the figure.

Figure 7-6
Ten-digit screening translations

Incoming call

(214) (555) – (1234)

(1)

| (555) | (555) | (22) | Y | Table |
| FROMDIGS | TODIGS | RTEREF | CAMAAUTH | FNPACONT.FNPACODE |

(2)

| (22) | (EXDS (XXX 01) (S D ATRUNK) $ | Table |
| RTE | RTELIST | FNPACONT.RTELIST |

(3)   **(4)**

| (XXX 01) | (1111) | (2222) | (10) | Table |
| CUSTREF | FROMDIGS | TODIGS | RTTABIDX | TENDTSCR |

(5)

| (10) | (S D MDALWDTGS91)   (S D MDALWDTGS92) $ | Table |
| RTE | RTELIST | TENDRTE |
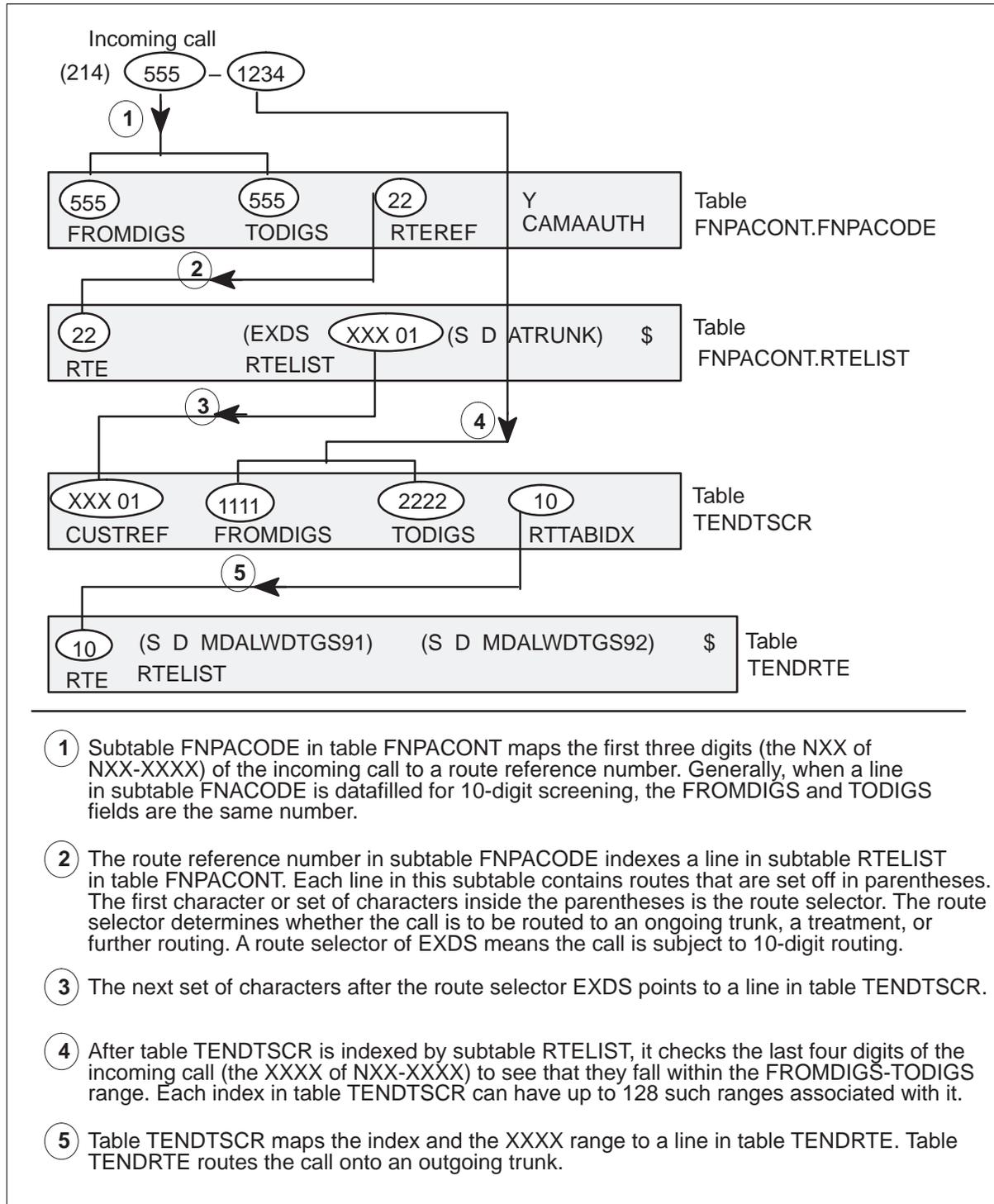
(1) Subtable FNPACODE in table FNPACONT maps the first three digits (the NXX of
NXX-XXXX) of the incoming call to a route reference number. Generally, when a line
in subtable FNACODE is datafilled for 10-digit screening, the FROMDIGS and TODIGS
fields are the same number.

(2) The route reference number in subtable FNPACODE indexes a line in subtable RTELIST
in table FNPACONT. Each line in this subtable contains routes that are set off in parentheses.
The first character or set of characters inside the parentheses is the route selector. The route
selector determines whether the call is to be routed to an ongoing trunk, a treatment, or
further routing. A route selector of EXDS means the call is subject to 10-digit routing.

(3) The next set of characters after the route selector EXDS points to a line in table TENDTSCR.

(4) After table TENDTSCR is indexed by subtable RTELIST, it checks the last four digits of the
incoming call (the XXXX of NXX-XXXX) to see that they fall within the FROMDIGS-TODIGS
range. Each index in table TENDTSCR can have up to 128 such ranges associated with it.

(5) Table TENDTSCR maps the index and the XXXX range to a line in table TENDRTE. Table
TENDRTE routes the call onto an outgoing trunk.

Test calls

DMS-250 switch test calls enable various manual and automatic tests from distant toll and local offices without intervention at the called office. The test line presents known conditions upon connections being made to them. Test line test calls can be originated manually from the trunk test position (TTP), or automatically in automatic trunk test.

The switch supports connections to T100 and T102 test lines from PRI trunks.

- 100 test line—known as quiet or balanced termination; provides noise and loss measurement
- 102 test line—known as milliwatt testline; provides far-to-near transmission loss measurement

The switch also supports calls received from distant offices. These calls are classified as test calls by conforming to the format 10X or 95X-XXXX. The digits 10 or 95 are information digits that indicate test calls. For more information on test calls, see Chapter 10, "Service verification."

IEC screening and routing

PRI supports the following IEC screening and routing services. Screening and routing capabilities denoted with an * are provided for IEC-translated calls and calls that use ISA direct routing. These screening and routing functions can be used for all call types, regardless of LTCALLS datafill.

- restricted usage by date and time
- incoming exclusion
- time-of-day routing *
- class-of-service screening
- trunk group class-of-service screening *
- retranslations for originating PRI interfaces *

Restricted usage by date and time

This feature restricts subscribers from making calls during specified time periods based on the parameter USERCLASS associated with the filed authcode in table AUTHCODM.

The authcode parameter specifies the type of time-restricted service, such as the following:

- unrestricted (subscriber is not time limited)
- restricted class 1
- restricted class 2

- restricted class 3

If the authcode associated with a call type is time-restricted, the date and time of the origination are compared against the restricted times for the subscriber. The origination date and time are calculated by using the local time bias field in the originating trunk group (field TIMEBIAS). This field specifies whether to add or subtract up to 12 hours in one-hour increments from the DMS-250 switch time to calculate the call origination date and time.

Calls failing restricted usage by date and time screening are blocked and given restricted usage treatment. Depending on service subscription parameters, cause-to-treatment mapping may be performed.

Incoming exclusion

Incoming exclusion prevents subscribers from calling back into their own local calling area. In this way, intrastate traffic that is not permitted for specialized common carriers by individual state public utilities commissions can be blocked. Incoming exclusion is performed only on offnet numbers of at least six digits. If the offnet number consists of exactly seven digits, the trunk group parameter SNPA is temporarily prefixed onto the dialed digits before screening is performed. This ensures that screening is performed against the intended NPA-NXX combination.

The trunk group parameter IEXCLINX controls incoming exclusion. IEXCLINX specifies which of the 160 area codes are excluded. Up to eight of these excluded area codes can be further excluded down to the exchange code (NXX) level. Up to 256 incoming exclusion schemes may be specified.

If a DDD number is collected from the dialed digit stream or retrieved from a speed list, the first three or six digits of the ten-digit number are compared against the excluded NPA and/or NPA-NXX combinations for that originating PRI interface. Calls that are excluded are given local call area barred treatment; this may result in treatment-to-cause mapping.

Time-of-day routing

Time-of-day routing allows or denies route choices based on the time of day. Routes can also be varied based on the day of the week or the day of the year (to account for weekends and holidays). This provides a cost-effective use of facilities.

Time-of-day routing for the DMS-250 switch is done for the routing tables as a refinement of the conditional selectors (CND, NOT). This allows efficient routing to other routes in and between these tables as a function of time of day. Because time-of-day routing uses the existing capabilities of the

conditional selectors, the functionality of time-of-day routing is not modified with the introduction of PRI on the switch.

Trunk group class-of-service screening

Trunk group class-of-service screening is performed to determine whether the originating and terminating types of trunks are allowed to be connected to each other based on their class of service. Trunk group class-of-service screening is performed on all PRI calls, regardless of whether ISA direct routing is performed.

Retranslation

The DMS-250 switch currently provides the ability to assign an outgoing route selector as the *RX* route selector. This means that calls terminating to that route are capable of retranslating, and choosing another outgoing route. In retranslations, the following can be specified:

- the STS used when retranslating the call

- a digit manipulation (DIGMAN) index used to add or delete digits from the called number field prior to retranslations. The new digits are then pretranslated and translated according to IEC translations.

The pretranslator name used cannot be specified. The source of the pretranslator name depends on the nature of the retranslated call. For non-PRI-originated calls, the pretranslator name is taken from table TRKGRP. For PRI-originated calls, the pretranslator name is taken from table CALLATTR and from the CALLATTR tuple used on the originating PRI call.

Satellite screening

Satellite screening prevents the use of more than one satellite hop for a call. The PRI is not supported over satellite facilities. All PRI agencies originating on or terminating from the DMS-250 switch must travel over land-based transmission media. However, if satellite screening is performed on PRI agencies, the call does not produce an error and satellite screening passes. (Screening indicates that the PRI is a non-satellite trunk.)

Satellite screening always fails for calls marked as *DATA*. Any of the following bearer capabilities always cause satellite screening to prevent a satellite jump: 56 kbit/s unrestricted, 64 kbit/s unrestricted, 64 kbit/s restricted, and 3.1 kHz audio.

Identifying voice/data and transmission rate—bearer capability

Bearer capability (BC) (an information element carried in the SETUP message) indicates whether the call is voice or data and the rate of

transmission required. (For more information on bearer capability, see Chapter 4, "Message structure and functions.")

The DMS-250 switch supports the following bearer capabilities for PRI trunks:

- speech
- 56 kbit/s unrestricted
- 64 kbit/s unrestricted
- 64 kbit/s restricted
- 3.1 kHz audio

When terminating to a PRI, the BC information element passes unchanged unless the call has been marked as data through translations.

Data calls

Any one of the following conditions indicate a data call:

- ISDN PRI bearer capability information element is set to 56 kbit/s, 64 kbit/s restricted, 64 kbit/s unrestricted, or N×64 calls (N=2 to 24).
- ISUP User Service Information parameter is set to 56 kbit/s, 64 kbit/s restricted, 64 kbit/s unrestricted, or N×64 calls (N=2 to 24).
- A data call is indicated by one of the following:
  — the DATA field in table TRKGRP, for the originating trunk
  — the NCS response
  — the DATA field in table ANISCRN
  — received IMT information digits

Table 7-7 shows the data call dialed number interpretation.

Table 7-7
Data call dialed number

Type of dialed number	Interpretation
Datacall	#56+7/10 digits
—end—	

If the call is marked as data, the following rules apply:

- PRI origination

— If no BC was received, the BC of SPEECH is sent with the outgoing SETUP message.

— If the BC is 3.1 kHz, the BC of SPEECH is sent. If the originating BC is 56 kbit/s, 64 kbit/s, or 3.1 kHz, the BC is passed unchanged.

- non-PRI origination

  — If the DIGITAL field in the trunk group is set to YES, the BC of SPEECH is sent with the outgoing SETUP message.

  — If the DIGITAL field in the trunk group is set to NO, treatment is applied to the call.

- terminating over a CCS7 IMT

  A data call that originates over a PRI facility with a BC information element of 56 kbit/s or 64 kbit/s (restricted or unrestricted) terminating over a CCS7 IMT is terminated only over a CCS7 IMT marked DIGITAL in table TRKGRP. If an appropriate CCS7 IMT cannot be found, the call is blocked. The call is routed to GNCT treatment.

- terminating over non-IMT trunks

  No restriction is applied to calls destined to non-IMT trunks.

Data call cause handling

For all data calls, the DMS-250 propagates the non-normal cause parameter or cause information element received in one of the following messages from the terminating agency:

- ISUP RELease with cause

- ISDN RELease with cause

- ISDN DISConnect with cause

- ISDN RELease COMplete with cause

The non-normal cause parameter or cause information element received is propagated unchanged to the originating agency when

- the call is a data call

- the terminating agency has received one of the previously listed messages (and the cause value is not equal to 16 "normal clearing").

Data call cause handling requires that office parameter CSE_TRTMT_ENHANCEMENTS is set to "N."

Figure 7-7 shows cause value handling for data calls.

Figure 7-7
Data call cause value handling
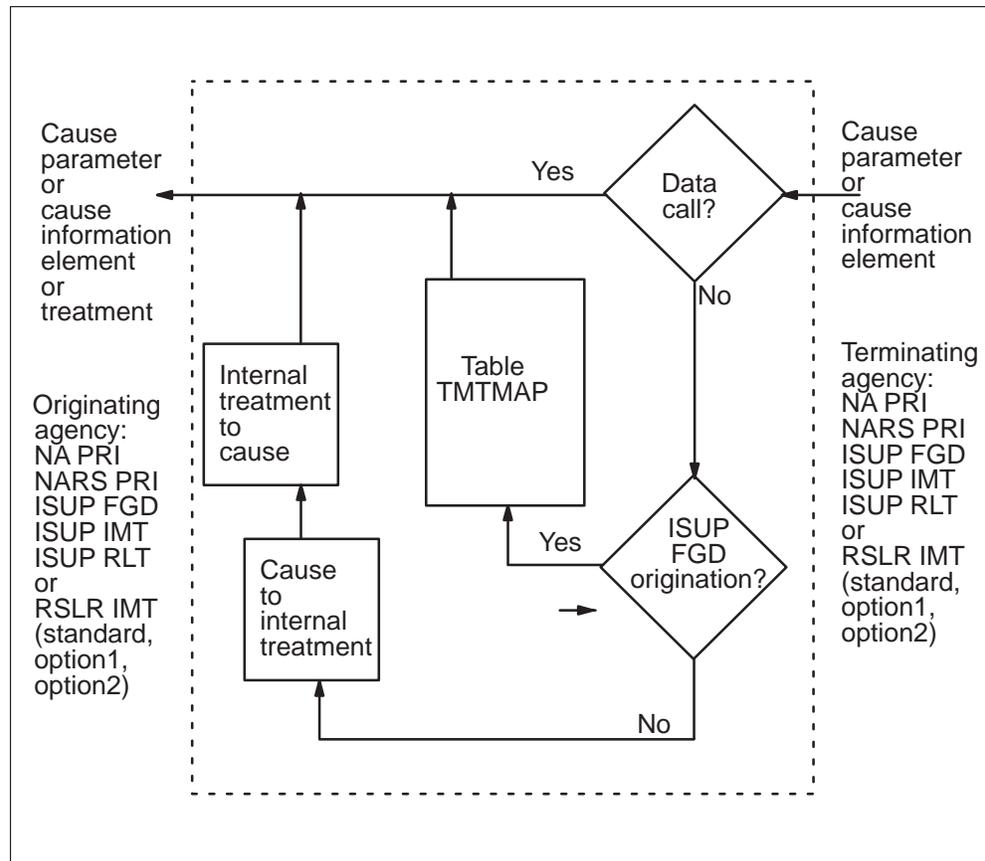
Route advancing

For all data calls, route advancing occurs if any of the following cause values are received at a terminating DMS-250 switch (and therefore the terminating agency is not an MCI ISUP IMT):

- 34—no circuit available
- 41—temporary failure
- 42—network congestion
- 47—resource unavailable

Identifying call origin—calling number delivery

The calling number information element identifies the origin of the call. The calling number delivery service provides this number to the called party (except when interworking from a PTS trunk).

SETUP message
When a SETUP message is received, the network checks to see whether the calling number information element is included. If so, it is captured in the ANI field in the appropriate billing record. (PRI delivers pseudo-ANI for FGC trunks.)

SETUP contains calling number
If the calling number information element is included in the SETUP message, the following rules for the calling number delivery apply (depending on the CPIALLOW value in Table CALLATTR for the terminating PRI):

- CPIALLOW = YES
  - If the screening indicator is not present in the calling number, the screening indicator is set to *user-provided, not screened* and the calling number is sent unchanged in the outgoing SETUP message to the terminating PRI. If the screening indicator is present in the calling number, it is relayed to the terminating PRI.
  - If the user has provided the presentation indicator in the calling number, it is passed unchanged to the terminating PRI. Otherwise, the presentation indicator is set to the subscription default value "presentation allowed."

- CPIALLOW = NO
  - The calling number information element is not delivered in the SETUP message to the terminating PRI. This means the presentation indicator and screening indicator fields are also not delivered.

SETUP does not contain calling number
If the SETUP message does not contain the calling number information element, the following rules apply (depending on the CPIALLOW value in Table CALLATTR for the terminating PRI):

- CPIALLOW = YES
  - If the calling number is not received, then it is not sent.
  - The screening indicator is set to "network provided," and the presentation indicator is set to the default value "presentation allowed." The calling number is not sent.

- CPIALLOW = NO
  - The calling number information element is not passed to the terminating PRI.

PTS-to-PRI call

The DMS-250 switch may receive the ANI from the following originating agencies:

- FGB

- FGD

- centralized automatic message accounting

PRI delivers pseudo-ANI for FGC trunks.

If PRI termination from these agencies is required, the following rules for calling number delivery are applied, depending on the CPIALLOW value in table CALLATTR for the terminating PRI:

- CPIALLOW = YES

  — Because the presentation indicator and screening indicator are not available for these types of agencies, the switch sets the presentation indicator to the subscription default value *presentation allowed* and screening indicator to *user-provided, not screened*.

  — The ANI number without the information digits is outpulsed in the SETUP message to the terminating PRI.

  — Note that the ANI is delivered to the terminating PRI only for calls that generate a CDR.

- CPIALLOW = NO

  — The ANI number is not passed to the terminating PRI.

If the calling number is not available due to interworking with a PTS trunk, the calling number information element is not sent over the outgoing PRI interface. This means that the presentation indicator and screening indicator fields are also not delivered.

SS7 network interworking

Upon receiving an ALERT message from the terminating PRI, the DMS-250 switch sends an ACM message with the Backward Call Special Indicator (BCSI) parameter. The BCSI is typically sent in the ACM, but if an ACM is not sent (because of fast answer, for example), then the BCSI is sent in the ANM.

The following values are coded in the BCSI to indicate the calling number delivery status:

00 = No calling number is delivered (default)
01 = Calling number is delivered

The calling number delivered indicator is captured in the call detail record (CDR) in the originating switch. A new call disposition qualifier (TP3 or *C) field containing value 11 (decimal) in both the CDR and PNR is added to indicate that the calling number is delivered at the terminating PRI. For the CDR, this is in word 27, bits 0 to 3; for the PNR, this is in word 15, bits 6 to 9.

Figure 7-8 shows calling number delivery within the SS7/ISDN network.

Figure 7-8
Calling number delivery in the SS7 network
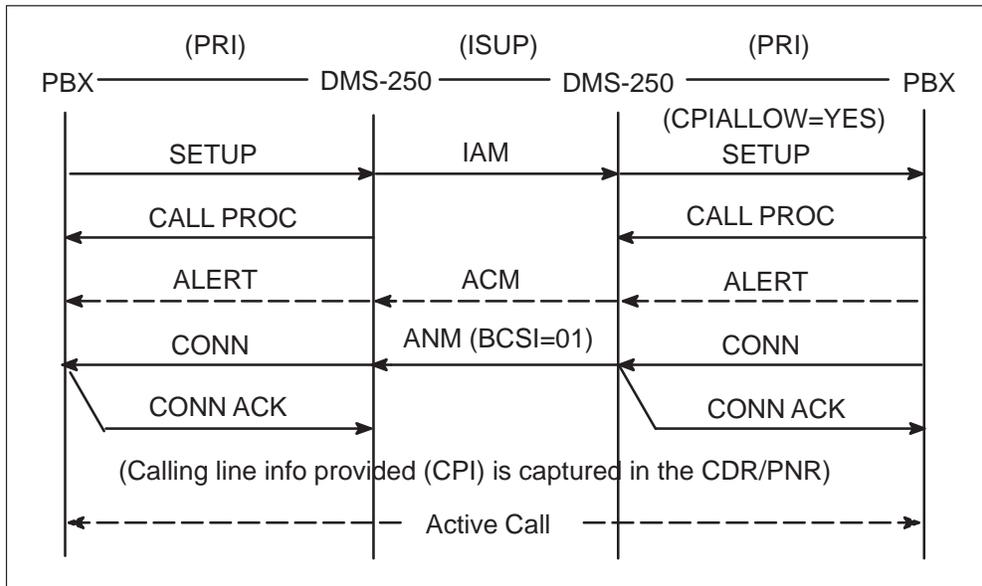
Figure 7-9 illustrates nondelivery of calling number within the SS7/ISDN network.

Figure 7-9
Calling number not delivered in the SS7 network
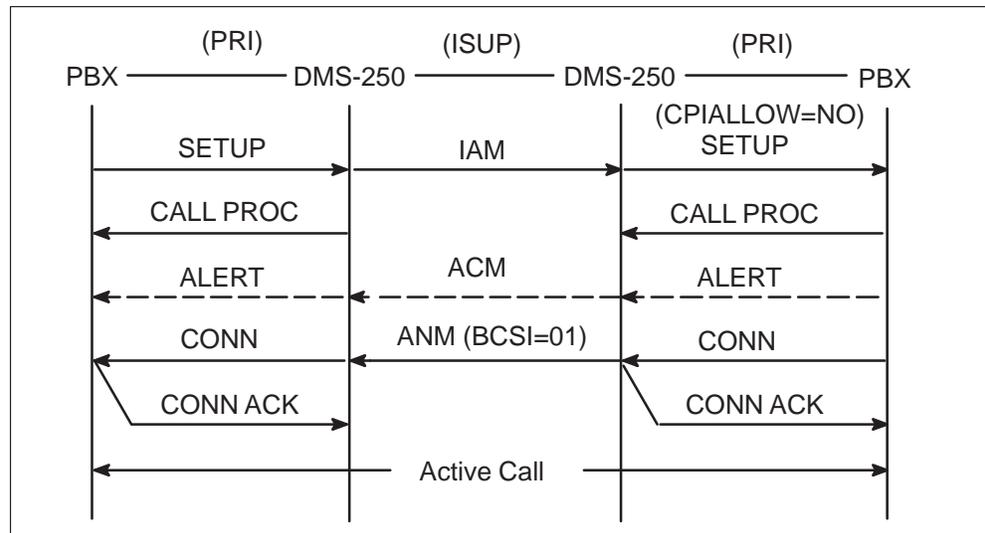
PRISM service

PRISM service is the generic service for public calls. PRISM calls are translated in-switch instead of through the NCS/DAP.

Call processing

If the NSF parameter in the incoming SETUP message indicates PRISM service, the DMS-250 switch initiates the originating DAL call processing. If required, the switch performs DTMF digit collection of supplemental code (suppcode) and/or account code. Depending on the subscription parameters of the PRI interface, treatment-to-cause mapping may be performed (as described in Chapter 5, "Call control procedures").

Translation and routing

Translation and routing are initiated by screening the called number in the SETUP message in the PRTNM field in table CALLATTR. Pretranslator datafill determines whether the conflict or nonconflict dialing plan is in use. The standard routing mechanism is then performed by using the STS filed against the authcode in table AUTHCODM. For more information about calling number delivery and call type delivery for PRISM service on a PRI, see "Identifying call origin—calling number delivery" and "Identifying call type" in this chapter.

Table 7-8 describes the conflict dialing plans supported by PRISM.

Table 7-8
PRISM conflict dialing plans

Field	Dialing plan
7D VNET	NXX-XXXX
10D VNET	1 + NXX-NXX-XXXX
10D DDD	1 + NXX-NXX-XXXX
IDDD	011 + CC + NN
HOTLINE	7/10D VNET or DDD dialing plans filed against the authcode in AUTHCODM
N = 2–9; X = 0–09	
—end—	

Table 7-9 describes the non-conflict dialing plans supported by PRISM.

Table 7-9
PRISM non-conflict dialing plans

Field	Dialing plan
7D DDD	NNX-XXXX
10D DDD	NXX-NXX-XXXX
IDDD	011 + CC + NN
HOTLINE	7/10D VNET or DDD dialing plans filed against the authcode in AUTHCODM.
N = 2–9; X = 0–9	
—end—	

Hotline calls

The called number field of the SETUP message is overwritten with the filed hotline number if the call is marked as a hotline call in the authcode database. For more information on hotline numbers, see "Call authorization" in this chapter.

ANI screening

ANI screening is not performed for incoming PRISM calls on a PRI.

VNET services

VNET offers all the services of a true private network but shares standard switching network and transmission facilities. VNET allows multi-location corporate users to have a private corporate network operating over the public-switched network. VNET is a software-defined private network that shares the physical resources of the MWC network. VNET subscribers can "create their own network" without the additional expense of physical resources.

Both dedicated and switched access into its VNET are offered to corporate users. Customers may reconfigure the network numbering plans and routing information through the customer information management system.

There are three main entities in the VNET:

- switch
- network control system (NCS)
- data base administrator (DBA)

Operation overview

An overview of VNET operation is given below:

1 After accessing the reseller's network, a VNET customer typically dials a number.
2 The switch sends the dialed digits to the NCS for real-time database translation.
3 The NCS translates the dialed digits, returns a destination number, action instructions, or both (as previously specified to the DAP database) to the switch for call completion. VNET customers update their database directories through the database administrator (DBA) mechanism. The DBA updates the active operational copy in the NCS processor either periodically or as requested.

Features

The following VNET features are supported:

- 7D and 10D VNET dialing
- 10D and international direct distance dialing (IDDD) standard translations
- originating direct termination overflow
- conflict dialing or nonconflict dialing
- enhanced overflow
- VNET hotlines

- supplementary code redial

- enhanced reorigination

Dialing plans

The VNET dialing plans driven by pretranslation and supported by this feature are described in Tables 7-10 and 7-11.

Table 7-10
VNET conflict dialing plans

Field	Dialing plan
7D VNET	NXX-XXXX
10D VNET	1 + NXX-NXX-XXXX
10D DDD	1 + NXX-NXX-XXXX
IDDD	011 + CC + NN
HOTLINE	7/10D VNET or DDD dialing plans filed against the authcode in AUTHCODM
N = 2–9; X = 0–09	
—end—	

Table 7-11
VNET non-conflict dialing plans

Field	Dialing plan
7D VNET	NNX-XXXX
10D VNET	(1) + NXX-NXX-XXXX
10D DDD	(1)+ NXX-NXX-XXXX
IDDD	011 + CC + NN
HOTLINE	7/10D VNET or DDD dialing plans filed against the authcode in AUTHCODM 2.
N = 2–9; X = 0–9; () = Optional parameter	
—end—	

Call processing

When the PRI PBX requests VNET service by call service selection in the incoming SETUP message (NSF=VNET), the DMS-250 switch initiates VNET dedicated access line (DAL) call processing.

Request of NCS

To initiate call processing, the switch sends the DAL CALL PROCEDURE REQUEST message to the NCS for real-time database translation.

The message fields that are valid in the ISDN environment are

- message type

- NCS transaction identification

- switch ID

- trunk group number

- authcode number

- authorization code; filed in table CALLATTR

- address digits; provided as received in the SETUP message or hotline number filed against the authcodes in table CALLATTR

- supplementary code

- automatic number indicator (ANI); provided if received in the calling number information element of the SETUP message

NCS response

After translating the called number, the NCS/DAP responds to the DMS-250 switch for call completion with

- a routing response—A successful translation of the VNET call occurred if the NCS sends a routing response to the originating switch. The information returned is used to route the call to the correct switch and trunk.

- a failure response—A translation failure occurred if the NCS sends a VPN failure response to the originating or terminating switch. The action code specifies the type of failure.

- other responses—Other types of response messages result in the call being routed to the reorder (RODR) treatment. The one exception is the SUPPCODE DIGITS COLLECTION RESPONSE message. The NCS sends this message to the originating switch to indicate SUPPCODE is to be collected for this call.

- routing/treatment information and/or action instructions—as previously specified by the customer in the NCS/DAP database

Translation and routing

The translation and routing responses for VNET direct termination calls, direct distance dialing (DDD) calls, and international direct distance dialling (IDDD) calls are described as follows.

VNET direct termination calls

The NCS/DAP returns the routing response with the action code set to originating direct termination (ODT). The response contains a destination switch ID, a dedicated intermachine trunk (IMT) trunk group number (optional), and other information for direct termination of the call.

If the originating switch ID (NCS_SWITCH_ID in table OFCVAR) is equal to the destination switch ID, the NCS/DAP sends the response with the terminating trunk group number, subsequent address number, and other routing information. After the DMS-250 switch receives this information, it attempts to complete the call over the terminating trunk group number received in the NCS/DAP response.

If the call cannot be completed due to an all-trunk-busy condition, the switch sends an OVERFLOW TREATMENT REQUEST message to the NCS/DAP requesting an alternate DDD/IDDD number and originating partition number for completion of the call. After the switch receives the terminating VPN overflow response message from the NCS/DAP, the switch routes the call using the standard home numbering plan area (HNPA) routing. The serving translation scheme (STS) is obtained by converting the partition number received in the response to the corresponding STS using table PARTRAN4.

If the originating switch ID (NCS_SWITCH_ID in table OFCVAR) is not equal to the destination switch ID, an IMT is selected on which to terminate. If a dedicated IMT trunk group number is provided, the switch accesses table VPNTRMRT to get a route.

The dedicated IMT trunk group can be either per-trunk signaling (PTS) or signaling system 7 (SS7) IMT. No enforcement is made to route the call to the SS7 IMT. If a PTS IMT is used to route the call, all ISDN information is lost during the interworking.

If no dedicated trunk is available or if the trunk is busy, the switch must route using the destination switch ID. The destination switch ID accesses table VPNIMTRT to obtain a route list.

If all of these circuits are busy, the call is routed to generalized no circuit treatment (GNCT) with an in-band tone or announcement provided.

DDD/IDDD calls

The NCS returns the routing response with action code set to originating direct distance dialing/international direct distance dialing (ODI) offnet parameters. The response contains a subsequent address and partition number that is translated using standard DMS-250 switch translations. The partition number is translated to an STS using table PARTRAN4. If the NCS does not respond, an attempt is made to translate the called number in the setup message using the STS from table CALLATTR.

For more information about calling number delivery and call type delivery for VNET calls on a PRI, refer to "Identifying call origin—calling number delivery" and "Identifying call type" in this chapter.

SAC service

A service access code (SAC) is a three-digit code using the same format as an area code. SAC codes differ from DDD calls because there is no geographical link between the number dialed and the terminator's actual geographic location. SAC codes are reserved for and allocated to provide callers with access to a service instead of access to a specific geographical area. The geographical link is not made until the dialed number is translated into the actual routing information.

These nongeographic codes are reserved for and allocated to provide caller access to interexchange or local exchange carriers (LEC). The first three digits replace the numbering plan area (NPA) and designate a particular type of switched service. The caller must always dial the access code in connection with their respective services.

SAC is a basic service offering of the DMS-250 switch. No special hardware, such as peripherals, circuits, or software loads are required for domestic service. Hardware required for remote translations is dependent upon the network platform used.

800 and 900 service

The DMS-250 switch receives 800 and 900 service calls over FGC and FGD trunks. The 800 or 900 services calls are routed to the terminating switch along with the ten-digit ANI (if received at the originating switch). If the terminating trunk in the terminating switch indicates ISDN PRI, the DMS-250 switch sends a SETUP message with optional ANI. The NSF information element is set to 800 or 900 on the terminating PRI interface.

Call authorization

Call authorization on the DMS-250 switch occurs with authcodes, filed hotline numbers, security codes, supplementary or account codes, and calling line identifiers.

Authorization codes

Authorization codes (authcodes) are multidigit codes used to identify a subscriber, to bill a call to a subscriber, to prevent unauthorized access to the network, and to indicate class of service and special features available to the subscriber. The DMS-250 switch supports five, six, and seven digit authcode numbers. However, to the subscriber, the authcode may be 0–7 digits in length, depending on how parameters are datafilled. Authcodes can be entirely dialed by the subscriber, entirely filed in the originating trunk group data, or partially dialed and partially filed.

On the DMS-250 switch, each call that originates over a PRI is associated with an authcode. For PRI, this association is performed by table CALLATTR. In this table, the field VAUTHFLD contains the authcode filed against the ISA call type. If the originating call contains a call type that is not datafilled or is not allowed, the call is routed to treatment.

Validation

For each call made over PRI, authcode validation is performed against the authcode filed in table CALLATTR. The authcode is searched for in the filed authcode in the network control system database. (For more information about the network control system, see Chapter 5, "Call control procedures."

Found in database—If the authcode is found in the database, the status of the authcode is examined to determine the course of action to take in handling the call. If the status of the authcode is valid, call processing proceeds normally on the call, using the data stored against the authcode to process the address digits received in the CALL SETUP message.

The following information related to the authcode is returned to the original call processing agency. These parameters help specify how many more digits to collect and the eligibility of the call.

- valid or invalid status
- account code
- partition number
- city code
- global authcode indicator
- restricted usage by date and time
- hotline number (if any)

Not found in database—If the authcode is not found in the database, the authcode is assumed to be invalid and the treatment INVALID AUTHCODE (INVA) is applied to the call. If necessary, treatment-to-cause mapping is

performed as outlined in "Mapping of treatments to cause values" in Chapter 5, "Call control procedures."

Invalid status—If the status of the authcode is temporarily invalid, treatment TEMPORARILY INVALID is applied to the call. If necessary, treatment-to-cause mapping is performed. If the status of the authcode is permanently invalid, treatment INVALID AUTHCODE is applied to the call. If necessary, treatment-to-cause mapping is performed.

Not global authcode—If the authcode is valid, but is not a global authcode (as designated by an authcode parameter in table AUTHCODM), city code screening occurs. This screening matches the city code in the authcode database (table AUTHCODM) and the city code in table CALLATTR. If the comparison fails, the call goes to invalid city code treatment (INCC) and results in treatment-to-cause mapping.

Filed hotline numbers

The DMS-250 switch allows the option to file hotline numbers against a subscriber's authcode. If an authcode is a "hotline," all calls originating on that trunk group are automatically placed to a predetermined number without the subscriber having to enter any digits. If there are hotline digits filed against an authcode, any calls that originate with that authcode cause the address digits from the Q.931 SETUP message to be replaced with the digits filed against the authcode's hotline number. The hotline number is then used for any necessary routing and screening.

However, if a call originates on a PRI with an authcode that has a filed hotline number, that hotline number is used as the address digits for the call. Due to the filed-only authcode restriction, all calls that originate on that authcode result in the same address digits. The restriction and use of authcode hotlines are the administrative responsibility of the operators of the switch.

Security codes

Security codes are multidigit DTMF codes used as another level of screening beyond the authcodes. Security codes are of variable length up to four digits and are based on the authcode parameter SECURITY. These DTMF digit codes are not supported as part of the dialing plan. If the authcode filed against the call attribute specifies that security codes are required, the security codes are ignored for incoming calls using that authcode.

Calling line identification

The calling line identification number (calling number field of the SETUP message) is not screened in any way. The calling number field, if present, is captured into the call detail record (CDR) or private network record (PNR)

and is optionally delivered to the outgoing PRI, depending on the CPIALLOW field in table CALLATTR. However, no check occurs to ensure the number is valid in format or in content.

Supplementary/account codes

The suppcode/account code is a multidigit DTMF code used to allow chargeback of calls to projects, departments, or accounts. Calls that involve NCS/DAP initiation of collection of these codes use *suppcodes*. When codes are invoked in-switch, these are called *account codes*. Throughout this chapter, *supplementary code collection* means retrieval of digits based on a request from the NCS/DAP. *Account-code collection* refers to the in-switch retrieval of digits based on table AUTHCODM datafill.

Suppcode or account code collection is determined by the account code length (ACCTLEN) parameter in table AUTHCODM. This parameter specifies the number of account code digits to dial. If ACCTLEN > 0, the call is processed as in-switch. If ACCTLEN = 0, suppcodes are collected through NCS/DAP-based methods. With VNET calls, the account code length (ACCTLEN) can be 0 to 11 digits.

Supplementary code redial

This feature allows the user, after reorigination, to automatically redial the supplementary codes that were entered on the previous call by pressing the star (*) key. After the user presses the star key, the previous supplementary codes are used exactly as if the user manually re-entered them. This redial feature is available on all calls that support supplementary code collection and allow reorigination.

Voice call suppcode/account code collection

If the DMS-250 switch receives a voice call requiring a suppcode, it sends a 400-Hz prompt tone, then collects and processes the number.

Data call suppcode/account code collection

If the DMS-250 switch receives a data call requiring supplementary or account code collection, it does *not* send a prompt tone; it collects the number from table MLTATTR.

Datafill

To use the suppcode collection feature, enter a MLTIDX value in the LTCOPT field of table LTCALLS. Enter a corresponding index value and a default number (up to 11 digits) in the appropriate fields of table MLTATTR. Table 7-12 shows example entries for table MLTATTR.

Table 7-12
Table MLTATTR example entries

Field	Example Datafill
INDEX	1
SUPPCODE	1234567
—end—	

Table MLTATTR contains a field to store a default suppcode. The table also contains an INDEX field with a value (0–1024). This value coincides with the value of the MLTIDX option in the LTCOPT field of table LTCALLS. Table 7-13 shows example entries for table LTCALLS.

Table 7-13
Table LTCALLS example entries

Field	Example Datafill
LTID	ISDN 1 VNET
XLARTE	XLAIEC
CALLATTR	8
TABNAME	$
LTCOPT	MLTIDX 1
—end—	

Collection flow

The flow diagram in Figure 7-10 shows supplementary/account code collection for PRI data calls.

Figure 7-10
Data call suppcode/account code collection
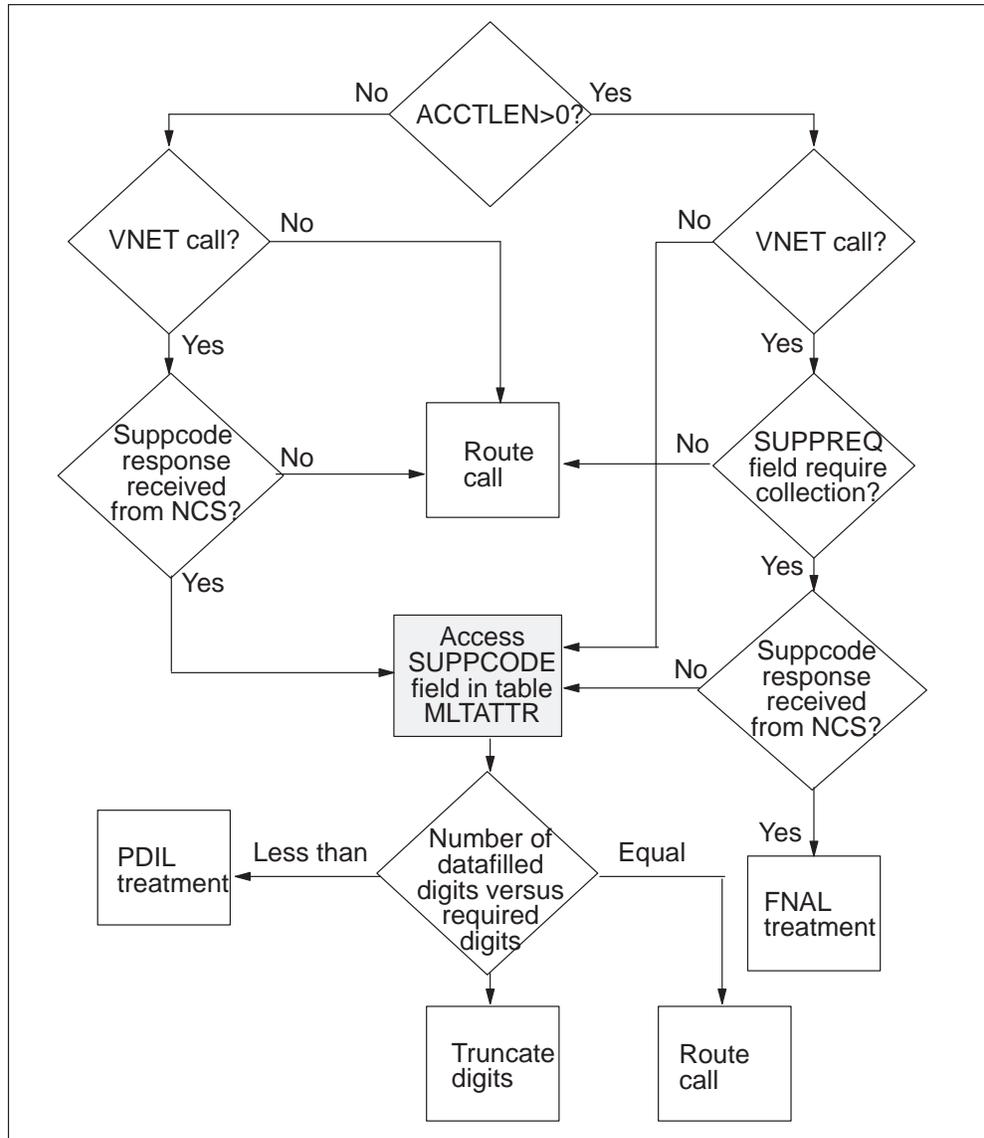
In-switch versus out-of-switch digit collection
When the DMS-250 switch receives a data call with an account code greater than zero (ACCTLEN field in table AUTHCODM > 0), it processes the call as in-switch. If the data call has an account code less than or equal to zero (ACCTLEN field in table AUTHCODM ≤ 0), it processes the call as out-of-switch.

In-switch: VNET versus non-VNET

When the DMS-250 switch receives an in-switch VNET data call requiring an account code, it attaches an indexed account number according to the value of the SUPPREQ field in table CALLATTR. The following table shows SUPPREQ functionality.

Table 7-14
SUPPREQ field functionality

Value	Explanation
ALLVNET	VNET as well as non-VNET calls collect account code
NOVNET	VNET calls do not collect SUPPCODE; non-VNET calls collect account code
ALLEXC7D	VNET calls with seven address digits collect account code; all other VNET calls do not collect account code; non-VNET calls collect account code
—end—	

If the data call satisfies the SUPPREQ condition for account-code collection, the switch checks for an incoming NCS response message contradicting the current call processing (in other words, a message indicating out-of-switch supplementary code collection). If no such message exists, the account code is retrieved from the SUPPCODE field in table MLTATTR, as described previously. If the contradiction exists, FNAL treatment is initiated (refer to "Error conditions" in this chapter).

When the switch receives an in-switch, non-VNET data call requiring an account code, it attaches an indexed account number without consulting the value of the SUPPREQ field. The account code is retrieved from the SUPPCODE field in table MLTATTR, as described previously.

Out-of-switch: VNET versus non-VNET

Out-of-switch VNET data calls may include a SUPPCODE response containing routing information from the NCS. In this case, the DMS-250 switch collects the supplementary code from table MLTATTR, as described previously, and processes the call without validation from the NCS.

If the response does not contain routing information, the DMS-250 switch collects the supplementary code from table MLTATTR and requests validation of the code from the NCS. It then processes the call according to the response.

Out-of-switch, non-VNET data calls are routed to their destination without SUPPCODE processing.

Suppcode/account code truncation

The supplementary or account code used is truncated from the right if one of the following is true:

- The number of digits datafilled in the SUPPCODE field of table MLTATTR is greater than the number of digits datafilled in the ACCTLEN field in table AUTHCODM.

- The number of digits is greater than the number of digits specified by the SUPPCODE response message received from the NCS.

A partial dial (PDIL) condition exists if one of the following is true:

- The length of the SUPPCODE field is less than the datafilled ACCTLEN field

- The length of the SUPPCODE field is less than the SUPPCODE response message field.

Table 7-15 shows examples of code truncation.

Table 7-15
Suppcode/account code truncation

Required length	SUPPCODE field	Treatment
1	12345678	1
2	12345678	12
5	123	PDIL
8	12345678	12345678
11	12345678999	12345678999
3	$	PDIL
—end—		

Error conditions

The following error conditions are associated with supplementary/account code collection for PRI data calls:

- PDIL treatment is initiated under the following conditions:

— If the number of digits datafilled in the SUPPCODE field of table MLTATTR is less than the number datafilled in the ACCTLEN field in table AUTHCODM, or less than specified by the NCS response message, then PDIL treatment is initiated. Only the number of digits datafilled in the SUPPCODE field of table MLTATTR is recorded in the billing record.

— When supplementary/account code processing is required (either in-switch or out-of-switch) and no digits are datafilled in the SUPPCODE field of table MLTATTR, PDIL treatment is initiated.

— When supplementary/account code processing is required (either in-switch or out-of-switch) and the LTCOPT field in table LTCALLS does not contain the MLTIDX option with a value greater than zero, PDIL treatment is initiated.

— If the ACCTLEN field in table AUTHCODM is equal to one (indicating in-switch account code collection of one digit, per current functionality), the call is blocked with PDIL treatment and a TRK255 log containing the text VPNAUTH_ON_NONVPN_CALL is generated.

— If the number of digits datafilled in the SUPPCODE field of table MLTATTR is less than the number of digits datafilled in the ACCTLEN field in table AUTHCODM, or less than the number of digits specified by the supplementary code response message received from the NCS, then PDIL treatment is initiated.

- FNAL treatment is initiated and the call is dropped if the ACCTLEN file in table AUTHCODM is greater than zero (indicating in-switch account code collection) and NCS returns a message indicating out-of-switch supplementary code collection is required.

Overflow call control

Two types of overflow call control are available with the DMS-250 switch:

- direct termination overflow

- enhanced overflow

Direct termination overflow

Direct termination overflow is the control by the terminating switch of overflow processing and intiation of overflow transaction.

Enhanced overflow

Enhanced overflow has the following capability:

- consolidates control of the overflow process at the originating switch

- handles calls that have already accessed the NCS/DAP and encountered overflow conditions (either in-switch or after receiving a release with cause from a terminating ISUP or ISDN interface)

- allows the user to specify a timer value for each NCS/DAP configured termination

- can be enabled or disabled by setting the ENHANCED_OVERFLOW field in table OFCOPT.

- can only be enabled on a DMS-250 switch with 9.X billing

- works with both VNET and SAC calls with NCS/DAP-based non-validated suppcode collections

For further information on overflow functionality, refer to the *Common Channel Signaling 7 Reference Manual*.

Enhanced reorigination

Enhanced reorigination allows a user to originate and complete multiple calls successively. To access enhanced reorigination, the user presses the octothorpe (#). Enhanced reorigination uses a combination of dual tone multiple frequency (DTMF) receivers and special tone receivers (STR) to ensure proper detection of the octothorpe. STR hardware is not presently supported on the ISDN DTCI. Reorigination occurs with DTMF receivers only.

Originating agencies

Enhanced reorigination is available for calls that access VNET services via dedicated access agencies that connect user equipment directly to the DMS-250 switch. Enhanced reorigination is conditionally available for dedicated access calls with the following originating agencies:

- DAL

- FGD-DAL

- VNET CAMA

- North American PRI

- MWC IMPT RSLR (standard, option 1, and option 2)

Datafill in TRKGRP

VNET calls on PRI agencies that allow reorigination are based on the settings in table TRKGRP of the VNREORIG (VNET reorigination) parameter.

ISA defines the process of giving call-by-call access to public and private network services through one common ISA facility, as shown in Figure 7-3.

Network call transfer

MWC ISDN PRI customers can transfer a call across the MWC network via network call transfer on a subscription basis.

User-to-user service

User-to-user service allows customers to transport user-defined information across the network to another user. The following applies to user-to-user information (UUI):

*   Customer premises equipment that is connected to the DMS-250 switch (with PRI) transports the user-defined information by means of one or more User-to-User information elements within the User Information message.

*   UUI transports transparently across the network without interpretation.

*   UUI signaling involves a temporary signaling connection. UUI messages are used only when the UUI feature is active.

*   The customer defines what is carried within the User-to-User information element.

*   PRI interworks with ISUP to transport UUI messages. UUI can also enter and exit the MWC network on ISUP resellers. The UUI information element is used on both PRI and ISUP. Figure 7-11 shows valid UUI originations and terminations.

Figure 7-11
UUI originations and terminations for PRI and ISUP
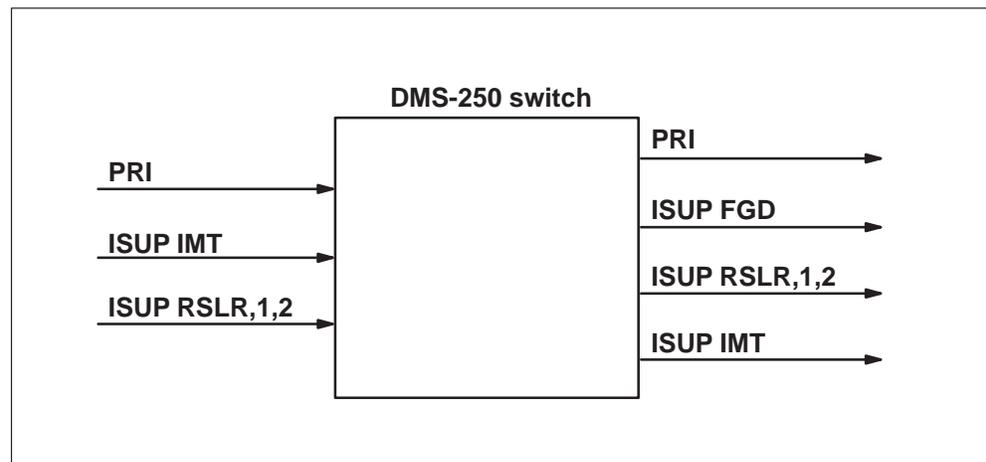
There are two methods for sending user-to-user information as follows:

*   call-associated user-to-user information (CAUUI) signaling—allows multiple information elements to be transported in the User Information message on PRI and ISUP

- message-associated user-to-user information (MAUUI) signaling—allows the transport of one information element in any PRI or ISUP call control message

Call-associated UUI signaling

This portion of user-to-user service allows the user to send UUI messages along with a call. The call-associated UUI (CAUUI) message is transported on the D-channel and voice is transported on the B-channel. The UUI message can be sent either at the time of or after the SETUP message is sent. UUI signaling confirms UUI feature capability for the receiving CPE, congestion level of the receiving CPE and the DMS-250 switch, the transfer of UUI message, and temporary signaling connection clearing.

Figure 7-12
CAUUI signaling
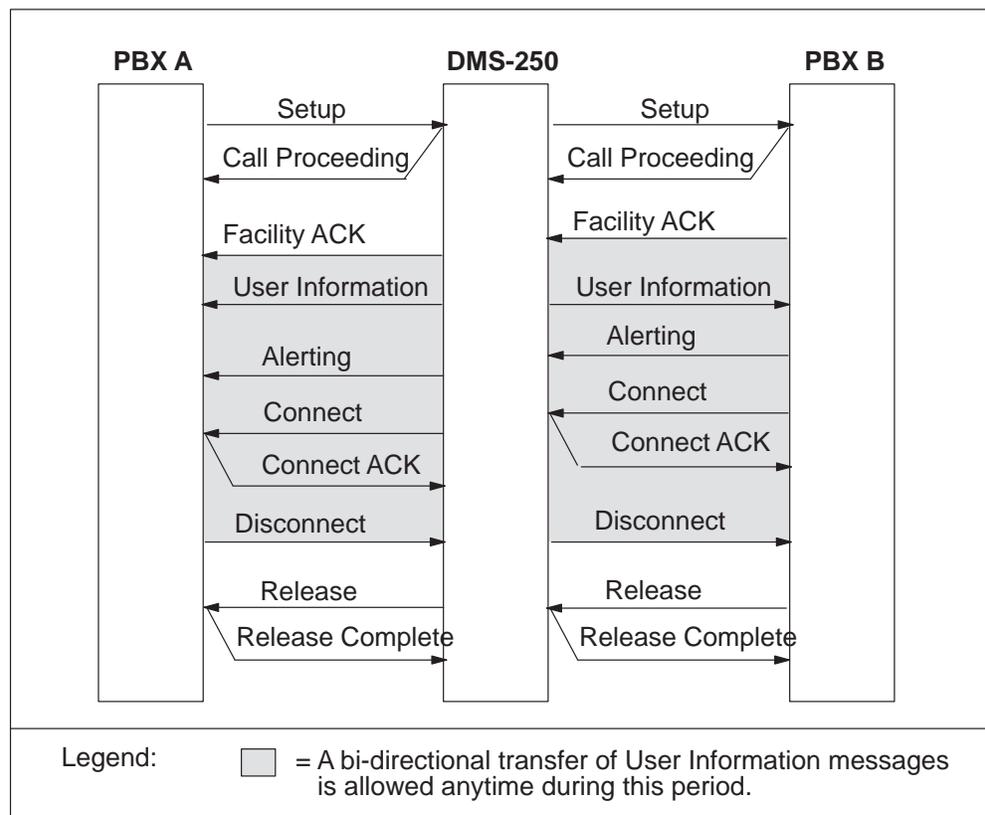
The possible stages of call-associated UUI signaling are listed as follows:

- feature request—the sending facility requests a temporary signaling connection for sending a UUI message either at call setup or after call setup

- positive acknowledgment—indicates the feature is supported and the UUI message can be received; the receiving facility accepts the temporary signaling connection

- transfer of user information—the UUI message is sent by either the calling or called user

- connection clearing—indicates clearing of the temporary signal connection by either the calling or called user with the reasons "Receiver not ready," "Receiver ready," or "Switching equipment congestion."

- negative acknowledgment—indicates the feature is either not supported by the facility or the facility does not currently have resources available to receive the UUI message; negative acknowledgment can occur at:

  — the DMS-250 of the sending user

  — the tandem DMS-250

  — the DMS-250 of the receiving user

  — the customer premises equipment of the receiving user

  Negative acknowledgment also includes the reason for failure, including "Facility rejected," "Resource unavailable," or "Requested facility not subscribed."

- congestion control—indicates either the receiving facility is unable to receive a UUI message because of congestion or the previously congested receiving facility is now clear of congestion and able to receive a UUI message

Table 7-16 lists the signaling stages for both at and after call setup and the messages (and information elements within them) used for PRI and interworking with ISUP messages.

Table 7-16
Call-associated UUI signaling stages and messages

Signaling stage	PRI message	ISUP message
Feature request	NSF IE in Setup message	NSF parameter in Initial Address Message
Positive acknowledgment	NSF IE in Facility Acknowledge message	Facility Indicator parameter in Facility Accepted message
—continued—		

Table 7-16
Call-associated UUI signaling stages and messages (continued)

Signaling stage	PRI message	ISUP message
Transfer of user information	UUI IE in User Information message	UUI optional parameter in User (USR) message
	More Data IE in User Information message	Enveloped within the optional Access Transport Parameter in the USR message
Congestion control	Congestion Level IE in Congestion Control message	Congestion Level parameter in SuperGD parameter in Call Progress message
User-initiated call clearing	Disconnect, Release, or Release Complete message	Facility Indicator parameter in Facility Request message
	Facility message—indicates clearing of temporary signaling connection or resource not available; does not impact the B-channel connection	
Network-initiated call clearing	Facility message—indicates call clearing or resource not available	Facility Indicator parameter in Facility Request message
Negative acknowledgment	NSF IE in Facility Reject message	Cause parameter in Facility Reject message
—end—		

Message-associated UUI signaling

MAUUI allows both the calling and called user to send and receive user-to-user information in an information element that travels within call control messages. MAUUI can only be requested by the originating customer premises equipment (CPE) that subscribes to MAUUI signaling. MAUUI functionality operates as follows:

- The originating CPE requests the UUI feature by including in the Setup message a PRI UUI information element.

- After activiation of the UUI feature, users on ISDN PRI can send user-specific information across the network in any call control message (including the Release or Release Complete message if either of these is the first expected clearing message).

- When interworking with ISUP, the PRI UUI information element maps to the ISUP UUI optional parameter.

- The PRI UUI information element sent by the called user is discarded if the UUI IE is included in a call clearing message destined for the calling user prior to the called user answering the call.

- MAUUI offers two levels of subscription, as follows:

  — required—If the UUI message cannot be delivered to the remote user, the call is taken down.

  — preferred—If the UUI message cannot be delivered to the remote user, the call continues without UUI service.

- Shift to codeset 7 and codeset 7 information is supported in the Setup, Alerting, Connect and Disconnect messages. To block or allow delivery of codeset 7 information, use table ISDNPARM. If ISUP interworking occurs, codeset 7 information is carried within the ATP optional parameter within the corresponding ISUP messages. For more information on locking shift to codesets, see Chapter 4, "Message structure and functions."

Figure 7-13
MAUUI signaling
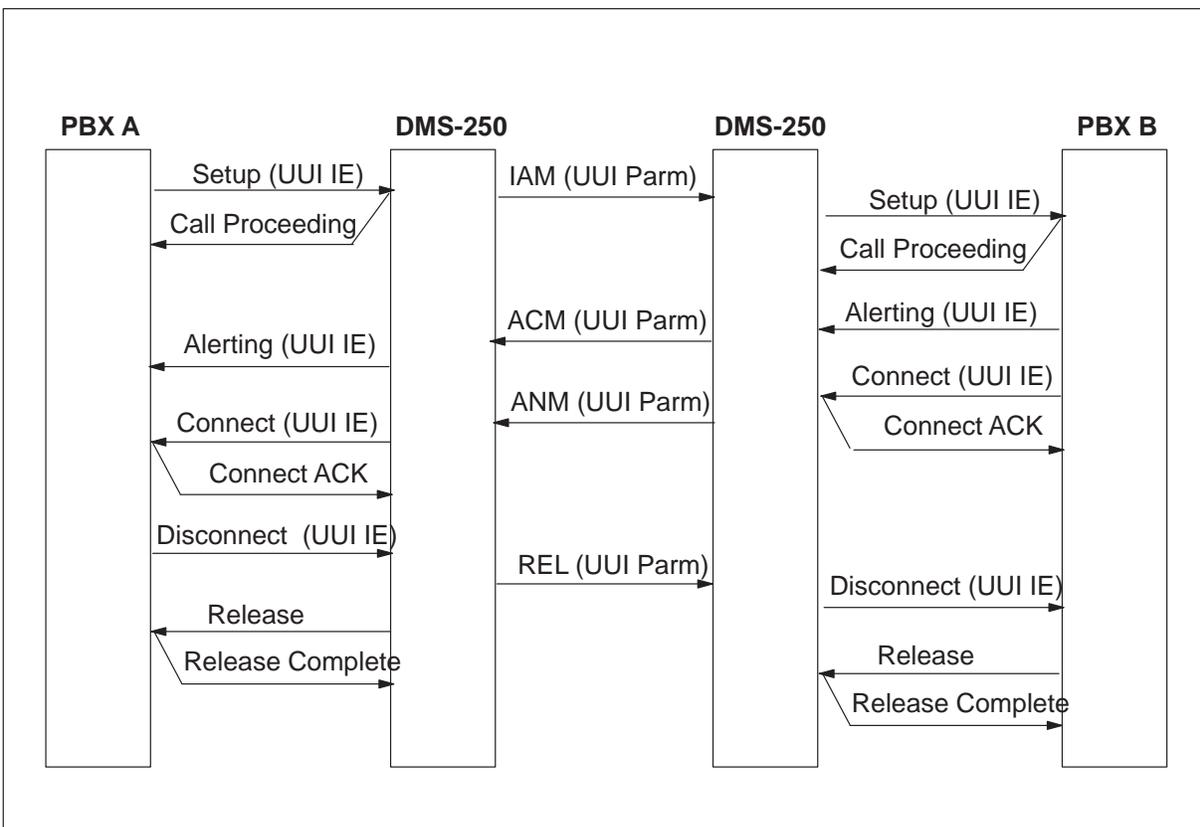
Datafill

The datafill settings for UUI signaling include:

Allow/disallow feature

Both CAUUI and MAUUI signaling setup are controlled by fields of table LTDATA, as follows:

- CAUUI2—controls call-associated user-to-user signaling at setup

- CAUUI3—controls call-associated user-to-user signaling after setup

- MAUUI—controls preferred message-associated user-to-user signaling

- MAUUI and U1RQ—controls required message-associated user-to-user signaling

Office parameters

The following office parameters control UUI signaling:

- MAX_USER_INFO—limits the number of UUI messages that can be transported for the life of the call. If a request for invocation of either CAUUI2 or CAUUI3 is received at the switch where the datafill value is equal to zero, the request is rejected with a Facility Reject message and a cause of "facility rejected."

  — value range—0-65535

  — default value—25

- UUS_BURST—controls settings for the maximum number of messages that may be sent during a 10-second period. (After this period of time, a state of congestion is entered.)

  — value range—2-127

  — default value—16

- NUMBER_UUS_EXT_BLOCKS—determines the available number of user-to-user service extension blocks

  — value range—0-32767

  — default value—6000

Call tracing and billing—NCID

A unique network call identifier (NCID) generates at the switch and is passed along to the platforms that participate in the call across the MWC network.

The unique NCID enables

- the ability to trace calls through the network

- the downstream billing platform to use the NCID to match billing records from the various platforms of the MWC network.

For more information on billing, see the *DMS-250 Billing Reference Manual.* For more information on NCID PRI interworking with ISUP, see the *DMS-250 CCS7 Reference Manual.*

The NCID consists of the following:

- originating switch ID
- originating trunk group
- originating port number
- time point one
- sequence number

NCID generation

An NCID can be generated by the originating switch, an intermediate or terminating switch, or the reoriginating switch. An NCID generates at the originating switch when

- at least one valid digit is received at the originating switch
- a SETUP message is received on an originating PRI agency or an IAM message is received on an originating ISUP agency
- no NCID is received

If the originating switch fails to create an NCID, the first intermediate or terminating DMS-250 switch in the call may generate it. When reorigination occurs, a new NCID is generated. If reorigination occurs at a switch other than the originating one, the new NCID will differ from the NCID associated with the originating switch. After the NCID is generated, it is transported to other platforms including other switches, the NCS/DAP, and the Intelligent Services Network (ISN) platform.

NCID acceptance and delivery on PRI

The NCID is accepted from and delivered to customer premises equipment with the Generic Digits information element. The Generic Digits information element is delivered Codeset 6 information.

EVS PRI

For calls originating on an EVS PRI:

- If the call is extended from the EVS to another switch, the EVS DMS-250 switch generates a new NCID to be transported on the second leg of the call.

- The incoming PRI SETUP message will not contain an NCID; however, the DMS-250 switch will generate one. This is an example of an NCID generating at an intermediary switch.

Passing the NCID

During the progress of a call, the NCID is passed as follows:

- in the MCI ISUP IMT IAM message to other switches

- in the ADF message to the DAP

- in the ISUP RLT IAM message to the ISN platform

- in the SETUP or IAM for PRI and ISUP RSLR originations to other switches

- from the DAP in an ADF message

- from the ISN platform in ISUP RLT FAR or ISUP RLT IAM message

- off the network to the PRI, ISUP RSLR (STD, OPTION1, or OPTION2), or ISUP FGD terminating agency

NCID screening

Table CALLATTR allows control of NCID delivery in the outgoing PRI SETUP messages.

Enhanced voice system audio response unit

The enhanced voice system (EVS) audio response unit (ARU) is designed for functions that include menu routing, announcements, and voice mail, and can record and replay audio messages and detect customer DTMF digits or voice input. It can also initiate a call transfer (extension) to a new destination. Switches that have voice and data interfaces to an EVS ARU are called EVS switches.

Figure 7-14 shows the EVS network configuration, and illustrates that an EVS call can originate on either an EVS or non-EVS switch. However, only EVS switches can terminate EVS calls.

Figure 7-14
EVS network configuration
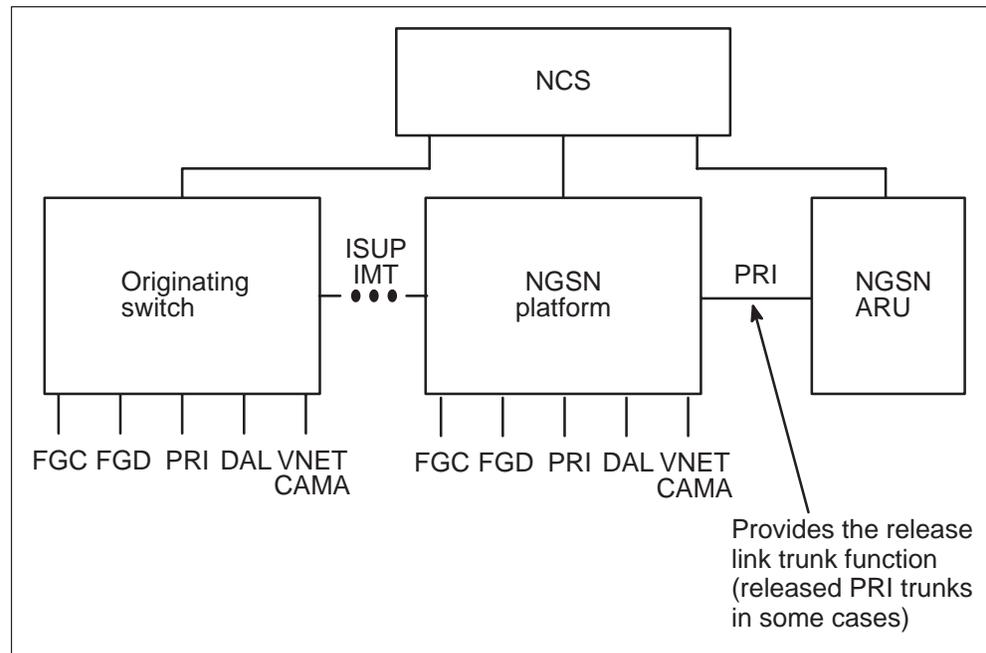
The following attributes apply to the Next Generation Service Node (NGSN):

- Terminating to an NGSN platform switch—Calls are terminated to an NGSN platform from the customer's network switches using common channel signaling 7 (CCS7).

- Sending and receiving from NGSN ARU—ISDN call processing is used to send and receive calls from the NGSN ARU. The originating switch receives 800 and 900 calls through FGC or FGD agencies.

- VNET originations—may be initiated on FGD, PRI, DAL, or VNET CAMA trunks. VNET CAMA originations are treated the same as VNET DALs.

- VNET or 800 calls—can originate on a DAL HOTLINE. Originating agencies supported by this feature are shown in Table 7-17.

Table 7-17
EVS-supported originating agencies

Originating trunk type	VNET	800 and 900	800 remote access
FGA	Not supported	Not supported	Not supported
FGB	Not supported	Not supported	Not supported
FGC	Not supported	Supported	Supported
FGD	Supported	Supported	Supported
DAL	Supported	Not supported	Not supported
DAL HOTLINE	Supported	Supported	Not supported
VNET CAMA	Supported	Not supported	Not supported
PRI	Supported	Not supported	Not supported
ISUP IMT	Supported	Supported	Not supported
—end—			

Virtual trunk elimination

The EVS switch accepts and processes a seven-digit or ten-digit subsequent address (SA) for action codes 10 or 11. The ten-digit SA eliminates the need for the direct termination request to the network control system. Call processing for a seven-digit SA is unchanged.

If a call receives a ten-digit SA (with action codes of 10 or 11) and is intended to terminate at an EVS switch (based on destination switch ID), the call is routed from table VPNTRMRT.

- For action code 10—If all trunks in the trunk group are busy, treatment is applied (based on the value in the STDATB field in table TRKGRP).

- For action code 11—If all trunks in the trunk group are busy, an overflow request is made.

If a call is not intended to terminate at an EVS switch, the call is routed from table VPNIMTRT.

RLT/ATP

This feature allows the DMS-250 ISUP network to transport the Access Transport Parameter (ATP) on Release Link Trunks (RLT) in the IAM, and to the Facility Redirect (FAR) messages. The RLT/ATP feature affects redirect and bridging calls and provides the ISDN with the ability to transport the ISUP ATP for calls that interwork with ISUP RLT trunks.

If the terminator is ISUP, then the ATP is copied in the outgoing IAM. If the terminator is PRI, then the ATP is converted into Q.931 format information elements and sent in the SETUP message to the terminator.

The RLT/ATP feature affects redirect and bridging calls and provides the ISDN with the ability to transport the ISUP ATP for calls that interwork with ISUP RLT trunks.

When a FAR message is received with ATP at a DMS-250, the outgoing IAM from the DMS-250 copies the ATP from the incoming FAR to the outgoing IAM for ISUP termination.

Within the DMS-250 Integrated Services Digital Network, the originating and terminating nodes provide the interface between PRI and ISUP. These nodes use the ATP to transport information back and forth to each other and across the DMS-250 ISDN. The DMS-250 switch transports the ATP from the incoming IAM on an ISUP trunk to the outgoing SETUP message on a PRI trunk.

If an ATP is received from the originator and the call is sent to the RLT platform, then it will be included in the IAM.

If an ATP is received in either an IAM or FAR message from the RLT platform, it is sent out to the terminator for appropriate processing.

If the terminator is ISUP, then the ATP is copied in the outgoing IAM. If the terminator is PRI, then the ATP is converted into Q.931 format information elements and sent in the SETUP message to the terminator.

Figure 7-15 shows how this feature works.

Figure 7-15
ATP traversing the ISUP network
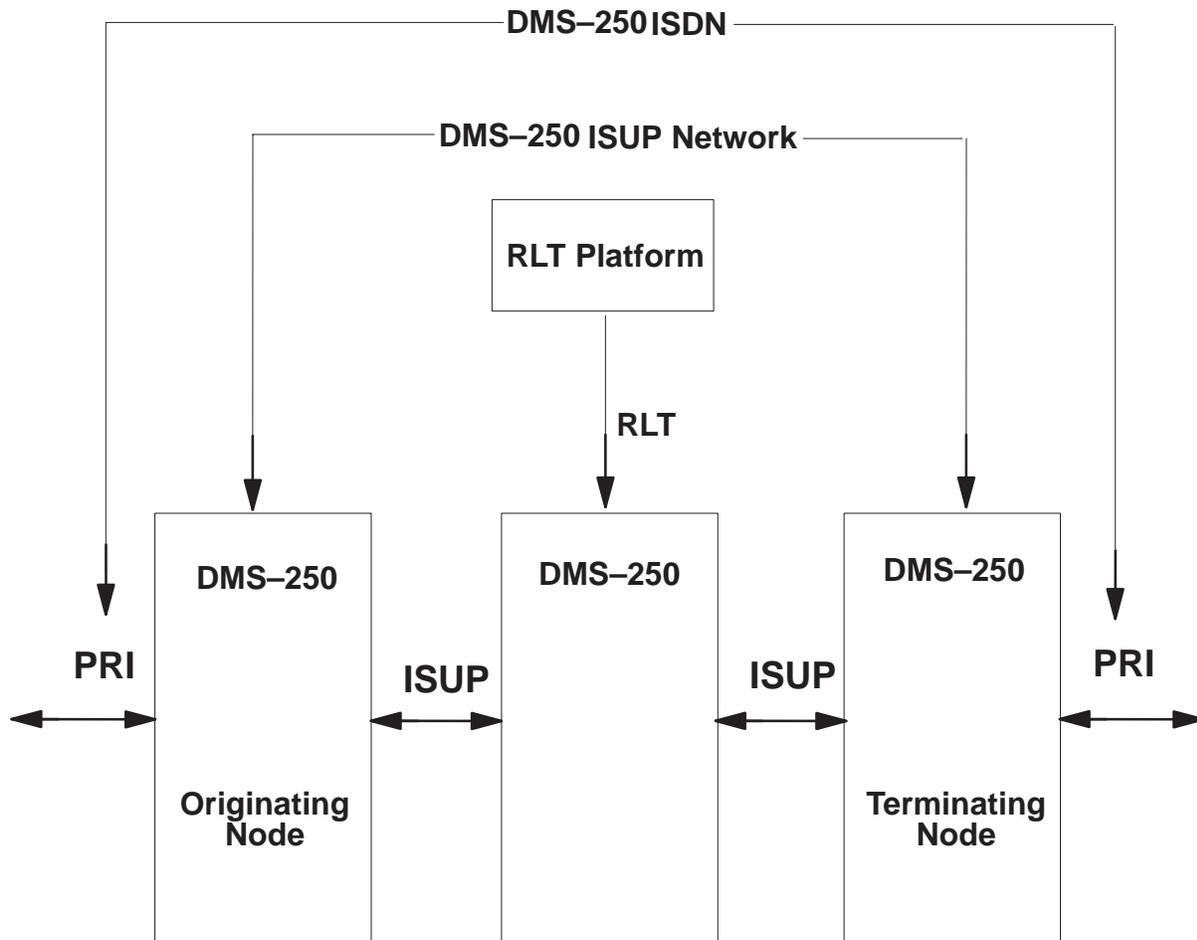
Fraud Call Interrupt

The Fraud Call Interrupt feature allows an ISN application to identify a fraudulent call, initiate a special "Interrupt Call Order," seek out the offending call, and release the associated circuits. This feature allows an ISN application to take down any previously bridged or redirected call that the application declares fraudulent. When a fraudulent call is released, the ISS107 log is generated. This log helps identify why a call is being released without having to look at the billing record. No billing formats are changed; however, a new value for the Time Point 7 Qualifier (TP7Q) field is

introduced. For calls that are released because they were fraudulent, the value is 8. Prior to this feature, values 8–15 were unused.

Once the fraudulent call is found, the originator is released, followed by the terminator. If either of these is an ISUP or PRI trunk, it is released with cause values of normal call clearing.

When the bridging switch processes the ISUP facility message, it commands the fraudulent call to take itself down. If the call is released before the release command reaches the call, the status ISUP facility message indicates that the call was found and released. However, the TP7Q in the billing record is not set to 8; rather it is set to the value that indicates how the call was released.

The call reference is contained within the Call Interrupt Information (CII) parameter, which is included in the Super Generic Digits (SGD) of an incoming ISUP Initial Address Message (IAM).

Figure 7-16 shows the method of handling a fraudulent call through an ISUP facility.

Figure 7-16
Method of handling a fraudulent call through an ISUP facility
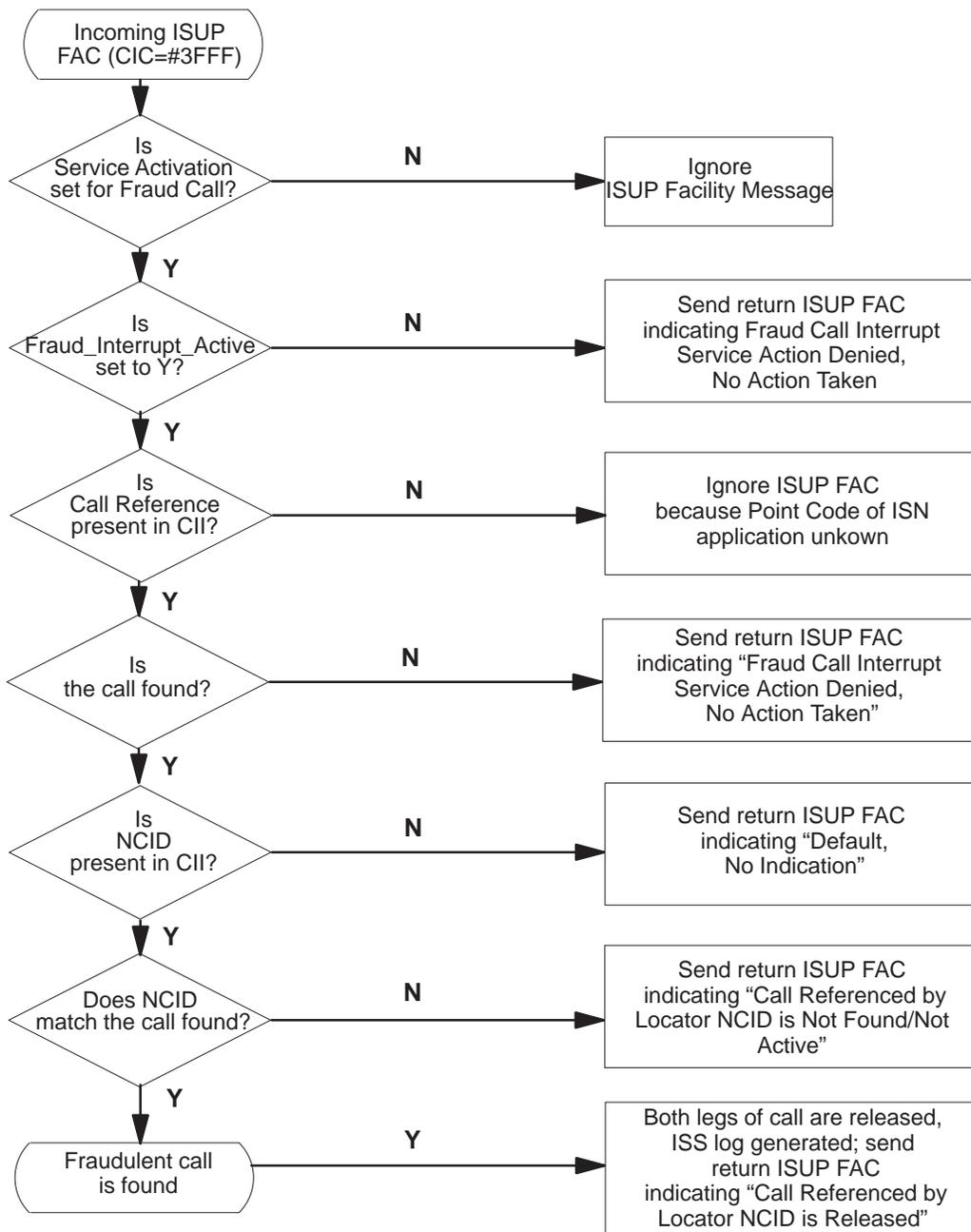
Interactions

This feature interacts with re-origination. If the originator of a fraudulent
call re-originates before the "Interrupt Call Order" is received, a new NCID
is generated. This new call cannot be taken down by the same "Interrupt Call
Order" because there is no way to tell whether this originator was previously

involved in the fraudulent call. However, this new offending call can be taken down if the new "Interrupt Call Order" contains an NCID.

Datafill

In release MWC14, the IAM_OPT_PARMS field in table SS7ATTR is expanded to include SGD_CALL_INTERRUPT_INFO. This value allows the Fraud Call Interrupt service to block the SGD CII.

For tables CLLI, MCLLICDR, TRKGRP, and TRKSGRP, the trunk must be datafilled as an MCI ISUP IMT. For table TRKSGRP, the protocol field must be set to MCI.

To activate the Fraud Call Interrupt feature, set the office parameter FRAUD_INTERRUPT_ACTIVE, which resides in the OFCVAR table, to Y. The default is N.

Dialable Wideband Service

Introduction

This chapter describes how Dialable Wideband Service (DWS) works, including hardware, translation and routing, and datafill relationships.

Before the advent of Dialable Wideband Service, data transfers used only DS-0 channels (one 64 kbit/s channel of a 24-channel T1 span) to transfer data. With PRI, you have the option of combining several B-channels into one larger channel called an H-channel. Thus, DWS increases the data transfer rate (by using additional DS-0 channels). The most common H-channel is H0—six B-channels at a rate of 384 kbit/s. DWS also provides you with the flexibility of selecting from the channels available for data transfers.

Hardware requirements

The following DMS-250 switch hardware is required to support the functionality of DWS:

- enhanced network hardware on all switches used by DWS

- ISDN digital trunk controller (DTCI) and digital trunk controller 7 (DTC7), with an enhanced time switch (ETS) card (NTAX78AA or NTAX78AB)

- 6X50AB DS-1 controller cards

- DTCIs and DTC7s require the ISDN NT6X01AB or NT6X01AD frame; backplane wiring is required to support the ETS card for NT6X01AA.

The digital trunk controller (DTC) for ISDN allows the provisioning of ISDN PRI trunks on the DMS-250 switch system. The DTC ISDN (DTCI) provides a maximum of 20 T1 spans, each of which contains 24 channels. Figure 8-1 shows the relationship of DMS-250 switch DTCIs to T1 spans and DS-0 channels.

Figure 8-1
Relationship of DTCIs, channels, and spans
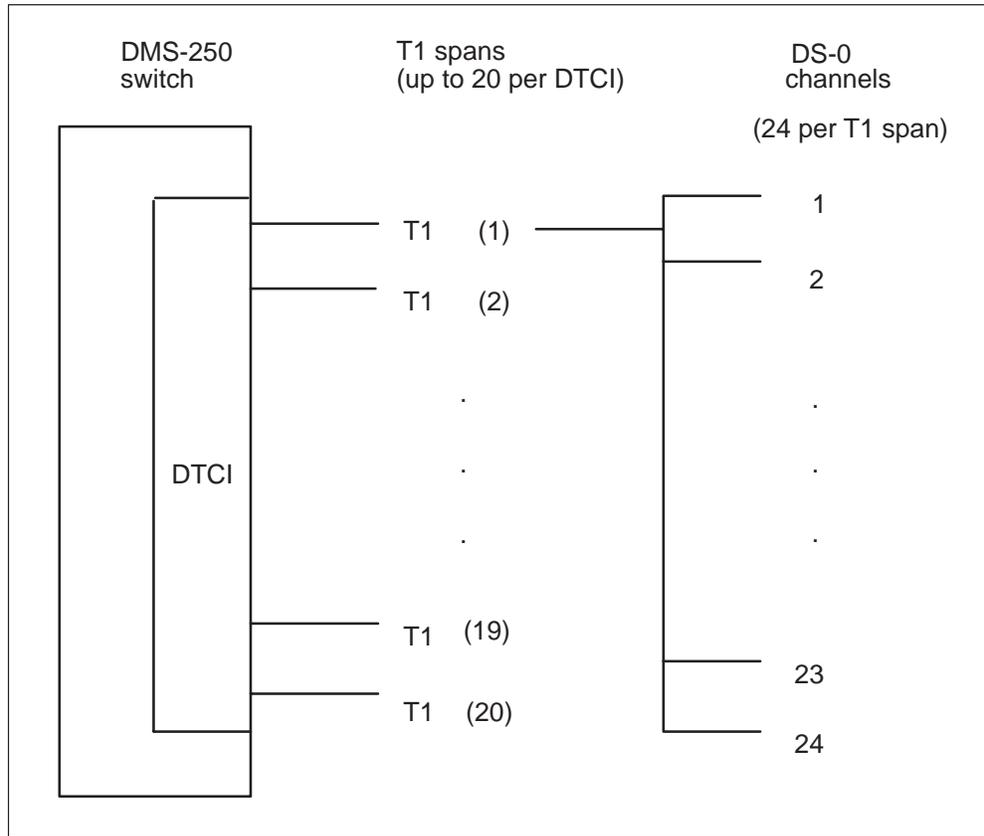
Trunk types

The following trunk types, shown in Figure 8-2, are used in DWS:

- primary rate interface (PRI)

- ISDN user part intermachine trunk (ISUP-IMT)

- ISUP FGD

Figure 8-2
Network trunk types used in DWS
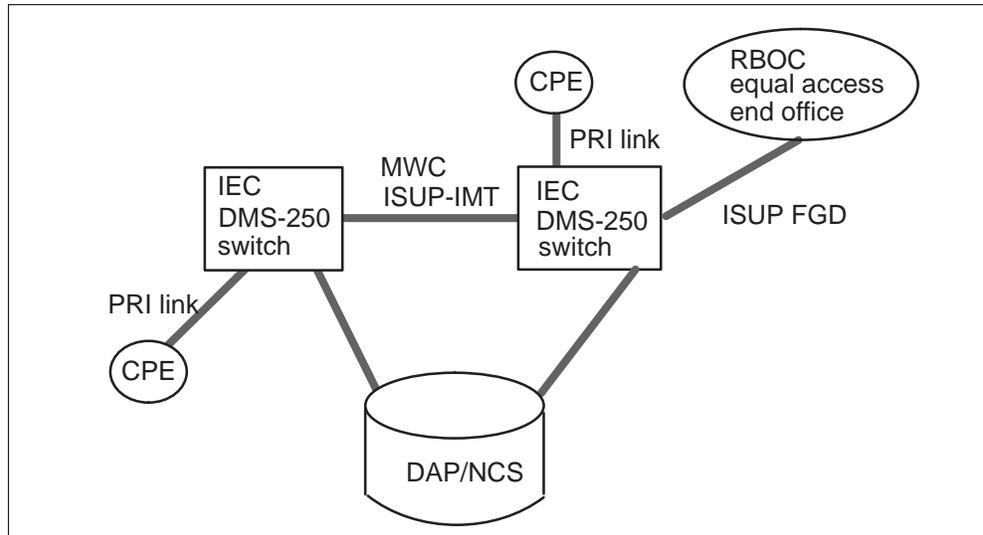
Originations on PRI and MWC ISUP-IMTs can terminate only on an ISUP FGD. ISUP FGD originations can terminate on all three of the available trunk types.

Translating and routing

The DMS-250 switch translates incoming wideband calls and routes outgoing wideband calls by performing the following functions:

- determine the channel requirements
- determine the protocol of the call
- select the available, appropriate channel(s) on which to route the call

Route selectors

A dialable wideband call can only terminate to a wideband trunk group. The following route selectors are supported under DWS:

- standard
- table routing
- non-standard
- same table routine
- time-of-day screening
- digital manipulation route retranslation
- extended digit screening

Constraints

The following constraints apply to processing wideband calls:

- The trunk group must be either ISUP FGD, PRI, or MWC ISUP-IMT.
- The SELSEQ field in Table TRKGRP must be set to wideband.
- The selector in the route list must be supported for wideband services.
- Group reset circuit is supported but not with respect to a controlling or non-controlling channel or when it has a channel assignment map.
- The following is not supported:
  - reseller trunks and release link trunks
  - TCAP
  - in-band tones datafilled through the TRMT route selector
  - reorigination
  - rate adaptation
  - operator-assisted calls
  - remote access to VNET
  - off-hook queuing
  - internal echo cancelers
  - CARD services
  - SAC remote calls

Protocol datafill

Operating company personnel identify the desired protocol version when establishing datafill values in Table TRKSGRP. The version field associates the particular wideband service protocol for each trunk group. The DWS protocol expected on the PRI trunk is defined in the version field of Table TRKSGRP (shown in Figure 8-3) and is UNISPEC20 for MWC. (The UNISPEC20 protocol is defined in the UNISPEC document, *S/DMS SuperNode DWS User-Network Interface Specification*, NIS A216-1.)

Protocol version information is also identified in the appropriate fields in the BC and CID information elements of the setup message.

Figure 8-3
Table TRKSGRP protocol definition for PRI

```
                    TRKSGRP
                    element                MCI

              CLLI                 WBPRI
              CARDCODE             DS1SIG
              SIGDATA              ISDN
              PSPDSEIZ             15
              PARTDIAL             15
              VERSION              UNISPEC20
              CRLENGTH             2
              BCHNEG               N
              BCHGLARE             STAND
              IFCLASS              NETWORK
              CONFIG               PT_PT
              LOCATION             PVTNET
              SAT                  N
              ECSTATE              UNEQ
              TRKGRDTM             16
              ADJNODE              PRANODE
              L1FLAGS              N
              PARMNAME             DEFAULT
              PMTYPE               DTCI
              DTCINO               0
              DTCICKTNO            0
  Indicates protocol    DTCICKTTS   24
              DCHRATE              64K
              HDLCTYPE             HDLC
```

Signaling

When a dialable wideband call is initiated, the data can be sent over a PRI link in the network. This data transfer can begin with an ISDN message and end with a CCS7 message (PRI to ISUP FGD) or begin with a CCS7 message and end with an ISDN message (ISUP FGD to PRI). The message identifies the requirements of the wideband call to the network (destination address, number of DS-0 channels, and channel grouping). The network transfers the data as directed by the information contained in the message.

ISDN SETUP message

The information contained in the SETUP message lets the switch know how to handle the data transfer of the wideband call. The manner in which the DMS-250 switch handles the data transfer is established in datafill of the switch database.

When a SETUP message is sent over a PRI link, the message includes the following:

- B-channel request—a request for a specific number of B-channels to be allocated for the data transfer

  The DMS-250 switch selects the number of B-channels to accommodate the bandwidth requirements contained in this SETUP message.

- wideband call requirements, including:

  — a bearer capability (BC) information element—identifies the data transfer rate

  — a channel identification (CID) information element—identifies the individual B-channels that are grouped to form the wideband channel

When the BC element identifies a transfer rate greater than 64kbit/s, and the CID element identifies more than one B-channel, the switch system utilizes DWS.

Bearer capability information element
The BC, represented by a binary code, is located in the information transfer rate field of the BC information element. The code for MWC is compliant with the UNISPEC/NT.

Channel identification information element
The CID information element identifies the channel(s) to be used in the wideband call, the type of interface, the coding standard, and the channel type (B, H0, or H11). If there are no protocol violations, the DMS-250 switch reads the CID information element to allocate the channels indicated in the CID information element. Figure 8-4 shows the fields contained in the CID information element.

Figure 8-4
CID information element fields
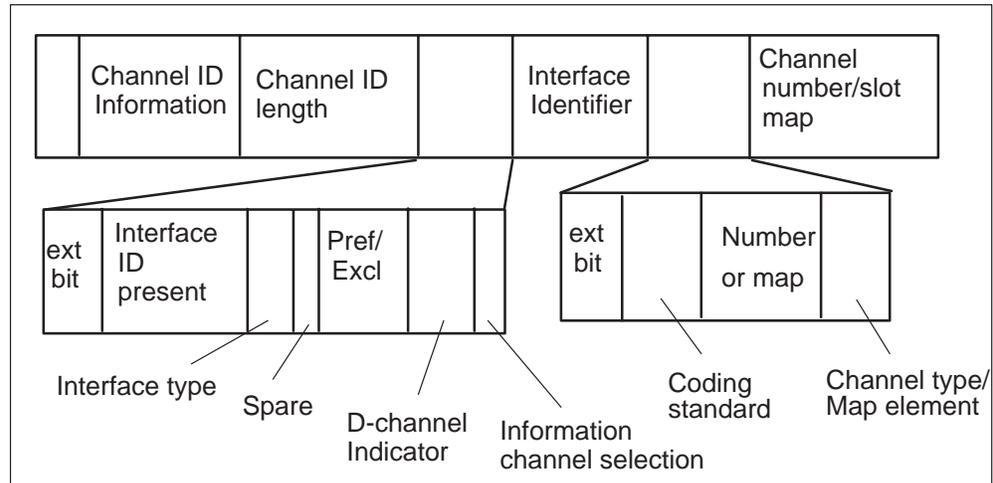
Selecting a route

When selecting a route for the wideband call, the DMS-250 switch performs a search based on

- *grouping*—searching trunks for the channel grouping required (the channel range to be dedicated to the wideband service)

- *sequence*—channel selection in either ascending or descending sequence

- *type*—searching for either the first or smallest block of available idle channels

Channel selection grouping

The minimum data transfer rate is based on the combined transfer rates of two DS-0 channels (2 x 64 kbit/s = 128 kbit/s). Each additional DS-0 channel increases the data transfer rate by 64 kbit/s up to a maximum of 1536 kbit/s (24 x 64 kbit/s = 1536 kbit/s).

Three types of channel grouping (fixed, floating, or flexible) are determined by the protocol and trunk type.

- Fixed allocation—selecting channels that are contiguous and begin and end on exact boundaries in a group of either of the following:

  — six DS-0 channels with a data transfer rate of 384 kbit/s (called H0 channel)

  — all 24 DS-0 channels occupying a full T1 span with a data transfer rate of 1536 kbit/s (called H1 channel)

- Floating allocation—a selection of 2–24 consecutive DS-0s on a T1 span

- Flexible allocation—a selection option of 2–24 DS-0s on a T1 span

Channel selection sequence

The DMS-250 switch uses either of two algorithms to search for idle trunks on which to route wideband calls:

- wideband bestfit ascending sequence (ASEQ)—starts the channel search at the top of the T1 list (lowest DS-0 number to highest DS-0 number), as shown in Figure 8-5

- wideband bestfit descending sequence (DSEQ)—starts the channel search at the bottom of the T1 list (highest DS-0 number to lowest DS-0 number), as shown in Figure 8-5

T1 list

When selecting channels for routing, the DMS-250 switch considers a trunk group connecting two switches as a list of T1s with trunk members in each T1. The switch adds a T1 to the list when its first channel is available. Figure 8-5 shows the T1 list.

Figure 8-5
Trunk selection sequence
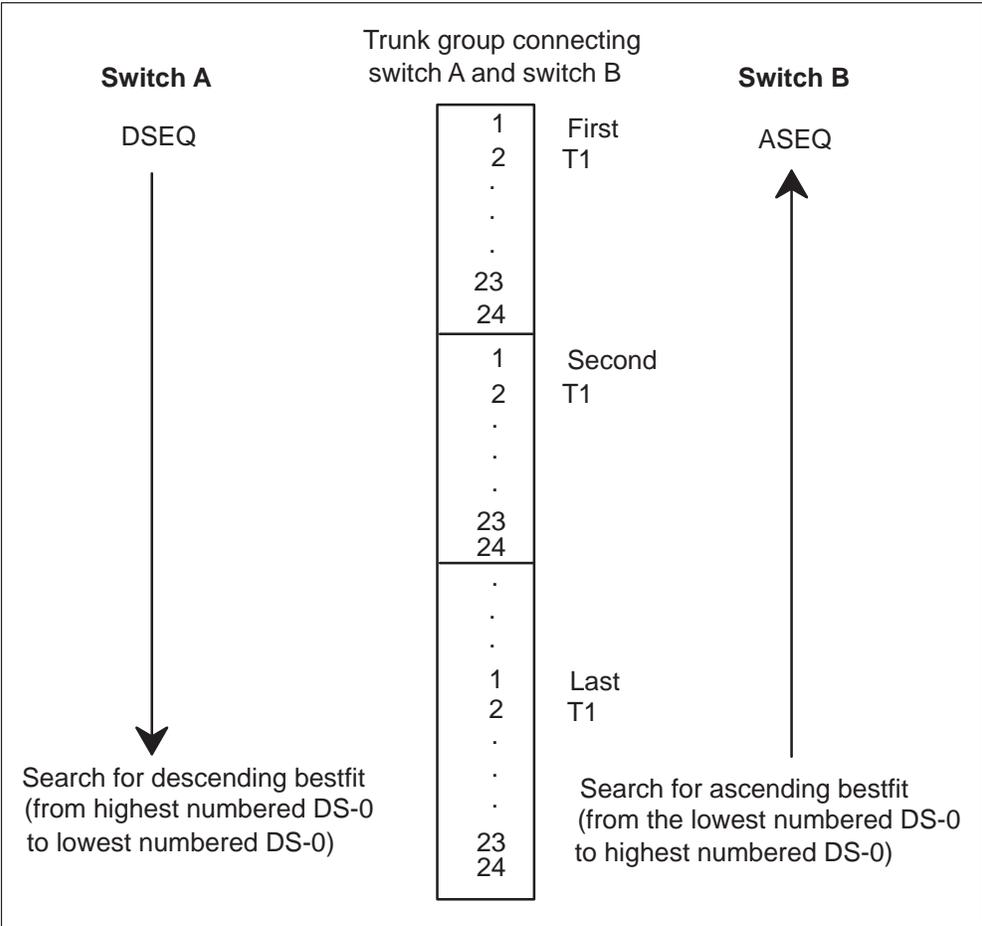
T1s are not ordered numerically; they are added to the list as they become available. When a T1 channel is added, the T1 retains its position on the list. Subsequent additions of T1 channels to the list do not affect its position on the list. The system deletes a T1 from the list when its last channel is deleted from Table TRKMEM.

Channel availability selection

The DMS-250 switch can be set to look for either of the following:

- bestfit—searches for the smallest block of idle channels that fulfills the requirements of the wideband call

  This search will initially skip over a large block of idle channels in a T1 to find a smaller block on which to route the call. Only when the search determines that the large block is the smallest available on that T1, will the call be routed over the large block of channels.

- firstfit—searches for the first available idle channels that fulfill the requirements of the wideband call; this option minimizes the possibility of glare.

Datafill for channel selection

Tables TRKMEM and TRKGRP establish the protocol, circuit requirements, and trunks for DWS. The combination of these assignments determine the type of circuit used for the wideband call. A call can come in on a trunk defined as one protocol and go out on a trunk defined as another protocol.

The method of channel selection is defined in Table TRKGRP. The SELSEQ field must first be set to WIDEBAND. When the SELSEQ field is set to WIDEBAND, the three SELSEQ subfields must also be defined. These are shown in Figure 8-6.

- WBSELSEQ (WideBand SELection SEQuence)—identifies the ASEQ or DSEQ selection algorithm

- WBGRPING (WideBand GrouPING)—identifies the grouping of the wideband channels as fixed, floating, or flexible

- WBSEARCH (WideBand SEARCH)—identifies the type of search through the T1 list as bestfit or firstfit

Figure 8-6
Table TRKGRP SELSEQ field and subfields

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Table 8-1 shows an example of how datafill relates to channel selection. In this example the DMS-250 switch selects 6 or 24 contiguous and bounded B-channels as fixed selection (for example, six B-channels that begin and end on fixed time slot boundaries of 1–6, 7–12, 13–18, or 19–24).

Table 8-1
Relationship of datafill and resulting channel configuration

Datafill for Table TRKGRP			Channel configuration result	
Field WBGRPING	Field OPTION	Field VERSION	Number of channels	Chosen channels are. . .
FIXED	WIDEBAND	UNISPEC20	6 or 24	Contiguous and bounded

Datafill values

Table 8-2 lists important datafill values for DWS capability on the DMS-250 switch.

Table 8-2
Datafill for DWS capability

Table	Parameters	Value
OFCENG	MAX_NUM_WIDEBAND_CALLS	0 to 4096
TRKGRP	SELSEQ	WIDEBAND
OFCOPT	ISUP_SUBGRP_GLARE_AVAILABLE	Y
TRKSGRP	GLARETYP	SGRPYLD
LTCINV	OPTCARD EXECTAB	DCTAX78 PRAB UTR250
CARRMTC	CARD FF ZLG	NT6X50AB ESF B8ZS

Potential routing problems

The potential routing problems of fragmentation and glare are described as follows, with suggestions for avoiding these problems.

Fragmentation

Fragmentation occurs when the total of B-channels over all the T1 spans is enough to accommodate a request for wideband services, but there are not enough B-channels on any single T1 to accommodate the request. If a call requires more channels than are available on the first T1 of the route list, the call advances to the next T1 of the list. If the call exhausts all the T1s of the route list, the call is released and a GNCT is applied.

Fragmentation not only increases call time as the route list is searched for a T1 with enough idle B-channels; it also can cause more calls to be released if no T1 of the route list can accommodate the request.

Dense datafill

To avoid fragmentation, datafill B-channels densely on each T1 span, rather than distribute them over many T1 spans. This method of datafilling prevents wideband calls from having to check the next element in the route list.

When wideband and narrowband traffic are routed over the same T1 span, fragmentation becomes a problem, particularly for calls that require H0-channels. H-0 channels are six contiguous channels in one of four timeslots: 1–6, 7–12, 13–18, or 19–24.

Separate wideband and narrowband traffic

Keeping wideband traffic and narrowband traffic on separate T1s also helps prevent fragmentation. When a single channel on a wideband T1 (channel 1, for example) is carrying narrowband traffic, a call requiring an H0-channel cannot use the first timeslot, even if the other five channels (channels 2–6) are idle.

For the T1s to work as efficiently as possible, route single B-channel calls on T1s that do not support wideband services. Only route a single B-channel call over a wideband trunk as a last resort.

Glare

Glare occurs when the switches at each end of the trunk seize the trunk at the same time and cause a call to be blocked. The following can occur in relation to glare:

- If a glare condition occurs during a narrowband call, the call will try to reselect another member from the same trunk group.

- If the termination is set to YIELD and glare occurs at the terminator, a terminating trunk group is selected from the valid route list element.

- If the route list is exhausted, a REL message with a cause of "resource unavailable" is returned.

- If the origination is set to YIELD, a REL COM message is returned to the far end.

- If a glare condition occurs during a wideband call, a route advance is performed to the next available terminating trunk group in the route list.

- If the glare conflict is between a wideband call and a narrowband (single B-channel) call, the narrowband call will yield if the appropriate glare field in Table TRKSGRP is datafilled for YIELD.

Different trunk selection methods

Many glare situations can be avoided if the switches at each end of the same trunk group use different trunk selection methods such as the following examples.

- Selection sequence—If the switch at one end uses the ascending bestfit algorithm for trunk selection, the switch on the other end of the trunk should use the descending bestfit algorithm.

- Selection type—To minimize glare, use firstfit for trunk selection.

- Route list—It is not recommended or supported that the same trunk group be placed in the same route list more than once; this greatly increases the chances that glare will occur.

Datafill and subscription parameters

This chapter describes the subscription parameters that apply to the primary rate interface on the DMS-250 switch and their datafill.

PRI subscription parameters allow customers to support and configure PRI to their particular needs. The DMS-250 switch assigns the parameters by datafilling a set of software tables. At the end of this chapter, there is information about the CI command DISPDCH.

Parameter groups

The parameters are divided into three groups as listed below.

Facility parameters

- define the hardware configuration of the PRI
- include locations of PRI B- and D-channels, Q.931 message characteristics, and variable aspects of the call control procedures

Service parameters

- define the logical services applied to the PRI interface
- primarily specify the number of calls allowed on an interface, together with the allowable bearer services

Integrated access parameters

- define the integrated services access (ISA) environment of the PRI interface
- are specifically related to call types
- supply information for translations and routing

  For more information on ISA subscription parameters, see Chapter 9, "Feature interaction."

Parameter relationships

The facility, service, and ISA parameter groups that define a PRI interface are closely related. The basis for the association among the three groups is

the common language location identifier (CLLI) and the logical terminal identifier (LTID). The CLLI identifies the PRI interface as a unique trunk group, together with associated subgroup and member data. The LTID functions as the key to the various service-related tables. Together they completely define a PRI interface.

The CLLI and LTID are related to each other through the use of mapping controlled by a tuple in the Table LTMAP. Table LTMAP identifies the CLLI related to a given LTID. (Table LTMAP can be updated by service personnel.) The relationship of CLLI to a given LTID is reflected in the read-only field LTID of Table TRKGRP. This method provides a consistent and flexible means of associating facility and service data for PRI interfaces.

Figure 9-1 shows the various subscription parameters for PRI interfaces.

Figure 9-1
Originating PRI subscription parameters
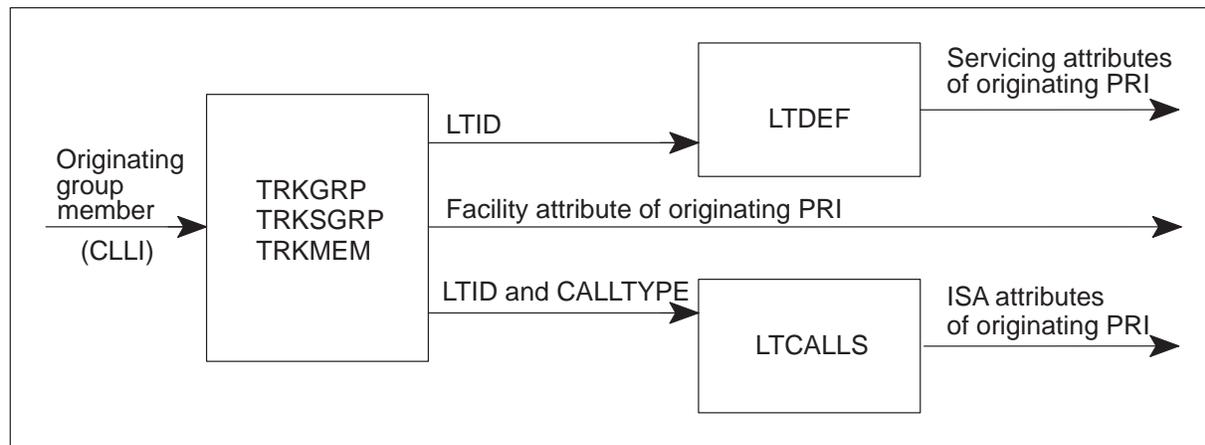
Facility-related interface parameters

The software tables listed below define the facility interface parameters for a PRI. Each table is indexed primarily by CLLI and supplies a level of detail about the characteristics of the PRI interface.

Table TRKGRP

- defines the general interface parameters

Table TRKSGRP

- defines the parameters that affect the Q.931 signaling protocol
- defines the location of the timeslot tied to the D-channel handler

Table TRKMEM

- defines individual B-channels for the PRI interface
- Each entry in TRKMEM corresponds to a B-channel on the PRI. These B-channels must be on the same peripheral as the D-channel handler that is datafilled in Table TRKSGRP.

Service-related interface parameters

The software tables listed below define the service interface parameters for a PRI interface. Each table is indexed primarily by LTID and supplies a description of the service provided on the PRI interface.

Table LTDEF

- defines the logical terminal identifier
- provides parameters that control the number of calls that appear on the logical terminal

Table LTMAP

- provides mapping between the logical terminal identifier (service data) and the trunk group (facility data)

Database correlation

A number of database items must be correlated in the DMS-250 switch to ensure a properly functioning PRI. This includes configuration data correlation, layer 1 data correlation, layer 2 data correlation, layer 3 facility data correlation, and layer 3 service data correlation. (For more information regarding layer descriptions, see Chapter 1, "Introduction.")

Configuration data correlation

There is no correlation in the hardware-related database.

Layer 1 data correlation

The correlation of layer 1 data is shown in Table 9-1.

Table 9-1
Layer 1 database correlation

Description	DMS-250 switch (Table CARRMTC)
Card type	Field CARD Value: NT6X50AA, NT6X50AB, or NT6X50EC
Frame format Superframe Extended superframe	Field FF Value: SF ESF
Line encoding Zero code suppression Bit8 zero suppression	Field ZLG Value: ZCS B8ZS
Bit error ratio Base: Bipolar violations CRC errors	Field BERB Value: BPV or CRC

Data link
No data link
FDL - source ts 2
FDL - source ext
	Field DLK
	Value: NILDL
	            FDL1
	            FDL2

Inhibit alarm transmit	Field IAT Value: Y or N
Bit error ratio maintenance limit	Field BERML Value: 6 (exponent)
Bit error ratio out of service limit	Field BEROL Value: 3 (exponent)
Errored second threshold	Field ES Value: 864
Frame bit error maintenance limit	Field FRAMEML Value: 17
Frame bit error out of service limit	Field FRAMEOL Value: 511
Slip count maintenance limit	Field SLIPML Value: 4
Slip count out of service limit	Field SLIPOL Value: 255
—end—	

Layer 2 data correlation

The correlation of layer 2 data is shown in Table 9-2.

Table 9-2
Layer 2 database correlation

Description	DMS-250 switch
Associate D-channel with PRI	Table TRKSGRP Field: DCHNL Value: Timeslot on DS-1 of the PRI D-channel
Data rate of D-channel	Table TRKSGRP Field DCHRATE Value: 56 kbit/s, 64 kbit/s
—end—	

Layer 3 facility data correlation

The correlation of layer 3 facility data is shown in Table 9-3.

Table 9-3
Layer 3 database correlation

Description	DMS-250 switch
Q.931 interface identifier	Table LTCPSINV Field IID Value: 0 ***Note:*** When datafilling multiple DS-1s per trunk group, a unique IID must be used for each DS-1.
Q.931 call reference value length	Table TRKSGRP Field CRLENGTH Value: 2
B-channel selection	Table TRKGRP Field SELSEQ Value: ASEQ, DSEQ, or WIDEBAND
Loss and level	Table TRKGRP Field PADGRP Value: NPDGP
User-network interface	Table TRKSGRP Field IFCLASS Value: NETWORK
—continued—	

Table 9-3
Layer 3 database correlation (continued)

Description	DMS-250 switch
Q.931 progress indicator location	Table TRKSGRP Field LOCATION Value: NETWORK
B-channels defined	Table TRKMEM Field PMTYPE Value: DTCI Fields: DTCICKTTS, DTCICKTNO
—end—	

Layer 3 service data correlation

Layer 3 service-related database correlation ensures certain service-related parameters are aligned with their equivalents in the other switch. Such settings includes:

- the translation information associated with PRI

- the call types subscribed to

- the bearer capabilities (BC) enabled

Datafill tables

Tables are datafilled from top to bottom. Figure 9-2 shows the interdependencies of tables within the DMS-250 switch and the resulting datafill order. Tables at the same vertical position (as shown in in Figure 9-2) can be datafilled in parallel.

Figure 9-2
DMS-250 switch datafill order for ISDN PRI tables

Table CLLI

The codes (maximum of 1024) in Table CLLI (Common Language Location
Identifier) uniquely identify the far end of each:

- announcement
- service circuit
- test trunk
- tone

- trunk group

Table CLLI contains four fields from left to right, in the following order:

- CLLI
- ADNUM
- TRKGRSIZ
- ADMININF

CLLI field

The 16-character alphanumeric CLLI field must start with an alpha character and must contain no special characters. (It is recommended that a CLLI code contain no more than 12 characters.) The recommended subfields for a CLLI code are:

- PLACE (four characters)—identifies the city or town at the far end of each trunk group, or the name for each tone, announcement, test trunk, or service circuit

- PROV (two characters)—PROVince or state; identifies the province or state at the far end of the trunk group

- BLDG (two characters)—BuiLDinG; identifies the building number at the far end of the trunk group

- TRAFUNIT (three characters)—TRAFFic UNIT; identifies the designation of the traffic unit at the far end of the trunk group. (This is not currently used for the DMS-250 switch)

- SUFX (one character)—SUFfiX; uniquely identifies trunk groups that terminate at the same CLLI location. (This is not currently used for the DMS-250 switch.)

ADNUM field

The ADNUM (ADministrative trunk group NUMber) field contains a numeric value in the range of 0 to 8191. Enter a number that is one less than the current size of Table CLLI datafilled in field SIZE of Table DATASIZE. For example, if size of Table CLLI is 650, the maximum ADNUM value is 649.

The following is true for ADNUMs:

- To allow for future growth in the number of pseudo CLLI codes, it is recommended that the operating company not assign ADNUMs below 51.

- ADNUMs for pseudo CLLI codes added by external (EXT) files must use the default value.

- The value of ADNUM must be unique. Attempts to add a CLLI code with an ADNUM already in use are rejected.

For restrictions on modifying the ADNUM field, see *DMS-250 Data Schema Reference Manual*.

TRKGRSIZ field

The TRKGRSIZ (TRunK GRoup SIZe) field contains a numeric value in the range of 0 to 2047. Set this field to equal the maximum number of trunks that are assigned to a trunk group. The value in this field allocates store; therefore, the value may be greater than the number of initial working trunks.

ADMININF field

The 32-character alphanumeric ADMININF (ADMINistration INFormation) field is treated as a character string. Subfields are separated by periods, and the string ends with a blank. The operating company uses this field to record administrative information not used by the switch.

The recommended subfields for ADMININF are:

- TRAFCLS (alphanumeric)—trunk group TRAFfic CLaSs; optional for administrative purposes only. If not required, enter a dash. Otherwise, set it equal to a traffic class defined in operating company practices.

- OFFCLS (alphanumeric)—OFFice CLaSs; optional, for administrative purposes only. If not required, enter a dash. If the TRKGRTYP subfield is blank, leave this subfield blank. Otherwise, set it equal to an office class defined in operating company practices.

- TRKGRTYP (alphanumeric)—TRunK GRoup TYPe; optional, for administrative purposes only. If not required, leave blank. If CLLI is set to SPARE, set this subfield to SPARE. Otherwise, set it to equal a trunk group type defined in operating company practices.

Table 9-4 shows example entries for Table CLLI fields for a toll switching unit.

Table 9-4
Table CLLI example field entries

CLLI	ADNUM	TRKGRSIZ	ADMININF
HLFSNS0101T0	100	24	PH.43.IT
OTWAON23CG00	101	225	FG.45.DTS
OTWAON23CG01	102	30	CO.54.CA

Table 9-4
Table CLLI example field entries (continued)

CLLI	ADNUM	TRKGRSIZ	ADMININF
OTWAON2323H1	103	150	LA.54.LA
FPOT	51	0	MI
LKOUT	52	0	MI
IDLE	53	0	MI
CF3P (Note 1)	56	12	MI
TERM102T (Note 2)	57	10	MI
TERM102L (Note 2)	58	0	MI
TERM100Q (Note 2)	59	0	MI

Note 1: This pseudo-fixed CLLI code is associated with the 3-port conference circuits in a toll switching unit.

Note 2: This recommended CLLI code is associated with the terminating 102 test lines in a switching unit.

—end—

Table MCLLICDR

Table MCLLICDR associates the originating CLLI with the terminating trunk group number identified in the call detail record (CDR). Table MCLLICDR must be datafilled before restoring a load (after a load dump) and after datafilling Table CLLI.

Fields

Table MCLLICDR contains two fields:

- CLLINAME (alphanumeric)—CLLI name. Enter any CLLI name that exists in Table CLLI.

- EXTNUM (0 to 8191)—EXTernal NUMber. Enter the external value to be associated with a CLLI name in the CDR.

Example

```
CLLINAME        EXTNUM
DMODEMC         2145
TERM105T        2258
```

Table LTCINV

Table LTCINV maintains a list of line-trunk controller (LTC)-based peripherals that are datafilled in the DMS-250 switch. This table identifies the location of the ISDN digital trunk controller (DTCI) is located, the load and exec lineups required, and the network link connections.

Important fields

Important fields in the TERMTYPEs vector include:

- TERMTYPE—PRAB must be datafilled.

- EXEC—Datafill as UTR250.

- OPTCARD—This vector must include ISP16.

ITA configuration

To configure integrated trunk access (ITA) on DTCI, the TERMTYPES vector in Table LTCINV must be datafilled as follows:

- TERMTYPE—PRAB must be datafilled.

- EXEC—Datafill as UTR250.

- TERMTYPE—AB250 must be datafilled.

- EXEC—Datafill as UTR250.

- TERMTYPE—ABTRK must be datafilled.

- EXEC—Datafill as DTCEX.

Table LTCPSINV

This table replaces Table IACPSINV. An entry in this table is automatically added when a DTCI is added in the Table LTCINV.

PRI trunks—important fields

Important fields in the P-side links vector for PRI trunks include:

- AREASELECT—must be DS1PRA

- CARRIDX—as defined in Table CARRMTC

- IID—must be unique for each DS-1 within a PRI trunk group

Example

```
0  DS1PRA  DEFAULT  N  0  NIL
```

PTS trunks—important field

An important field in the P-side links vector for PTS trunks is

- AREASELECT—must be DS1

Example:
```
0  DS1PRA  DEFAULT  N
```

Table CARRMTC

The attributes of DS-1 carriers are datafilled in this table and referenced from the DTCI P-side inventory Table LTCPSINV.

Example tuple
```
DTCI  DEFAULT  255  255  DS1  NT6X50AB  MU_LAW  SF  B8ZS  BPU
NILDL  N  250  1000  50  50  150  3  6  864  100  17  511  4
255
```

The DS-1 link can be configured in four basic operational modes:

- SF/ZCS

- SF/B8ZS

- ESF/ZCS

- ESF/B8ZS

Levels for performance parameters of DS-1 links may be changed from their default values. Although the DS-1 card type can be either NT6X50AA or NT6X50AB, the card type must be specified as NT6X50AB or NT6X50EL. This is because the NT6X50AA card cannot support 64 kbit/s clear data rate.

SF/ZCS

Superframe (SF) format and zero code suppression (ZCS) line encoding result in a maximum transfer capability of 64 kbit/s restricted information. No all-zero bytes/octets are passed.

SF/B8ZS

SF format and bipolar 8 zero substitution (B8ZS) line encoding allow the passing of 64 kbit/s unrestricted information. All bytes/octets are passed transparently.

ESF/ZCS

Extended superframe (ESF) format and ZCS line encoding are similar to SF/ZCS except:

- The yellow alarm is sent through the facility data link (FDL).

- The cyclic redundancy check (CRC) information can be used as the bit error ratio base.

ESF/B8ZS

ESF format and B8ZS line encoding offer the same transfer capability as SF/B8ZS.

The following are other carrier options that may be specified. Defaults are in parentheses.

- bit error ratio base—bipolar violations (BPV) or CRC; CRC is only available with ESF framing.

- data link (NILDL)

- inhibit alarm transmit (N)

- local carrier group alarm set threshold (250) specified in units of 10 ms

- local carrier group alarm clear threshold (1000) specified in units of 10 ms

- remote carrier group alarm set threshold (50) specified in units of 10 ms

- remote carrier group alarm clear threshold (50) specified in units of 10 ms

- alarm indication signal set threshold (150) specified in units of 10 ms

- alarm indication signal clear threshold (1000) specified in units of 10 ms

- bit error rate maintenance limit threshold expressed as a negative exponent of 10 ($6 \rightarrow 10^{-6}$)

- bit error rate out-of-service limit threshold expressed as a negative exponent of 10 ($3 \rightarrow 10^{-3}$)

- errored second limit (864)

- severe errored second limit (100)

Changing attributes

The DS-1 attributes for a given carrier are changed as follows:

- Ensure the associated carriers are either manual busy (MANB) or offline (OFFL).

- Create a new tuple, if necessary, in Table CARRMTC, with the required attributes. Usually it is recommended that you copy an existing tuple and change only the fields you want to modify.

- In the P-side inventory Table LTCPSINV, assign the new tuple to the desired DS-1 carriers.

- Busy and return the carrier to service.

PRI facility-related tables

Facility-related tables describe the characteristics of the PRI hardware interface and B-channel allocation. These parameters are datafilled in tables TRKGRP, TRKSGRP, and TRKMEM.

Table TRKGRP

For all applications (PRI and non-PRI), Table TRKGRP defines data associated with each trunk group interface.

Example tuple

```
ML2DPR64CLD0  PRA250  0  NPDGP  NCIT  MCI  MIDL  N  NIL 0  N
714  0  (ISDN00  1)  $  N  N  VNET  N  0
```

Fields of importance include the following:

- GRPTYP—used for call processing. For PRI, this should always be PRA250, as shown in the preceding example.

- WBGRPING—specifies the trunk selection method used for wideband calls on a particular trunk group. The range of values is: FIXED, FLOATING, or FLEXIBLE.

- SELSEQ—For PRI narrowband services, ASEQ or DSEQ is used. The other end of the trunk uses the opposite value to reduce B-channel glare.

- NSFDFLT—default network-specific facilities. Applied to calls when no network-specific facilities (NSF) are applied. Valid values are VNET and PRISM. Default value is PRISM.

- LTID—read-only field is composed of LTGRP (ISDN) and LTNUM (555). Upon making an entry in Table LTMAP, the two parts of the LTID field are automatically updated.

- DDI—allows the call processing task to screen calls to allow route selections of data only, voice only, or mixed (default). The DDI field is applicable to the following trunk group types:

  — DAL

  — ONAT (FGB and FGC)

  — EANT (DAL FGD, PTS FGD, and ISUP FGD)

  — PRI

  — IMT (PTS IMT, ISUP IMT, ISUP IMT Reseller, and ISUP RLT)

- OPTIONS—eases the introduction of new features and fast features

  — A field is activated by typing its symbolic name in the OPTIONS vector.

  — NCT—specifies network call transfer subscription on a per-trunk group basis. If this subfield is not datafilled for PRI, these functionalities are not activated. Default value is NIL. To datafill an NCT value, NARSDED must not be datafilled in the OPTION field.

  — A field is deactivated by deleting its symbolic name from the OPTIONS vector. If no fields are to be added to the OPTIONS vector, a $ is typed in the first OPTIONS field.

One of the fields that can be activated in the OPTIONS vector is NARSDED. NARSDED indicates the switch is an enhanced voice services (EVS) switch (formerly called network audio response system—NARS). This means there is a PRI trunk connecting the switch to an EVS audio response unit.

If the NARSDED field is activated incorrectly, operator service records and private operator service records are generated at the EVS switch instead of CDRs and private network records.

The SUPERGD field must be set to Y for ISUP RLT terminations so that the CII Call REference can be sent in the outgoing IAM.

Table TRKSGRP

Table TRKSGRP lists the supplementary information for each subgroup assigned to one of the trunk group interfaces listed in Table TRKGRP. For PRI applications, it is in this table that the signaling channel (the D-channel) is defined for each trunk group.

Example tuple

```
K2KPRI64CL 0 DS1SIG ISDN 15 15 87Q931 2 N STAND +  NETWORK
PT_PT  PVTNET  Y  UNEQ  16  PRANODE  N  DEFAULT  DTCI  10  0
24  64K  HDLC  $
```

Important fields

Important fields include:

- CARDCODE—DS1SIG is the card code used for ISDN PRI.

- SIGDATA—the protocol used for call processing. ISDN is the only valid field for a PRI trunk.

- IFCLASS—describes this end of the PRI trunk as the network end or the user end of the protocol. The DMS-250 switch should always be datafilled as the network end.

- DCHNL—the main D-channel to be used for the PRI interface. It consists of:

  — DTCINO

  — DTCICKTNO

  — DTCICKTTS

  — DCHRATE (data rate of D-channel, values are 64 kbit/s and 56 kbit/s)

ITA configuration

To configure ITA on DTCI, the non-PRI trunk groups must be datafilled in Table TRKSGRP along with PRI trunk groups.

Table TRKMEM

Table TRKMEM lists the data associated with each analog or digital trunk. For PRI, this table defines the B-channels in each trunk group.

Example tuples

```
K2KPRI64CL 1 0 DTCI 10 0
K2KPRI64CL 2 0 DTCI 10 0 2
K2KPRI64CL 3 0 DTCI 10 0 3
```

Important fields

Important fields include:

- EXTRLNUM—external trunk number. The first digit of the key of this external trunk number tuple should be (but is not required to be) the same as the DTCI circuit time slot number to ensure that trunk selection is done in the correct order.

- PMTYPE—peripheral module type. The peripheral module type used for PRI is DTCI.

ITA configuration

Non-PRI trunk members are datafilled in Table TRKMEM along with PRI B-channels. The following example shows an ITA configuration.

Example tuples

```
K2KPRI64CL 1 0 DTCI 10 0 1
K2KPRI64CL 2 0 DTCI 10 0 2
K2KPRI64CL 3 0 DTCI 10 0 3
K2KABTRK1  1 0 DTCI 10 0 4
K2KABTRK2  1 0 DTCI  10 0 5
```

Important field

The AREASELECT field (in P-side links vector of the DTCI tuple in Table LTCPSINV) must be DS1PRA for ITA.

PRI service-related tables

The parameters in the following tables describe the type and level of services provided (or logical characteristics) on the PRI interface. These tables are Table PRIPROF, Table LTDEF, and Table LTCALLS. The mapping of these logical attributes to the physical interface is done through Table LTMAP.

Table PRIPROF

Table PRIPROF holds data about the status of the function switches that define a particular issue of a variant. When this table is initialized, the default values for the fields are invoked.

Important fields

Important fields include:

- PROFNAME—PROFile NAME; an 8-character string (user defined). The default is NIL.

- VARIANT—specifies one of three protocols the profile name is to be associated with. Possible values are NTNAPRI, NTMCIPRI, or N449PRI. The default is NTNAPRI.

- ISSUE—specifies the release issue of the variant. Possible values are, V1 or MCIV1. The default is V1.

- PROFILE—a vector of up to 64 function switch names. The default is NIL.

Function switches for the profile vector

To provide complete interworking between the DMS-250 switch and an SL-1, the following function switches have been implemented for protocol variants NTNAPRI and NTMCIPRI.

- NOPIALRT—Do not put PI in the ALERT message if sending to an SL-1.

- XPLCTIID—Always send "XPLCTIID" for Sl-1.

- CIXBIT0—Always set the extension bit to 0 in the channel number byte of the CID.

- CSE27T47—The SL-1 cannot handle a cause of 27 (dest_out_of_service). This function switch changes the cause value to 47 (resource unavailable).

- RMBCSE82—The SL-1 sends a cause of 82 (identified channel does not exist); then the DMS-250 switch sets the channel RMB.

To meet interworking requirements for interfacing with an SL-1 switch, one or more of the function switches in the list must be datafilled as enabled for protocol variants NTNAPRI and NTMCIPRI.

Table LTDEF

Table LTDEF defines logical terminals along with their access privileges. For PRI, the only allowable access privilege is B.

Important fields

Important fields include the following:

- LTAP—the access privilege of the LT; must be B for PRI
- VARIANT—specifies the protocol variant for a particular interface
- ISSUE—contains a specific release of a PRI variant
- PROFNAME—The profile name contained in this field has been previously defined in Table PRIPROF.
- OPTIONS—the options listed as follows control the use of bearer capability on the PRI:
  - NOVOICE—prevents calls with a bearer capability of SPEECH from terminating or originating on this PRI
  - NOVBD—prevents calls with a bearer capability of 3.1 Khz audio (also known as voice-band data)
  - NOCMD—prevents calls with a bearer capability of 64 kbit/s (clear or restricted) and 56 kbit/s (also known as circuit-mode data)
  - NOPMD—prevents calls with packet mode data; the default entry

Table LTCALLS

Table LTCALLs stores ISA call type-related data needed to determine how calls are translated and screened.

Important field

The important field is:

- LTCOPT—Logical Terminal Call OPTion. Enter MLTIDX 1–1024 into Table MLTATTR.

Table LTMAP

Table LTMAP maps logical terminal identifiers (LTID) to CLLIs. When an entry has been made in LTMAP, an update to Table TRKGRP is performed automatically. The TRKGRP field LTID is changed from $ to the LTGRP, and LTNUM is entered in LTMAP.

Example tuple

```
ISDN 555 CLLI K2KPRI64CL (TEI 0) $
```

Important fields

Important fields include:

- MAPTYPE—always CLLI for PRI
- CLLI—the name of the PRI trunk datafilled in Table TRKGRP

- OPTIONS—the only valid entry in this field is TEI 0.

CI command—DISPDCH

The command DISPDCH is not supported for the DTCI D-channel handler (DCH). The following message is displayed when the CLLI corresponds to a DCH on a DTCI:

```
There is no DCH associated with this trunk group.
```

Service verification

This chapter outlines the verification of the various services and describes the following:

- steps performed to guarantee that services function properly

- steps taken to isolate problems when they occur

Call setup service over PRI

To ensure that calls over a primary rate interface (PRI) can be placed successfully, put the PRI-related facilities into service and perform T100 and T102 tests.

Putting PRI-related facilities into service

To put PRI-related facilities into service, perform the following steps:

1   Ensure the carrier is in service (INSV). For more details on bringing a carrier into service, see "Verification of PRI facility on DMS-250 switch" in this chapter.

2   Ensure the PRI trunk is in service and idle (IDL).

    For more details on bringing a PRI into service, see "Verification of PRI facility on DMS-250 switch" in this chapter.

3   Datafill the PRI-related tables.

    For more details on datafilling PRI-related tables and their functions, see "PRI datafill verification" in this chapter.

TL100 tests over PRI trunks

The TL100 test, also known as a quiet or balanced termination, provides noise and loss measurements. There are three versions of the test:

- T100

- N100

- S100

In the T100 and T102 testline test descriptions, the terms *on-hook* and *off-hook* are used. These terms are not applicable for ISDN PRI trunks. A diagram of the TL100 configuration is shown in Figure 10-1.

Figure 10-1
TL100 configuration
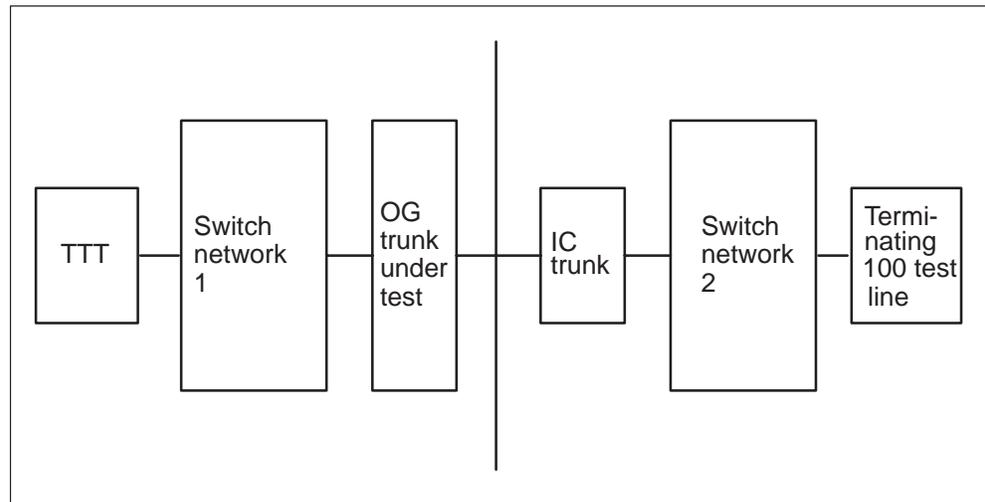
T100 test

To execute a T100 or T102 test and monitor levels of the MAP terminal, you can use TST (TeST) commands from the trunk test position (TTP).

If you know the version of the distant office testline, you can perform that version directly, and a 2 s delay per trunk is not required. Otherwise, perform the T100 test.

When the T100 testline test is performed, a 2 s time-out is used to check for a milliwatt tone. If a milliwatt tone is detected, the N100 version of the test is executed. If no tone is detected, the S100 version of the test is initiated.

N100 test
The N100 test includes a milliwatt test and can be used for far-to-near loss measurements.

The operating sequence of the N100 version of the 100 testline is as follows:

- Connect level meter of trunk test terminator (TTT) to outgoing trunk.

- Outpulse test code to terminating office that responds with off-hook when milliwatt generator is connected.

- Milliwatt tone is received from the far-end office and measured by level meter.

- The far-end office provides continuous quiet termination until released. The near-end office measures noise on the trunk.

- The test is terminated and the trunk is disconnected.

S100 test
In the S100 version, the steps involving the milliwatt test are eliminated.

TL102 tests over PRI
The 102 testline, also known as a milliwatt testline, provides far-to-near transmission loss measurements.

Figure 10-2 shows a block diagram of the TL102 configuration.

Figure 10-2
TL102 configuration
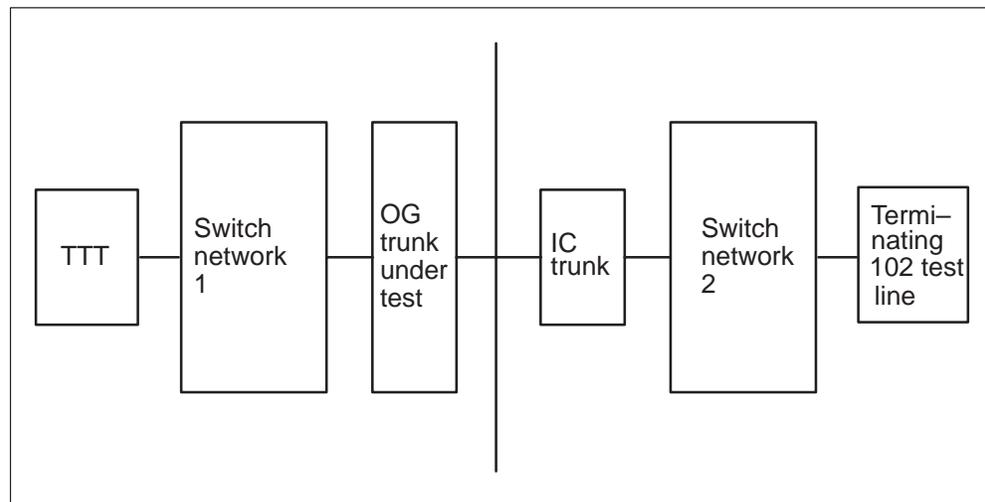
A 9-second off-hook signal is sent from the far end, during which the milliwatt test tone is applied. The milliwatt test tone is followed by an on-hook signal, then quiet termination.

If the far end is a local office, the test tone is repeated in 10 second cycles (9 seconds on and 1 seconds off).

If the far end is a toll office, quiet termination continues until the near end releases the connection, or requests another test cycle (by means of a ring-forward signal). The milliwatt source-levels are office-dependent and trunk-group-dependent.

ISDN PRI trunks do not support ring-forward.

The operating sequence of the 102 testline is as follows:

1   Connect trunk under test to TTT.

2   Outpulse test code to far end office that returns off-hook.

3   The level meter of TTT measures milliwatt tone level and compares it with the expected measured loss (EML).

4   The test terminates.

Call over a PRI

Follow these steps for a call over a PRI:

1   From an ISDN private branch exchange (PBX), make a call over a PRI trunk facility to another ISDN PBX.

2   Verify the call terminates correctly.

3   Verify the calling party number displays on the terminating set.

4   Verify the called party number displays on the ISDN-compatible PBX terminal.

5   Verify the call can be released properly from either end.

Verify data connectivity

Make basic data calls from one type of data module to another through PRI trunks. After a connection is established, perform the BERT test (described in the *DMS-100 Bit Error Rate Performance Testing Manual)*. Northern Telecom recommends a minimum of ten minutes per test.

Customer questionnaires

Two customer questionnaire forms are provided.

- PBX Telecom Manager Trouble Report Form (two pages)

- PBX End-User Trouble Report Form (one page)

PBX telecom manager trouble report form

The PBX telecommunications manager completes this form when reporting problems to the operating company. The form emphasizes the problems that may be visible to the operating company's manager. Circle or check all possible problems in the appropriate areas on the forms.

Figure 10-3
PBX Telecom Manager Trouble Report Form

<div style="border:1px solid">

PBX Telecom Manager Trouble Report Form

TIME _____ hrs. _____ m _____ DATE ____ / ____ /19 ____ PROBLEM NO. _____ ;

CUSTOMER NAME _____ ; CONTACT NAME _____ ;

DMS RELEASE BCS _____ ; DTCI _____ ;

PROBLEM

dead   audring   no_i/c   ctoff   1wayxmit   noise   xtalk   sldt

hi+dry   alwzbsy   gtann   tonelvl   dod   did   esn   pvt   tie

display   cpi   bpv   sync_loss data   cid   watts

other:
_____

_____

DS–1 Attributes

LTID = ISDN_____ DTCI_____ _____ CLLI_____

D–Channel DTCI_____ _____ _____ _____ Number of B–Channels_____

Call Attributes

CDN_____ NPI_____ CGN_____

DMS-250) Solution/Action Taken

no_fault   found_ok   miss_operate   no_response   mb/rts

unable_to_reproduce   database_table   fris   clear_when_tested

CSR_____   clear_after_diagn
_____

</div>

Figure 10-4
PBX Telecom Manager Trouble Report Form, page 2

Outside Plant Solution/ActionTaken

FORWARDED   TIME   hrs.   m   DATE   /   /19

CLEARED   TIME   hrs.   m   DATE   /   /19

WORK DONE

_____

_____

_____

SWITCH PROBLEM =   DMS   PM   CPU   CMC   LCM   DTCI   DS1

TERMINAL PROBLEM = CPE

OTHER

_____

HARDWARE
PEC: ;   SERIAL #:   ;   LOCATION: ;

DIAGNOSTIC   FAILURE ON SUSPECT   HARDWARE   YES/NO

OTHER DETAILS:

_____

_____

                              RELEASE

DS-1   6X50AB   ————————

PRINTOUTS

Attach any relevant printouts or files in SFDEV associated
with identifying the fault

PBX end-user trouble report form

This form is completed when trouble reports are filed by end users of the switch. It emphasizes the problems that may be visible to the end user; it has space for comments. Circle or check all possible problems in the problem description area of the form.

Figure 10-5
PBX End-User Trouble Report Form

PBX End–User Trouble Report Form

TIME ____HRS ____MIN   DATE____/ ____/19____   PROBLEM NO._____

NAME _____   TELEPHONE NO. _____

APPLICATION:

VOICE   DATA

DATA MODULE USED:

ASDM   ASIM   AILU   ADO   OTHER   BAUD RATE_____

PROBLEM DESCRIPTION

ORIGINATION DN_____ NUMBER DIALED_____

CALL TRANSFER/CONFERENCE DN_____

CUTOFF NOISY CROSSTALK FASTBUSY   HI&DRY WRONG–TERMINATION

1WAY–CONVERSATION   DIGIT–DISPLAY   DATA–CORRUPTION

OTHER

SUPPLEMENTARY INFORMATION _____

_____

SYSTEM_____   LOC_____

S/W RELEASE + ISSUE_____

FREQUENCY_____

IMPACT _____

WORKAROUND_____

FORWARD TO_____   FORECAST FIX _____

Verification of PRI facility on the DMS-250 switch

This section defines the possible states for the following PRI components:

- PRI trunk
- carrier
- ISDN digital trunk controller (DTCI)
- D-channel

PRI datafill verification

The PRI-related tables fall into two categories: facility-related and service-related.

The PRI facility-related tables consist of

- table TRKGRP
- table TRKSGRP
- table TRKMEM

The PRI service-related tables consist of

- table LTDEF
- table LTCALLS
- table LTMAP

If the trunk group has not been associated with a logical terminal identifier (LTID) in table LTMAP, PRI is not accessible. This may be verified by scanning the tuple in table TRKGRP for an LTID (for example, ISDN 999).

Interpreting PRI trunk states on the DMS-250 switch

Table 10-1 lists PRI trunk states.

Table 10-1
PRI trunk states

PRI trunk state	Explanation
Carrier fail (CFL)	The circuit is removed from service because of a failure associated with the DS-1.
Call processing busy (CPB)	The facility or member is currently carrying traffic; thus, the facility is busy.
—continued—	

Table 10-1
PRI trunk states (continued)

PRI trunk state	Explanation
Call processing deload (CPD)	The circuit is currently carrying traffic; however, another entity has requested to be informed when the circuit is released. Usually, maintenance on the circuit is pending.
D-channel fail (DFL)	The D-channel associated with this B-channel is not in service and no messaging can take place.
D-channel manual busy (DMB)	The state an ISDN PRI trunk member has when the D-channel handler (DCH) associated with the D-channel is out of service. Every member in the trunk group that is not INB and is associated with the out-of-service DCH sustains the state D-channel manual busy (DMB) until the DCH is returned to service.
Idle (IDL)	The trunk member is in service and idle.
Installation busy (INB)	The circuit is installed but has not yet been placed in service.
Lockout (LO)	The D-channel associated with the facility is in service. However, CCS7 layer 3 cannot communicate with the far end because there is no synchronization over CCS7 layer 2; there is synchronization but no logical link is established; and CCS7 layer 3 is not responding to a restart or release.
Manual busy (MB)	The circuit is removed from service by a maintenance person.
Peripheral manual busy (PMB)	The circuit is not available because the associated peripheral (the PRI DTCI) is out of service.
Remote make busy (RMB)	A circuit has the state RMB when the far end of the B-channel is removed from service. As a result, call setup fails.
System busy (SB)	The circuit is removed from service by system maintenance; system maintenance performs periodic tests.

—**end**—

Restoring service to the PRI trunk on the DMS-250 switch

Table 10-2 lists the various actions to be taken based on trunk states shown at the DMS-250 switch MAP terminal.

If the problem is due to the DCH—that is, B-channel states in D-channel manual busy (DMB), D-channel fail (DFL), and lockout (LO)—refer to Table 10-4 for troubleshooting information.

Table 10-2
PRI trunk (B-channel) states and actions

DMS-250 switch states	Resource out of service	Actions to be taken
PMB	The PRI DTCI is out of service.	- Enter PM level of the MAP terminal - Post the DTCI - Isolate the fault
DMB	The DCH is out of service.	- Enter PRADCH level of the MAP terminal - Post the DCH - Isolate the fault
RMB	The remote end of the PRI trunk is out of service.	- Enter TTP level of the MAP terminal - Post the PRI trunk group - Isolate the fault
LO	DCH cannot communicate with layer 3.	- Enter PRADCH level of the MAP terminal - Post the associated DCH - Isolate the fault
CFL	The carrier is out of service.	- Enter carrier level of the MAP terminal - Post the carrier - Isolate the fault
MB	The PRI is manual busy.	- Enter TTP level of the MAP terminal - Post the PRI trunk group - Return the circuits to service
SB	The PRI circuit is system busy.	The system will return the member to service after test is completed.

—**end**—

Interpreting carrier states on the DMS-250 switch

Table 10-3 lists DS-1 carrier states and actions.

Table 10-3
DS-1 carrier states

DS-1 carrier state	Explanation
INSV	The DS-1 is in service and can be used to service a trunk. No alarms are present.
Manual busy (MANB)	The DS-1 is out of service because of a command issued by maintenance personnel.
System busy (SYSB)	The DS-1 is system busy because of a local or remote alarm.
Unequipped (UNEQ)	A P-side port for the PRI DTCI is unequipped when no datafill exists in table LTCPSINV to define that port. Any trunks that may be datafilled for that facility will be off-line.
Off-line (OFFL)	The DS-1 is off-line.
—end—	

Restoring service to the carrier

Table 10-4 lists DS-1 carrier states and actions.

Table 10-4
DS-1 carrier states and actions

DMS-250 switch states	Resource out of service	Actions to be taken
OFFL	Carrier is off-line	From carrier level of the MAP terminal: busy and return the carrier to service.
MANB	Carrier is manual busy	From carrier level of the MAP terminal: return the carrier to service. Note the new carrier state.
SYSB	Carrier is system busy	From carrier level of the MAP terminal: diagnose the fault. Note the new carrier state.
	—end—	

Interpreting PRI DTCI states

Table 10-5 lists PRI DTCI states.

Table 10-5
PRI DTCI states and actions

DTCI state	Explanation and action
In service (INSV)	The DTCI is in service. No action is required.
In service trouble (IStb)	A fault does exist in the DTCI; however, services are not impacted.
Off-line (OFFL)	The DTCI is off-line and possibly pending office data modifications.
Manual busy (MANB)	The DTCI has been manually busied by maintenance personnel. Manual maintenance may be in progress.
C-side busy (CBSY)	This implies there is no in-service message connection between the DTCI and the network, or the network is out of service.
System busy (SYSB)	The DTCI is out of service. The system has detected a fault and taken the DTCI out of service.
—end—	

Restoring service to the DTCI

Table 10-6 lists DTCI states and actions.

Table 10-6
DTCI states and actions

DMS-250 switch states	Resource out of service	Actions to be taken
MANB	DTCI is manual busy	From PM level of the MAP terminal: - Post the DTCI - Return the DTCI to service
ISTB	DTCI is in service trouble	From PM level of the MAP terminal: - post the DTCI - enter QUERYPM FLT - diagnose fault
—end—		

Table 10-6
DTCI states and actions

DMS-250 switch states	Resource out of service	Actions to be taken
CBSY	The DTCI is C-side busy	From PM level of the MAP terminal: - post the DTCI - enter TRNSL C - diagnose C-side links not in service
SYSB	The DTCI is system busy because of a problem the system detected	- System log is generated as to fault that occurred. - Diagnose the problem. - System returns the DTCI to service if no fault is found.
—end—		

Interpreting DCH states

Table 10-7 lists DCH states.

Table 10-7
Interpreting DCH states

DCH state	Explanation
In service (INSV)	The D-channel is in service.
Manual busy (MANB)	Maintenance personnel have manually busied the D-channel to perform maintenance actions.
Installation busy (INB)	The D-channel is installed but has not been put into service thus far.
Peripheral MANB (PMB)	Peripheral is taken out of service by operating company personnel.
Initializing (INI)	The D-channel is being initialized by the system. The system brings up the D-channel when the other facilities are brought into service.
Carrier fail (CFL)	The carrier on which the D-channel is provisioned failed.
Lock-out (LO)	This state indicates a failure at the logical link level or the hardware (not the carrier).
Remote not responding (RNR)	This state indicates that CCS7 layer 3 at the far end is not responding although CCS7 layer 2 is established and ready.
—end—	

Restoring service to the DCH
When the DCH state is LO or RNR, refer to "Troubleshooting" in Chapter 3, "D-channel handler," for additional information on troubleshooting. Table 10-8 lists the DCH states and actions.

Table 10-8
DCH states and actions

DMS-250 switch states	Resource out of service	Actions to be taken
INB	D-channel is installation busy	- Enter the PRADCH level of the MAP terminal. - Post, BSY, and RTS the DCH.
INI	DCH is being initialized	No action is required. The system will bring up the DCH.
PMB	DTCI is busy	- Enter the PM level from the MAP terminal. - Post the DTCI. - Isolate the fault.
CFL	carrier failed	No action is required if DTCI is going through a restart. Otherwise, -enter the carrier level of the MAP terminal, then - BSY and RTS the carrier.
MANB	DCH is manual busy	From CI level of the MAP terminal: - Enter - MAPCI; MTC; TRKS; TTP; PRADCH. - Post the DCH. - Return the DCH to service.
LO	logical link failed	Refer to "Troubleshooting" in Chapter 3, "D-channel handler."
RNR	far-end layer 3 is not responding	Make sure that the far-end DCH is in service.
—end—		

Engineering recommendations

This chapter provides recommendations to simplify the configuration and engineering of the ISDN digital trunk controller (DTCI) primary rate interface (PRI).

PRI configurations

The configurations for single DS-1 per PRI, single PRI per DS-1, and the usage of non-PRI channels on the DS-1 switch are given in the following paragraphs.

Single DS-1 per PRI

In this release, multiple DS-1s can contain B-channels that are controlled by a single PRI D-channel.

Single PRI per DS-1

The DMS-250 switch supports multiple D-channels and PRIs within a single DS-1.

Usage of non-PRI channels on DS-1

Any channels within the DS-1 that are not used as B-channels (that is, controlled by the D-channel for circuit-switched calls) need not be left idle (that is, containing idle code, hex 7F). The DTCI allows these non-PRI channels to be provisioned as a per-trunk signaling (PTS) trunk. In other words, any AB-trunk supported by DMS-250 switch can be datafilled on the non-PRI channels.

D-channel handler to DS-1 mapping

There exists a one-to-one mapping between the D-channel handler and the DS-1, as datafilled in table TRKSGRP.

Recommended D-channel handler to DS-1 mapping on DMS-250 DTCI

This does not apply; the mapping is determined by the datafill.

Optimal DS-1/D-channel handler card assignments on DMS-250 DTCI

This does not apply; this manual pertains to signaling terminal (ST) card provisioning.

Signaling terminals

This does not apply to the DTCI.

DTCI port allocation

DS-1/DS-30 port groups

For trunk call processing, C-side channels are preallocated for each trunk member. The members on the first five P-side ports (0 to 4) are scattered over the channels on the first four C-side ports (0 to 3). The next five P-side ports use the next four C-side ports, and so on. The scattering of channels was chosen to minimizes transit delays through the DTCI timeswitch. Scattering also reduces the chances of an entire DS-1 being taken out of service by a C-side link failure. (C-side ports can only be datafilled in ascending order in table LTCINV.)

Table 11-1 summarizes the mapping of groups of P-side ports to C-side ports. The number of ports usable as DS-1 ports and ST ports per grouping is also indicated.

Table 11-1
RI DTCI P-side-to-C-side port mapping

Port group (configuration)	P-side port	C-side port	DS-1 ports minimum	DS-1 ports maximum
A	0–4	0–3	3	4
B	5–9	4–7	3	5
C	10–14	8–11	5	5
D	15–19	12–15	5	5
—end—				

C-side port requirements

C-side port requirements do not apply because ST cards are not used on the DTCI.

DS-1 card locations

DS-1 card locations do not apply because ST cards are not used on the DTCI.

Reliability considerations

Reliability considerations relating to backup trunk groups, use of non-PRI trunks as backup, multiple PRI links, and DMS-250 switch loss and level datafill are described in the following paragraphs.

Backup trunk group

To reduce the impact of PRI failures or degradations, backup trunk groups can be set up in the DMS-250 switch routing tables. The backup groups can be either PRI or AB-trunk groups.

Non-PRI trunks as backup

The backup trunk group may reside on the DTCI because it can support non-PRI trunks. Route selection should be set up to select the PRI trunk first, with rerouting to the non-PRI trunk(s) if the PRI is completely busy or out of service. The route/trunk databases in the DMS-250 switch have to be set up to accomplish this. The overflow from PRI could result in calls being offered in both directions by means of a single two-way trunk group, or by means of two one-way trunk groups.

The following is an example of a non-PRI backup trunk:

```
Table OFRT
       99        S D DMS2MSLPRI
                 S D DMS2MSLDAL
```

When a user dials the code to reach the PRI trunk, the call is routed using route OFRT 99. Calls are first offered through the PRI group DMS2MSLPRI. If this is 100% busy, out of service, or experiences protocol failure during call setup, the call is reoffered on the DAL trunk DMS2MSLDAL. Calls incoming on DMS2MSLDAL are handled the same way as calls incoming on DMS2MSLPRI.

Multiple PRI links

This does not apply.

DMS-250 switch loss and level datafill

PRI requires the addition of some tuples in table PADDATA. The following example in Table 11-2 shows the recommended datafill for the DMS-250 switch central office to support the ISDN PRI loss and level plan. The key port 1 in Table 11-2, PRIP, is the PAD group associated with the PRI on the DMS-250 switch.

Table 11-2
Datafill to support the ISDN PRI loss and level plan

Key port 1	Key port 2	Data pad 1T02	Data pad 2T01
PRIP	ONS	6	3
PRIP	OPS	3	0
PRIP	PONS	3	3
PRIP	POPS	0	0
PRIP	DONS	6	0
PRIP	ATT	3	0
PRIP	DTT	0	0
PRIP	ACO	3	0
PRIP	DCO	0	0
PRIP	PRIP	0	0
		—end—	

DS-1 to DS-30 channel mapping

Tables 12-1 and 12-2 provide the mapping of DS-1 ports and channels to DS-30 ports and channels. Given a particular DS-1 port and channel (port 0, channel 1, for example), Table 12-1 shows that DS-1 port 0, channel 1 maps into DS-30 port 3, channel 30. Similarly, table 12-2 shows that DS-30 port 3, channel 30 maps into DS-1 port 0, channel 1.

Table 12-1
DS-30 port/channel per DS-1 channel and port

DS-1 channel	DS-1 port 0	DS-1 port 1	DS-1 port 2	DS-1 port 3	DS-1 port 4
1	3/30	0/1	1/1	2/1	3/1
2	0/2	1/2	2/2	3/2	0/3
3	1/3	2/3	3/3	0/4	1/4
4	2/4	3/4	0/5	1/5	2/5
5	3/5	0/6	1/6	2/6	3/6
6	0/7	1/7	2/7	3/7	0/8
7	1/8	2/8	3/8	0/9	1/9
8	2/9	3/9	0/10	1/10	2/10
9	3/10	0/11	1/11	2/11	3/11
10	0/12	1/12	2/12	3/12	0/13
11	1/13	2/13	3/13	0/14	1/14
12	2/14	3/14	0/15	1/15	2/15
13	3/15	0/16	1/16	2/16	3/16
14	0/17	1/17	2/17	3/17	0/18
15	1/18	2/18	3/18	0/19	1/19
—continued—					

Table 12-1
DS-30 port/channel per DS-1 channel and port (continued)

DS-1 channel	DS-1 port 0	DS-1 port 1	DS-1 port 2	DS-1 port 3	DS-1 port 4
16	2/19	3/19	0/20	1/20	2/20
17	3/20	0/21	1/21	2/21	3/21
18	0/22	1/22	2/22	3/22	0/23
19	1/23	2/23	3/23	0/24	1/24
20	2/24	3/24	0/25	1/25	2/25
21	3/35	0/26	1/26	2/26	3/26
22	0/27	1/27	2/27	3/27	0/28
23	1/28	2/28	3/28	0/29	1/29
24	2/29	3/29	0/30	1/30	2/30
			—end—		

Table 12-2 is indexed by DS-30 port number (across the top) and DS-30 channel number (down the left). The resulting entry is the DS-1 port number and channel number (within the port group).

Table 12-2
DS-1 port/channel per DS-30 channel and port

DS-1 channel	DS-1 port 0	DS-1 port 1	DS-1 port 2	DS-1 port 3
1	1/1	2/1	3/1	4/1
2	0/2	1/2	2/2	3/2
3	4/2	0/3	1/3	2/3
4	3/3	4/3	0/4	1/4
5	2/4	3/4	4/4	0/5
6	1/5	2/5	3/5	4/5
7	0/6	1/6	2/6	3/6
8	4/6	0/7	1/7	2/7
		—continued—		

Table 12-2
DS-1 port/channel per DS-30 channel and port (continued)

DS-1 channel	DS-1 port 0	DS-1 port 1	DS-1 port 2	DS-1 port 3
9	3/7	4/7	0/8	1/8
10	2/8	3/8	4/8	0/9
11	1/9	2/9	3/9	4/9
12	0/10	1/10	2/10	3/10
13	4/10	0/11	1/11	2/11
14	3/11	4/11	0/12	1/12
15	2/12	3/12	4/12	0/13
16	1/13	2/13	3/13	4/13
17	0/14	1/14	2/14	3/14
18	4/14	0/15	1/15	2/15
19	3/15	4/15	0/16	1/16
20	2/16	3/16	4/16	0/17
21	1/17	2/17	3/17	4/17
22	0/18	1/18	2/18	3/18
23	4/18	0/19	1/19	2/19
24	3/19	4/19	0/20	1/20
25	2/20	3/20	4/20	0/21
26	1/21	2/21	3/21	4/21
27	0/22	1/22	2/22	3/22
28	4/22	0/23	1/23	2/23
29	3/23	4/23	0/24	1/24
30	2/24	4/24	4/24	0/1

—end—

ETSI PRI

Introduction

ETSI PRI is an adaptation by the European Telecommunications Standards Institute (ETSI) of the International Telecommunication Union (formerly known as CCITT) ISDN primary rate recommendations for European users. To comply with the deployment of DMS-250 switches in Europe, a new interface was developed.

A limited set of features that currently exist on the American National Standards Institute (ANSI) PRI interface is supported for ETSI PRI. All specific database information (for example, tables and their specific fields) are supported in the same manner for ETSI PRI as for ANSI PRI.

The following features are not supported for ETSI PRI:

- hotline numbers
- VNET access based on NSF=VNET in SETUP
- Dialable Wideband Service calls on ETSI PRI
- network call transfer
- card calls for ETSI PRI originations
- ANI in the feature all B-channels busy for ETSI PRI originations
- packet mode access connections
- location code mapping for ETSI PRI (the location code received in the cause information element is tandemed as received)
- D-channel backup
- Enhanced reorigination

Protocol—network mode

In the network mode, the ETSI PRI interface is used as a dedicated access to the DMS-250 from the PBX customer. The network mode supports the following functionality:

- call processing—supported functions; table control

- protocol conformance—ETSI PRI messages and information elements; messages formats

Figure 13-1 shows the network mode configuration for ETSI PRI. The DMS-250 is the network side of the ETSI PRI interface and is interworked with ITU ISUP IMT interface to provide communication with the public switched network.

Figure 13-1
**ETSI PRI DMS-250 switch configuration—network mode**
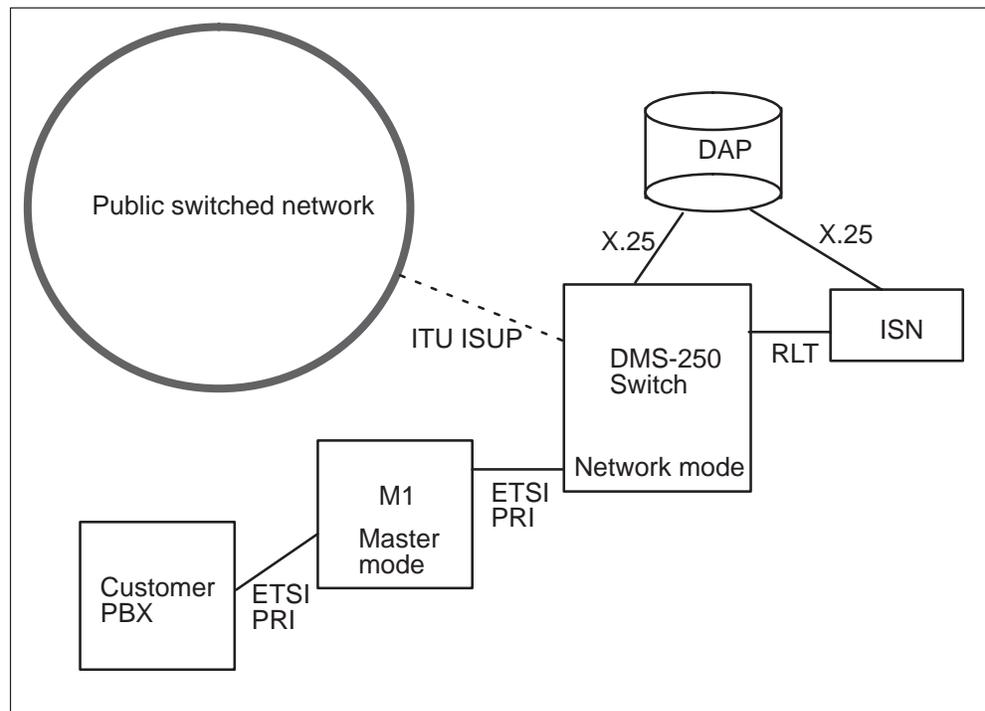
The ISDN layer 1 and Layer 2 protocols for ETSI PRI are handled solely by the DTCOi+ peripheral and are generally in compliance with the appropriate ETSI standard. Layer 3 functionality is handled jointly by the customer connect and the extended peripheral modules. As part of this feature, the layer 3 protocol for basic call control on ETSI PRI is supported on the DMS-250 switch. The implementation of layer 3 is based on ETS 200 102-1 and is generally in compliance with the ETSI standard.

Protocol—user mode

In addition to the network mode functionality of the DMS-250, the user mode allows the DMS-250 to connect to the public switched telephone network in the user mode. Figure 13-2 shows this configuration.

Figure 13-2
ETSI PRI DMS-250 switch configuration—user mode
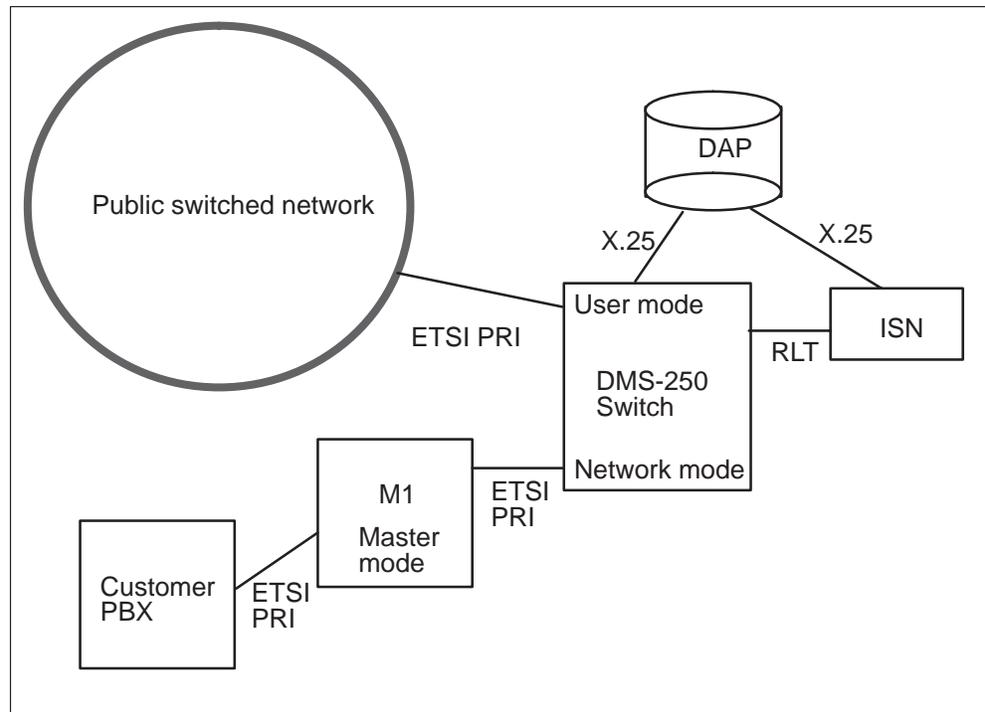
Current functionalities of the network mode configuration are supported in the user mode configuration. The mode is controlled by table TRKSGRP, parameter IFCLASS.

Messages

The following messages are ignored and discarded:

- messages for which call processing has not been developed

- unexpected or out of sequence messages

Parameters

Parameters are handled as follows:

- Unrecognized parameters or parameters for which call processing has not been developed are ignored and discarded.

- Parameters tandemed across the network will not be processed. The parameter is passed as received from the originating node.

- Ignored parameters are discarded.

Message formats

The following message formats are available:

- alerting
- call proceeding
- connect
- connect acknowledge
- disconnect
- progress
- release
- release complete
- restart
- restart acknowledge
- setup
- setup acknowledge
- status
- status enquiry
- information

Protocol timers

All protocol timers can be datafilled in table ISDNPROT.

Hardware configuration

The hardware for the ETSI PRI interface is the DTCOi+ peripheral. The DTCOi+ provides up to 16 PCM30 (E1) external interfaces. Each external interface has 32 time slots and comprises a 2.048 Mbyte/s carrier.

Time slot 0 is used for framing purposes. Time slot 16 is used to carry a 64 kbit/s control data channel (the D-channel). The remaining time slots provide 30 bearer channels (B-channels) of up to 64 kbit/s.

DTCOi+ overview

The following applies to the ETSI PRI DTCOi+:

- ETSI PRI supports only the DTCOi+ on an A-law or mu-law network. The DTCOi is not supported for use with ETSI PRI.
- PRI trunks are provisioned using the ETSI protocol variant.
- Provisioning of trunks other than ETSI PRI is not supported on the DTCOi+.

- The DTCOi+ integrates into the DMS-250 switch in the same manner as the PTDC and is referred to in the switch (for example, at the MAP terminal) as a "PDTC."

- The DTCOi+ is similar to the DTCOi except that DTCOi+ uses the single unified processor instead of dual MP/SP processors.

- DTCOi+ uses the enhanced ISDN signaling processor to provide D-channel processing for ETSI PRI.

- DTCOi+ uses the 6X44EA time switch for data and A-law or mu-law pulse code modulation voice conversions.

- The universal tone receiver is used for inband digit collection. The single tone receiver is not currently supported on the DTCOi+.

- ETSI PRI does not support the partitioning of an E1 interface into separate trunk groups. Also, a D-channel cannot control trunks across multiple E1 interfaces. Therefore, with ETSI PRI, each E1 interface corresponds to a single trunk group and its associated D-channel.

D-channel handler

Backup D-channels are not supported for ETSI PRI. The datafilling of more than one D-channel for an ETSI PRI trunk group in table TRKSGRP is not supported.

Interworking

The following interworking trunk configurations are supported:

- ETSI PRI to/from inband DAL

- ETSI PRI to/from North American PRI

- ETSI PRI to/from MCI ISUP IMT

- ETSI PRI to/from ITU ISUP RSLR

- ETSI PRI to/from MR2

- ETSI PRI to/from RSLR OPT2

- ISUP RLT to ETSI PRI

Call processing for ETSI PRI originations

The following information applies to ETSI PRI originations.

Identifying call type

Calls incoming on ETSI PRI can either be treated as VNET or PRISM calls. Either table TRKGRP or RTGATTR determines the call type, as follows:

- table RTGATTR—If the VNETCUST field is set to DAL, the call is treated as VNET. If VNETCUST is set to NIL, the call is treated as PRISM. If the RTGATTR tuple is not found, the switch goes to the parameter NSFDFLT in table TRKGRP.

- table TRKGRP—If NSFDFLT is set to VNET, the call type is set to private and a DAL procedure request is sent to the DAP. Otherwise, the call type is set to PRISM. For calls not tagged as VNET, call type is determined by in-switch pretranslations and translations.

Pretranslation name determination

The RTGATTR tuple contains field PRTNM for indexing into the GPXHEAD (Global Prefix Head) table. If either the RTGATTR tuple is not found or if the PRTNM field is NIL, table GPXHEAD is accessed. This is done by using PRTNM from table CALLATTR and the incoming called party number type of number (TON). Otherwise, table GPXHEAD is accessed using the PRTNM from the RTGATTR tuple and the incoming called party number TON.

OTG and OSID

Calls originated on ETSI PRI trunks can send the originating site location code (OSLC) and the originating trunk group (OTG) number (both in the SETUP message) to the DMS-250 switch. This occurs by prefixing the OTG and OSLC to the called party number.

The following terminology applies to the information that follows. OTG received in the incoming digit stream is referred to as the "logical OTG;" the OTG from table MCLLICDR is referred to as the "physical OTG." The originating switch ID (OSID) datafilled in table TRKGRP is referred to as the "logical OSID;" the OSID from the NCS_SWITCH_ID office parameter is referred to as the "physical OSID."

With OSLC and OTG prefixed to the called party number, the called party number can be up to the maximum of 28 digits:

- OTG (optional)—four digits
- OSLC (optional)—up to five digits
- prefix—up to four digits
- address—up to 15 digits

Prefixing to calling party number
With calls originated on ETSI PRI trunks, one of the following occurs:

- *Both the OTG and OSLC are prefixed to the calling party number*—The OSID TRKGRP parameter (the logical OSID) must be set to the switch ID of the adjacent node (Meridian 1). The logical OTG is extracted using the received OTG, logical OSID, and OSLC digits to construct an index into the OSLC table.

- *Only the OSLC is prefixed to the calling party number*—The OSID TRKGRP parameter must be set to NIL to indicate the user will be identified using the physical OSID/OTG. The logical OTG is extracted from the OSLC table using the physical OTG (defined by table MCLLICDR for the current originating trunk group), physical OSID (defined by office parameter NCS_SWITCH_ID), and OSLC digits to construct the index. The OSID TRKGRP parameter is NIL, therefore the logical OSID is obtained from the NCS_SWITCH_ID office parameter.

- *Neither the OTG nor OSLC are prefixed to the calling party number*—The OSID TRKGRP parameter must be set to NIL to indicate the user will be identified using the physical OSID/OTG. The logical OSID and logical OTC are NIL and 0. Therefore, routing based on the logical OSID/OTG does not occur.

The OTG and OSLC digits are removed before translations are attempted. After the OTG and OSLC digits are removed, if the length of the address digits is greater than 15, only the first 15 digits are used for translations. The remaining digits are ignored.

Logical OTG
When the first four digits of the called party number and the OSLC digits are received, they are removed from the incoming called party number before pretranslations. The DMS-250 switch does the following with the logical OTG:

- sends it to the dedicated access point (DAP) as the OTG in a dedicated access line (DAL) and overflow call procedure requests

- records it in billing as the OTG in the A field

- outpulses it in the Generic Digits parameter of the Initial Address Message (IAM) as the OTG

The physical OSID/OTG is used (unless the logical OSID/OTG was received) to optionally retrieve an alternate index into table GPXHEAD (Global Prefix Head). This table is accessed to optionally override the existing pretranslator name. The remaining called party number digits are sent through pretranslations.

Logical OSID

The OSID may be datafilled on a per-trunk basis in table TRKGRP for ETSI PRI trunks. If the OSID field is datafilled with a non-NIL value, the logical OTG is expected to be prefixed to the called party number. The DMS-250 uses the value datafilled in the OSID field (the logical OSID) as follows:

- sends it to the DAP as the OSID in a DAL and overflow call procedure requests

- records it in billing as the OSID in the A field

- outpulses it in the Generic Digits parameter of the IAM as OSID for ISUP terminations that normally include GD with OSID/OTG in the IAM

B-channel negotiation

For ETSI PRI, B-channel negotiation allows the two ends of the ETSI PRI interface to negotiate the B-channel to be used for a call. This feature is supported in the same manner as on the ANSI PRI. However, only the network mode of the ETSI PRI B-channel negotiation is supported.

Charge Number/Calling Party Number Delivery

The type definition of table RTGATTR field ANI is modified. The type definition ANI_TYPE has the range {Y, N}.

The fields of table CPIATTR are listed below:

- SIGTYPE – This field indicates whether this index represents a trunk group type associated to the signaling type PRI, SS7, or PTS.

- SIGVER – This field indicates the supported signaling versions {ANSI, ETSI, FGD7, IMT7, RLT7, RSLR_STD, RSLR_OPT1, RSLR_OPT2, ITU7, MTUP7, or TIE.

- CPNDELV – This field indicates if and when the received calling party number should be delivered to the terminator. For PRI trunks, the possible values for this field are {Always, Primary and Secondary}.

- CHGDELV – This field indicates if and when the received charge number parameter should be delivered to the terminator as the calling number. For PRI trunks, the possible values for this field are {Always, Secondary, and Primary}.

- NOATONSC – This field indicates if calling/charge delivery should be subject to Nature of Address/Type of Number screening. ANSI PRI does not support NOA/TON screening and the only supported value for this field is {No}. ETSI PRI does support NOA/TON screening and the values for this field is {Yes, No}.

- CGNPISCR – This field indicates if calling party delivery should be subjected to Presentation Indicator (PI) screening. ETSI PRI trunks support possible values {Yes, No}. ANSI PRI trunks support possible values of {Y, N, Cond}. The Cond value indicates that PI screening will be performed, but presentation restriction will be overridden for VNET and 800 calls.

- CHGPISCR – This field indicates if charge number is to be delivered and subject to calling party PI screening. ETSI PRI only supports a value of {No}. ANSI PRI supports values of {Yes, No}.

The process to determine the CGN delivery to an ETSI PRI terminator is discussed below. The ANI field in table RTGATTR must be datafilled as "Y" for the following functionality to take effect.

Delivery of the CGN Information Element (IE) for ETSI PRI terminations is based on CGNDELV, CHGDELV, NOATONSC and CGNPISCR. The functionality is described below:

- CGNDELV = Always   CHGDELV = Never
  NOATONSC = No   CGNPISCR = No
  If CGN is available, the CGN is delivered.

- CGNDELV = Primary   CHGDELV = Secondary
  NOATONSC = No   CGNPISCR = No
  If CGN is available, the CGN is delivered. Otherwise if CHG is available, CHG is delivered as CGN with PI of "Allowed" and SI of "Network Provided".

- CGNDELV = Secondary   CHGDELV = Primary
  NOATONSC = No   CGNPISCR = No
  If CHG is available, CHG is delivered as CGN with PI of "Allowed" and SI of "Network Provided". If CHG is not available and CGN is available, CGN is delivered.

- CGNDELV = Always   CHGDELV = Never
  NOATONSC = No   CGNPISCR = Yes
  If CGN is available, PI of the CGN parameter is screened. If PI is "Restricted", the CGN is not delivered. For any other value of PI, CGN is delivered.

- CGNDELV = Primary   CHGDELV = Secondary
  NOATONSC = No   CGNPISCR = Yes
  If CGN is available, PI of the CGN parameter is screened. If PI is "Restricted", the CGN is not delivered. For any other value of PI, CGN is delivered. If CGN is not available and CHG is available, CHG is delivered as CGN with PI of "Allowed" and SI of "Network Provided".

- CGNDELV = Secondary   CHGDELV = Primary
  NOATONSC = No   CGNPISCR = Yes
  If CHG is available, CHG is delivered as CGN with PI of "Allowed" and
  SI of "Network Provided". Otherwise, if CGN is available, PI of the
  CGN parameter is screened. If PI is "Restricted", the CGN is not
  delivered. CGN is delivered for any other value.

- CGNDELV = Always   CHGDELV = Never
  NOATONSC = Yes   CGNPISCR = No
  If CGN is available, NOA/TON of the CGN parameter is checked. If
  NOA/TON is "Subscriber", the CGN is not delivered. CGN is delivered
  for any other value of NOA/TON.

- CGNDELV = Primary   CHGDELV = Secondary
  NOATONSC = Yes   CGNPISCR = No
  If CGN is available, NOA/TON of the CGN parameter is checked. If
  NOA/TON is "Subscriber", the CGN is not delivered. CGN is delivered
  for any other value of NOA/TON. If CGN is not available and CHG is
  available, CHG is delivered as CGN with PI of "Allowed" and SI of
  "Network Provided".

- CGNDELV = Always   CHGDELV = Primary
  NOATONSC = Yes   CGNPISCR = No
  If CHG is available, CHG is delivered as CGN with PI of "Allowed" and
  SI of "Network Provided". Otherwise, if CGN is available, NOA/TON
  of the CGN parameter is checked. If NOA/TON is "Subscriber", the
  CGN is not delivered. CGN is delivered for any other value of
  NOA/TON.

- CGNDELV = Always   CHGDELV = Never
  NOATONSC = Yes   CGNPISCR = Yes
  If CGN is available, CGN is delivered based on the NOA/TON field and
  the PI field of the CGN parameter. The NOA/TON is checked first. If
  NOA/TON is "Subscriber", PI is not screened and CGN is not delivered.
  PI is screened for any other value of NOA/TON. If PI is "Restricted",
  the CGN is not delivered. CGN is delivered for any other value of PI.

- CGNDELV = Primary   CHGDELV = Secondary
  NOATONSC = Yes   CGNPISCR = Yes
  If CGN is available, CGN is delivered based on the NOA/TON field and
  the Pi field of the CGN parameter. The NOA/TON is checked first. if
  NOA/TON is "Subscriber", PI is not screened and and CGN is not
  delivered. If PI is "Restricted", the CGN is not delivered. CGN is
  delivered for any other value of PI. If CGN is not available and CHG is
  available, CHG is delivered as CGN with PI of "Allowed" and SI of
  "Network Provided".

- CGNDELV = Secondary   CHGDELV = Primary
  NOATONSC = Yes   CGNPISCR = Yes
  If CHG is available, CHg is delivered as CGN with PI of "Allowed" and
  SI of "Network Provided". Otherwise, if CGN is available, CGN is
  delivered based on the NOA/TON field and the PI field of the CGN
  parameter. The NOA/TON is checked first. If NOA/TON is
  "Subscriber", PI is not screened and CGN is not delivered. PI is
  screened for any other value of NOA/TON. If PI is "Restricted", the
  CGN is not delivered. CGN is delivered for any other value of PI.

ANSI PRI

The process to determine the CGN delivery for ANSI PRI terminations is
discussed below. The CPIALLOW field in table CALLATTR must be
datafilled as "Y".

Delivery of the CGN Information Element (IE) for ANSI PRI terminations
is based on fields CGNDELV, CHGDELV, CGNPISCR, and CHGPOSCR in
table CPIATTR and is described below:

- CGNDELV = Always   CHGDELV = Never
  CGNPISCR = N
  If CGN is available, the CGN is delivered.

- CGNDELV = Primary   CHGDELV = Secondary
  CGNPISCR = No
  If CGN is available, the CGN is delivered. Otherwise if CHG is
  available, CHG is delivered as CGN with PI set to "Allowed" and SI set
  to "Network Provided".

- CGNDELV = Secondary   CHGDELV = Primary
  CGNPISCR = No   CHGPISCR = No
  If CHG is available, the CHG is delivered as CGN with PI set to
  "Allowed" and SI set to "Network" Provided". If CHG is not available
  and CGN is available, CGN is delivered.

- CGNDELV = Secondary   CHGDELV = Primary
  NOATONSC = No   CGNPISCR = Yes
  If CHG is available, the availability of CGN is determined. If CGN is
  not available, CHG is delivered as CGN with PI set to "Allowed" and SI
  set to "Nework Provided". If CGN is available, the PI of the CGN
  parameter is screened. If PI is "Restricted", CGN is not delivered. For
  any other value of PI, CHG is delivered as CGN with PI set "Allowed"
  and SI set to "Network Provided". If CHG is not available and CGN is
  available, CGN is delivered.

- CGNDELV = Always   CHGDELV = Never
  CGNPISCR = Yes
  If CGN is available, PI of the CGN parameter is screened. If PI is "Restricted", CGN is not delivered. For any other value of PI, CGN is delivered. If CGN is not available, CGN is not delivered.

- CGNDELV = Always   CHGDELV = Never
  CGNPISCR = Cond
  If CGN is available, PI of the CGN parameter is screened. If PI is "Restricted", CGN is delivered for SAC800, SAC900, or VNET calls only. For any other value of PI, CGN is delivered. If CGN is not available, CGN is not delivered.

- CGNDELV = Primary   CHGDELV = Secondary
  CGNPISCR = Cond
  If CGN is available, PI of the CGN parameter is screened. If PI is "Restricted", CGN is delivered for SAC800, SAC900, or VNET calls only. For any other value of PI, CGN is delivered. If CGN is not available, but CHG is available, CHG is delivered as CGN with PI set to "Allowed" and SI set to "Network Provided".

- CGNDELV = Secondary   CHGDELV = Primary
  CGNPISCR = Cond   CHGPISCR = No
  If CHG is available, PI of the CGN parameter is screened. Otherwise, if CGN is available, CGN is delivered for SAC800, SAC900, or VNET calls only. For any other value of PI, CGN is delivered.

- CGNDELV = Secondary   CHGDELV = Primary
  CGNPISCR = Cond   CHGPISCR = Yes
  If CHG is available, the availability of CGN is determined. If CGN is not available, CHG is delivered as CGN with PI set to "Allowed" and SI set to "Network Provided". If CGN is available, the PI of the CGN parameter is screened. If Pi is "Restricted", CGN is not delivered. For any other value of PI, CHG is delivered as CGN with PI set to "Allowed" and SI set to "Network Provided". If CHG is not available and CGN is available, PI of the CGN parameter is screened. If PI is set to "Restriced", CGN is delivered for SAC800, SAC900, or VNET calls only. For any other value of PI, CGN is delivered.

- CGNDELV = Primary   CHGDELV = Secondary
  CGNPISCR = Yes
  If CGN is available, PI of the CGN parameter is screened. If PI is "Restricted", CGN is not delivered. For any other value of PI, CGN is delivered. If CGN is not available, but CHG is available, CHG is delivered as CGN with PI set to "Allowed" and SI set to "Network Provided".

- CGNDELV = Secondary   CHGDELV = Primary
  CGNPISCR = Yes   CHGPISCR = No
  If CHG is available, CHG is delivered as CGN with PI set to "Allowed"
  and SI set to "Network Provided". If CHG is not available and CGN is
  available, PI of the CGN parameter is screened. If PI is "Restricted",
  CGN is not delivered. For any other value of PI, CGN is delivered.

- CGNDELV = Secondary   CHGDELV = Primary
  CGNPISCR = Yes   CHGPISCR = Yes
  If CHG is available, the availability of CGN is determined. If CGN is
  not available, CHG is delivered as CGN with PI set to "Allowed" and SI
  set to "Network Provided". If CGN is available, the PI of the CGN
  parameter is screened. If PI is "Restricted", CGN is not delivered. For
  any other value of PI, CHG is delivered as CGN with PI set to
  "Allowed" and SI set to "Network Provided". If CHG is not available
  and CGN is available, PI of the CGN parameter is screened. If PI is
  "Restricted", CGN is not delivered. For any other value of PI, CGN is
  delivered.

Standard cause and treatment handling

Table 13-1 lists the cause values in ETSI PRI specifications that do not
apply to North America PRI specifications.

Table 13-1
Cause-to-treatment mapping for ETSI PRI specifications

Cause	Treatment
Call awarded and being delivered in an established channel (7)	Reorder (RODR)
Non-selected user clearing (26)	Reorder (RODR)
Quality of service unavailable (49)	Reorder (RODR)
A suspended call exists, but this call identity does not (83)	XPM sends back "Invalid Information Element Contents"
Call identity in use (84)	XPM sends back "Invalid Information Element Contents"
No call suspended (85)	XPM sends back "Invalid Information Element Contents"
—continued—	

Table 13-1
Cause-to-treatment mapping for ETSI PRI specifications (continued)

Cause	Treatment
Call having the requested call identity has been cleared (86)	XPM sends back "Invalid Information Element Contents"
Invalid transit network selection (91)	Reorder (RODR)
—end—	

Table 13-2 lists the cause values that are mapped differently due to the limitation in the extended peripheral module (XPM).

Table 13-2
Cause values mapped differently

Cause	Treatment
Channel unacceptable (6)	Received on an ETSI PRI agent, mapped to cause value 41 "Temp fail"
Call awarded and being delivered in an established channel (7)	From customer connect onto the ETSI PRI agent, this cause value is mapped to 00 "Unassigned number."
Non-selected user clearing (26)	Reorder (RODR)
Quality of service unavailable (49)	From customer connect onto the ETSI PRI agent, this cause value is mapped to 00 "Unassigned number."
Identified channel does not exist (82)	Received on an ETSI PRI agent, mapped to cause value 41 "Temp fail"
A suspended call exists, but this call identity does not (83) Call identity in use (84) No call suspended (85) Call having the requested call identity has been cleared (86)	Rejected with "Invalid information element contents." This cause value is then mapped to cause value 31, "Normal unspecified."
Invalid transit network selection (91)	From customer connect onto the ETSI PRI agent, this cause value is mapped to 00 "Unassigned number."
(98)	Received or sent out on an ETSI PRI agent, this is mapped to cause value 111 "Protocol error unspecified"
—end—	

VNET services

The VNET services discussed below are available for ETSI PRI.

Access to NCS/DAP

For ETSI PRI, both dedicated VNET access or shared VNET access is available.

Shared VNET access

Shared VNET processing occurs when one of the following conditions are met:

- The ANISCRN field in table RTGATTR is set to "Y," the VNETCUST field in table RTGRATTR is set to "NIL," and the VNET CUST field in table ANISCRN is set to "Y."

- The optional field ANISCRN is turned on in table TRKGRP and the VNETCUST field in table ANISCRN is set to "Y."

Dedicated VNET access

NCS/DAP message processing access is controlled by the PRIVDIAL field in table CALLATTR. If this field is not set to "NCS," no NCS message processing takes place; in-switch routing is invoked instead. The DMS-250 switch supports a VNET address digit length of 1–15 digits (excluding the prefix). The VLPD/FlexDTC is used as a basis for this logic.

If the address digits received in the called party number are not datafilled in the pretranslator, the type of number indicator set in the setup message determines the processing. These types of number indicators and their processing are listed as follows:

- subscriber number—Call is processed in the same manner as when an address is datafilled with an ONNET pretranslation selector.

- national number—Call is processed in the same manner as when an address is datafilled with an OFFNET pretranslation selector.

- international number—Call is processed in the same manner as when an address is datafilled with an IP pretranslation selector.

Post-NCS/DAP processing

The DAP can return one of the following responses:

- ROUTING RESPONSE—sent by the NCS to the originating switch to indicate successful translation of the VNET call. The information returned is used to route the call to the correct DMS-250 switch and trunk.

- FAILURE RESPONSE—sent by the NCS to the originating or termination switch to indicate there was some kind of translation failure. The action code specifies the type of failure.

- SUPP-CODE DIGITS COLLECTION RESPONSE—sent by the NCS to the originating switch to indicate suppcode is to be collected for this call.

- OVERFLOW RESPONSE—sent by the NCS to the terminating switch to indicate a successful translation of the VNET overflow request. The information returned is used to route the call to the correct DMS-250 switch and trunk.

- ENHANCED OVERFLOW RESPONSE—sent by the NCS to the originating switch to indicate a successful translation of the VNET enhanced overflow request. The information returned is used to route the call to the correct DMS-250 switch and trunk.

Remote access

VNET subscribers originating on ETSI PRI trunks can access a specific VNET directory with a unique remote access number. Address and supplementary codes may be collected and translated at the DAP before final call routing and termination. Reset and reorigination are also available with remote access as follows:

- reset—enabled during the address state collection of the DTMF digits. Subscribers may press the "#" key to indicate a reset.

- reorigination—can occur with DTMF receivers; enabled after DTMF digit collection during ringing, during treatment, and after called party disconnect

After receiving a remote access response or enhanced remote access response, the DMS-250 provides a prompt tone to the subscriber in order to collect digits. The answer supervision enhancement establishes the voice path for DTMF digit collection. The prompt tones required for address and suppcode collection are configurable on each switch.

Supplementary/account codes

The PBX does not cut voice path until after it receives an alerting or progress message. Suppcode collection is only possible after voice path is cut.

The following types of suppcode collection is supported:

- DAP-based

- data calls

- in-switch account code collection

The DMS-250 can collect in-switch account codes and DAP-based suppcodes using configurable prompt tones and answer supervision enhancements. Prompt tones can be configured for each office in table OFCVAR with field RSLR_SUPPCODE_TONE.

Reset

Reset is allowed during suppcode collection for remote access.

In-band digit collection—answer supervision

When in-band digit collection is required, some European PBXs and public telephone networks require a connect message (CONN) prior to cutting a voice path. Answer supervision allows the DMS-250 to send a CONN message on an originating DMS-250 ETSI PRI trunk variant. This occurs before the terminating trunk is answered, even before routing has been determined.

The DMS-250 sends a CONN message on the originating ETSI PRI trunk under the following conditions:

- A call originates on a trunk datafilled with the DMS-250 ETSI PRI protocol variant (ETSI250 in table LTDEF).

- The trunk datafill supports answer supervision enhancements (ASE_ACTIVE in table TRKGRP).

- The call requires the collection of in-band digits (either in-switch or by the NCS).

Variable length private dialing

Variable length private dialing allows the DMS-250 to accept 1–15 address digits from ETSI PRI trunks. ETSI PRI signaling uses address stages that have delimiters identified by this protocol. These types of originations assume the address stage received is a valid length for the user and generate the appropriate ADF message to the DAP for translation of the digits.

This feature is controlled by OFCVAR table in office parameter VLPD_ALLOWED. To enable variable length private dialing, set this office parameter to yes (Y).

Direct termination overflow

Direct termination overflow (DTO) is supported for terminating ETSI PRI interfaces if the ENHANCED_OVERFLOW office parameter is set to "N" at the originating DMS-250 switch.

DTO is invoked when the following occurs:

- A call cannot terminate due to an all trunks busy condition.

- DTO is allowed for that call (through the NCS action code or the incoming FCSI); then DTO is invoked. When DTO is invoked, an overflow treatment request is sent to the DAP. DAP provides an overflow response with new routing information.

Additionally, if enhanced overflow is disabled, network-based DTO is invoked when the following occurs:

- A call receives a release message from an ETSI PRI interface with a cause of BUSY or GNCT.

- DTO is allowed for that call (through the NCS action code and trunk group option DTO enabled); then network DTO is invoked with the intent to access another route.

A TRKGRP parameter is used to enable/disable network-based DTO on ETSI PRI trunks. When network DTO is invoked, an overflow treatment request is sent to the DAP. The DAP provides the overflow response with new route information.

The following NCS network DTO overflow action codes are supported:

- 2—7-digit termination with overflow

- 11—10-digit termination with overflow

- 51—flexible termination with overflow

Enhanced overflow

Enhanced overflow is supported for terminating ETSI PRI interfaces if the ENHANCED_OVERFLOW office parameter is set to "Y" at the originating DMS-250 switch.

Enhanced overflow is invoked when the following occurs:

- A call cannot terminate due to an all trunks busy condition or the trunk receives a release message from an ETSI PRI with a non-normal release cause or no answer timer.

- Direct termination overflow is allowed for that call (through the NCS action code); then enhanced overflow is invoked.

The following NCS overflow action codes are supported:

- 2—7-digit termination with overflow

- 11—10-digit termination with overflow

- 12—DDD routing with overflow

- 13—international with overflow

- 51—flexible termination with overflow

- 53—outbound VNET with overflow

Enhanced overflow is also supported for Remote Access and Suppcode collections on ETSI PRI trunks. Two existing Application Data Field (ADF) parameters, NO ANSWER TIMER and NCS INFORMATION, are used. If

a No Answer Timer is received from the DAP/NCS in the Suppcode Response, the No Answer Timer will determine the length of time the originating switch allows the call to wait for an answer before attempting overflow.

The No Answer Timer is started under the following conditions:

- The originating switch receives an Address Complete Message (ACM) from a termination ISUP trunk.

- The originating switch receives an Alerting message from an ISDN PRI terminating trunk group.

- Outpulsing is completed on a PTS trunk.

When the No Answer Timer expires before an Answer Message (ANM) or Release message is received from an ISUP termination, a Connect message or an Answer Supervision on an inband termination, the originating switch shall requery the DAP with the Enhanced Overflow Treatment Request.

Registered access calls

With registered access, a call originating over an ETSI PRI trunk comes into the DMS-250 switch. The switch sends a request to the NCS/DAP for additional routing information or routes the call to an operator. This decision is based on the Nature of Address (NOA) parameter of the calling party number.

Registered access calls meet the following conditions:

- The call originates over an ETSI PRI trunk.

- A calling party number is present in the setup message.

- SACFEAT=FLEXFREE in table STDPRTCT.

- REGACC=Y in table FLEXSAC.

Global flexible SAC

Global flexible service access code services are available on all MWC agencies. FlexSAC services include:

- Free Phone (FLEXFREE)—similar to 800 SAC (called party is billed), except that FLEXFREE calls route through table FLEXSAC; typically used for non-domestic services

- Flexible Premium (FLEXPREM)—similar to 900 SAC (calling party is billed), except that FLEXPREM calls route through table FLEXSAC; uses ANI screening; typically used for non-domestic services

FLEXFREE/FLEXPREM and enhanced service access code services are available on ETSI PRI originations. These services are controlled by table FLEXSAC. The SAC attribute field nature of call (NOC) distinguishes

national from international freephone numbers. For FLEXPREM calls originating from ETSI PRI, call processing checks for the presence of a CLI in the SETUP message.

Routing for FLEXFREE/FLEXPREM calls occurs either in-switch or based on the response of the DAP. FLEXFREE/FLEXPREM override the shared VNET and dedicated VNET designation for call processing.

PRISM services

The following covers PRISM services for ETSI PRI.

Universal translation

If the pretranslator is NIL or the called party number is not found, the called party type of number (TON) defines how the call is routed. In-switch processing routes the calls by means of the universal translation tables (STS to CCDB, CTHEAD, CTCODE, CTRTE) when the following parameters are set as follows:

- called party TON set to national or subscriber and office parameter DEFAULT_TRANSLATION is set to UNIV (universal)

- called party TON set to international

If the pretranslator is not NIL and the called party number is datafilled in the pretranslator, the call type is checked. In-switch routing occurs as follows.

- The call is routed by means of universal translation tables as a result of the following settings:

  — call type is ONNET or OFFNET and UNIV field in table STDPRTCT is set to true

  — TRANSYS field in table STDPRTCT is set to IP

- The call is routed by means of HNPACONT or FNPACONT as a result of the following settings:

  — call type is ONNET or OFFNET and UNIV field is set to false

For the following calls, translation may occur with either the universal translation tables or table HNPACONT. A call detail record is generated these calls.

- subscriber calls

- national calls

For the following calls, translation occurs by means of the universal translation tables. A call detail record is generated these calls.

- international calls

Long call disconnect

Calls that remain in an unanswered state are monitored. If the call is unanswered for the period of time specified, the call is disconnected. To use this feature, enable the LCDDUR option for ETSI PRI trunks and specify a period of time in the TRKGRP option.

Non-standard routing

DDD/IDDD calls may prefix an NNNN when routing through the remote point of presence to the public switched network. The maximum number of digits for non-standard routing is 24.

Class of service screening

Class of service screening determines whether originating and terminating types of trunks can be connected to each other based on their class of service. Trunk group class of service screening is performed on all ETSI PRI calls (regardless of whether ISA direct routing is performed).

Test calls/automatic trunk routing

Testline calls can be made over ETSI PRI trunks by using automatic trunk routining (ATR), automatic trunk testing (ATT), and the manual level of trunk test position (TTP) as currently used for ANSI PRI. For ATR test calls, an additional PM type of 3 is added to indicate termination to a PDTC instead of a DTCI.

Trunk group class-of-service screening

Trunk group class-of-service screening is performed on all ETSI PRI calls, regardless of whether ISA direct routing is performed.

ETSI PRI trunks that allow class of service screening have the class of service option in table CALLATTR set to an index datafilled in table COS (class of service). Table COS is a two-dimensional matrix indexed by the COS value of the incoming and outgoing trunk groups. A "Y" in table COS allows calls to go through. "N" causes the call to attempt to route advance. If a route advance is not successful, a GNCT occurs. "N" in table COS generates a log based on the office parameter GEN_COSBLOCK_LOG in either case.

Data calls

A call that originates over a PRI facility must terminate over a facility that allows data to be transmitted if it has one of the following:

- a BC information element of 64 kbit/s (restricted or unrestricted)

- a DAP response that indicates the facility must be capable of transmitting data

These facilities can be either CCS7 IMT trunk groups with the DDI field marked in table TRKGRP as either MIXED or DATA, or another ETSI PRI trunk group. If an appropriate digital trunk cannot be found, the call is blocked. The call is routed to GNCT treatment if DDI field is datafilled as voice.

For data calls, supplementary/account code collection (through both in-switch and NCS/DAP means) can be overridden. This is controlled by tables LTCALLS and MLTATTR.

In-switch account code collection
When datafilled as PRISM calls, the account length of 1 is not supported in table AUTHCODM.

User-to-user information services
User-to-user information (UUI) service allows the transport of user-specific information between ISDN users across the network. The DMS-250 does not interpret the UUI; it only transports it. This service operates by means of the UUI information element.

NCID
The DMS-250 switch creates a new network call identifier (NCID) on ETSI PRI originations.

Dialable Wideband Service
ETSI PRI does not support Dialable Wideband Service.

EIR on ETSI PRI
ETSI PRI supports Enhanced International Routing (EIR). There is no additional datafill.

Flexcard on ETSI PRI
Flexcard on ETSI PRI provides the following functionality to card services:

- Flexible Access Number
- Flexible Card Type
- Pretranslator Per Access Number
- Flexible Dialing Stage
- Selectable Prompts
- Optional Confirmation Tone

- Variable Number of Card Digits

Flexcard call processing

All functionality is datafilled in table FLEXSAC. When the access number is datafilled with a PRERTSEL of SAC and a SACFEAT of FLEXFREE or FLEXPREM in table STDPRTCT, the last field, SACATRIDX, provides an index into table SACATTR.

Table SACATTR contains four fields, Index, NOC, FSPART, and DMI. These fields are described as follows:

- INDEX. This is the key to the table. The value is assigned in subtable STDPRT of head table STDPRTCT. Tuple 0 contains the default values for NOC, FSPART, and DMI. Tuple 0 cannot be changed or deleted by table control.

- NOC. NOC determines if the call is subscriber, national, international, etc.

- FSPART. This field defines the value of the first key needed to access into subtable SACDATA of head table FLEXSAC.

- DMI. This field assigns the value used to index into table DIGMAN, which is for digit manipulations. All digit manipulations are done before sending a DAP request or accessing the FLEXSAC table. If DMI is set to 0, then no digit manipulation is performed.

Table FLEXSAC allows access numbers from 4–15 digits. The key to the table is the length of the access number. Once you have positioned on the index, subtable SACDATA is available. The key to subtable SACDATA is FSPART (from table SACATTR) and the flexible access number.

When field SACFEAT in table STDPRTCT is FLEXPREM, ANI screening is performed by way of tables FLEXANI and ANISCRN. If ANI screening fails, ADBF treatment is given. If the ANI is not datafilled in table FLEXANI, the DEFAULT_ANI_INDEX field in table OFCVAR will be used to index into table ANISCRN.

The default value for the prefix digits field in table STDPRTCT is 0.

If an access number is present in table FLEXSAC with CARDCALL set to Y, the call is a flexible card call. Before further processing, it is necessary to check whether flexible card services have been disabled. The FLEXCARD field in table TRKGRP is used for this purpose. A FLEXCARD value of N indicates that flexible card services has been disabled and a Services Currently Unavailable (SCUN) treatment will be generated.

Flexible Card Type

The CARDTYPE allows the call to function like an MWC calling card or a MWC credit card call.

Flexible Credit Card Calls

If the field is datafilled as FLEXCRTC, the call behaves like a MWC credit card call. An MWC credit card call is described as follows:

- Upon datafilling field CARDTYPE as FLEXCRTC in table FLEXSAC, the user is prompted for CRTCTYPE. Currently, CRTCTYPE can only be assigned the value of 1 to indicate a VISA credit card.

- The type of Card Call Request sent to the Network Control System (NCS) is a Credit Card Call Request.

- The entry code in billing is set to 10 if the call does not time out to the operator.

- If the call times out to the operator, the info digits are set to 84. The TNS parameter in the outgoing IAM message is given the value of the last 3 or 4 digits of the accessing number depending on the value of UAC_CIC_SIZE in table OFCVAR.

- The operational measurement (OM) group MCRT_OMS is pegged.

Flexible Calling Card Calls

If the CARDTYPE field is datafilled as FLEXCARD, the call behaves like an MWC calling card call. An MWC calling card call is described as follows:

- The type of Card Call Request sent to the NCS is an MWC Card Call Procedure Request.

- The entry code in billing is set to 6 if the call does not time out to the operator.

- If the call does time out to the operator, the info digits are set to 98. The TNS parameter in the outgoing IAM message is given the value of the last 3 or 4 digits of the access number depending on the value of UAC_CIC_SIZE in table OFCVAR.

Pretranslator Per Access Number

Field PRETRANS allows the choice of pretranslator to pretranslate the address digits. The office parameter MCCS_PRTNM is not used for these type of card calls.

If the PRETRANS field is datafilled with the nil value NPRT, the call will generate a Vacant Code (VACT) treatment. This is the same functionality performed by domestic card calls when MCCS_PRTNM is datafilled with NPRT.

Note: Address digit collection is handled in the same manner as the domestic address digit collection for MWC card calls. The only difference is MWC card calls must collect a minimum of 4 digits while the flexible card calls must collect a minimum of only 2 digits and a maximum of 15 digits.

Flexible Dialing Stage

Normal Digit Collection Using BEGSTAGE

Field BEGSTAGE allows the choice of stage to begin digit collection. ADDRESS denotes collect address followed by card digits and CARD denotes collect CARD followed by ADDRESS digits.

Treatments that cause Address and Card Digits to be recollected beginning with the stage indicated by field BEGSTAGE

Treatments VACANT_CODE (VACT), VACANT_COUNTRY_CODE (VCCT), and NCS_INCOMING_EXCLUSION (NCIX) cause a restart of digit collection beginning with the BEGSTAGE value.

Note: Only one chance is given to enter the digits again after treatment.

Treatments that cause Card Digits to be recollected

Treatments CALLING_CARD_TIMEOUT (CCTO) and CALLING_CARD_INVALID (CCNV) cause a recollection of card digits. In some cases it may be necessary to collect Address Digits also. If the value of BEGSTAGE is equal to ADDRESS, it is only necessary to recollect card digits since Address Digits have already been collected. However, if the BEGSTAGE is equal to CARD and the card failure occurs before a NCS request, the Address Digits have never been collected.

If BEGSTAGE is equal to CARD, it is impossible to get the CALLING_CARD_TIMEOUT treatment and go to the CCTO announcement. In this case, a time out must be treated as if it were a rotary card time out to the operator.

Selectable Prompts

During card processing, there are three stages of digit collection: address, card, and suppcode. Each stage must prompt the user to enter the appropriate digits for the current stage. Field PROMPTS allows the user to fill the field with either announcements or tones.

Note: Currently, the suppcode stage is only supported on flexible card calls that have CARDTYPE of FLEXCARD and when a Card Service Response with a non-zero Supplementary Code Length is returned from the DAP.

ANNOUNCE indicates announcements used

To cover each stage, three indexes are available in table MMCCSANN: ADDR for address collection, CARD for card collection, and SUPP for suppcode collection. Each index can then be datafilled to go to an appropriate announcement Common Language Location Identifier (CLLI). For example, CARD could be datafilled against an announcement CLLI that gives the recording, "please enter your card number". If the indexes are not allocated to an announcement CLLI or if the allocated announcement CLLI is busy, a Storage Overflow Reorder (SORD) treatment is given.

Announcement CLLIs should be allocated so that there are enough CLLI members datafilled to handle the highest traffic period. If the call attaches to an announcement member that is already broadcasting to other calls, the announcement is not heard until the beginning of the next announcement cycle. The call will first try to attach to an idle announcement member. If none are idle, the call will attach to an announcement member that is broadcasting. To avoid large delays between announcement connect and announcement playback, it is recommended that a large number of announcement members be datafilled.

TONES indicates that tones are used.

The type of tone and duration for the card stage is programmable in table OFCVAR through parameters MCCS_PROMPT_TONE and MCCS_PROMPT_TONE_DUR, respectively. A delay before the tone is given can be datafilled through parameter MCCS_PROMPT_TONE_DELAY. This parameter is normally datafilled to apply dial tone.

The universal tone Dial Tone is used for flexible card services during address and suppcode stages of dialing.

Confirmation Tone

Field CONFTONE allows confirmation tone to be disabled on a per access number basis. The confirmation tone that is given is datafilled in table OFCVAR. It has a tone pattern of {on,off,on}. The timing of the pattern is controlled by the following OFCVAR parameters: MCCS_CONFIRM_FIRST_TONE_DUR, MCCS_CONFIRM_OFF_TONE_DUR, and MCCS_CONFIRM_SECOND_TONE_DUR. The tone that is given during the "on" sequence of the pattern is determined by the OFCVAR parameter MCCS_CONFIRM_TONE. Silence tone is given during the "off" state.

Variable Number of Card Digits

The fields MINDIGS and MAXDIGS in table FLEXSAC are present to determine the number of card digits to collect. These fields should be datafilled to include the pin digit count. For example, to collect a card

length of 10 and 4 pin digits would require MAXDIGS to be at least 14 digits. The range for these fields can be from 1 to 29.

Note: When the CARDTYPE is FLEXCARD, only 14 card digits is accepted and a SCUN treatment is generated if it is not 14 digits. When the CARDTYPE is FLEXCRTC, 1 to 29 card digits could be collected.

End of dialing in collecting Card Digits

The end of dialing occurs when

- the number of digits dialed is equal to MAXDIGS

- inter-digit time out occurs

- a terminating octothorpe (#) digit is entered

Reset Digit "#" in collecting Card Digits

Reset dialing allows the subscriber to correct a misdialed sequence without losing access to the DMS-250 switch. Dial tone is given upon pressing the reset digit (#) so that the subscriber can redial the digit sequence.

An octohorpe dialed before the minimum number of card digits (indicated by MINDIGS) is collected and recognized as a reset digit to the switch.

PIN digits for card number

Field PINDIGS is present to determine how many digits not to record (number to mask with TBCD A's) in billing upon the conditions that follow.

PIN digit masking is consistent across all card types.

- The masking digit is always a TBCD "A".

- PIN digits are masked unless an ACIF of 10, which indicates an invalid card, is received.

- When masking, only PIN digits located after the 10th digits of the card number are masked. PIN digits before or at the 10th digits of the card number are not masked.

Note: This PINDIGS field is used only for billing purposes and is not used to determine the number of digits to collect.

Reorigination

Call reorigination allows a caller to make several consecutive calls without losing access to the DMS-250 switch. Upon entering the octothorpe (#), the caller receives a prompt and may then dial a new destination address and suppcode (if required).

The octhothorpe (#) identifies a reorigination attempt. A DTMF receiver is used to detect a reorigination attempt at the beginning of the call during the

ringing phase. During the talking phase of a call, a DTMF receiver can also detect a reorigination attempt if the value of the office parameter DIALTONE_AFTER_ANSWER_DURATION in table OFCVAR is within the range of 0 to 30 seconds.

Furthermore, reorigination is allowed during the disconnect phase of the call by way of a DTMF receiver. This is the time during which the called party disconnects and the time that a permanent signal timer expires. This time can be varied by datafilling the following field with a range of 2 to 30 seconds:

- field PSPDSEIZ in table TRKSGRP for ETSI PRI trunks.

- field SNDRPSIG in table TRKGRP for MR2 and MTUP trunks.

Parameter REORIG_RECEIVERS in table OFCVAR can have three possible values: STR_AND_DTMF, DTMF_ONLY, and STR_ONLY. The value STR_ONLY is not supported by this feature since the STR card is not supported on the DTCO+.

Routing

This feature supports the following NCS responses:

- Card Service Response

- Routing Response

- Failure Response

In case of NCS time out, routing on address digits is attempted. For all OFFNET calls, the UNIV field in table STDPRTCT is checked to determine whether the address should be translated using HNPACONT or universal translation tables. All ONNET calls are blocked.

If the OFCVAR parameter MCCS_STS_ACTIVE is set to "Y", the STS is set to the value of MCCS_STS in table OFCVAR. Otherwise, for ETSI PRI originations, the STS is set to the STS value in table CALLATTR.

Card service response

If the address number is not datafilled in table STDPRTCT, then field DEFAULT_TRANSLATION in table OFCVAR is checked to determine HNPACONT or universal routing.

Routing and failure Responses

A routing or failure response returned from the DAP indicates the call is a VNET card call. The only exception to this is when Application Data Field (ADF) routing response with action code 32 (EIR no overflow) or 33 (EIR with overflow) is returned from the DAP. This implies that a Private

Network Recore (PNR) will not always be cut for card calls receiving a routing response because of the Enhanced International Routing feature.

For Routing or Failure Response, VNET call processing is used to terminate the call or invoke the related treatment.

Enhanced overflow

Enhanced overflow is supported for terminating ETSI PRI interfaces if the ENHANCED_OVERFLOW office parameter is set to "Y" at the originating DMS-250 switch.

Enhanced overflow is invoked when the following occurs:

- A call cannot terminate due to an all trunks busy condition or the trunk receives a release message from an ETSI PRI with a non-normal release cause or no answer timer.

- Direct termination overflow is allowed for that call (through the NCS action code); then enhanced overflow is invoked.

The following NCS overflow action codes are supported:

- 2—7-digit termination with overflow

- 11—10-digit termination with overflow

- 12—DDD routing with overflow

- 13—international with overflow

- 51—flexible termination with overflow

- 53—outbound VNET with overflow

Enhanced overflow is also supported for Remote Access and Suppcode collections on ETSI PRI trunks. Two existing ADF parameters, NO ANSWER TIMER and NCS INFORMATION, are used. If a No Answer Timer is received from the DAP/NCS in the Suppcode Response, the No Answer Timer will determine the length of time the originating switch allows the call to wait for an answer before attempting overflow.

The No Answer Timer is started under the following conditions:

- The originating switch receives an Address Complete Message (ACM) from a termination ISUP trunk.

- The originating switch receives an Alerting message from an ISDN PRI terminating trunk group.

- Outpulsing is completed on a PTS trunk.

When the No Answer Timer expires before an Answer Message (ANM) or Release message is received from an ISUP termination, a Connect message or an Answer Supervision on an inband termination, the originating switch shall requery the DAP with the Enhanced Overflow Treatment Request.

ETSI PRI Terminations by way of Table OPRTEID

This feature is used in the Avantel network. The feature allows Card time-out calls to route by way of table OPRTEID to an ETSI PRI trunk based upon the ID digits of 84 or 98. When the call terminates to the ETSI PRI trunk, the SETUP message Called Number parameter contains no digits and a Type Of Number (TON) of "Unknown".

Table OPRTEID Datafill

ETSI PRI terminations by way of OPRTEID alters the way table OPRTEID is datafilled and the way routing is handled for Card Call Time-outs. This feature allows ETSI PRI trunks to be datafilled in table OPRTEID for call terminations. None of the other OPNET tables support ETSI PRI trunks.

NCAUUI

NCAUUI (Non Call Associated User-to-User Information)

NCAUUI provides a service that allows PRI users located on the same switch to communicate by means of user-to-user signaling without setting up bearer channels at network access and egress points. In particular, the DMS-250 switch supports only the NTMCIPRI and N449PRI variant originations and terminations. The switch does not use bearer channels when establishing an NCA–TSC.

The system offers NCAUUI on a subscription basis at the switch level. After receiving a Q.931 SETUP message with a NCAUUI request, the DMS-250 switch verifies the subscription of the originating user before further processing the request.

After verifying the originating user is subscribed to NCAUUI, the DMS-250 sends an ADF DAL Request message to the DAP based on VNET or FLEXSAC call processing. The DAP validates the ADF DAL request for NCAUUI. After the DAP validates the ADF DAL request, the DAP returns an ADF Routing Response or an ADF Suppcode Response containing the subsequent address, terminating switch ID (TSID) and terminating trunk group (TTG) to the DMS-250. After receiving the ADF Routing Response, call processing routes the Q.931 SETUP message indicating NCAUUI to the terminating PRI user based on the TTG. If the DAP fails the ADF DAL request, the DAP returns an ADF Failure Response to reject the ADF DAL request.

When the terminating user receives the Q.931 SETUP message, the terminating user can acknowledge the NCAUUI request with a Q.931 CONNect message.

Once the switch establishes an NCA-TSC, either user may send User Information messages. The switch makes no attempt to interpret the contents of the User Information messages.

If the length of the User Information exceeds the maximum allowable length (251 bytes), the switch discards the message. The switch sends a Status message to the sender of the User information message with a cause value of

43 "Access Information Discarded," location code of "Transit," and coding standard of "CCITT."

Non Call Associated User to User Signaling Invocation

The following must be set in the incoming Q.931 Setup message in order for an NCAUUI request to be recognized by the DMS-250 switch.

ISDN PRI Bearer Capability Information Element

The ISDN PRI Bearer Capability Information Element is populated in the following manner:

- The Information Transfer Capability field is set to Unrestricted Digital Information.

- The Transfer Mode field is set to the value Packet Mode.

- The Layer and Protocol Identification field can be set such that User Information Layer 2 Protocol is Q.921 and User Information Layer 3 Protocol is Q.931.

ISDN PRI Channel Identification Information Element

The ISDN PRI Channel Identification Information Element is populated as follows:

- The Preferred/Exclusive field is set to Exclusive.

- The D-Channel Indicator field is set to D-Channel.

- The Channel Selection field can be set to No Channel.

Incoming NCAUUI requests received with the Bearer Capability Information Element and Channel Identification Information Element that are different than what this section details are not NCAUUI requests. The system rejects the NCAUUI request by way of normal Q.931 setup call processing. In this case, the DMS-250 switch sends a RELease COMPlete message to the originating user in cause values, 65 (Bearer Capability Not Implemented) or 100 (Invalid Information Content Identifier).

NCAUUI Invocation Acknowledgement

A positive acknowledgement for a NCAUUI request is the Q.931 CONNect message. Please refer to Figure 14-1. After the terminating user sends the Q.931 CONNect message, the terminating user can begin sending User Information messages. The originating user can only send User Information messages after receiving the Q.931 CONNect message.

Figure 14-1
NCAUUI Invocation Acknowledgement
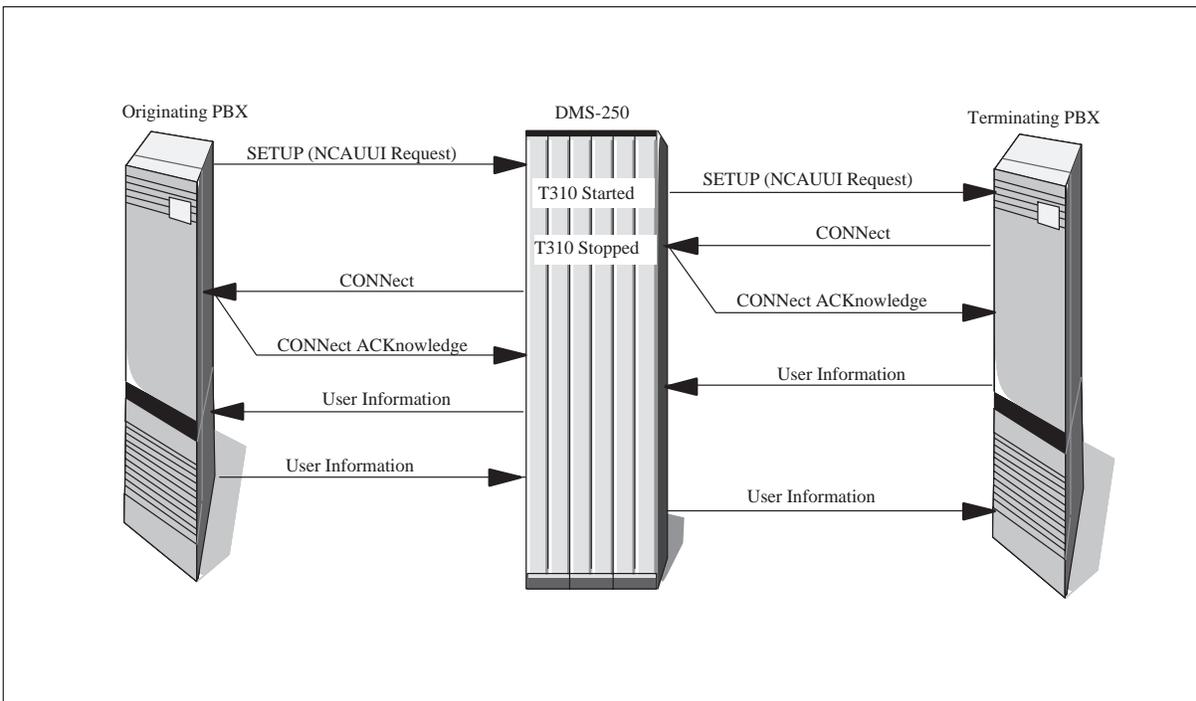
After the Q.931 NCAUUI SETUP message is sent to the terminating user, the DMS-250 switch moves into the Call Received network state (N7) and timer T310 (10 seconds) starts. This timer stops upon receiving the Q.931 CONNect message. If the T310 timer expires before receiving the Q.931 CONNect message, the DMS-250 switch sends a Q.931 RELease COMPlete message to the terminating user and a Q.931 RELease with a cause value of 18 "No User Responding" to the originating user.

The DMS-250 switch does not send a Q.931 CALL PROCeeding message to the originating PBX after receiving the NCAUUI SETUP message from the originating PBX.

If after sending the Q.931 NCAUUI SETUP message to the called user, the DMS-250 switch receives a CAUUI3 request within a FACility message from either the originating or the terminating user prior to receiving a Q.931 RELease, or RELease COMPlete message, the DMS-250 switch does not report the FACility message to the far-end user. The DMS-250 switch sends a FACility REJect message to the sender of the FACility message with a cause value of 29 "Facility Rejected," location code of "Transit," and coding standard of "CCITT." FACility messages received from the originating or terminating user for any other purpose than a CAUUI request are ignored.

The DMS-250 switch does not report the FACility message to the far-end user. Table 14-2 shows the Facility Messages.

Figure 14-2
Facility Messages
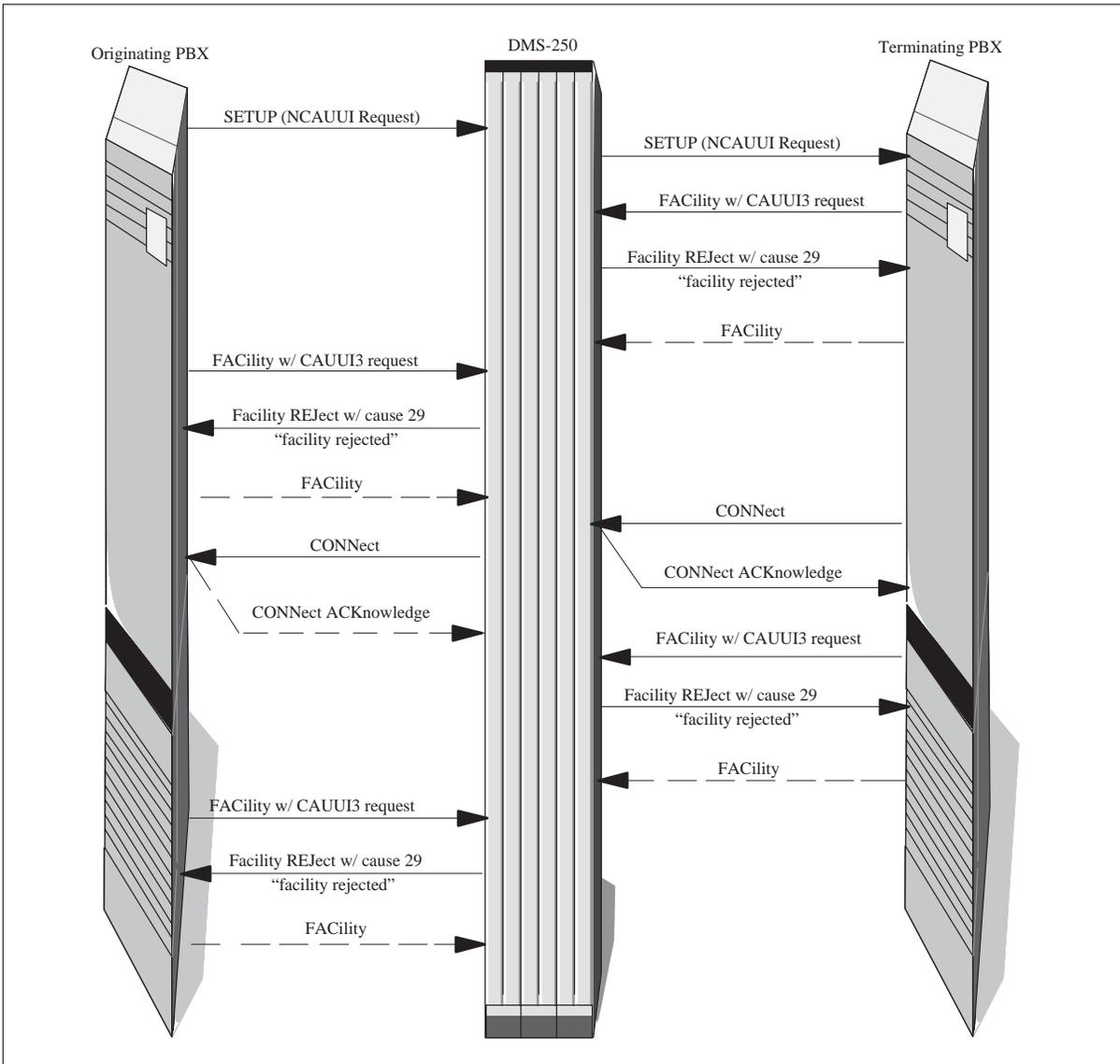
NCAUUI Invocation Rejection

User Rejection

The terminating user can reject a NCA-TSC request with a Q.931 DISConnect, RELease or RELease COMPlete message with a cause value of 29 "Facility Rejected." The far-end user honors the Q.931 DISConnect

message as a valid rejection even though there is no B-channel to disconnect.

Figure 14-3
NCAUUI Invocation Rejection from Terminating User
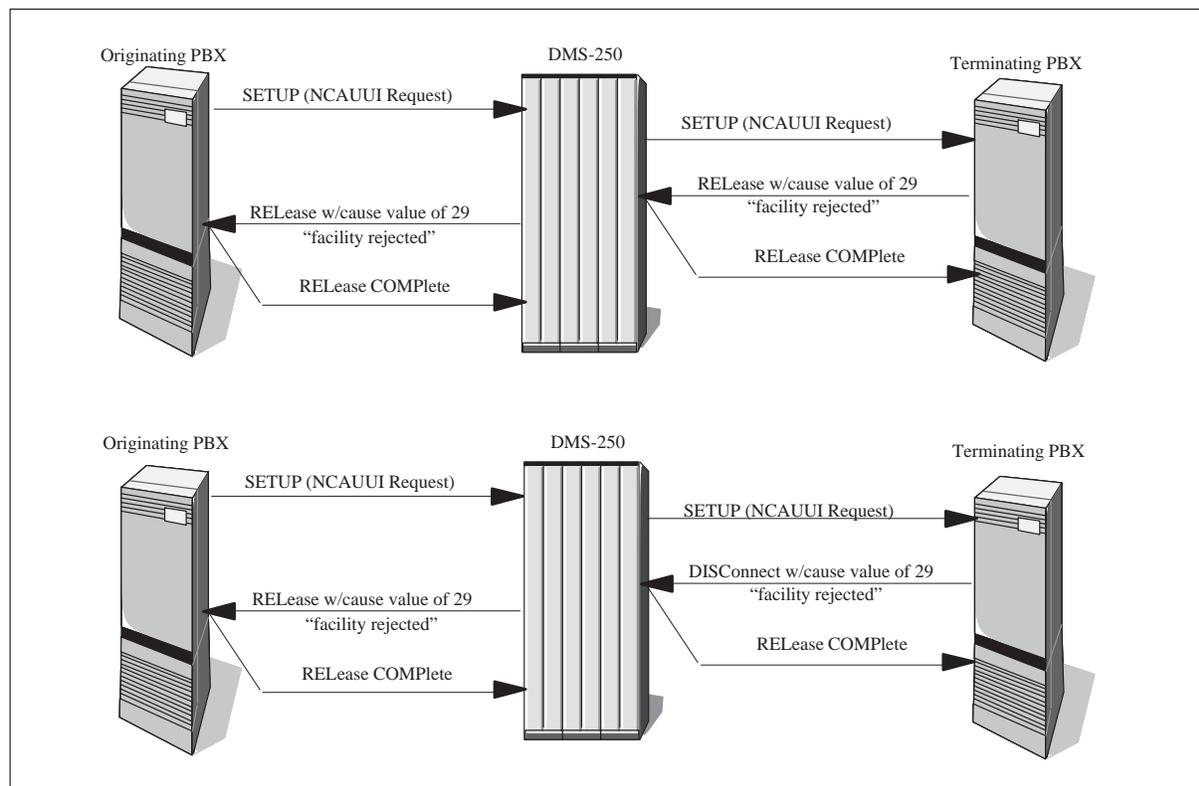
Network Rejection

The DMS-250 rejects an NCA-TSC request with a RELease or RELease COMPlete message. Please refer to Figure 14-4 "NCAUUI Invocation Rejection from Network" for network rejection.

When TSC resources are busy, the network rejects the NCA-TSC request. TSC resources are busy when one of the following CC resources cannot be allocated:

- OCCB

- HCB

- HDB

- UUS extension block

- SRU

- terminating D–channel interface

In this case, the DMS-250 sends a Q.931 RELease message with a cause value of 42 "Switching Equipment Congestion," location code of "Transit and coding standard of "CCITT."

If TSCBs are not available in the XPM, the DMS-250 rejects the NCA-TSC request by way of a Q.931 Release COMPlete message with a cause value of 42 "Switching Equipment Congestion," location code of "Transit and coding standard of "CCITT."

If the originating user sends a NCAUUI request in the Q.931 SETUP message and the terminating agency is not ISDN PRI agency, the request is denied by the DMS-250 by way of the Q.931 RELease message with cause value 21 "Call Rejected," location code of "Transit" and coding standard of "CCITT."

If the originating user sends a NCAUUI request in the Q.931 SETUP message and the terminating agency is an ISDN PRI agency, but it is not in-service, the request is denied by the DMS-250 by way of the Q.931 RELease message with cause value 21 "Call Rejected," location code of "Transit" and coding standard of "CCITT."

If the DMS-250 receives a NCAUUI request in the Q.931 SETUP message for a PRI user that is not subscribed, the DMS-250 switch denies the request by way of the Q.931 RELease COMPlete message with cause value of 50 "Requested Facility Not Subscribed," location code of "Transit" and coding standard of "CCITT."

Figure 14-4
NCAUUI Invocation Rejection from Network
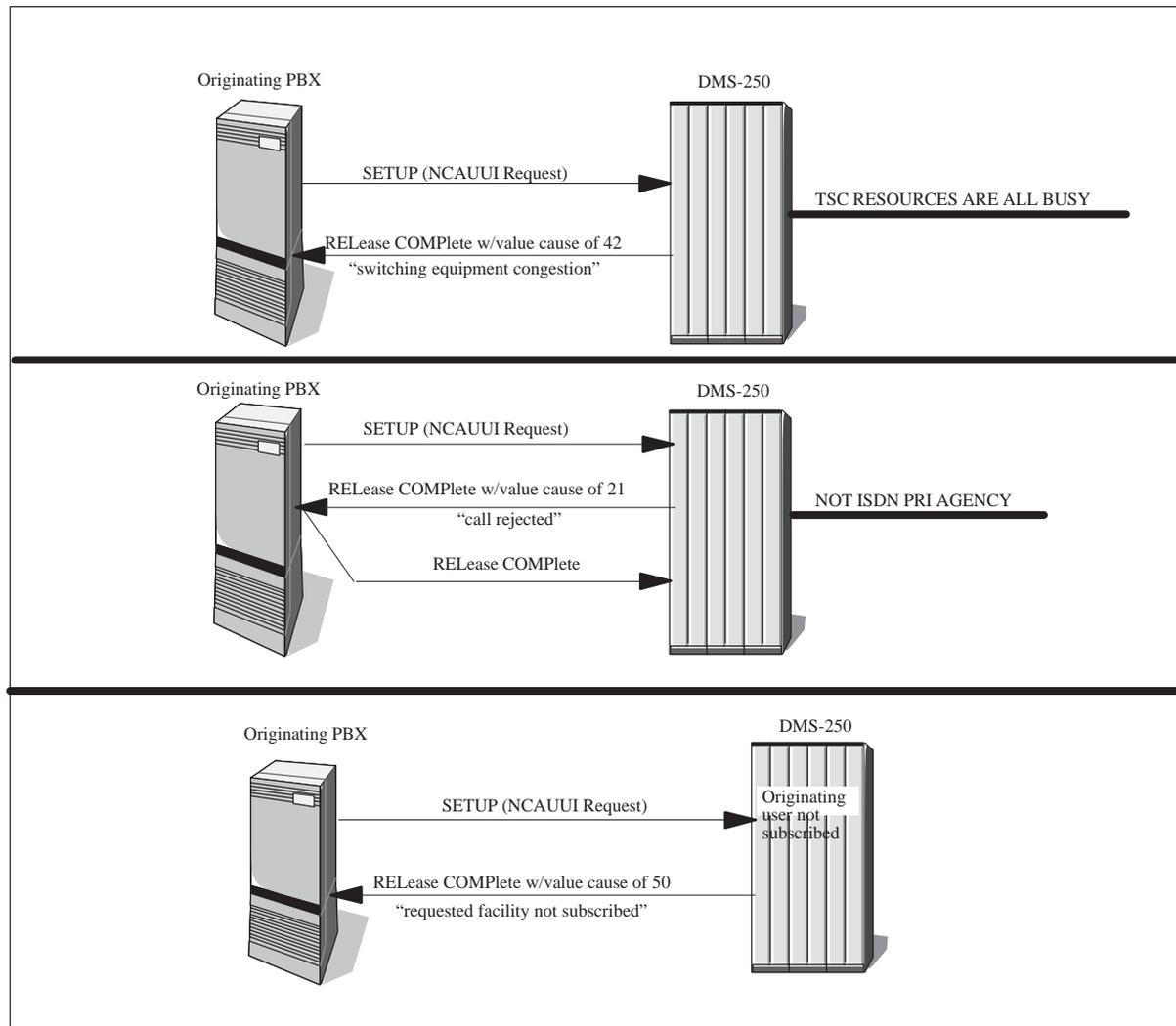
NCAUUI Congestion and Flow Controls

NCAUUI supports two types of congestion control: user congestion and network congestion flow control. The PRI user that receives a Q.931 Congestion Control message cannot distinguish whether the originator of the message is the far-end user or the DMS-250 switch.

When necessary, the DMS-250 switch or the end user controls the transfer of User Information messages by means of a Congestion Control message. The Q.931 Congestion Control message contains a Congestion Level IE that can be set to "Receiver Not Ready" indicating congestion or "Receiver Ready" indicating congestion clearing. The Q.931 Congestion Control message also contains an optional Cause IE.

User Flow Control
User Sending Congestion Control Message with "Receiver Not Ready"

Once the user enters a congestion state, the remote end user sends a Q.931 Congestion Control message containing Congestion Level IE set to "Receiver Not Ready" to the DMS-250 switch. When the DMS-250 switch receives this message, it marks the remote end user in congestion. The switch may forward the Congestion Control message to the far-end user by the DMS-250 switch. The DMS-250 switch serving the congested far-end user, does not send User Information messages to the congested user until the switch clears the user congestion. The user in a congestion state can continue to send User Information messages to the far-end user.

User Sending Congestion Control Message with "Receiver Ready"

Upon leaving the congestion state, the remote end user sends a Q.931 Congestion Control message containing Congestion Level IE set to "Receiver Ready" to the DMS-250 switch. When the DMS-250 switch receives this message, the switch marks the remote end user as non–congested. The system may forward the Congestion Control message to the far-end user by the DMS-250 switch.

User Receiving Congestion Control Message with "Receiver Not Ready"

If the far-end user receives a Congestion Control message with Congestion Level IE set to "Receiver Not Ready," the far-end user suspends sending User Information messages. If the far-end user, after receiving an indication of "Receiver Not Ready," continues to send User Information messages, the DMS-250 switch discards these messages. The far-end user receives no indication that the User Information messages are discarded.

User Receiving Congestion Control Message with "Receiver Ready"

If the far-end user receives a Congestion Control message with Congestion Level IE set to "Receiver Ready," the far-end user can resume sending User Information messages to the remote end user.

Network Flow Control

The DMS-250 switch uses the following algorithm to control the flow of User Information messages:

- burst parameter X, initialized to office parameter UUS_BURST

- User Information message counter N, initialized to X

- the replenishment parameter Y, initialized to X/2

- the DMS-250 switch timer TUUS is 10 seconds

A burst capability to send N User Information messages is available to each access/egress agent. The value of N decrements by one for each User Information message sent by the user and increments by Y at regular intervals of TUUS subject to the limitation that N does not exceed X. If the DMS-250 switch receives more than N User Information messages within the TUUS timer setting, "network congestion" occurs. The network sends a Congestion Control message to the user with Congestion Level parameter set to "Receiver Not Ready." The DMS-250 switch sets the Cause Parameter in the Congestion Control message to a value of 42, "Switching Equipment Congestion," Location "Transit," and Coding Standard "CCITT."

When network congestion clears, the DMS-250 switch sends a Congestion Control message is to the user with Congestion Level parameter in the Congestion Control message set to "Receiver Ready." The DMS-250 switch sets the Cause Parameter to a value of 42, "Switching Equipment Congestion," Location "Transit" and Coding Standard "CCITT." The DMS-250 only sends a Congestion Control message with "Receiver Ready" to the user previously notified of congestion.

User Congestion and Network Flow Control Interaction

The DMS-250 switch considers the congestion status of both end users and itself before sending or forwarding Congestion Control messages to the end users.

The network notifies the end user that the network or the end user is congested. The end user only receives one Congestion Control message with an indication of "Receive Not Ready" and an optional Cause parameter. Once a user receives a Congestion Control message for that user must have an indication of "Receiver Not Ready," the next Congestion Control message for that user must have an indication of "Receiver Ready" with the optional Cause parameter identical to the one received in the Congestion Control message with an indication of "Receiver Not Ready."

If the access DMS-250 switch goes into "network congestion" due to congestion flow control, the DMS-250 switch sends a Congestion Control message to the access user with an indication of "Receiver Not Ready." If the far-end user is congested, the DMS-250 sends a Congestion Control message with an indication of "Receiver Not Ready." The network forwards this user generated Congestion Control message across the network until it reaches the access switch that sent the first Congestion Control message with an indication of "Receiver Not Ready." If the access switch is still in

congestion, the access switch cannot forward the user generated Congestion Control message to the near end user.

When the network and the far-end user are ready to receive User Information messages, the DMS-250 notifies the end user of congestion. The end user can only receive one Congestion Control message with an indication of "Receiver Ready." Once a user receives a Congestion Control message with an indication "Receiver Ready," the next Congestion Control message for that user must have an indication of "Receiver Not Ready."

If, for example, the access switch is in congestion, and the far-end user congestion clears, the far-end user can send a Congestion Control message with an indication of "Receiver Ready." The network forwards the user generated Congestion Control message across the network until it reaches the access switch. The user generated Congestion Control message can not forwarded the near end user because the access switch is still in congestion.

User Congestion and Network Flow Control Interaction

The DMS-250 switch considers the congestion status of both end users and itself before sending or forwarding Congestion Control messages to the end users.

Figure 14-5
User Congestion and Network Flow Control Interaction
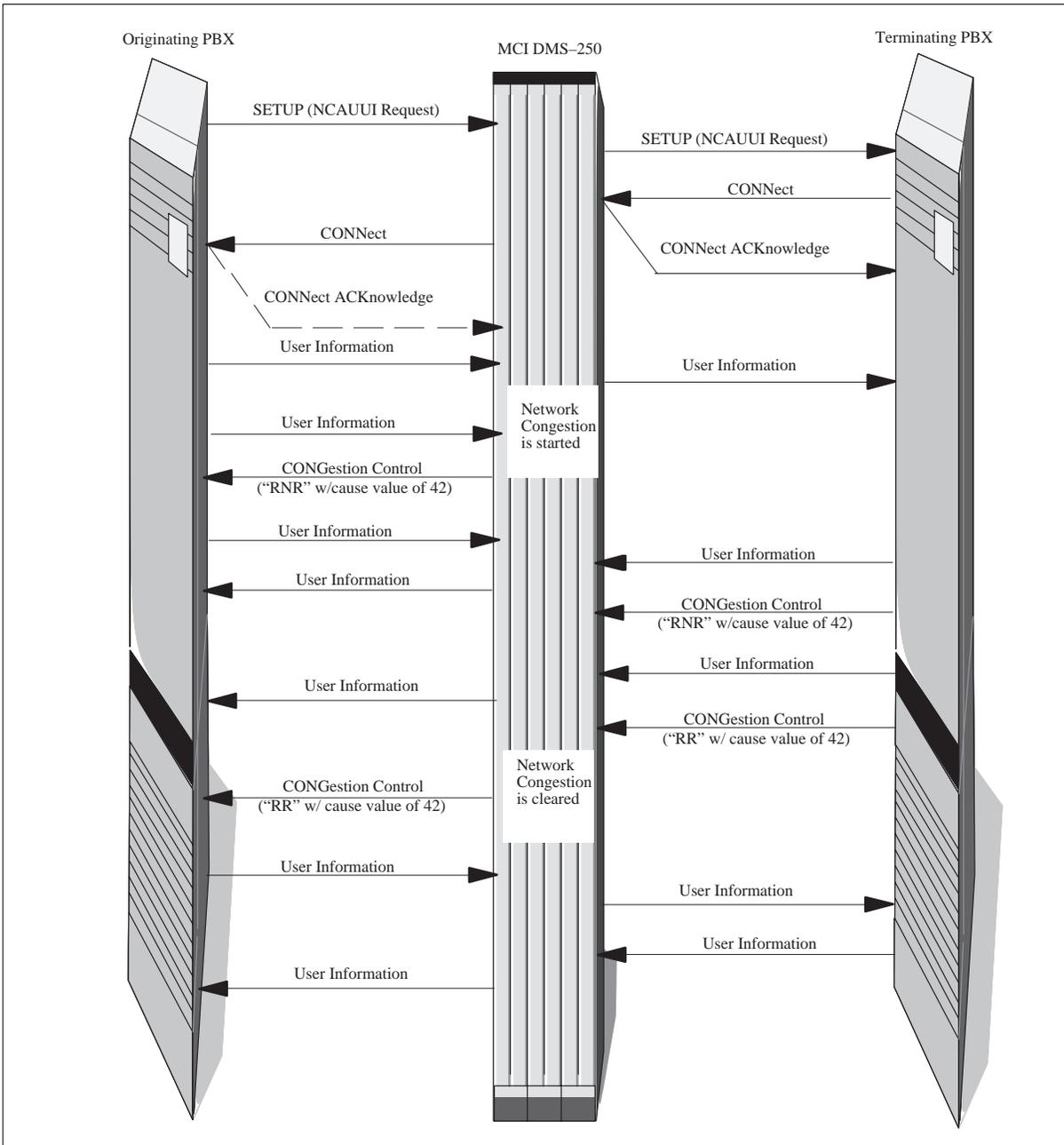
NCAUUI TSC Clearing

User Clearing

Either of the end users utilizes a Q.931 RELease or RELease COMPlete
message to clear the NCAUUI connection. The user that receives the Q.931

RELease message responds with a Q.931 RELease COMPlete. The system does not expect a Q.931 DISConnect since there is no B-channel to disconnect. If the system receives a Q.931 DISConnect, the system honors the disconnect as a valid indication of TSC clearing.

Network Clearing

The office parameter, MAX_USER_INFO, defines the maximum limit of the number of ISDN User Information messages that can be transported for the life of the call. If the number of user information messages transported in both directions equals MAX_USER_INFO, the DMS-250 sends a Q.931 RELease message with a cause value of 29 "Facility Rejected" to both end users. MAX_USER_INFO is default to 25; however, it can be up to 65,535 which is the maximum number of User Information messages that can be transported for the life of a NCAUUI call.

Data Access Point (DAP)

All NCAUUI calls must go to the DAP for translation. The DMS-250 switch receives all NCAUUI requests in traditional call requests that invoke VNET or FLEXSAC processing. DAP interaction is necessary to ensure the called party obtains TSID and TTG from the DAP. The TTG is the TTG of the terminating PRI agent.

The only request message that the ADF supports is the DAL Call Procedure Request message. The only response messages that the ADF supports are the Routing Response, the Suppcode Digit Collection Response, and the Failure Response messages.

The ADF Routing Response from the DAP receives the supported action codes 1, 2, 10, 11, 32, 33, 50, 51, 52, and 53. The system rejects all NCAUUI requests that receive anything other than the above action codes from the DAP. The DMS-250 sends a Q.931 RELease message with cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT" to the user who requests the NCAUUI service.

When the DMS-250 receives a Q.931 SETUP message that indicates NCAUUI request, the DMS-250 switch formulates and sends an ADF DAL Request message to the DAP based on existing VNET or FLEXSAC call processing. Note that the DMS-250 does not trigger the ADF DAL Request message by the setting of the Bearer Capability IE or the Channel Identification IE, or the IEs used to initiate NCAUUI. Traditional call processing for VNET and FLEXSAC calls triggers the initiation of the message.

There are two conditions that determine whether a call is a VNET. First, the PRIVDIAL field in table CALLATTR must be set to NCS. Second, the NSFDFLT field in table TRKGRP must be set to VNET or the NSF IE must

be set to NSF_PRIVATE or NSF_TIE in the Q.931 SETUP message. If the previous conditions are met, the call goes to the DAP for translation.

There are also two conditions that determine whether a call is FLEXSAC. In table STDPRTCT, the PRERTSEL field must be set to SAC and the SACFEAT field must be set to either FLEXFREE or FLEXFREM. If the above conditions are met and NCS_ALLOW field in table STDPRTCT is set to "Y," the NCAUUI calls immediately go to the DAP for routing purposes. Thus bypassing the IMMDAPREQ field in table STDPRTCT and FLEXSAC tables. If a NCAUUI call is FLEXSAC, but NCS_ALLOW is set to "N" then NCAUUI is rejected. The DMS-250 sends a Q.931 RELease message to the originating user with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT".

If the DMS-250 does not activate VNET or FLEXSAC processing, the call does not go to the DAP and the system rejects the NCAUUI request. The DMS-250 switch sends a Q.931 RELease message to the originating user with cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT."

The DAP validates the NCAUUI request. After the DAP validates NCAUUI request, the DAP returns an ADF Routing Response or an ADF Suppcode Response message that contains the subsequent address, TSID and TTG to the DMS-250 switch.

If the DAP returns an ADF Suppcode Response message without the routing information, the DMS-250 sends a second request to the DAP with the suppcode filed in table MLTATTR for suppcode validation. If the switch cannot get the suppcode digits from table MLTATTR, the switch sends a Q.931 RELease message with cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT" to the originating user.

The ADF Suppcode Response message contains the number of suppcode digits that the system requires. If the number of suppcode digits that the Suppcode Response requires is greater than number of suppcode digits entered in table MLTATTR, the DMS-250 switch sends a Q.931 RELease message with cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT" to the originating user.

After the DMS-250 obtains the required suppcode digits, the DMS-250 switch sends a second ADF DAL Request with the suppcode to the DAP. If the suppcode is valid, the DAP returns a normal routing response. Otherwise, the DAP returns an ADF Failure Response. Please refer to Figure 14 "Inswitch Suppcode Collection."

Figure 14-6
In-Switch Suppcode Collection
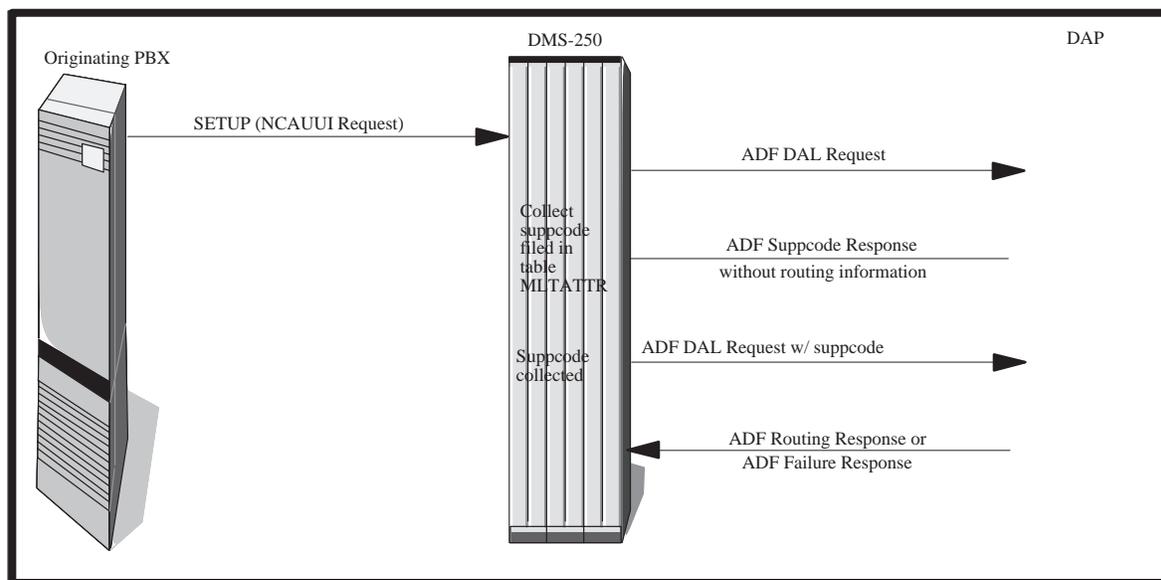
The system only supports suppcodes filed in-switch in accordance with existing procedures for data calls. The system does not support user dialed suppcodes. The DMS-250 switch sends a Q.931 RELease message with a cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT" to the originating user.

If the DAP rejects a NCAUUI request, the DAP sends an ADF Failure Response message to the DMS-250 switch. The DMS-250 switch then sends a Q.931 RELease COMPlete message with a cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT" to the originating user.

The DMS-250 switch routes NCAUUI calls through table VPNTRMRT. The DMS-250 switch does not route NCAUUI calls through table VPNIMTRT. After receiving the ADF Routing Response, call processing routes the Q.931 SETUP message indicating NCAUUI to the terminating PRI user based on the TTG. The subsequent address digits that the switch receives from the DAP at the DMS-250 switch are outpulsed as the Called Party Number IE in the outgoing Q.931 SETUP message.

The TSID that the DAP receives must match the switch ID of the switch that made the DAP request. If the received TSID and the switch ID of the switch that made the DAP request do not match, the DMS-250 switch sends a Q.931 RELease message with a cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT" to the originating user

rejecting the NCAUUI request. If the received TSID and the switch ID of the switch that made the DAP request match, the TTG that the DAP receives, the DMS-250 switch uses the value to establish the NCA-TSC.

If the TTG referenced in table VPNTRMRT is not an in–service PRI agency, the DMS-250 switch sends a Q.931 RELease COMPlete message with a cause value of 21 "Call Rejected," location code of "Transit," and coding standard of "CCITT" to the originating user rejecting the NCAUUI request.

NCAUUI (Two switch scenario)

Overview

This feature provides Non Call Associated User-to-User Services between PRI users that are located on two different switches in the network. The Signaling Connection Control Protocol (SCCP) Class 2 Connection Oriented protocol is used to set up a logical connection between two DMS-250 switch nodes in the CSS7 network without setting up a voice circuit. Once the logical connection is established between the two DMS-250 switch nodes, information is transferred between the two DMS-250 switch nodes in either direction.

Feature Description

NCAUUI provides a service which allows PRI users to communicate by means of user-to-user signaling without setting up bearer channels at network access and egress points. Only the NTMCIPRI and N449PRI PRI variant originations and terminations are supported. Bearer channels are not used when establishing an NCA-TSC from originating switch to a terminating switch within the network due to the choice of transport protocols. The implementation of an NCAUUI transport uses SCCP Connection Oriented class 2 service.

Nortel Networks offers the NCAUUI feature on a subscription basis at the trunk group level. After receiving a Q.931 SETUP message with an NCAUUI request, the DMS-250 switch verifies that the originating user is subscribed by way of table LTDATA before further processing the request.

After verifying that the originating user is subscribed to NCAUUI, the DMS-250 switch sends an ADF DAL Request message to the DAP based on VNET or FLEXSAC call processing. The DAP validates the ADF DAL request for NCAUUI. After the ADF DAL request for NCAUUI is validated by the DAP, the DAP returns an ADF Routing Response or an ADF Suppcode Response containing the subsequent address, terminating switch ID (TSID) and terminating trunk group (TTG) to the DMS-250 switch.

Upon receipt of a Q.931 SETUP message indicating NCAUUI, the originating DMS-250 switch translates the received TSID into a destination point code.

When the terminating DMS-250 switch receives an SCCP Class 2 Connection Request (CR) message, it builds and sends the Q.931 SETUP message. The Q.931 message indicates the presence of NCAUUI to the terminating ISDN user based on the TTG received in the SCCP Class 2 CR message.

The user at the terminating end can acknowledge the NCAUUI request with a Q.931 CONNect message. Once the terminating DMS-250 switch receives a Q.931 CONNect message, it generates and sends a Q.931 CONNect ACKnowledgment message to the terminating ISDN user and SCCP Class 2 Connection Confirm (CC) to the originating DMS-250 switch. When the originating switch receives the SCCP Class 2 CC message, it formulates and sends a Q.931 CONNect message to the originating ISDN user. At this point, a NCA-TSC virtual connection has been established.

Once a NCA-TSC has been successfully established, either PRI user may send User Information messages. No attempt is made by the switch to interpret the contents of the User Information messages.

Non Call Associated User-to-User Signaling Invocation

The incoming Q.931 SETUP message must have valid Bearer Capability and Channel Identification, in order for a NCAUUI request to be recognized by the DMS-250 switch.

Incoming Q.931 SETUP messages received without the NCAUUI defined Bearer Capability Information Element and Channel Identification Information Element are not considered NCAUUI requests, therefore are handled by way of regular call processing.

The call reference that the PBX receives in the NCAUUI SETUP message must contain a valid call reference. Global or null call references are not supported for feature invocation.

When the originating DMS-250 switch receives the Q.931 SETUP message and receives an ADF response from the DAP, the following criteria is verified before an SCCP Connection Request (CR) message is sent to the terminating switch:

- Table C7LOCSSN datafill for the local Non-Call Associated User-to-User Service (NCAUUS) subsystem is present.

- Table SCCPDEST datafill for the TSID returned from the DAP is present.

- Table C7RTESET datafill for the terminating routeset for the TSID is present.

- The C7NETSSN datafill for the NCAUUS subsystem at the terminating routeset is present.

- The NCAUUS Local Subsystem and Remote Subsystem must be in-service.

- The Remote Point Code must be in-service.

- A maximum of 2048 SCCP per switch are allowed. An SCCP reference number must be available.

Once the terminating DMS-250 switch receives the SCCP CR message, it checks to see if the terminator is a supported ISDN variant. If the system supports the ISDN variant, the DMS-250 switch generates and sends a Q.931 SETUP message to the terminating ISDN user. The length of the Data Parameter field for this message is 128 bytes; however, due to the size requirement of mandatory parameters, the actual payload of the Data Parameter Value field is 95 bytes.

If the DMS-250 switch receives a Q.931 CALL PROCeeding message, PROGress or ALERTing message from the terminating user prior to receiving a Q.931 CONNect, RELease, or RELease COMPlete message, the terminating DMS-250 switch ignores these messages.

ISDN PRI Bearer Capability Information Element

The ISDN PRI Bearer Capability Information Element is populated as follows:

- the Information Transfer Capability field is set to Unrestricted Digital Information,

- the Transfer Mode field is set to the new value Packet Mode,

- the new Layer and Protocol Identification field is set such that User Information Layer 2 Protocol is Q.921 and User Information Layer 3 Protocol is Q.931.

Note: Octets 5, 6, and 7 are considered optional and do not affect the request of NCAUUI service. Octet 5 is ignored if it is received in a NCAUUI request message. Octets 6 and 7 may be included by the user in NCAUUI requests. However, the DMS-250 switch ignores Octet 6 and Octet 7.

ISDN PRI Bearer Capability Information Element								
Bit / Octet	8	7	6	5	4	3	2	1
1	0	0	Bearer Capability 0 Information Element Identifier	0	0	0	0	0
2	Length of Bearer Capability Information Element							
3	1	0 Coding Standard	0	0	1 Information Transfer Capability	0	0	0
4	1 Ext	Transfer Mode 1 0 (Packet Mode)		0	Information Transfer Rate 0 0 0 0 (Used only for Packet Mode)			
5	1	Multiplier/ Layer Id. 0 1 (Layer 1 Id.)		User Information Layer 1 Protocol 0 0 0 1 0				
6	1	Multiplier/ Layer Id. 1 0 (Layer 2 Id.)		User Information Layer 2 Protocol 0 0 0 1 0 (Recommendation Q.921)				
7	1	Multiplier/ Layer Id. 1 1 (Layer 3 Id.)		User Information Layer 3 Protocol 0 0 0 1 0 (Recommendation Q.931)				

NCAUUI Invocation Positive Acknowledgment

A positive acknowledgment for an NCAUUI request is the Q.931 CONNect message.

If the terminating ISDN user positively acknowledges the request for NCAUUI with the Q.931 CONNect message, the terminating DMS-250 switch formulates and sends a Q.931 CONNect ACKnowledge message to the terminating ISDN user and an SCCP Connection Confirm (CC) message to the originating switch.

If the Non-Call Associated Temporary Signaling Connection (NCA-TSC) request receives a positive acknowledgment at the far end, the originating switch receives an SCCP CC message. Then, a TSC is established between the originating switch and the terminating switch. Once the originating switch receives the SCCP CC message, the originating switch sends a Q.931

CONNect message to the originating ISDN user to indicate positive acknowledgment of the NCA-TSC request message.

CAUUI2 and CAUUI3 Requests

If the DMS-250 switch receives CAUUI2 requests in the NSF IE included in the Q.931 SETUP message requesting NCAUUI, the DMS-250 switch rejects the CAUUI2 request. The rejection is done by sending a Q.931 FACility REJect message with a cause value of 29 "Facility Rejected", location code of "Transit", and coding standard of "CCITT" to the originating ISDN user. The request for NCAUUI is still considered valid.

IF the DMS-250 switch receives a CAUUI3 request within a Q.931 FACility message from either the originating or the terminating ISDN user, the DMS-250 switch does not report the Q.931 FACility message to the far end user. If this message is received before the first call clearing message, a Q.931 FACility REJect message with a cause value of 29 "Facility Rejected", location code of "Transit", and coding standard of "CCITT" is sent to the sender of the Q.931 FACility message.

Connect Timers

T310 Timer

The T310 timer tracks the Q.931 SETUP message that is sent to the terminating ISDN user. The terminating DMS-250 switch waits to receive a Q.931 CONNect message indicating a connection. The default for this timer is 10 seconds. After the Q.931 SETUP message is sent to the terminating ISDN user, the DMS-250 switch moves into the Call Received network state (N7) and timer T310 is started. The timer is stopped when the DMS-250 switch receives the Q.931 CONNect message. The T310 timer is datafilled in table ISDNPROT. However, datafilling timer T310 in table ISDNPROT affects all PRI calls for that protocol variant and not just NCAUUI calls.

If the T310 timer expires before the DMS-250 switch receives the Q.931 CONNect message, the terminating DMS-250 switch sends a Q.931 RELease COMPlete message with cause value of 102 "Recovery on Timer Expiry" to the terminating ISDN user and an SCCP Connection Refused (CREF) message to the originating DMS-250 switch. Once the originating switch receives the SCCP CREF message, a Q.931 RELease message with a cause value of 18 "No User Responding" is sent to the originating ISDN user.
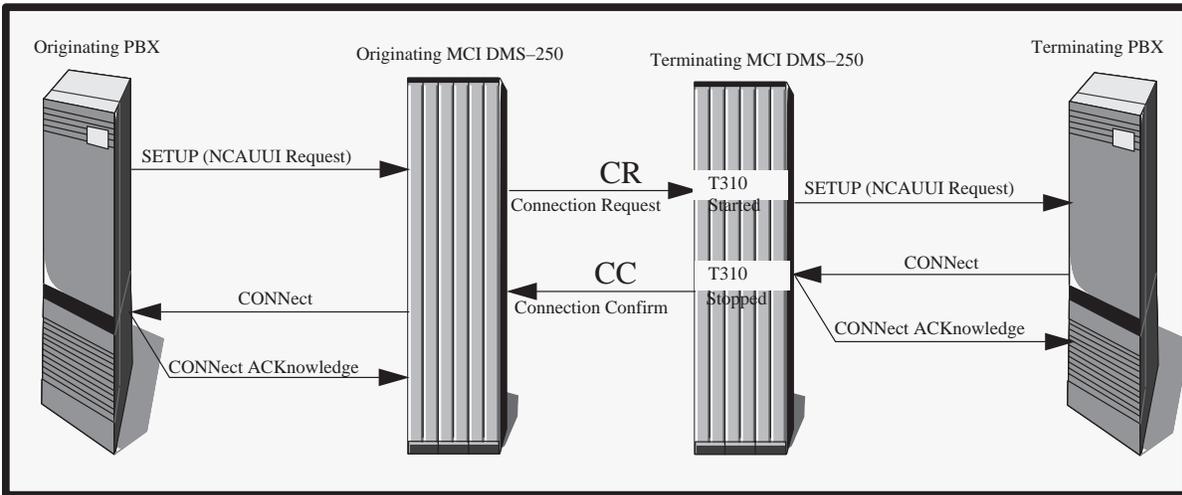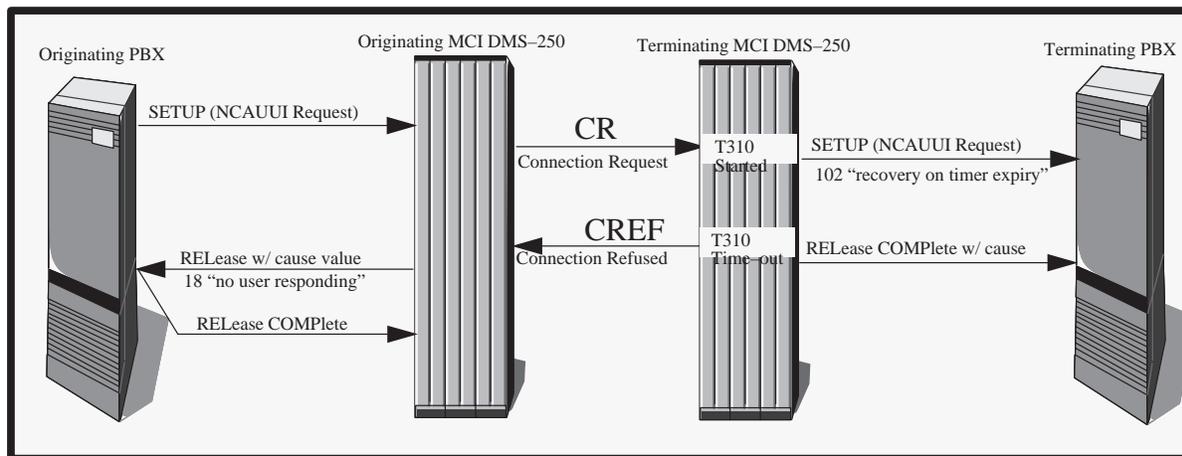
Figure 15-1
T310 Timer

Figure 15-2
T310 Time-out

Connection Establishment Timer T(connest)

The T(connest) timer tracks the SCCP CR message that is sent to the terminating DMS-250 switch by the originating DMS-250 switch. The originating DMS-250 switch waits to receive an SCCP CC message. The default for this timer is 1 minute. Timer T (connest) is started after the SCCP CR message is sent to the terminating DMS-250 switch. The timer is stopped after it receives the SCCP CC message. The T timer (connest) is available is datafilled in table SCCPTMR. The values for T (connest) timer ranges from 10 to 360 seconds.

Figure 15-3
T(connest) Timer
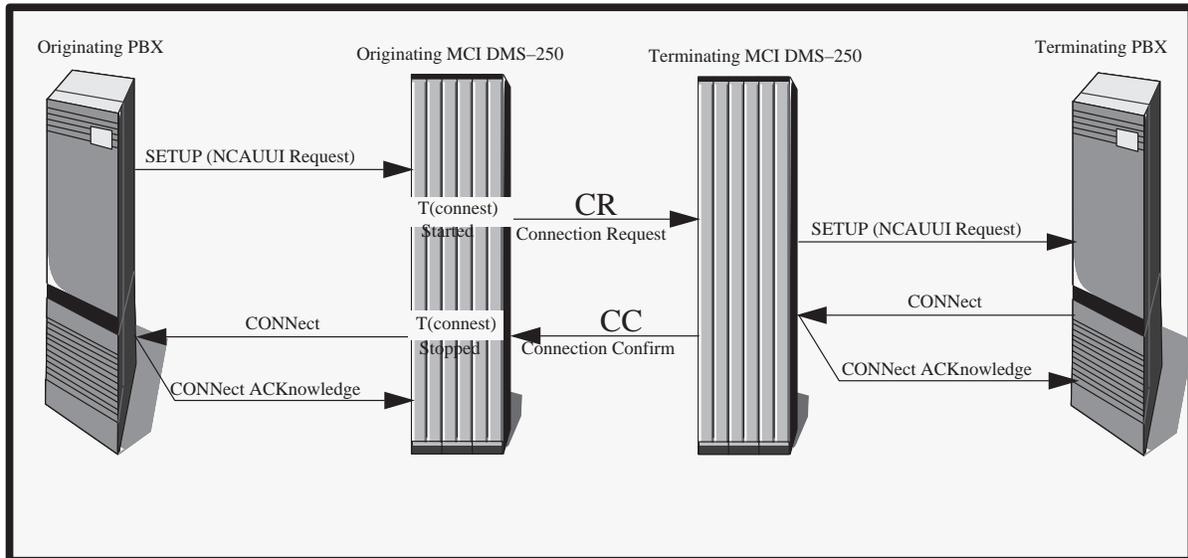
Figure 15-4
T(connest) Time-out
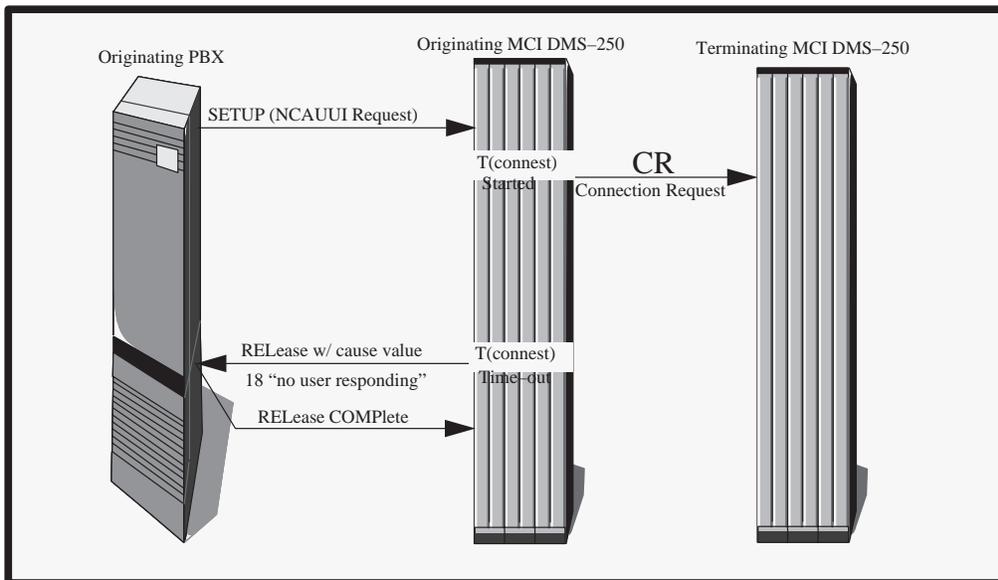
NCAUUI Invocation Negative Acknowledgment

User Invocation Rejection

The ISDN user at the terminating DMS-250 switch rejects a NCA-TSC request message with a Q.931 DISConnect, RELease or RELease COMPlete

message. The cause value received and this clearing message is propagated to the originating ISDN user.

Note: If the terminating switch receives a Q.931 DISConnect, RELease, or RELease COMPlete message for NCAUUI invocation rejection, the terminating switch builds and sends an SCCP CREF message to the originating switch.

For example, if the terminating ISDN user negatively acknowledges the request for NCAUUI with the Q.931 DISConnect or RELease message with cause value of 29 "Facility Rejected", the terminating DMS-250 switch sends a Q.931 RELease COMPlete message to the terminating ISDN user and an SCCP CREF message to the originating switch.

If the NCA-TSC request message receives a negative acknowledgment at the far end, the originating switch receives an SCCP CREF message. Once the originating switch receives an SCCP CREF message, a Q.931 RELease message is sent to the originating ISDN user to indicate negative acknowledgment of the NCA-TSC request message.

Figure 15-5
NCAUUI Invocation Rejection with a Q.931 DISConnect or RELease Message
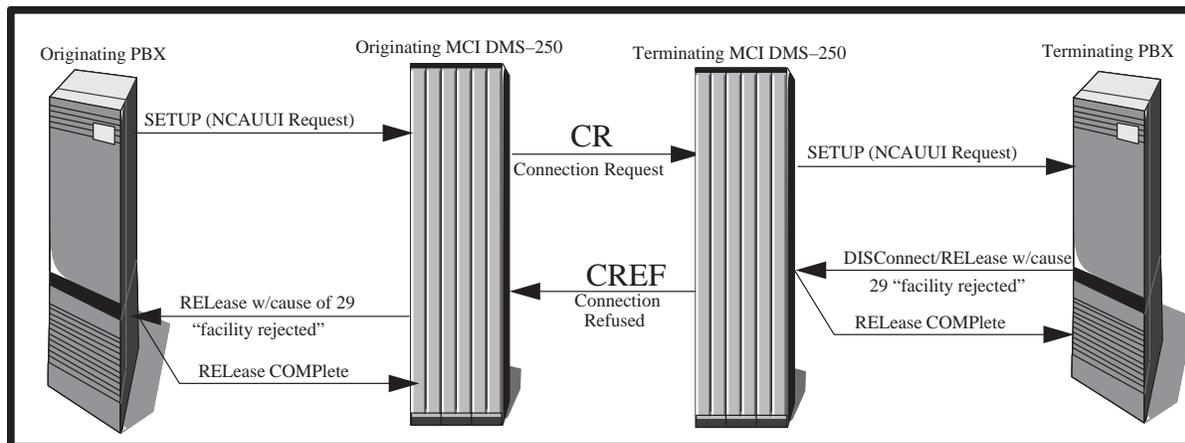
If the terminating ISDN user negatively acknowledges the request for NCAUUI with the Q.931 RELease COMPlete message, the terminating switch sends an SCCP CREF message to the originating switch.

If the NCA-TSC request message receives a negative acknowledgment at the far end, the originating switch receives an SCCP CREF message. Once the originating switch receives an SCCP CREF message, a Q.931 RELease message is sent to the originating ISDN user to indicate negative acknowledgment of the NCA-TSC request message.

Figure 15-6
NCAUUI Invocation Rejection with a Q.931 RELease COMPlete Message
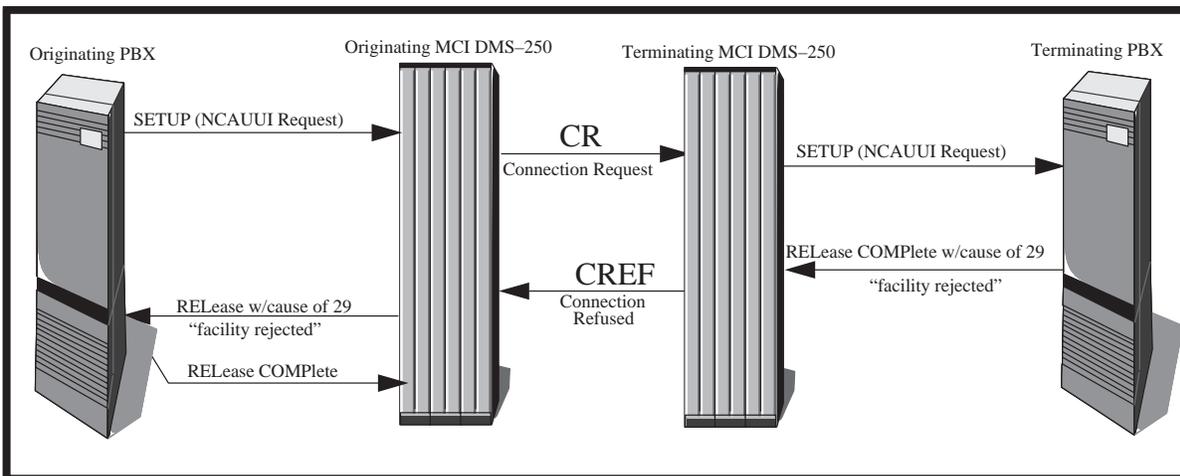
Network Rejection

The DMS-250 switch rejects a NCA-TSC request message with a Q.931 RELease, RELease COMPlete, or SCCP CREF message.

Note: A Q.931 RELease Message is sent if NCAUUI rejection occurs at the CC. A Q.931 RELease COMPlete message is sent if NCAUUI rejection occurs at the XPM.

Network rejection is handled in one of the following areas:

- Negative Acknowledgment at the Originating XPM

- Negative Acknowledgment at the Originating DMS-250 switch

- Negative Acknowledgment at the Originating SCCP

- Negative Acknowledgment at the Terminating SCCP

- Negative Acknowledgment at the Terminating DMS-250 switch

- Negative Acknowledgment at the Terminating XPM

NCAUUI Invocation Rejection from the Originating XPM

Temporary Signaling Connection Blocks (TSCB) are data structures that are allocated for NCAUUI calls at the originating and terminating XPM. There are 127 TSCBs available per DTCI. If TSCBs are not available at the originating XPM, the XPM rejects the NCA-TSC request message by sending a Q.931 RELease COMPlete with a cause value of 42 "Switching Equipment Congestion", location code of "Transit" and coding standard of "CCITT" to the originating ISDN user.

NCAUUI Invocation Rejection from the Originating DMS-250 switch

If the originating DMS-250 switch receives a NCAUUI request in the Q.931 SETUP message from a PRI user that is not subscribed, the request is denied by the DMS-250 switch by way of the Q.931 RELease message with cause value of 50 "Requested Facility Not Subscribed", location code of "Transit" and coding standard of "CCITT".

When TSC resources are busy at the originating DMS-250 switch, the network rejects the NCA-TSC request message. TSC resources are busy when one of the following CC resources cannot be allocated:

- HCB
- HDB
- UUS extension block
- SRU

The originating DMS-250 switch sends a Q.931 RELease message with a cause value of 42 "Switching Equipment Congestion," location code of "Transit and coding standard of "CCITT" to the originating ISDN user.

If the originating ISDN user sends a NCAUUI request in the Q.931 SETUP message and the terminating agency of the originating DMS-250 switch is not ISDN PRI D-channel or an ANSI SS7 Routeset, then the request is denied. The originating DMS-250 switch sends a Q.931 RELease message with cause value 21 "Call Rejected", location code of "Transit" and coding standard of "CCITT" to the originating ISDN user.

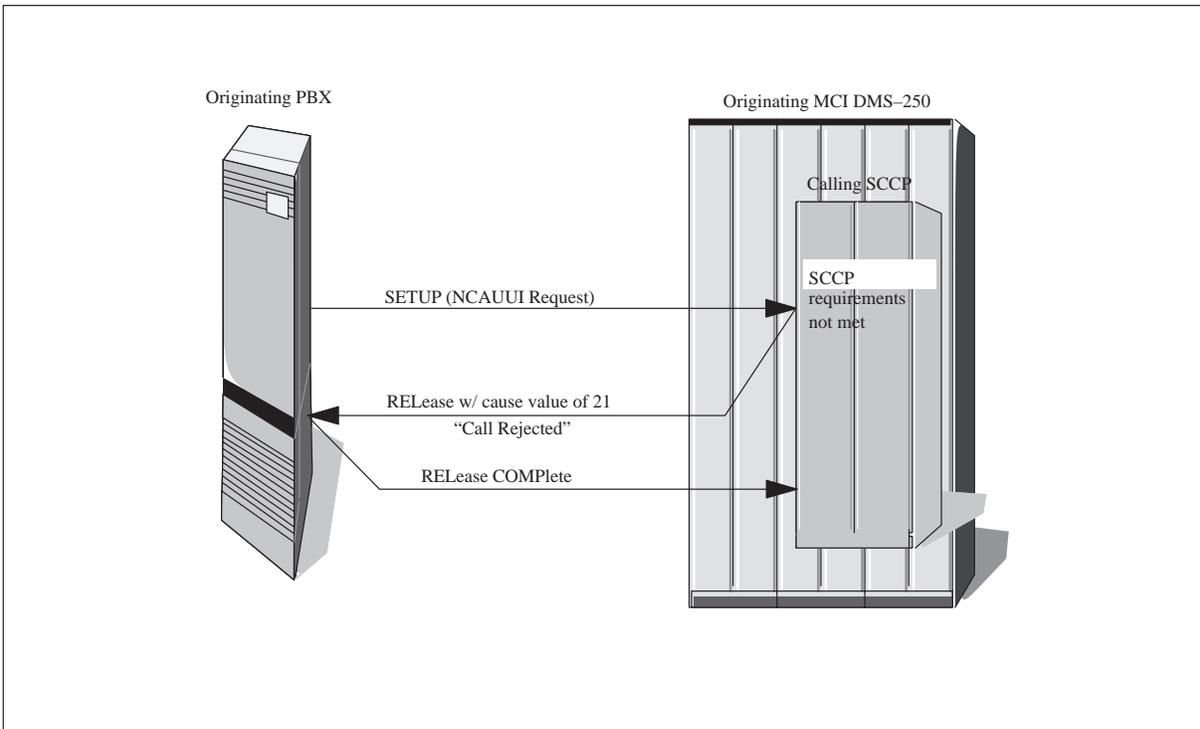### NCAUUI Invocation Rejection from the Originating SCCP

Before the calling SCCP generates and sends an SCCP Connection Request (CR) message to the terminating switch, the following criteria must be met:

- Table C7LOCSSN datafill for the local NCAUUS subsystem is present.
- Table SCCPDEST datafill for the TSID returned from the DAP is present.
- Table C7RTESET datafill for the terminating routeset for the TSID is present.
- The C7NETSSN datafill for the NCAUUS subsystem at the terminating routeset is present.
- NCAUUI Local Subsystem and Remote Subsystem is in-service.
- Remote Point Code is in-service.

- A maximum of 2048 SCCP per switch are allowed. An SCCP reference number is available.

If any one of the above criteria is not met, the originating DMS-250 switch sends a Q.931 RELease with cause value of 21 "Call Rejected" to the originating ISDN user rejecting the NCA-TSC request message.

Figure 15-7
SCCP Requirements at Originating SCCP Not Met

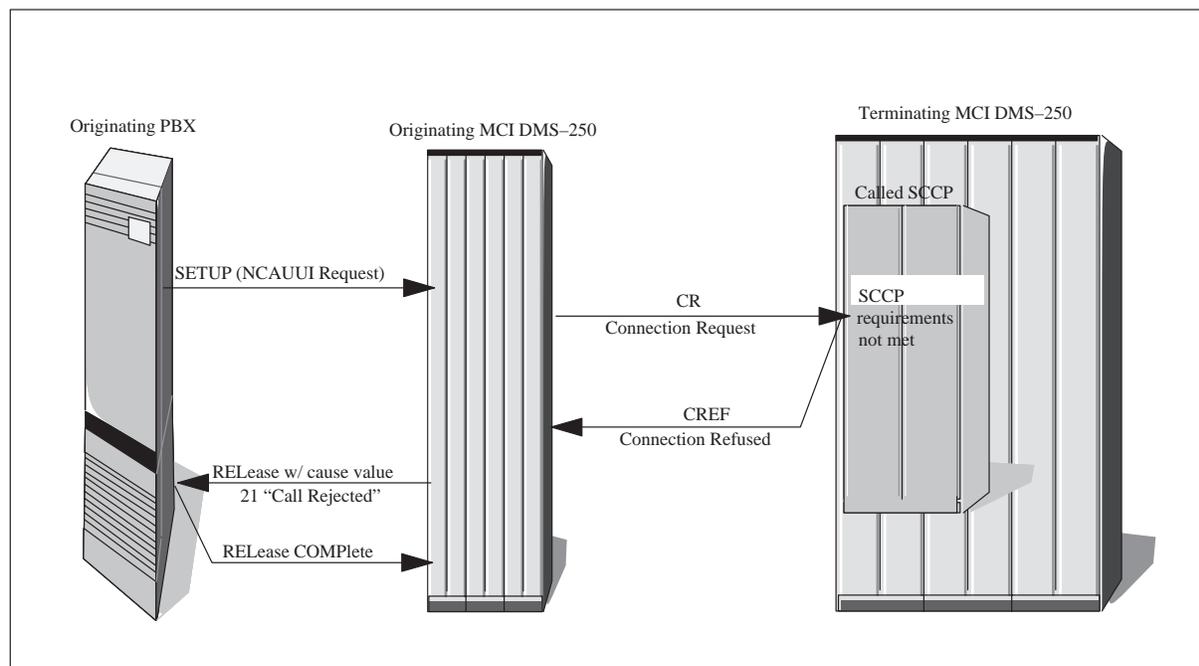### NCAUUI Invocation Rejection from the Terminating SCCP

When the called SCCP receives an SCCP CR message, the following criteria must be met before the SCCP generates and sends a Q.931 SETUP message to the terminating ISDN user:

- A maximum of 2048 SCCP per switch are allowed. An SCCP reference number must be available.

- A local NCAUUS subsystem must be in service.

- A valid routing information in SCCP Class 2 CR message.

If the above criteria is not met, the called SCCP sends an SCCP CREF message to the originating DMS-250 switch. When the originating DMS-250 switch receives the SCCP CREF message, the DMS-250 switch builds and sends a Q.931 RELease with cause value of 21 "Call Rejected"

location code of "Transit," and coding standard of "CCITT" to the
originating ISDN user.

Figure 15-8
SCCP Requirements at Terminating SCCP Not Met

NCAUUI Invocation Rejection from the Terminating DMS-250 Switch

If resources are not available at the terminating DMS-250 switch, then an
SCCP CREF message is sent to the originating DMS-250 switch. Once the
originating switch receives the SCCP CREF message, the originating switch
sends a Q.931 RELease message with a cause value of 42 "Switching
Equipment Congestion", location code of "Transit", and coding standard of
"CCITT" to the originating ISDN user.

TSC resources are busy when one of the following CC resources cannot be
allocated:

- UUS extension block
- SRU

If the originating user sends a NCAUUI request in the Q.931 SETUP
message and the terminating DMS-250 switch agency is not ISDN PRI or is
ISDN PRI that are neither NTMWCPRI or N499PRI variants, the NCAUUI
request is rejected. Also, if the originating user sends a NCAUUI request in

the Q.931 SETUP message and the terminating DMS-250 switch agency is not an in-service PRI agency, the NCAUUI request is rejected.

For both cases, the request is denied by the terminating DMS-250 switch by way of the SCCP CREF message. When the originating DMS-250 switch receives the SCCP CREF message, the DMS-250 switch builds and sends a Q.931 RELease message with cause value 21 "Call Rejected", location code of "Transit" and coding standard of "CCITT" to the originating ISDN user.

NCAUUI Invocation Rejection from the Terminating XPM

If TSCBs are not available at the terminating XPM, the terminating DMS-250 switch rejects the NCA-TSC request message by way of an SCCP CREF message. When the originating DMS-250 switch receives the SCCP CREF message, the DMS-250 switch generates and sends a Q.931 RELease message with a cause value of 42 "Switching Equipment Congestion," location code of "Transit and coding standard of "CCITT".

Transfer of User-to-User Information

After a NCA-TSC has been successfully established, User Information messages may be sent by either the originating or terminating ISDN users. After the terminating ISDN user sends the Q.931 CONNect message, the terminating user can begin sending User Information messages. The originating ISDN user can only send User Information messages after receiving the Q.931 CONNect message.

When the DMS-250 switch receives a Q.931 User Information message, the DMS-250 switch builds and sends an SCCP Data Transfer (DT1) message to the far end switch. The User-to-User Information Parameter Code of #20 in the Data Parameter field of the SCCP DT1 message indicates User-to-User Information. This message is sent by either SCCP user to transparently send user data across a signaling connection. Once the far end switch receives the SCCP DT1 message, it generates and sends a Q.931 User Information message to the far end user.

Figure 15-9
Transfer of User Information
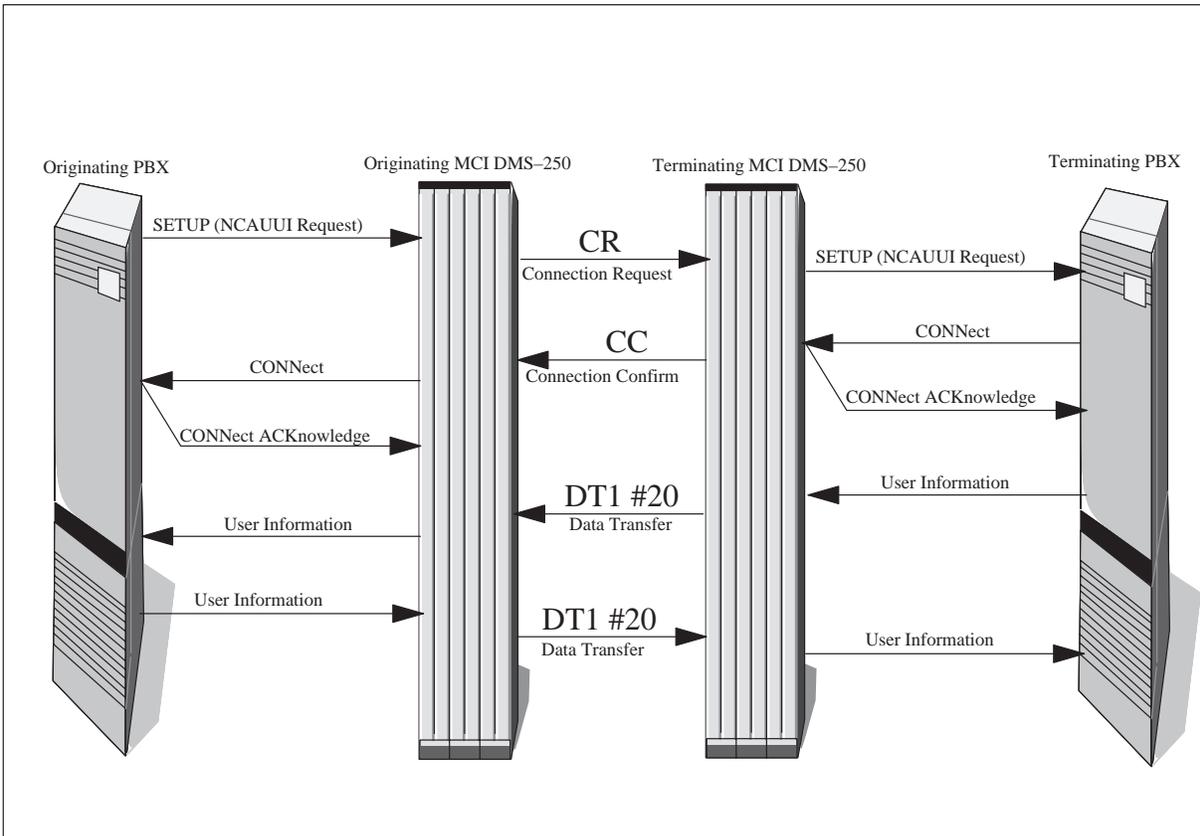
The UUI inside the Q.931 User Information messages is transported by the network without any interpretation. Any errors contained within the messages are resolved by the end users. If the length of the Q.931 User Information exceeds the maximum allowable length (251 bytes), the message is discarded. A Q.931 Status message is sent to the sender of the User Information message with a cause value of 43 "Access Information Discarded", location code of "Transit", and coding standard of "CCITT".

Note: The maximum allowable length of a UUI IE carried by a User Information message is 251 bytes. This includes the information element codepoint and length indicator. The actual payload is 249 bytes of user information. If more data is included in the ISDN User Information message, the actual payload is 248 bytes of user information.

SCCP Inactivity Timers
Two inactivity control timers, the Receive Inactivity control timer T(iarcv) and the Send Inactivity control timer T(iasend), are required at each end of the connection section.

The Send Inactivity control timer T(iasend) controls how long to wait before local connection is considered inactive. T(iasend) is default to 2 minutes. This timer is available by way of datafill in table SCCPTMR. The values for T(iasend) timer ranges from 2 to 10 minutes.

The Receive Inactivity control timer T(iarcv) controls how long to wait before remote connection is considered inactive. T(iarcv) is default to 11 minutes. This timer is available by way of datafill in table SCCPTMR. The values for T(iarcv) timer ranges from 11 to 22 minutes.

The length of the T(iarcv) timer must be longer than the length of the T(iasend).

When any SCCP Class 2 message is sent on a connection section, the T(iasend) timer is reset. When the T(iasend) timer expires, an SCCP Inactivity test (IT) message is sent on the connection section.

When any SCCP Class 2 message is received on a connection section, the T(iarcv) timer is reset. When the T(iarcv) expires, the connection release procedure is initiated on a temporary connection section.

For example, if the T(iarcv) expires at the originating DMS-250 switch, a Q.931 RELease message is sent to the originating ISDN user and an SCCP RLSD message is sent to the terminating DMS-250 switch. When the terminating DMS-250 switch receives the SCCP RLSD message, it sends an SCCP RLC message to the originating DMS-250 switch and a Q.931 RELease message to the terminating ISDN user. The end user will respond to a Q.931 RELease message with a Q.931 RELease COMPlete message.

NCAUUI Congestion and Flow Controls

NCAUUI supports two kinds of congestion control: user congestion and network congestion flow control. The PRI users that receives a Q.931 Congestion Control message cannot distinguish whether the originator of the message is the far end user or the DMS-250 switch.

When necessary, the DMS-250 switch or the end users control the transfer of User Information messages by means of a Congestion Control message. The Q.931 Congestion Control message contains a Congestion Level IE which is set to "Receiver Not Ready" indicating congestion or "Receiver Ready" indicating congestion clearing. The Q.931 Congestion Control message contain an optional Cause IE.

If a Q.931 Congestion Control message is received from the near end user, the DMS-250 switch formulates and sends an SCCP DT1 message to the far end switch. The Congestion Control Parameter Code of #F1 in the Data Parameter field of the SCCP DT1 message indicates Congestion Control.

The Data Parameter field contains a Congestion Level IE which is set to "Receiver Not Ready" indicating congestion or "Receiver Ready" indicating congestion clearing. The Data Parameter field contains a mandatory Cause IE. This cause value is received from the User or generated by the DMS-250 switch. When the far end switch receives an SCCP DT1 message with congestion information, it generates and sends a Q.931 Congestion Control message to the far end user.

Note: Flow Control of UUI messages is applied only at access egress points. No flow control is applied to the SS7 Routset.

User Flow Control
User Sending Congestion Control Message with "Receiver Not Ready"

The remote end user, upon entering congestion state, sends a Q.931 Congestion Control message containing Congestion Level IE set to "Receiver Not Ready" to the DMS-250 switch. When the DMS-250 switch receives this message, it marks the remote end user as congested. The Congestion Control message is forwarded to the far end user by the DMS-250 switch. The DMS-250 switch, serving the congested far end user, does not send User Information messages to the congested user until user congestion is cleared. The congested user continues to send User Information messages to the far end user.

User Sending Congestion Control Message with "Receiver Ready"

The remote end user, upon leaving the congestion state, sends a Q.931 Congestion Control message containing Congestion Level IE set to "Receiver Ready" to the DMS-250 switch. When the DMS-250 switch receives this message, it marks the remote end user as non-congested. The Congestion Control message may be forwarded to the far end user by the DMS-250 switch.

User Receiving Congestion Control Message with "Receiver Not Ready"

If the far end user receives a Congestion Control message with Congestion Level IE set to "Receiver Not Ready", the far end user suspends sending User Information messages. If the far end user, after receiving an indication of "Receiver Not Ready", continues to send User Information messages, the messages are discarded by the DMS-250 switch. No indication is made to the far end user that the User Information messages are discarded.

User Receiving Congestion Control Message with "Receiver Ready"

If the far end user receives a Congestion Control message with Congestion Level IE set to "Receiver Ready", the far end user resumes sending User Information messages to the remote end user.

The cause value that is received in the Q.931 Congestion Control message with "Receiver Not Ready" is the same cause value that is sent in the Q.931 Congestion Control message with "Receiver Ready"

For example, if the near end user is congested, the near end user sends a Q.931 Congestion Control message with "Receiver Not Ready" and a cause value of 42 "switch equipment congestion" to the near end switch. Once the near end switch receives the Q.931 Congestion Control message, it generates and sends an SCCP DT1 message with a Congestion Control Parameter Code of #F1 and a Congestion Level of "Receiver Not Ready" to the far end switch. When the far end receives the SCCP DT1 message, it builds and sends a Q.931 Congestion Control message with "Receiver Not Ready" and a cause value of 42 "switch equipment congestion" to the far end user.

When the near end congestion is cleared, the near end user sends a Q.931 Congestion Control message with "Receiver Ready" to the near end switch. Once the near end switch receives the Q.931 Congestion Control message, it generates and sends an SCCP DT1 message with a Congestion Control Parameter Code of #F1 and a Congestion Level of "Receiver Ready" to the far end switch. When the far end receives the SCCP DT1 message, it builds and sends a Q.931 Congestion Control message with "Receiver Ready" and a cause value of 42 "switch equipment congestion" to the far end user regardless if a cause value is received or a different cause value is received in the Q.931 Congestion Control message with "Receiver Ready".

Network Flow Control

Flow control of User Information messages at the DMS-250 switch is done using the following algorithm:

- burst parameter X, initialized to office parameter UUS_BURST
- User Information message counter N, initialized to X,
- the replenishment parameter Y, initialized to X/2,
- the DMS-250 switch timer TUUS, which is 10 seconds.

A burst capability of sending N User Information messages is immediately available to each PRI agent in each direction, . The value of N is decremented by one for each User Information message sent by the user and incremented by Y at regular interval of TUUS subject to the limitation that

N does not exceed X. If the DMS-250 switch, within the period of TUUS timer, receives more than N User Information messages, "network congestion" occurs. The network sends a Q.931 Congestion Control message to the user with Congestion Level IE set to "Receiver Not Ready" and the Cause IE set to 42 "Switching Equipment Congestion", location code set to "Transit", and coding standard set to "CCITT".

When network flow control is cleared, a Q.931 Congestion Control message is sent to the user with Congestion Level IE set to "Receiver Ready" and the Cause IE set to 42 "Switching Equipment Congestion", location code set to "Transit", and coding standard set to "CCITT".

Note: Only the end user who was previously notified of network flow control is sent a Q.931 Congestion Control message with "Receiver Ready".

User Congestion and Network Flow Control Interaction

The DMS-250 switch considers the congestion status of both end users and itself before sending or forwarding Congestion Control messages to the end users.

An end user who is to be notified that the network and/or the far end user is congested only receives one Q.931 Congestion Control message with an indication of "Receiver Not Ready" and an optional Cause IE. Once a user receives a Q.931 Congestion Control message with an indication of "Receiver Not Ready", the next Q.931 Congestion Control message for that user must have an indication of "Receiver Ready" with the optional Cause IE identical to the one received (if applicable) in the Q.931 Congestion Control message with an indication of "Receiver Not Ready".

If, for example, the access DMS-250 switch goes into "network congestion" due to congestion flow control, the originating DMS-250 switch sends the access user a Q.931 Congestion Control message with an indication of "Receiver Not Ready". At this point, the originating switch cannot receive any User Information messages from the originating ISDN user. However, the originating switch can receive User Information messages from the terminating ISDN user. Now, if the terminating ISDN user gets congested, that terminating ISDN user sends a Q.931 Congestion Control message with an indication of "Receiver Not Ready". The terminating switch sends the SCCP DT1 message with a Congestion Control Parameter Code of #F1 and a Congestion Level of "Receiver not Ready" to the access switch. The access DMS-250 switch does not forward this user generated Q.931 Congestion Control message to the access ISDN user. The congested user continues to send User Information messages to the far end user.

Conversely, the originating ISDN user is only notified of congestion clearing when both the originating DMS-250 switch and the terminating ISDN user

are ready to receive User Information messages. The originating ISDN user only receives one Q.931 Congestion Control message with an indication of "Receiver Ready". Once a user receives a Q.931 Congestion Control message with an indication of "Receiver Ready", the next Q.931 Congestion Control message for that user must have an indication of "Receiver Not Ready".

If, for example, the access DMS-250 switch remains congested and the terminating ISDN user congestion is cleared, the terminating ISDN user sends a Q.931 Congestion Control message with an indication of "Receiver Ready". Once the terminating switch receives the Congestion Control message, the terminating switch sends an SCCP DT1 message with a Congestion Control Parameter Code of #20 and a Congestion Level of "Receiver Ready" to the access DMS-250 switch. The access DMS-250 switch does not forward this user generated Q.931 Congestion Control message with "Receiver Ready" to the access ISDN user because the access DMS-250 switch is still in congestion. Once the network flow control is cleared, the access DMS-250 switch sends the Q.931 Congestion Control message with "Receiver Ready" to the access ISDN user. At this point both users can resume sending and receiving User Information messages.

Note: The DMS-250 switch only sends cause value of 42 "Switch Equipment Congestion" in the Q.931 Congestion Control message. The far end user includes any cause value in the Q.931 Congestion Control message with the limitation that some cause values are not supported for AT&T variant.

NCAUUI TSC Clearing
User Clearing

A Q.931 DISConnect, RELease, or RELease COMPlete message is utilized by either of the end users to clear a NCAUUI connection. The user that receives the Q.931 RELease message responds with a Q.931 RELease COMPlete message. A Q.931 DISConnect message is not expected since there is not a B-channel to disconnect but is honored as a valid indication of TSC clearing if received.

If the originating user clears an established NCA-TSC with a Q.931 RELease COMPlete message, the originating DMS-250 switch formulates and sends an SCCP RLSD message towards the terminating switch. Once the terminating switch receives the SCCP RLSD message, it sends an SCCP RLC message to the originating switch and a Q.931 RELease message to the terminating ISDN user. Any cause value received by the originating switch is forwarded in the SCCP RLSD message and is delivered to the terminating ISDN user in the corresponding Q.931 RELease message.

If the terminating user clears an established NCA-TSC with a Q.931 RELease or DISConnect message, the terminating DMS-250 switch formulates and sends a Q.931 RELease COMPlete message to the terminating ISDN user and an SCCP RLSD message towards the originating switch. Once the originating switch receives the SCCP RLSD message, it sends an SCCP RLC message to the terminating switch and a Q.931 RELease to the originating ISDN user. Any cause value received by the originating switch is forwarded in the SCCP RLSD message and is delivered to the originating ISDN user in the corresponding Q.931 RELease message.

Network Clearing

The network initiated Non-call associated clearing procedure is to send a Q.931 RELease message to both end users.

The office parameter, MAX_USER_INFO, defines the maximum number of User Information (i.e. UUI Information Element) that can be transported for the life of the call. The DMS-250 switch does not check the MAX_USER_INFO for NCAUUI call setup messages (i.e. Q.931 SETUP and Q.931 CONNECT). The MAX_USER_INFO is only checked by the DMS-250 switch upon receiving Q.931 USER INFORMATION message from the end user. If the number of User Information transported in both directions exceeds MAX_USER_INFO, the DMS-250 switch sends Q.931 RELEASE message with a cause value of 29 "Facility Rejected" to both end users. MAX_USER_INFO is default to 25. However, it can be up to 65,535 which is the maximum number of User Information that can be transported for the life of a NCAUUI call.

When the originating switch clears an established NCA-TSC, the originating DMS-250 switch sends a Q.931 RELease message to the originating ISDN user and an SCCP RLSD message to the terminating switch. Once the terminating switch receives an SCCP RLSD message, it sends an SCCP RLC message to the originating switch and a Q.931 RELease message to the terminating ISDN user.

When the terminating switch clears an established NCA-TSC, the terminating DMS-250 switch sends a Q.931 RELease message to the terminating ISDN user and an SCCP RLSD message to the originating switch. Once the originating switch receives an SCCP RLSD message, it sends an SCCP RLC message to the terminating switch and a Q.931 RELease message to the originating ISDN user.

Release Timers
Release Sent Timer

The T308 timer is the RELease sent timer. The default is 4 seconds. After a Q.931 RELease or DISConnect message is sent, timer T308 is started. This timer is stopped upon receiving the Q.931 RELease COMPlete. Timer T308 is datafilled in table ISDNPROT. However, datafilling timer T308 in table ISDNPROT affects all PRI calls for that protocol variant and not just NCAUUI calls.

If timer T308 expires before receiving the Q.931 RELease COMPlete message, the DMS-250 switch sends a Q.931 RELease COMPlete message to the end user that sends the Q.931 RELease COMPlete message.

T(connrel) Connection Release Timer

T(connrel) timer is the connection release timer where the DMS-250 switch is waiting to receive an SCCP RLC message. The default is 10 seconds. T(connrel) timer is started after the terminating DMS-250 switch sends the SCCP RLSD message to the originating DMS-250 switch. This timer is stopped upon receiving the SCCP RLC message. This timer is datafilled in table SCCPTMR. The T(connrel) timer has a value between 10 to 20 seconds.

If T(connrel) timer expires, the DMS-250 switch sends an SCCP RLSD message and restart T(connrel). This process continues until T(interval) expires.

DAP
All NCAUUI calls go to the DAP for translation. All NCAUUI requests are received in traditional call requests that invoke VNET or FLEXSAC processing. DAP interaction is necessary to ensure TSID and TTG are obtained from the DAP for the called party

Figure 15-10
NCAUUI and ADF Interaction
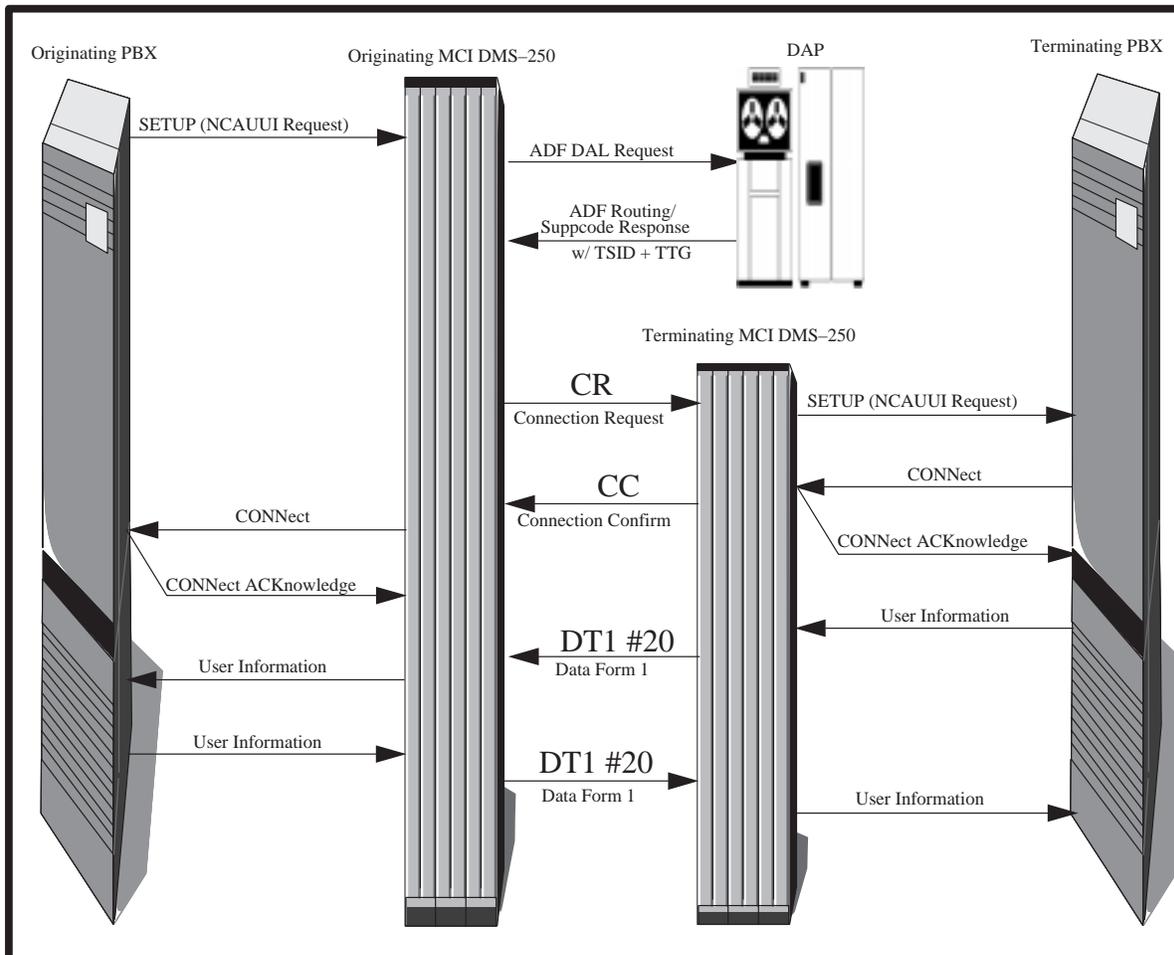
The only supported ADF request message is the DAL Call Procedure Request message and the only supported ADF response messages are the Routing Response, the Suppcode Digit Collection Response, and the Failure Response messages. All other ADF response messages other than the ones listed above are rejected. A Q.931 RELease message with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" is sent to the user who is requesting the NCAUUI service.

Only action codes 1, 2, 10, 11, 32, 33, 50, 51, 52, and 53 received in the ADF Routing Response from the DAP are supported. All NCAUUI requests that receive anything other than the above action codes from the DAP or attempt to translate in-switch are rejected. A Q.931 RELease message with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" is sent to the user who is requesting the NCAUUI service.

In the case of DAP links failure or transaction time out the second time, a Q.931 RELease message with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" is sent to the user who is requesting the NCAUUI service.

Network Transport

Network transport refers to the establishment, data transfer, and clearing of NCA-TSCs end to end from the perspective of the network. Both single switch and two-switch call scenarios must be considered.

Network Transport Using SCCP

The functions of the SCCP are performed by means of the SCCP protocol between two subsystems which provide the SCCP service to the NCAUUS Subsystem located above the SCCP layer. Within SCCP there are both connection oriented and connectionless services. This implementation uses connection-oriented class 2 service which allows for bi-directional, in-sequence transport of user-to-user messages by way of a true temporary signaling connection between two SCCP users. Since NCAUUS is a user of the SCCP, it has a recommended SSN of 72 (#48).

SCCP for NCAUUS utilizes two SCCP datafillable tables, C7NETSSN and C7LOCSSN. Since the NCAUUS subsystem only resides on CCS7 Service Switching Points (SSPs), because it is a point-to-point service, therefore not requiring datafill in the remaining SCCP tables.

NCA-TSC intranetwork setup and management functions utilizes the existing SS7 signaling link network. No voice circuits are established from the originating switch to the terminating switch. NCA-TSCs are setup from originating ISDN user to terminating ISDN user without using bearer channels at any point in the TSC path which makes this method truly a non-call associated implementation.

NCA-TSC Establishment at Originating Switch

NCAUUI is only supported for VNET and FLEXSAC call processing.

Upon receiving a Q.931 SETUP message indicating NCAUUI request, the DMS-250 switch formulates and sends an ADF DAL Request message to the DAP based on VNET or FLEXSAC call processing. Note that the ADF DAL Request message is not triggered by the setting of the Bearer Capability IE or the Channel Identification IE, the IEs used to initiate NCAUUI. Rather, it is initiated using call processing for VNET and FLEXSAC calls.

There are two conditions that determine whether a call is a VNET. First, the PRIVDIAL field in table CALLATTR must be set to NCS. Second, the

NSFDFLT in table TRKGRP is set to VNET or the NSF IE is set to NSF_PRIVATE or NSF_TIE in the Q.931 SETUP message. If the above conditions are met, the call will go to the DAP for translation.

There are also two conditions that determine whether a call is FLEXSAC. In table STDPRTCT, the PRERTSEL field must be set to SAC and the SACFEAT field must be set to either FLEXFREE or FLEXFREM. If the above conditions are met and NCS_ALLOW field in table STDPRTCT is set to "Y" then NCAUUI calls go to the DAP for routing purposes. Thus bypassing the IMMDAPREQ field in table STDPRTCT and FLEXSAC tables. If a NCAUUI call is a FLEXSAC, but NCS_ALLOW is set to "N" then NCAUUI is rejected. The originating DMS-250 switch sends a Q.931 RELease message to the originating user with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT".

Note: Digit manipulation through table DIGMAN is not supported for NCAUUI. If the SACATRIDX in table STDPRTCT points to a tuple in SACATTR that contains a non-zero DMI value then a DMI of zero is assumed and no digit manipulation is performed.

If VNET or FLEXSAC processing is not activated, the call does not go to the DAP and the NCAUUI request is rejected. The originating DMS-250 switch sends a Q.931 RELease message to the originating user with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT".

The DAP validates the ADF DAL request for NCAUUI. After the NCAUUI request is validated by the DAP, the DAP returns an ADF Routing Response or an ADF Suppcode Response message containing the subsequent address, TSID and TTG to the DMS-250 switch.
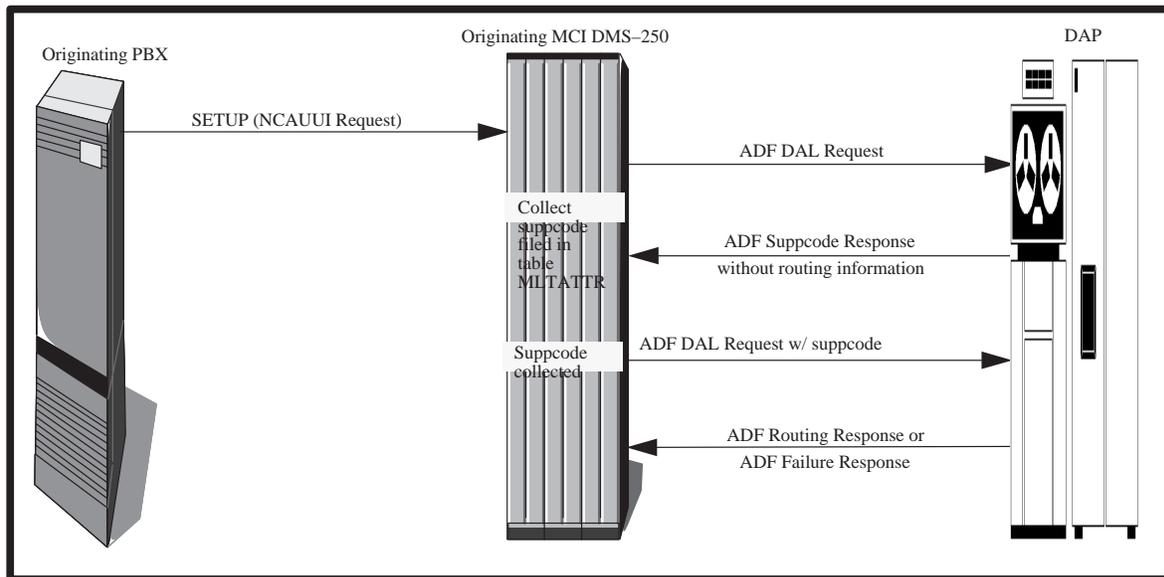
If the DAP returns an ADF Suppcode Response message without the routing information, a second request is sent to the DAP with the suppcode filed in table MLTATTR for suppcode validation. If the switch is not able to get the suppcode digits from table MLTATTR, it sends a Q.931 RELease with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" to the originating user.

The number of suppcode digits required is contained in the ADF Suppcode Response message. If the number of suppcode digits required by the Suppcode Response is greater than number of suppcode digits datafilled in table MLTATTR, the DMS-250 switch sends a Q.931 RELease with cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" to the originating user.

After the required suppcode digits are obtained, the originating DMS-250 switch sends a second ADF DAL Request with the suppcode to the DAP. If

the suppcode is valid, the DAP returns a normal routing response. Otherwise, the DAP returns an ADF Failure Response.

Figure 15-11
Suppcode Collection with DAP Validation

Only suppcodes filed in-switch in accordance with existing procedures for data calls are supported. User dialed suppcodes are not supported.

If the DAP rejects a ADF DAL request for NCAUUI, the DAP sends an ADF Failure Response message to the DMS-250 switch. The DMS-250 switch then sends a Q.931 RELease message with a cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" to the originating ISDN user.

Upon reception of a Q.931 SETUP message indicating NCAUUI and the corresponding ADF response message which contains TSID + TTG, the DMS-250 switch translates the received TSID into a destination point code using in-switch translations.

The TSID from the DAP is first checked to see if it matches the switch ID of the originating switch. If the received TSID and the switch ID of the originating switch match, then only the TTG received from the DAP is used to route the TSC. If the received TSID and the switch ID of the originating switch do not match, then table SCCPDEST is used to determine the routeset for the TSC. A new table, SCCPDEST, was implemented to map the TSID received from the DAP to a routeset for which to establish the TSC. If the TSID is not found in table SCCPDEST, the originating DMS-250 switch sends a Q.931 RELease message with a cause value of 21

"Call Rejected", location code of "Transit", and coding standard of "CCITT" to the originating ISDN user rejecting the NCA-TSC request message.

The routeset corresponding to the TSID in table SCCPDEST is used to index into tables C7RTESET and C7NETSSN. Table C7RTESET maps the routeset to a destination point code. Table C7NETSSN provides the set of remote point codes and their subsystems with which SCCP has direct routing capabilities. If the destination point code, subsystem, or subsystem number located at the remote point code corresponding to that routeset cannot be found, the originating DMS-250 switch sends a Q.931 RELease message with a cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" to the originating ISDN user rejecting the NCA-TSC request message. Only point to point signaling is supported. It is expected that TSC establishment and takedown messages is not tandemed by way of another SP/SSP in the network.

Before the originating DMS-250 switch generates and sends an SCCP CR message to the terminating DMS-250 switch, the SCCP requirements must be met. If one of the requirements is not met, the originating DMS-250 switch sends a Q.931 RELease with cause value of 21 "Call Rejected" to the originating ISDN user rejecting the NCA-TSC request message.

If the NCA-TSC request message receives a positive acknowledgment at the far end switch, the originating DMS-250 switch receives an SCCP CC message. At this point, a TSC is established from the originating switch to the terminating switch. Once the originating DMS-250 switch receives the SCCP CC message, it generates and sends a Q.931 CONNect message to the originating ISDN user to indicate positive acknowledgment of the NCA-TSC request message. After receiving the Q.931 CONNect message, the originating ISDN user begins sending User Information messages.

If the terminating switch or the terminating ISDN user rejects the TSC request, then the originating switch receives an SCCP CREF message which contains a cause value indicating the reason for rejection. This cause value is used in determining the cause value to send in the Q.931 RELease message that is sent to the originating ISDN user.

If the originating user clears an established NCA-TSC, the originating DMS-250 switch sends an SCCP RLSD message towards the terminating switch. Any cause value received by the originating switch is also forwarded in the RLSD message and is delivered to the terminating ISDN user in the corresponding Q.931 RELease message.

Note that all cause values received from the ISDN end users that require delivery to other ISDN end users are subject to the limitation that some cause values are not supported within some ISDN variants.

NCA-TSC Establishment at Terminating Switch

Upon receipt of an SCCP CR message, the terminating DMS-250 switch formulates and send a Q.931 SETUP message indicating NCAUUI to the terminating ISDN user using the TTG received in the SCCP CR message as an index into table VPNTRMRT. The subsequent address digits that were received from the DAP at the originating switch is sent as the Called Party Number parameter.

If table VPNTRMRT or subsequent tables indicate that the TTG is not a PRI agency, then the NCA-TSC request message is rejected. Also, if the TTG is a PRI agency that are neither NTMWCPRI or N449PRI variants, the NCA-TSC request message is rejected. If the TTG is not an in-service PRI agency, the NCAUUI request is also rejected. In these cases, the terminating DMS-250 switch sends an SCCP CREF message towards the originating switch effectively rejecting the NCAUUI request. Once the terminating DMS-250 switch receives the SCCP CREF message, it builds and sends a Q.931 RELease with a cause value of 21 "Call Rejected" to the originating ISDN user.

NCAUUI calls are not routed through table VPNIMTRT. For all NCAUUI calls attempting to route through table VPNIMTRT, the terminating DMS-250 switch sends an SCCP CREF message to the originating DMS-250 switch. When the originating DMS-250 switch receives the SCCP CREF message, it generates and sends a Q.931 RELease message with a cause value of 21 "Call Rejected", location code of "Transit", and coding standard of "CCITT" to the originating ISDN user rejecting the NCA-TSC request message.

If the terminating ISDN user positively acknowledges the request for NCAUUI with the Q.931 CONNect message, the terminating DMS-250 switch formulates and send a Q.931 CONNect ACKnowledgment message to the terminating ISDN user and an SCCP CC message towards the originating switch. Once the terminating user receives the Q.931 CONNect ACKnowledgment message, the terminating ISDN user may begin sending ISDN User Information messages.

If the terminating ISDN user negatively acknowledges the request for NCAUUI with the Q.931 RELease, RELease COMPlete, or DISConnect message, the DMS-250 switch sends the appropriate Q.931 message to the terminating ISDN user and send an SCCP CREF message towards the originating switch.

If the originating user clears an established NCA-TSC, the terminating DMS-250 switch receives an SCCP RLSD message. The cause value included in the originating user's Q.931 RELease message is carried in the

SCCP RLSD message. The terminating DMS-250 switch communicates this cause to the originating user in the corresponding Q.931 RELease message.

If the terminating user clears an established NCA-TSC, the DMS-250 switch formulates and sends an SCCP RLSD message towards the originating switch. Any cause value received by the terminating switch is also forwarded in the RLSD message and is delivered to the terminating ISDN user in the corresponding Q.931 message.

PRI Connected Number Transport

PRI Connected Number Transport

The PRI Connected Number Transport feature enhances the current ISDN functionality by way of support for the Connected Number information element (IE) within the following messages:

- Q.931 Connect
- Disconnect
- Release
- Release Complete

For PRI agencies, enter the datafill for the Connected Number IE with a supported action of Block (BLK) or Access Transport Parameter (ATP) as part of the Connect, Disconnect, Release and Release Complete messages in table ISDNPARM.

The DMS-250 switch transports the IE across the network in the corresponding ISUP message by way of the ISUP ATP parameter after receiving the Connected Number IE in one of the following messages:

- Q.931 Connect
- Q.931 Disconnect
- Release
- Release Complete

The above only occurs if table ISDNPARM has the ATP parameter. The Extended Peripheral Module (XPM) blocks the Connected Number IE from the supported Q.931 message if the value in table ISDNPARM is set to BLK.

Support for the Connected Number IE in the Connect, Disconnect, Release or Release Complete messages does not affect support for the Connect Number IE in the Notify message.

PRI Progress Indicator Transport

PRI Progress Indicator Transport

The PRI Progress Indicator Transport feature enhances the current ISDN functionality by supporting the progress indicator information element (IE) in the Q.931 PROGRESS message as it passes through the network. The supported protocol variants are

- NTMCIPRI (MCIPRI)

- N449(PRI (ATTPRI)

- NTNAPRI (NAPRI)

- ETSIPRI

The purpose of the progress Indicator is to describe an event that occurs during the life of the call. This feature provides the capability for the MWC DMS-250 switch to transport the progress indicator IE across the CCS7 network by way of the access transport parameter (ATP). The originating MCI DMS-250 converts the location value of the progress indicator. The LOCATION_CODE_MAPPING in the OFCOPT table is set to Y. The progress description value always maps according to the following tables. The location value of the progress indicator maps as follows.

Table 17-
Mapping of location in progress indicator at the originating switch

Value sent from terminating PRI user	Value sent to originating PRI user
0 –user	0–user
1–private network serving the local user	5–private network serving the remote user
Note: This mapping applies to PRI-to-ISUP-to-PRI scenarios.	
—continued—	

Table 17-
Mapping of location in progress indicator at the originating switch

Value sent from terminating PRI user	Value sent to originating PRI user
2–public network serving the local user	4–public network serving the remote user
3–transit network	3–transit network
4–public network serving the remote user	4–public network serving the remote user
5–private network serving the remote user	5–private network serving the remote user
6–local interface controlled by this signaling link	3–transit network
7–international network	7–international network
others	unknown
Note: This mapping applies to PRI-to-ISUP-to-PRI scenarios.	
—end—	

For Q.931 PROGRESS messages, the progress descriptions are mapped as shown in the following tables.

Table 17-
Mapping of progress description in progress indicator for MCIPRI and NAPRI originations

Value sent from terminating PRI user (ATTPRI, MCIPRI, NAPRI)	Value sent to originating PRI user (MCIPRI, NAPRI)
1–call is not end-to-end ISDN; further call progress information may be available in-band	1–call is not end-to-end ISDN; further call progress information may be available in-band
2–destination address is non ISDN	2–destination address is non ISDN
3–origination address is non ISDN	3–origination address is non ISDN
4–call has returned to the ISDN	4–call has returned to the ISDN
Note: This mapping applies to PRI-to-ISUP-to-PRI scenarios.	

Table 17-
Mapping of progress description in progress indicator for MCIPRI and NAPRI originations

Value sent from terminating PRI user (ATTPRI, MCIPRI, NAPRI)	Value sent to originating PRI user (MCIPRI, NAPRI)
8–in-band information or an appropriate pattern is now available	8–in-band information or an appropriate pattern is now available
Note: This mapping applies to PRI-to-ISUP-to-PRI scenarios.	

Table 6-1   Mapping of progress description in progress indicator for ATTPRI originations

Value sent from terminating PRI user (ATTPRI, MCIPRI, NAPRI)	Value sent to originating PRI user (ATTPRI)
1–call is not end-to-end ISDN; further call progress information may be available in-band	1–call is not end-to-end ISDN; further call progress information may be available in-band
2–destination address is non ISDN	1–call is not end-to-end ISDN; further call progress information may be available in-band
3–origination address is non ISDN	1–call is not end-to-end ISDN; further call progress information may be available in-band
4–call has returned to the ISDN	1–call is not end-to-end ISDN; further call progress information may be available in-band
8–in-band information or an appropriate pattern is now available	8–in-band information or an appropriate pattern is now available
Note: This mapping applies to PRI-to-ISUP-to-PRI scenarios.	

Table 17-
Mapping of progress description in progress indicator for ETSIPRI originations

Value sent from terminating PRI user (ATTPRI, MCIPRI, NAPRI)	Value sent to originating PRI user (ETSIPRI)
1–call is not end-to-end ISDN; further call progress information may be available in-band	1–call is not end-to-end ISDN; further call progress information may be available in-band
2–destination address is non ISDN	2–destination address is non ISDN
3–origination address is non ISDN	3–origination address is non ISDN
4–call has returned to the ISDN	4–call has returned to the ISDN
8–in-band information or an appropriate pattern is now available	8–in-band information or an appropriate pattern is now available
Note: This mapping applies to PRI-to-ISUP-to-PRI scenarios.	

Processing scenarios for backward call indicators

The following scenarios use the Backward Call Indicators of an ISUP ACM to determine the type of Q.931 message to send.

Scenario 1: PRI-to-ISUP-to-PRI

The originator for this scenario is a PRI trunk. The originator interworks with an ISUP trunk, which interworks with a PRI terminator.

The following scenario indicates this PRI-to-ISUP-to-PRI mapping.

Table 17-4
Scenario 1: Parameter field mapping for PRI-to-ISUP-to-PRI

Calling user/network	Network	Called user/network
PROGRESS	ACM	PROGRESS
progress indicator	DC=00 no indication	progress indicator
progress description=#1 (see note)	I=0 no interworking encountered	progress description=#1 (see note), call is not end-to-end ISDN
Note: The progress description values of 2, 3, 4, or 8 set the four fields of the backward call indicators of the ISUP ACM message in the same way.		

Table 17-4
Scenario 1: Parameter field mapping for PRI-to-ISUP-to-PRI

Calling user/network	Network	Called user/network
	K=1 uses ISUP end-to-end	
	M=1 terminating access ISDN	
	ATP carries progress indicator	
Note: The progress description values of 2, 3, 4, or 8 set the four fields of the backward call indicators of the ISUP ACM message in the same way.		

Scenario 2: PRI to ISUP to PTS

The originator for this scenario is a PRI trunk. This originator interworks with an ISUP trunk, which interworks with a PTS trunk.

Table 17-
Scenario 2: Parameter field mapping for PRI-to-ISUP-to-PTS

Calling user/network	Network	Called user/network
ALERTING	ACM	n/a
progress indicator	backward call indicators	no mapping applied
progress description=#1	DC=01 subscriber free	
	I=1 interworking encountered	
	K=0 uses ISUP end to end	
	M=0 terminating access non ISDN	
Note: This scenario does not comply with the ANSI TI.607 standard.		

Scenario 3: PTS to ISUP to PRI

The originator for this scenario is a PTS trunk. This originator interworks with an ISUP trunk, which interworks with a PRI terminator.

Table 17-
Scenario 3: Parameter field mapping for PTS to ISUP to PRI

Calling user/network	Network	Called user/network
n/a	ACM	ALERTING
no mapping applied	backward call indicators	no progress indicator
	DC=01 subscriber free	
	I=0 no interworking encountered	
	K=1 uses ISUP end to end	
	M=1 terminating access ISDN	
n/a	ACM	PROGRESS
no mapping applied	backward call indicators	progress indicator
	DC=00 no indication	progress description=#8, in-band information or an appropriate pattern is available
	I=0 no interworking encountered	
	K=1 uses ISUP end to end	
	M=1 terminating access ISDN	
	ATP carries progress indicator	
—end—		

Scenario 4: PRI-to-ISUP-to-PRI

The originator for this scenario is a PRI trunk. This originator interworks with an ISUP trunk, which interworks with a PRI terminator.

Table 6-2
Scenario 4: Parameter field mapping for PRI-to-ISUP-to-PRI

Calling user/network	Network	Called user/network
CONNECT	ANM	CONNECT
no mapping applied	backward call indicators	no progress indicator
	DC=01 subscriber free	
	I=0 no interworking encountered	
	K=1 uses ISUP end to end	
	M=1 terminating access ISDN	

Scenario 5: PRI-to-ISUP-to-PRI

The originator for this scenario is a PRI trunk. This originator interworks with an ISUP trunk, which interworks with a PRI terminator.

Table 17-
Scenario 5: Parameter field mapping for PRI-to-ISUP-to-PRI

Calling user/network	Network	Called user/network
CONNECT	ANM	CONNECT
progress indicator	backward call indicators	progress indicator
progress description=#1 (see note) Call is not end-to-end ISDN	DC=01 subscriber free	progress description=#1 (see note) Call is not end-to-end ISDN
	I=0 no interworking encountered	
Note: The progress description values of 2, 3, 4, or 8 set the four fields of the backward call indicators of the ISUP ACM message in the same way.		

Table 17-
Scenario 5: Parameter field mapping for PRI-to-ISUP-to-PRI

Calling user/network	Network	Called user/network
	K=1 uses ISUP end to end	
	M=1 terminating access ISDN	
Note: The progress description values of 2, 3, 4, or 8 set the four fields of the backward call indicators of the ISUP ACM message in the same way.		

Scenario 6: PRI-to-ISUP-to-ISUP

The originator for this scenario is a PRI trunk. This originator interworks with an ISUP trunk, which interworks with an ISUP terminator.

Table 17-
Scenario 6: Parameter field mapping for PRI to ISUP to ISUP

Calling user/network	Network	Called user/network
PROGRESS	ACM	ACM
progress indicator as received in ATP with location mapping	backward call indicators	backward call indicators
	DC=00 no indication	DC=00 no indication
	I=0 no interworking encountered	I=0 no interworking encountered
	K=1 uses ISUP end to end	K=1 uses ISUP end to end
Note: A fast answer scenario would also behave in the same manner as this scenario.		
—continued—		

Table 17-
Scenario 6: Parameter field mapping for PRI to ISUP to ISUP (continued)

Calling user/network	Network	Called user/network
	M=1 terminating access ISDN	M=1 terminating access ISDN
	ATP carries progress indicator	ATP carries progress indicator
Note: A fast answer scenario would also behave in the same manner as this scenario.		
—end—		

Migration strategy

To convert the switches from MCI16 or MCI17 to MCI18, the office parameter ATP_PROGRESS_IND in the OFCOPT table is set to N when the ONP is complete for MCI18. The parameter remains set to N until all switches convert to MCI18. At that time, the office parameter changes to Y. The office parameter allows you to turn the feature off and on by changing the datafill. Until all switches convert to MCI18, the code for patch BAV40 needs to be active.

For MCI18, Nortel Networks will support both the patch and the feature functionality to avoid any migration issues and help prevent the need to convert all switches at once.

To turn the feature on, proceed as follows:

* Change the setting of ATP_PROGRESS_IND to Y.

* Enter the datafill into the default action of the CONNECT message in ISDNPARM to ATP.

This process transports the progress indicator in a PRI to PRI scenario without the location mapping.

Feature impact

The restrictions and limitations of this feature are as follows:

* A progress indicator received in a Q.931 ALERTING, DISCONNECT, or SETUP message does not transport through the network in the ATP.

* A progress indicator received in a Q.931 CONNECT message transports through the ATP of an ISUP ANM. To transport this progress indicator, you must enter the datafill with a default action of ATP for the Q.931 CONNECT message in the ISDNPARM table

- This feature does not affect any existing functionality of incoming and outgoing Q.931 PROGRESS messages.

- Due to the specific functionality of the Q.931 PROGRESS message, the ISDNPARM table cannot control this portion of the feature.

- You can only turn this feature on if the office parameter ATP_PROGRESS_IND in the OFCOPT table is set to Y.

- The ISUP ACM and ISUP ANM are the only two ISUP messages that support the transport of the progress indicator through the ISUP ATP.

MAUUI Over Release Message for NCAUUI

Feature Description

The MAUUI Over Release Message for NCAUUI feature expands the NCAUUI functionality to allow MAUUI to be delivered in the first call clearing message prior to a Q.931 CONNect message. Only the NTMCIPRI (MCI PRI) and N449PRI (AT&T) variant egress and access points are supported.

MAUUI TSC clearing for NCAUUI

Single Switch Scenario

NCAUUI for a single switch scenario allows PRI users located on the same MWC DMS-250 to communicate by means of user-to-user signaling without setting up a circuit-switched (bearer/voice channel) connection.

Backward Clearing Single Switch Scenario 1

The following figure shows how the terminating user releases an NCAUUI call using a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in this message and the UUI request is delivered to the originating user.

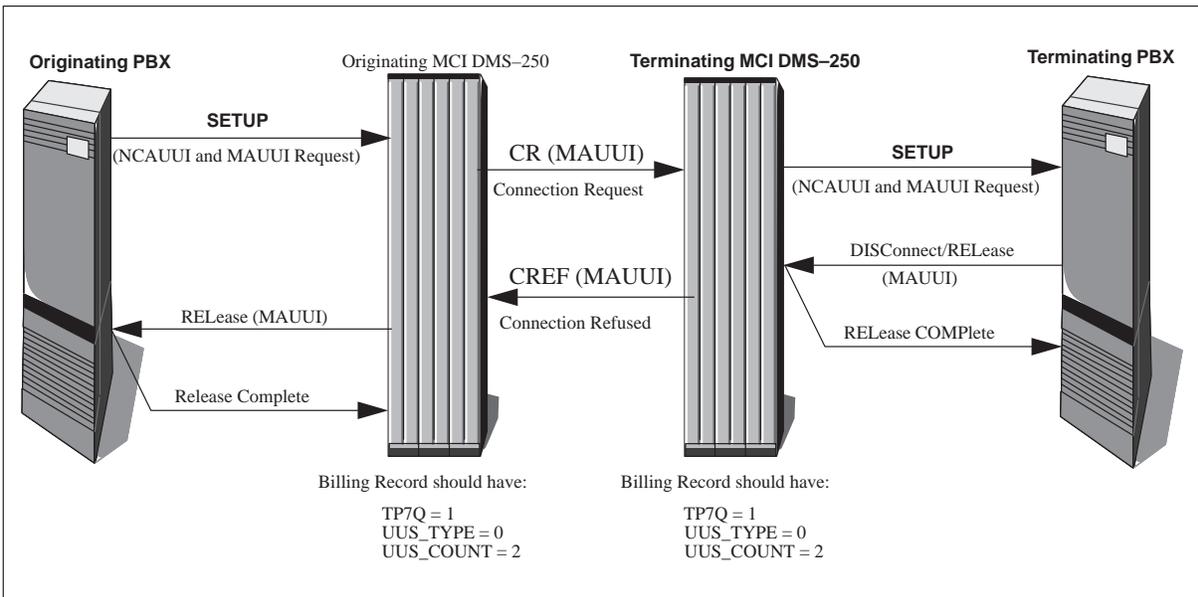**Figure 18-1**
Backward Clearing Single Switch Scenario 1
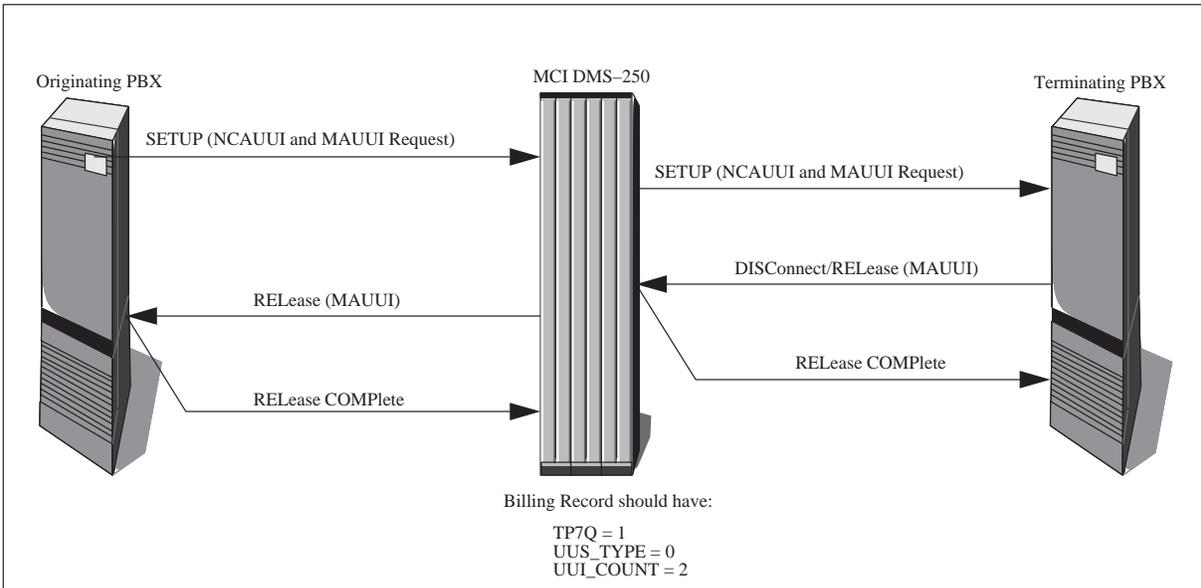
Backward Clearing Single Switch Scenario 2

The following figure shows how the terminating user releases an NCAUUI call using a Q.931 RELease COMPlete message before an NCAUUI call is connected. A UUI request is included in the message, and the UUI request is delivered to the originating user.

Figure 18-2
Backward Clearing Single Switch Scenario 2
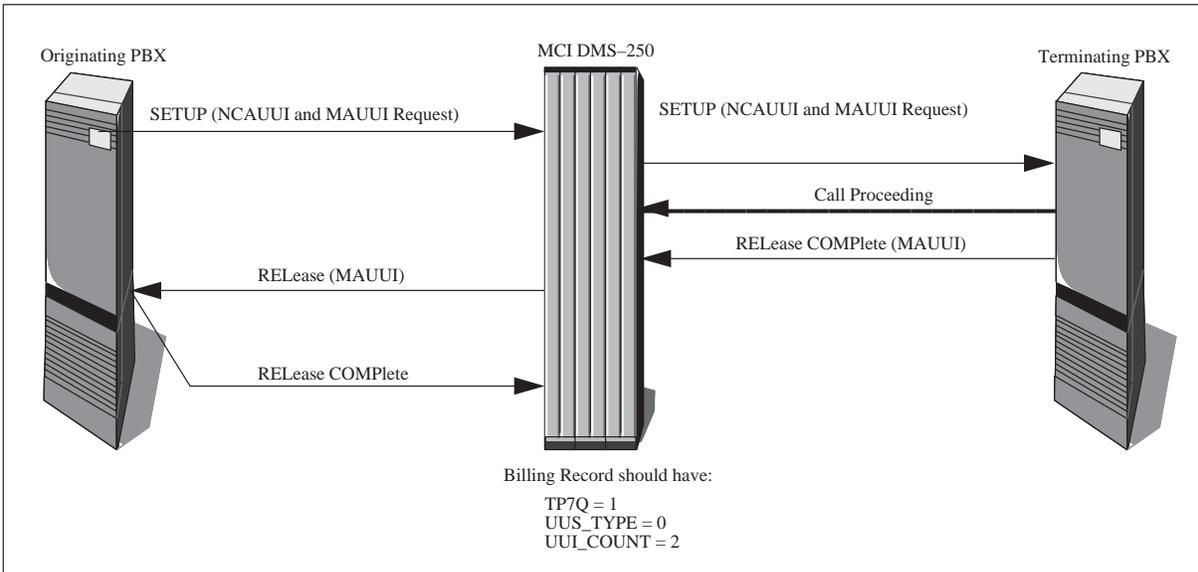
Originating PBX

MCI DMS–250

Terminating PBX

SETUP (NCAUUI and MAUUI Request)

SETUP (NCAUUI and MAUUI Request)

Call Proceeding

RELease COMPlete (MAUUI)

RELease (MAUUI)

RELease COMPlete

Billing Record should have:

TP7Q = 1
UUS_TYPE = 0
UUI_COUNT = 2

Forward Clearing Single Switch Scenario 1

The following figure shows how the originating user clears an NCAUUI call using a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in this message and the UUI request is delivered to the terminating user.

Figure 18-3
Forward Clearing Single Switch Scenario 1
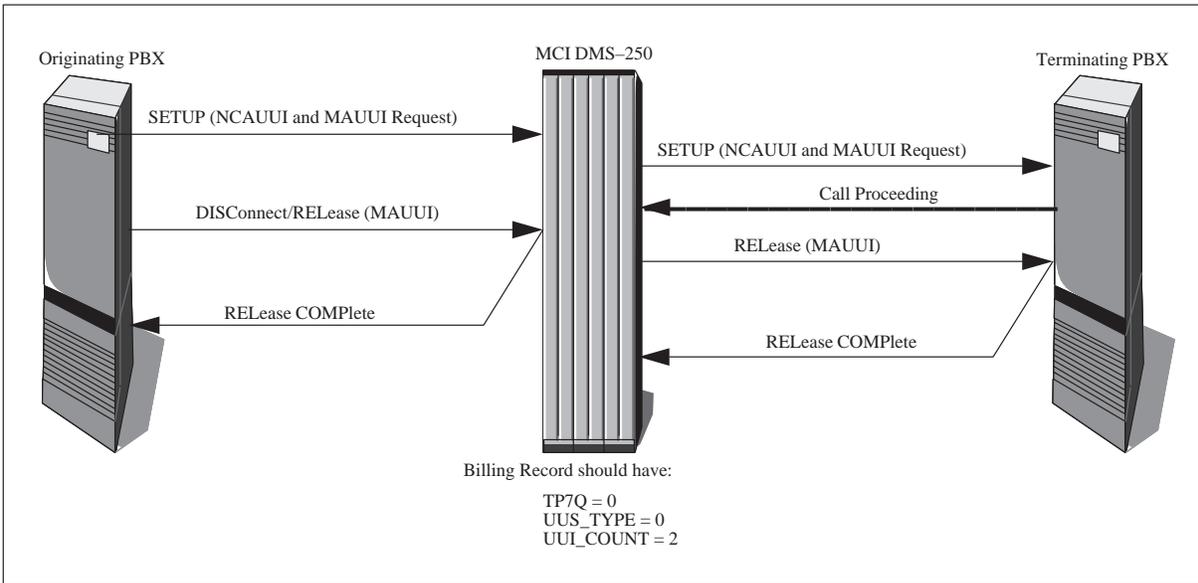
Originating PBX   MCI DMS–250   Terminating PBX

SETUP (NCAUUI and MAUUI Request)

SETUP (NCAUUI and MAUUI Request)

Call Proceeding

DISConnect/RELease (MAUUI)

RELease (MAUUI)

RELease COMPlete

RELease COMPlete

Billing Record should have:

TP7Q = 0
UUS_TYPE = 0
UUI_COUNT = 2

Forward Clearing Single Switch Scenario 2

The following figure shows how the originating user clears an NCAUUI call using a Q.931 RELease COMPlete message before an NCAUUI call is connected. A UUI request is included in this message and the UUI request is delivered to the terminating user.

Figure 18-4
Forward Clearing Single Switch Scenario 2

Originating PBX   MCI DMS–250   Terminating PBX

SETUP (NCAUUI and MAUUI Request)

SETUP (NCAUUI and MAUUI Request)

RELease COMPlete (MAUUI)

Call Proceeding

RELease (MAUUI)

RELease COMPlete

Billing Record should have:

TP7Q = 0
UUS_TYPE = 0
UUI_COUNT = 2
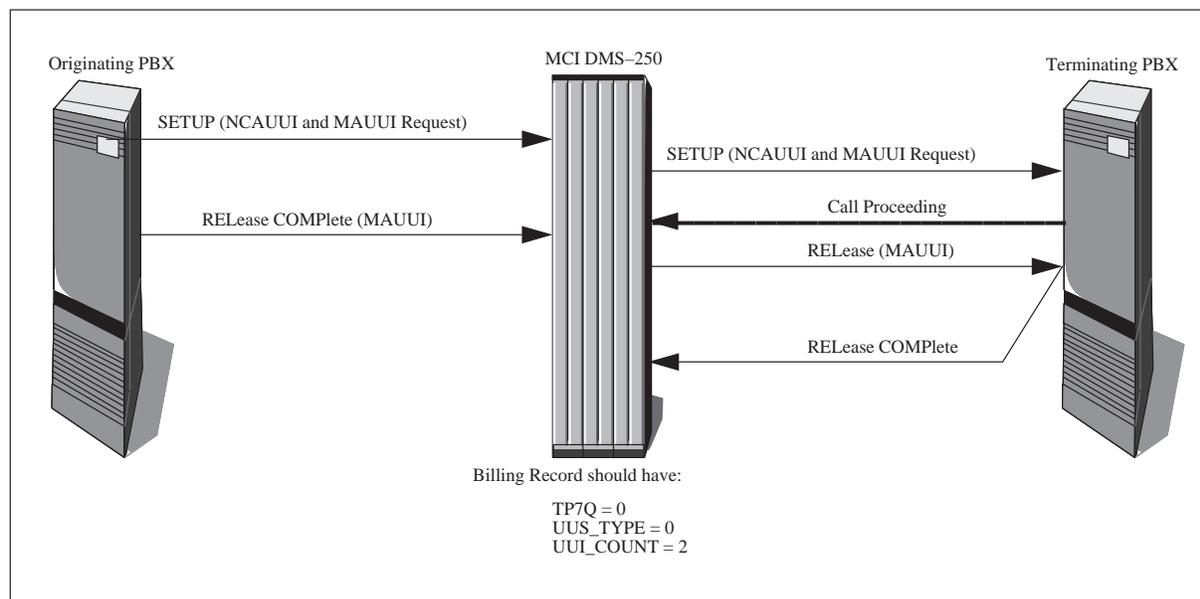
Two Switch Scenario

NCAUUI allows PRI users located on different switches to communicate by means of User Information messages without setting up a circuit-switched connection.

For the PRI interface, the user-to-user signaling messages are carried over the D-channel. For the SS7 interface, the user-to-user signaling messages are carried over the SS7 signaling link using SCCP.

Backward Clearing Two Switch Scenario 1

The following figure shows how the terminating user releases an NCAUUI call using a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in this message and the UUI request is delivered to the originating MWC DMS-250.

Figure 18-5
Backward Clearing Two Switch Scenario 1

Backward Clearing Two Switch Scenario 2

The following figure shows how the terminating user releases an NCAUUI call using a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in this message, but the UUI request is not delivered to the originating MWC DMS-250. A UUI request is not delivered because the UUI request cannot be accomadated in the data parameter of the SCCP CREF message.

Figure 18-6
Backward Clearing Two Switch Scenario 2
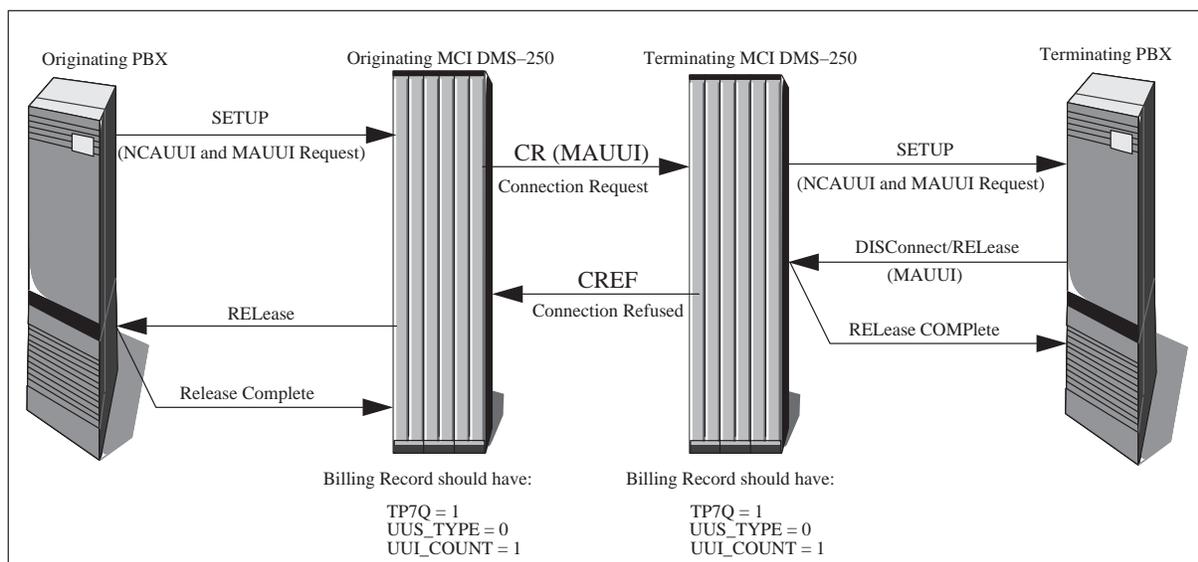
Backward Clearing Two Switch Scenario 3

The following figure shows the scenario in which the SCCP CR message does not contain the UUI request because the Data Parameter of the SCCP Connection Request (CR) message cannot accomadate the UUI request. MAUUI service is not activated at the terminating MWC DMS-250. When the terminating user releases the NCAUUI call using a Q.931 DISConnect message or Q.931 RELease message with the UUI request present, the UUI request is discarded at the terminating MWC DMS-250 switch since MAUUI service is not activated at this switch.

Figure 18-7
Backward Clearing Two Switch Scenario 3
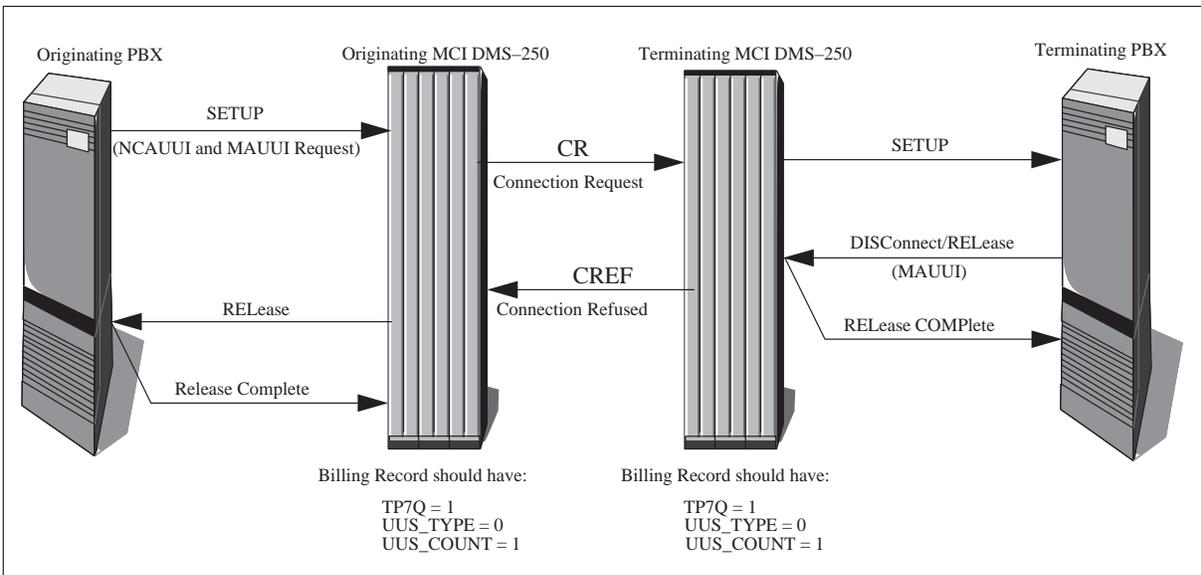
Note: The UUIE_COUNT is set to 1 at both originating and terminating MWC DMS-250 if no User Information is transferred for Non-Call Associated Temporary Signaling Connection (NCA-TSC).

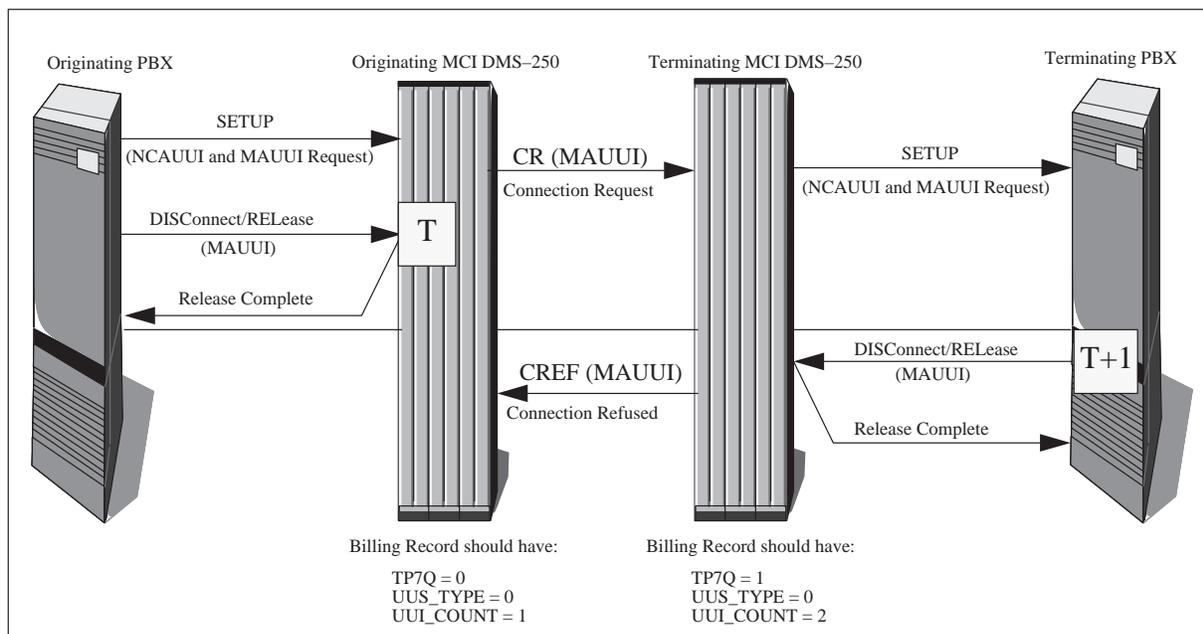### Forward Clearing Two Switch Scenario 1

The following figure shows how the originating user clears an NCAUUI call with a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in this message, but the UUI request is not delivered to the terminating MWC DMS-250 switch. The billing field, UUIE_COUNT is not incremented at the originating and terminating switch.

Figure 18-8
Forward Clearing Two Switch Scenario 1
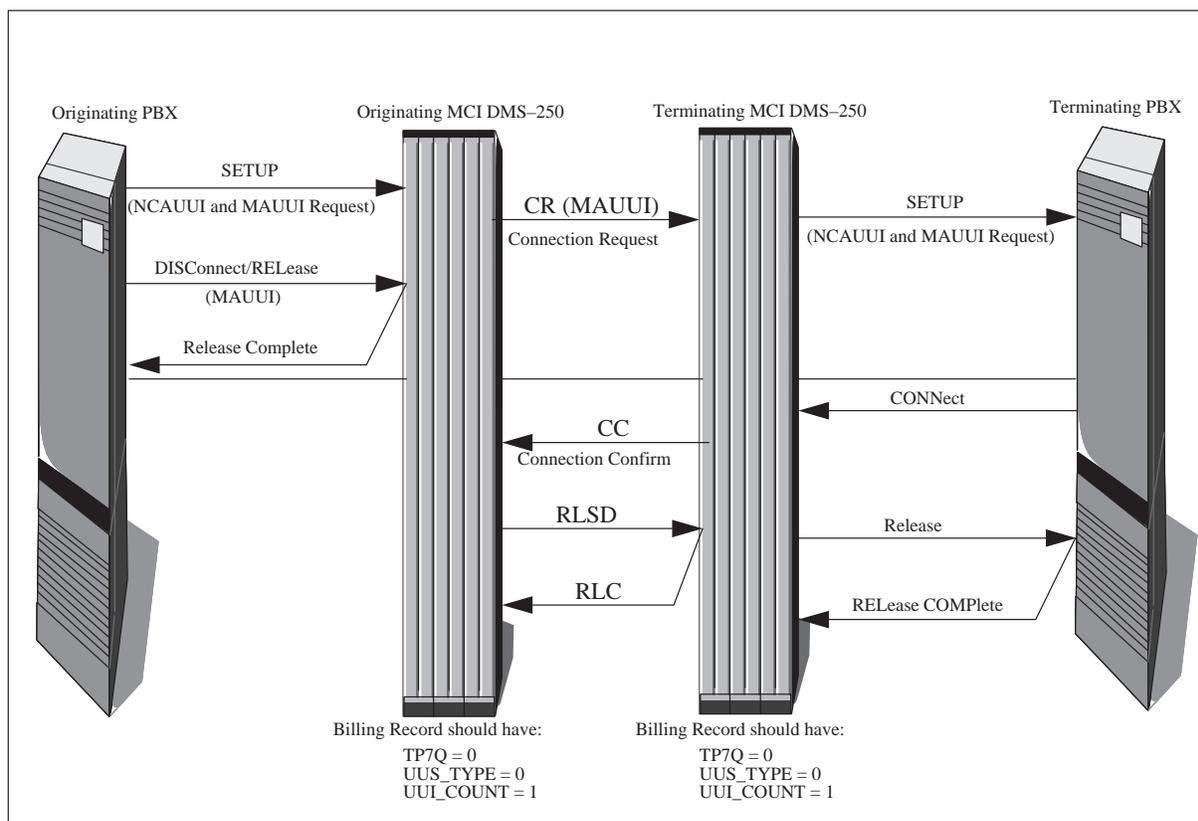
Note: Regardless of what cause value the PRI originator sends, the PRI terminator receives a cause value of 95 (call rejected).

Forward Clearing Two Switch Scenario 2

The following figure shows how the originating user clears an NCAUUI call using a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in the message, but the UUI request is not delivered to the terminating MWC DMS-250, and the billing field, UUIE_COUNT, is not incremented for this message.

The terminating user then sends a Q.931 CONNect message to the terminating MWC DMS-250 switch. A UUI request is included in the message and it is delivered to the originating MWC DMS-250. The billing field, UUI_COUNT, is incremented at the terminating MWC DMS-250 switch. When the originating DMS-250 receives the Connection Confirm (CC) message, it sends the SCCP RLSD message to the terminating MWC DMS-250 switch to release the call since the originating MWC DMS-250 switch releases the call.

Figure 18-9
Forward Clearing Two Switch Scenario 2
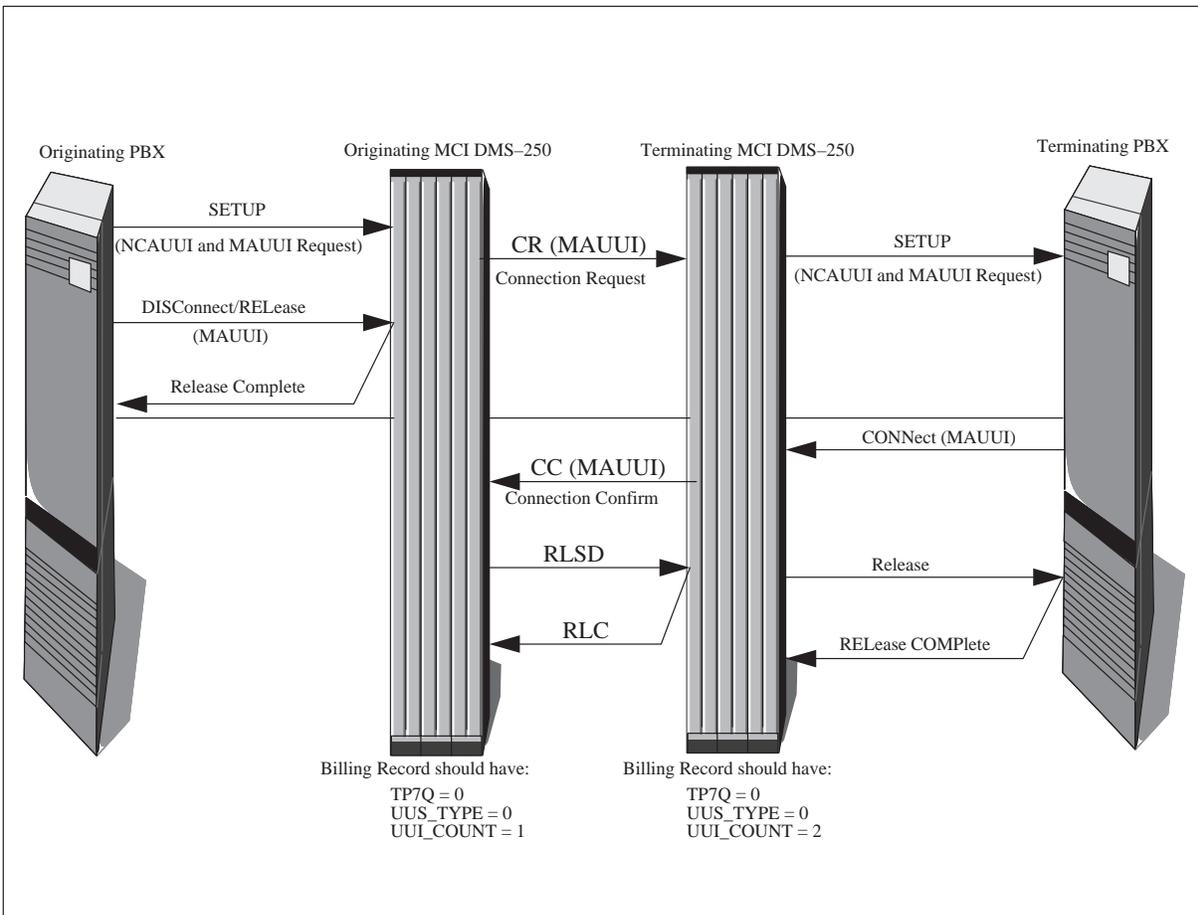
Forward Clearing Two Switch Scenario 3

The following figure shows how the the originating user clears an NCAUUI call at time T by way of a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in the message, but is not delivered to the terminating MWC DMS-250 switch. The billing field, UUIE_COUNT is not incremented for this message.

The following diagram shows the scenario where the originating user sends a Q.931 SETUP message that contains the UUI request and then clears an NCAUUI call by way of a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in the message, but it is not delivered to the terminating MWC DMS-250. The billing field, UUIE_COUNT, is not incremented for this message.

The terminating user upon receiving a Q.931 SETUP message that contains the UUI request, releases an NCAUUI call by way of a Q.931 DISConnect message or a Q.931 RELease message before an NCAUUI call is connected. A UUI request is included in the message and it is delivered to the originating MWC DMS-250. The billing field, UUI_COUNT, is incremented at the terminating DMS-250 for this message. When the originating MWC DMS-250 receives the SCCP CREF message, the originating DMS-250 clears the SCCP resources associated with the SCCP connection section. The UUI request is not delivered to the originating user since the originating MWC DMS-250 releases the call.

Figure 18-10
Forward Clearing Two Switch Scenario 3

Originating PBX   Originating MCI DMS–250   Terminating MCI DMS–250   Terminating PBX

SETUP
(NCAUUI and MAUUI Request)

CR (MAUUI)
Connection Request

SETUP
(NCAUUI and MAUUI Request)

DISConnect/RELease
(MAUUI)

T

Release Complete

CREF (MAUUI)
Connection Refused

DISConnect/RELease
(MAUUI)

T+1

Release Complete

Billing Record should have:

    TP7Q = 0
    UUS_TYPE = 0
    UUI_COUNT = 1

Billing Record should have:

    TP7Q = 1
    UUS_TYPE = 0
    UUI_COUNT = 2

Billing

Billing utilizes the existing NCAUUI fields and procedures implemented in MCI15. The only exception to this is setting the TP7Q field before the Q.931 CONNect. TP7Q is set to 1 if TSC is released by the called party and set to 0 if TSC is cleared by the calling party. TP7Q is not set to 7 if the UUI request is included in the first call clearing message prior to a Q.931 CONNect message since the UUIE Count equals a multiple of 4096.

MAUUI in First Call Clearing Message Before Connect

Feature synopsis

The functionality introduced by this feature allows User-to-User Information (UUI) to be transported in the first call clearing message received before an answer indication is received by the originating agent. In particular, this feature allows the UUI information element (IE) received in the first call clearing message from the terminating agent to be transported to the originating agent prior to the originating agent receiving an answer indication.

Functional overview

The MAUUI in First Call Clearing Message Before Connect feature allows the terminating agent to send the UUI to the originating agent in the first call clearing message before the originating agent receives an answer indication. In order for the functionality implemented by this feature to be used, the following conditions must be met:

- The originating agent supports MAUUI functionality. The following originating agents are supported: ISDN PRI (specifically the NTMCIPRI, N449PRI, and NTNAPRI variants), ISUP IMT, and ISUP RSLR (STD, OPT1, and OPT2).

- The terminating agent supports MAUUI functionality. The following terminating agents are supported: ISDN PRI (specifically the NTMCIPRI, N449PRI, and NTNAPRI variants), ISUP IMT, ISUP FGD, and ISUP RSLR (STD, OPT1, and OPT2).

- The originating agent sends the UUI in the call setup message (IAM or Q.931 SETUP) and the UUI is delivered to the terminating agent in the call setup message (IAM or Q.931 SETUP). If the originator is a PRI agent, the originator subscribes to the MAUUI functionality by way of table LTDATA.

- The first call clearing message from the terminating agent is received before the terminating agent answers the call or the originating agent receives an answer indication (i.e. An ISUP ANM or Q.931 Connect).

- MAUUI is invoked on a call by way of the call setup message in order for any other call control messages to contain UUI for transport. If UUI is not sent in the call setup message, the UUI received in any other call control messages is discarded.

Feature description

Currently for voice calls, if the originating agent disconnects the call by sending UUI in the first forward clearing message to the terminating agent before the call is answered, the UUI is transported to the terminating agent without being discarded. This feature focuses on how the terminating agent transports the UUI to the originating agent in the first call clearing message before the originating agent receives an answer indication.

For cases where the first call clearing message is passed directly to the originator without tones or announcements, the UUI from the received call clearing message from the terminating agent is sent out in the first call clearing message to the originating agent. If the first call clearing message received from the terminating agent causes tones or announcements to be set, table 18-1 shows how the UUI functions based on the last message delivered to the originating agent:

Table 19-1
UUI Functionality

If	Then
The call clearing message with UUI received before ACM/alerting delivered.	The UUI in the call clearing message is transported to the originating agent in the backwards ISUP ACM or Q.931 Progress messages. The messages are used to establish the voice path for the tones or announcements.
The call clearing message with UUI received after ACM/alerting delivered.	The UUI is transported in the backwards ISUP CPG or Q.931 Progress message before the tones or announcements are applied.
The call clearing message with UUI received after ANM/connect delivered.	Current functionality does not deliver UUI on calls that result in tones or announcements after answer indication is received. This functionality is not being changed by this feature but is included for completeness.
—end—	

The following sections concentrate on three different call originator-terminator combinations and the resulting basic scenarios that can arise with the new functionality in place. The combinations are as follows:

- PRI originator to PRI terminator scenarios

- ISUP originator to ISUP terminator scenarios

- PRI originator to ISUP terminator and ISUP originator to PRI terminator scenarios

- Network Scenarios

PRI–PRI scenarios

PRI-PRI Call Clearing Received before Alerting

There are two scenarios concerning User-to-User Interface (UUI) delivery in a call clearing message before the terminator sends an indication of alerting before answer. In the first scenario, the originating PRI agent includes UUI in the Q.931 Setup message to invoke the MAUUI service. The Q.931 Setup message with UUI is sent to the terminating PRI agent. The terminating PRI agent responds to this message with a Q.931 DISConnect message with

UUI. If treatment is not to be applied at this switch, the UUI is transported to the originating PRI agent in the corresponding Q.931 DISConnect message.

The following diagram shows the PRI to PRI call clearing before alerting without treatment applied.

Figure 19-1
PRI-PRI Call Clearing before Alerting when Treatment not Applied
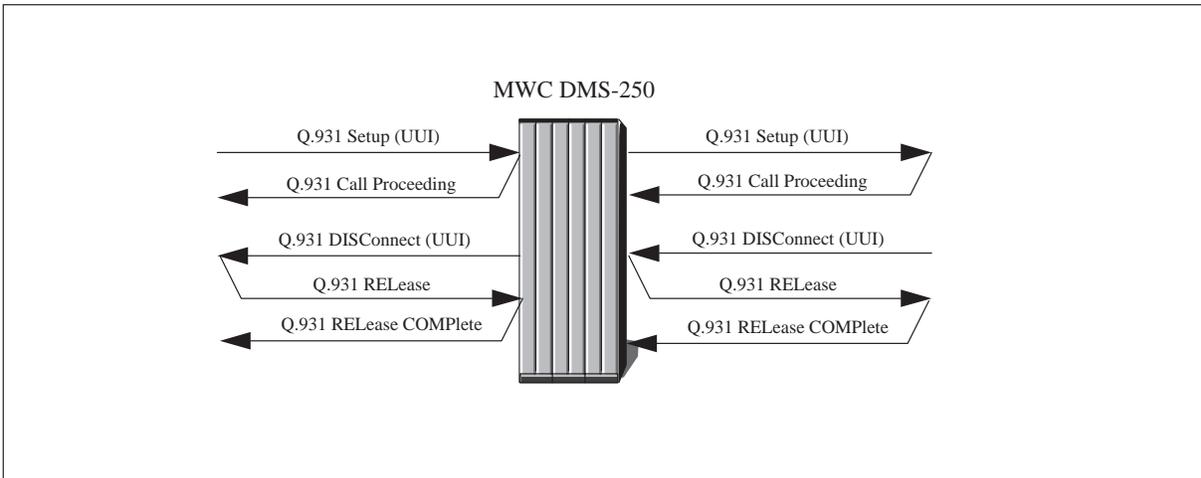
The following scenario is similar to the first scenario except that treatment is to be applied at this switch. The UUI from the received call clearing message is copied into the Q.931 Progress message. The UUI is used to establish the voice path and is transported to the originating PRI agent before the treatment is applied.

Figure 19-2
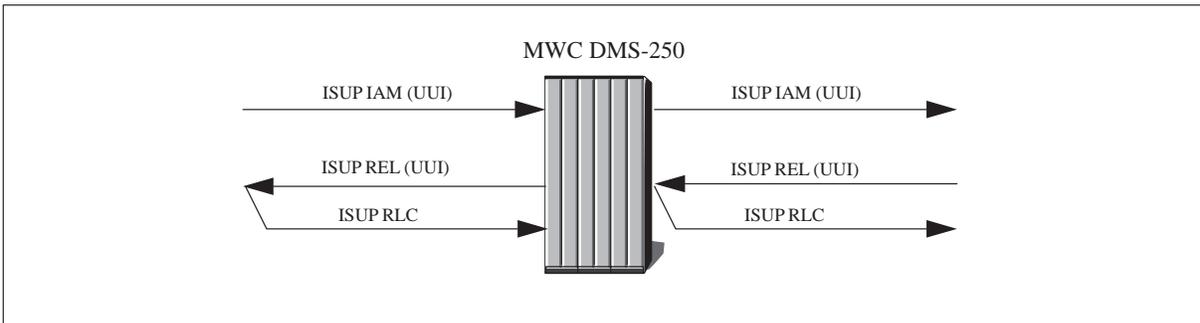**PRI–PRI Call Clearing before Alerting when Treatment Applied**
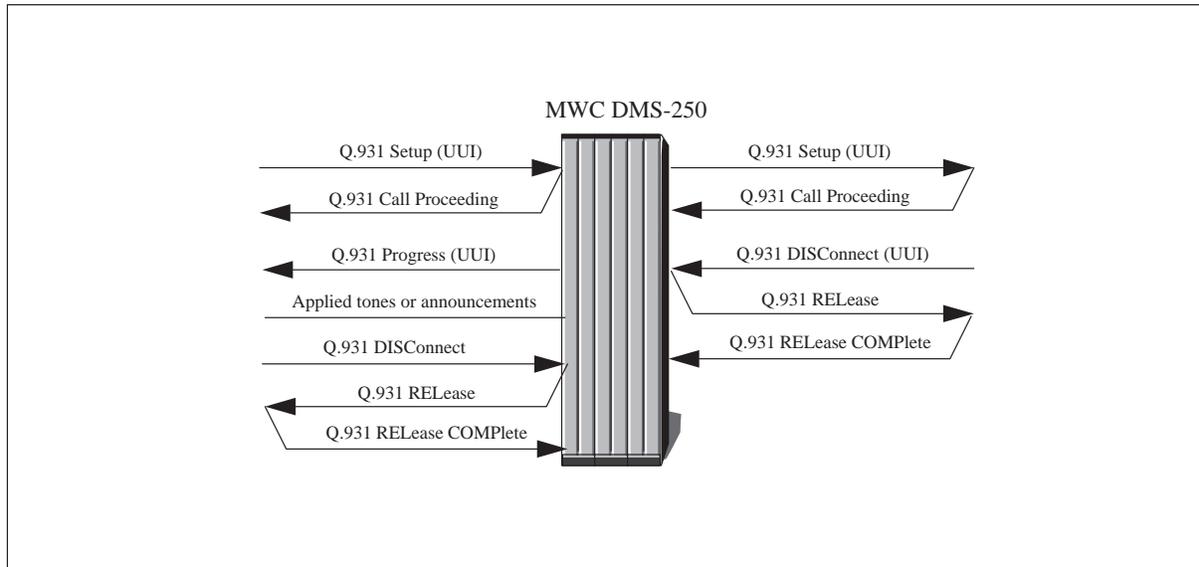
PRI–PRI Call Clearing After Alerting/Before Connect

There are two scenarios concerning User-to-User Interface (UUI) delivery in
a call clearing message before the terminator sends an indication of answer.
In the first scenario, the originating PRI agent includes UUI in the Q.931
Setup message to invoke the MAUUI service. The Q.931 Setup message
with UUI is sent to the terminating PRI agent. The terminating PRI agent
responds to this message with a Q.931 Alerting message and this message is
transported to the originating agent (UUI is included if received in the Q.931
Alerting message). The terminating agent then sends a Q.931 DISConnect
message with UUI. If treatment is not to be applied at this switch, the UUI is
transported to the originating PRI agent in the corresponding Q.931
DISConnect message. The following diagram shows the PRI to PRI call
clearing before connect when treatment is not applied.

Figure 19-3
PRI–PRI Call Clearing before Connect when Treatment not Applied
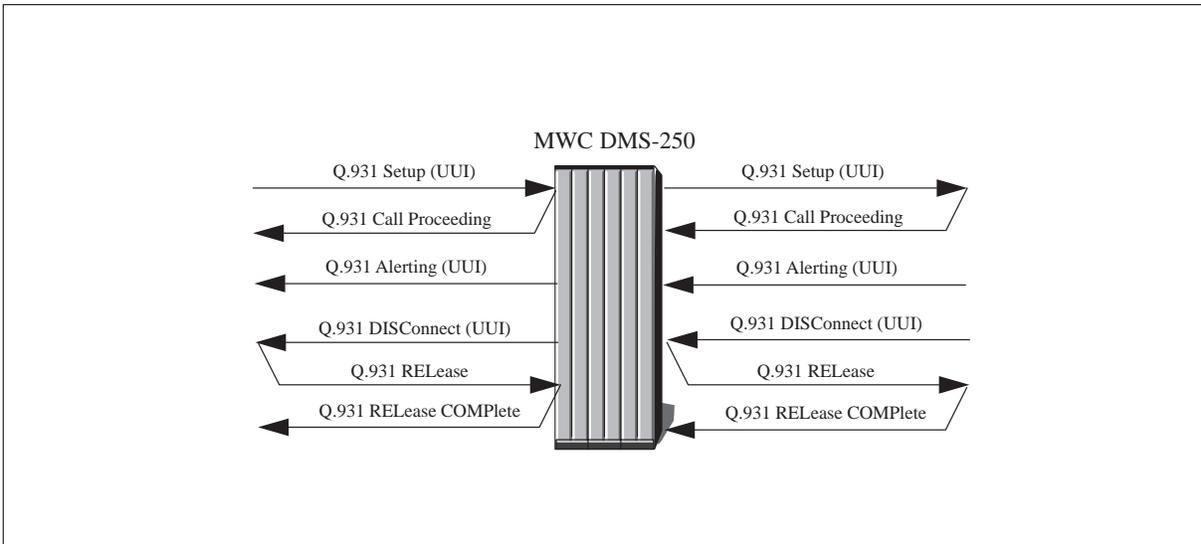
The second scenario is similar to the first scenario except that treatment is applied at this switch. The UUI from the received call clearing message is copied into a Q.931 Progress message and sent to the originating PRI agent before the treatment is applied.

Figure 19-4
PRI–PRI Call Clearing before Connect when Treatment Applied
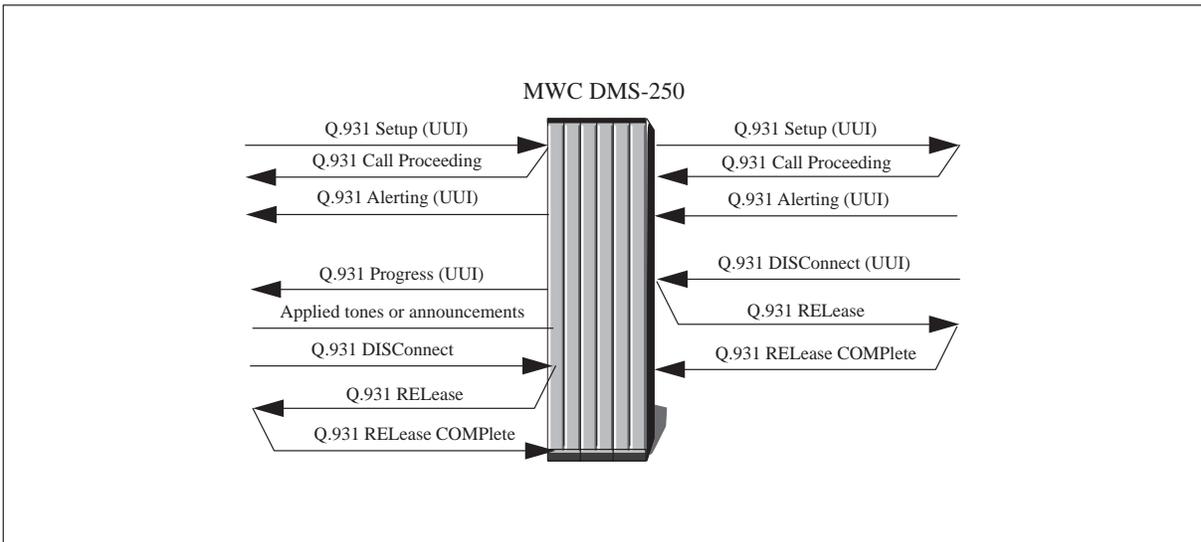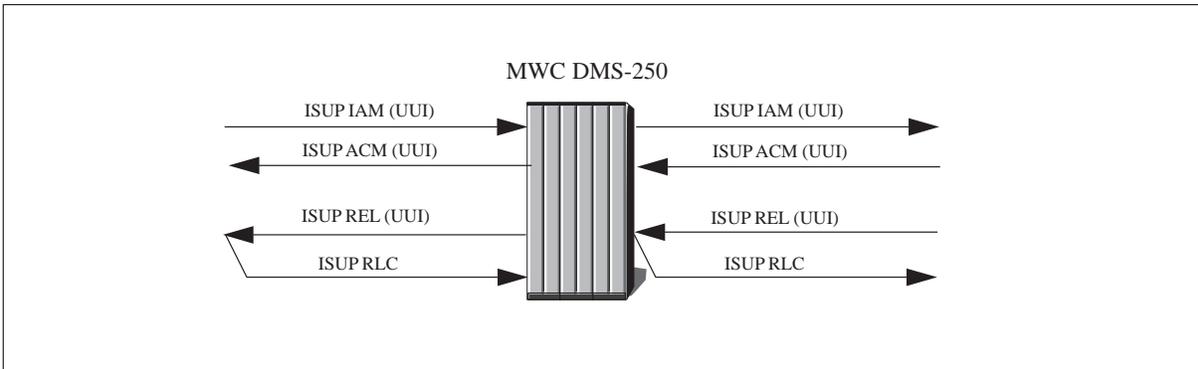
ISUP-ISUP Scenarios

ISUP-ISUP Call Clearing Received Before ACM

There are two scenarios concerning User-to-User Interface (UUI) delivery in a call clearing message before the terminator sends an indication of alerting before answer. In the first scenario, the originating ISUP agent includes UUI in the ISUP IAM message to invoke the MAUUI service. The ISUP IAM message with UUI is sent to the terminating ISUP agent. The terminating ISUP agent responds to this message with an ISUP REL message with UUI. If treatment is not applied at this switch, the UUI is transported to the originating ISUP agent in the corresponding ISUP REL message.

The following diagram shows the "ISUP to ISUP call clearing before Address Completed Message (ACM) when treatment not applied" scenario.

Figure 19-5
ISUP–ISUP Call Clearing before ACM when Treatment not Applied

The second scenario is similar to the first scenario except that treatment is to be applied at this switch. The UUI from the received call clearing message is copied into an ISUP ACM message and is used to establish voice path. The message is transported to the originating ISUP agent before the treatment is applied.

The following diagram shows the "ISUP to ISUP clearing before ACM when treatment applied" scenario.

Figure 19-6
ISUP–ISUP Call Clearing before ACM when Treatment Applied
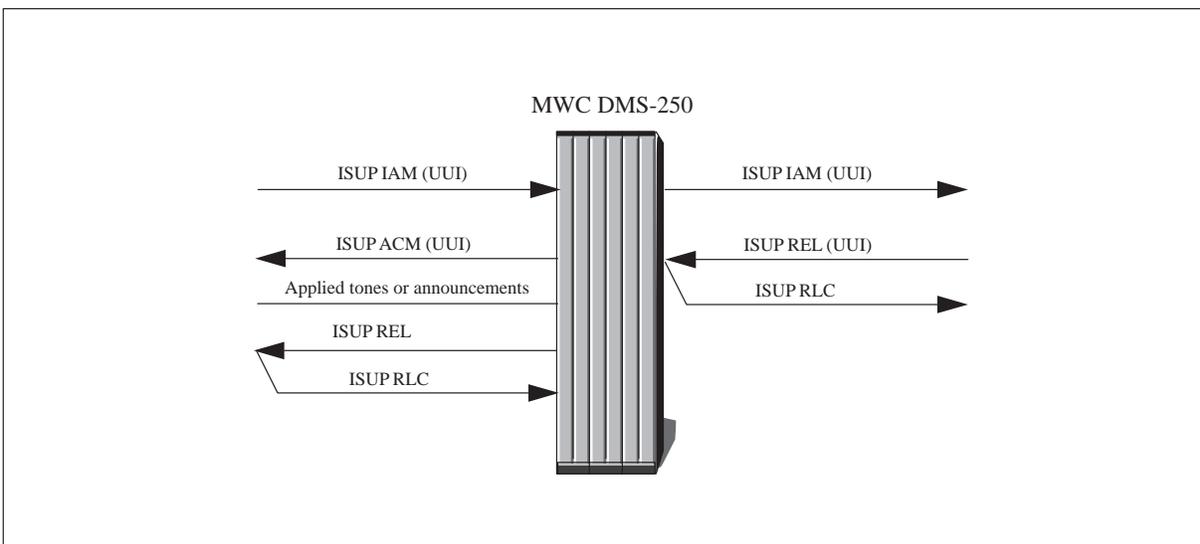
ISUP-ISUP Call Clearing After ACM/Before ANM

There are two scenarios concerning User-to-User Interface (UUI) delivery in a call clearing message before the terminator sends an indication of answer. In the first scenario, the originating ISUP agent includes UUI in the ISUP IAM message to invoke the MAUUI service. The ISUP IAM message with UUI is sent to the terminating ISUP agent. The terminating ISUP agent sends an ISUP ACM message to the originating ISUP agent (UUI is included if received in the ISUP ACM message). The terminating ISUP agent then sends an ISUP REL message with UUI. If treatment is not applied at this switch, the UUI is transported to the originating ISUP agent in the corresponding ISUP REL message.

The following diagram shows the "ISUP to ISUP call clearing before Answer Message (ANM) when treatment is not applied".
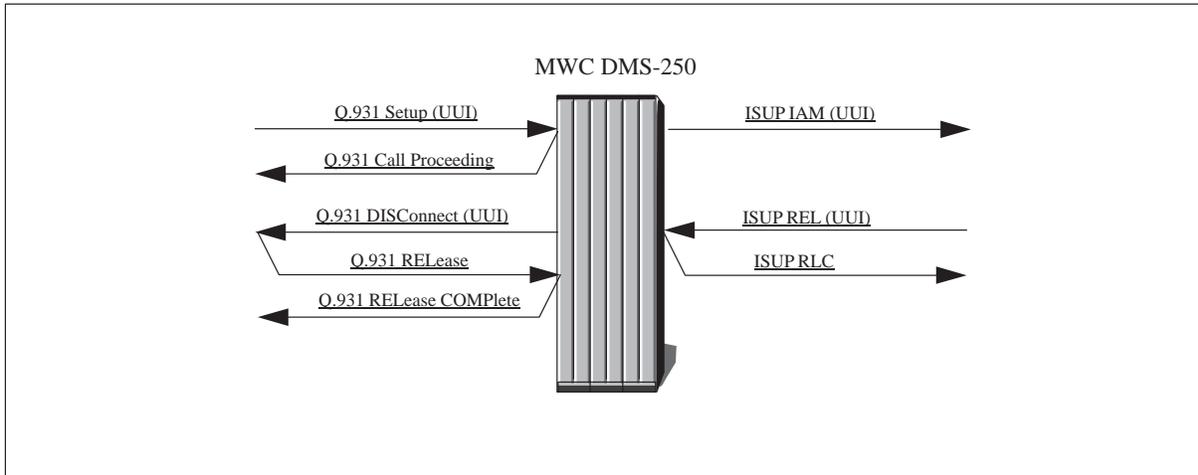
Figure 19-7
ISUP–ISUP Call Clearing before ANM when Treatment not Applied

The second scenario is similar to the first scenario except the treatment is applied at this switch. The UUI from the received call clearing message is copied into an ISUP ACM message and sent to the originating ISUP agent before the treatment is applied.

The following diagram shows the "ISUP to ISUP call clearing before ANM when treatment is applied".

Figure 19-8
ISUP–ISUP Call Clearing before ANM when Treatment Applied
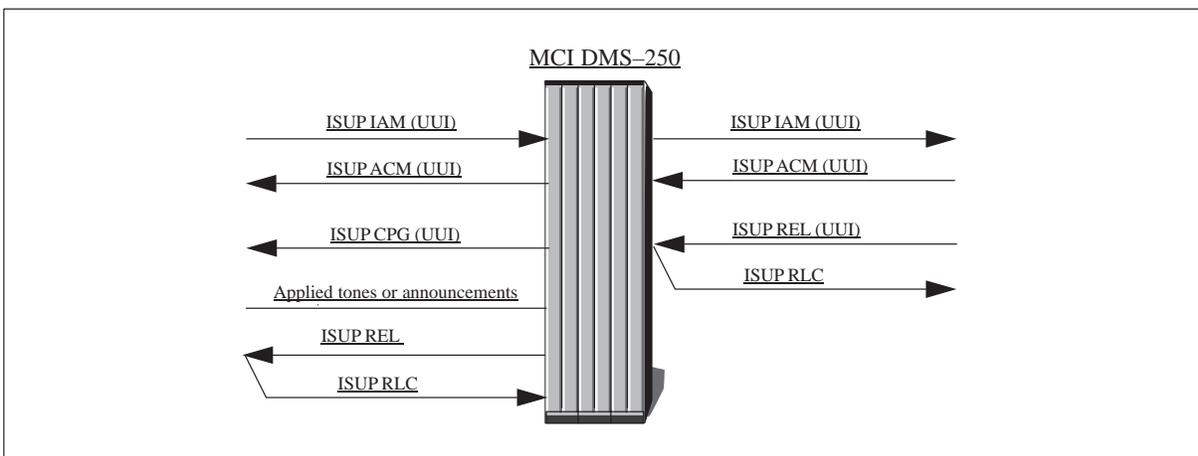
PRI-ISUP/ISUP-PRI Interworking Scenarios

PRI-ISUP Call Clearing Received before ACM

There are two scenarios concerning User-to-User Interface (UUI) delivery in a call clearing message before the terminator sends an indication of alerting. In the first scenario, the originating PRI agent includes UUI in the Q.931 Setup message to invoke the MAUUI service. An ISUP IAM message with UUI is sent to the terminating ISUP agent. The terminating ISUP agent

responds to this message with an ISUP REL message with UUI. If treatment is not applied at this switch, the UUI is transported to the originating PRI agent in the corresponding Q.931 DISConnect message.

The following diagram show the "PRI to ISUP call clearing before ACM when treatment is not applied" scenario.
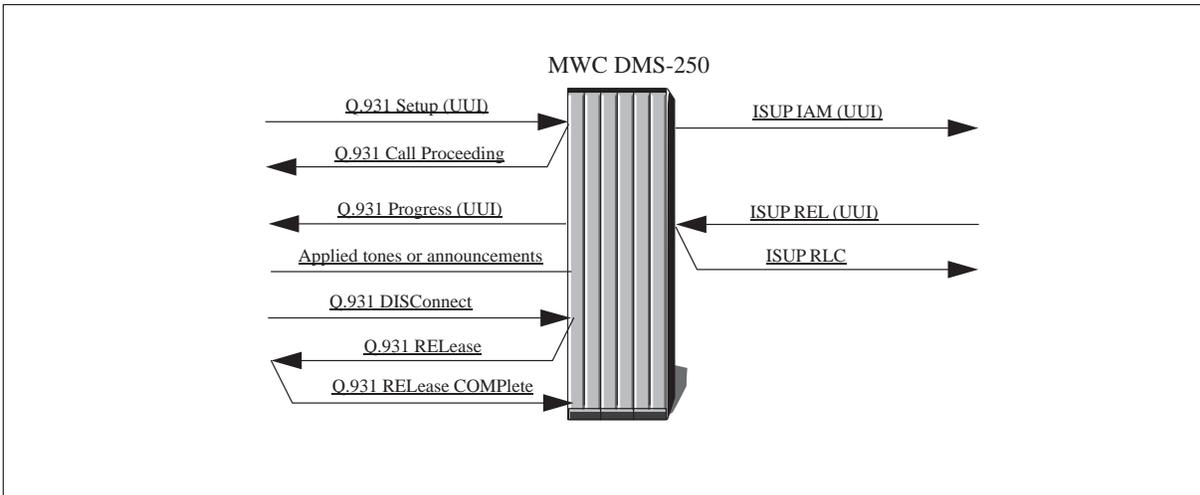
Figure 19-9
PRI–ISUP Call Clearing before ACM when Treatment not Applied

The second scenario is similar to the first scenario except that treatment is to be applied at this switch. In this situation, the UUI from the received call clearing message is copied into the Q.931 Progress message. The message is used to establish voice path and sent to the originating PRI agent before the treatment is applied.

The following diagram shows the "PRI to PRI call clearing before ACM when treatment is applied" scenario.

Figure 19-10
PRI-PRI Call Clearing before ACM when Treatment Applied

MWC DMS-250

Q.931 Setup (UUI) →
ISUP IAM (UUI) →

← Q.931 Call Proceeding

← Q.931 Progress (UUI)
← ISUP REL (UUI)

Applied tones or announcements
ISUP RLC →

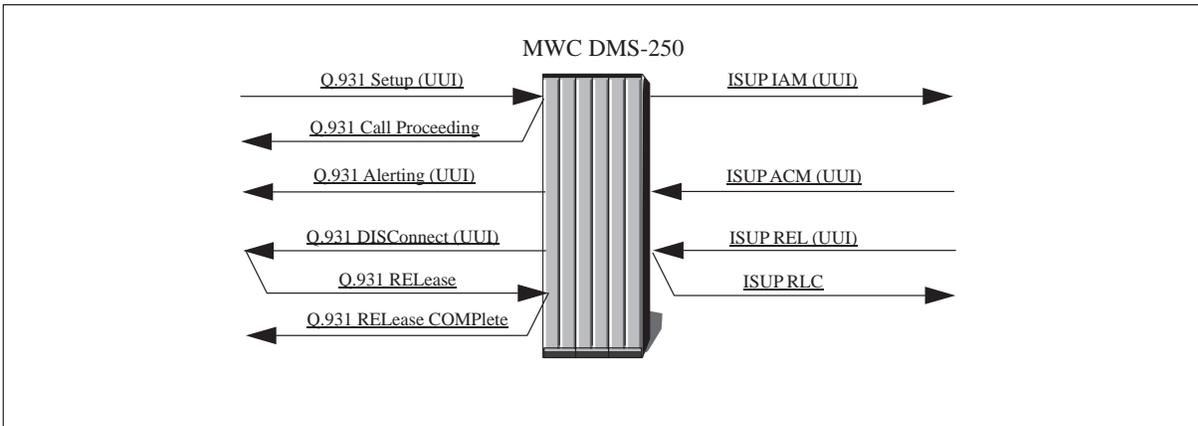Q.931 DISConnect →

← Q.931 RELease

Q.931 RELease COMPlete →

PRI-ISUP Call Clearing After ACM/Before ANM

There are two scenarios concerning UUI delivery in a call clearing message before the terminator sends an indication of answer. In the first scenario, the originating PRI agent includes UUI in the Q.931 Setup message to invoke the MAUUI service. AN ISUP IAM message with UUI is sent to the terminating ISUP agent. The terminating ISUP agent responds to this message with a ISUP ACM message and a Q.931 Alerting message is transported to the originating PRI agent (UUI is included if received in the ISUP ACM message). The terminating ISUP agent then sends an ISUP REL message with UUI. If treatment is not applied at this switch, the UUI is transported to the originating PRI agent in the corresponding Q.931 DISConnect message.

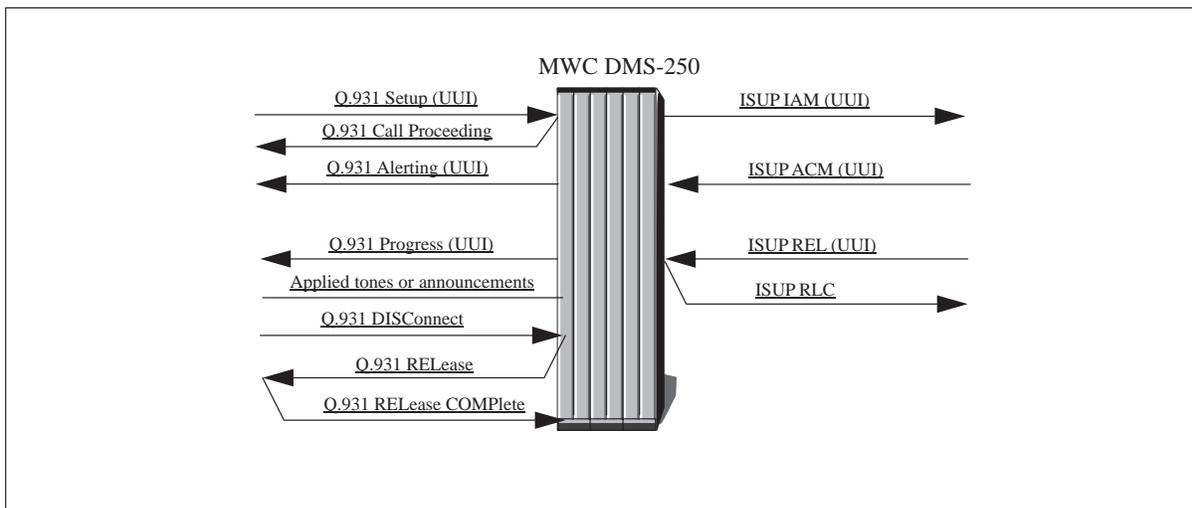The following diagram shows the "PRI to ISUP call clearing before ANM when treatment is not applied" scenario.

Figure 19-11
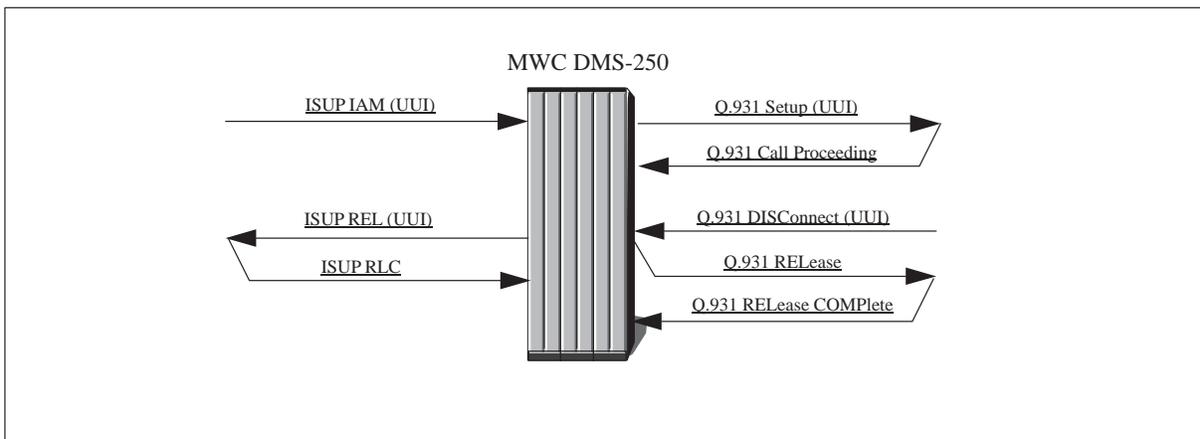**PRI-ISUP Call Clearing before ANM when Treatment not Applied**

The second scenario is similar to the first scenario except that treatment is to be applied at this switch. In this situation, the UUI from the received call clearing message is copied into a Q.931 Progress message and transported to the originating PRI agent before the treatment is applied.

The following diagram shows the "PRI to ISUP call clearing before ANM when treatment is applied" scenario.

Figure 19-12
PRI-ISUP Call Clearing before ANM when Treatment Applied

ISUP-PRI Call Clearing Received Before Alerting

There are two scenarios concerning UUI delivery in a call clearing message before the terminator sends an indication of alerting. In the first scenario, the originating ISUP agent includes UUI in the ISUP IAM message to invoke

the MAUUI service. A Q.931 Setup message with UUI is sent to the terminating PRI agent. The terminating PRI agent responds to this message with a Q.931 DISConnect message with UUI. If treatment is not applied at this switch, the UUI is transported to the originating ISUP agent in the corresponding ISUP REL message.

The following diagram shows the "ISUP to PRI call clearing before alerting when treatment is not applied" scenario.

Figure 19-13
ISUP-PRI Call Clearing before Alerting when Treatment not Applied

The second scenario is similar to the first scenario except that treatment is applied at this switch. In this situation, the UUI from the received call clearing message is copied into an ISUP ACM message. The ISUP ACM message is used to establish a voice path and is sent to the originating ISUP agent before the treatment is applied.

The following diagram shows the "ISUP to PRI call clearing before alerting when treatment is applied" scenario.

Figure 19-14
**ISUP-PRI Call Clearing before Alerting when Treatment Applied**
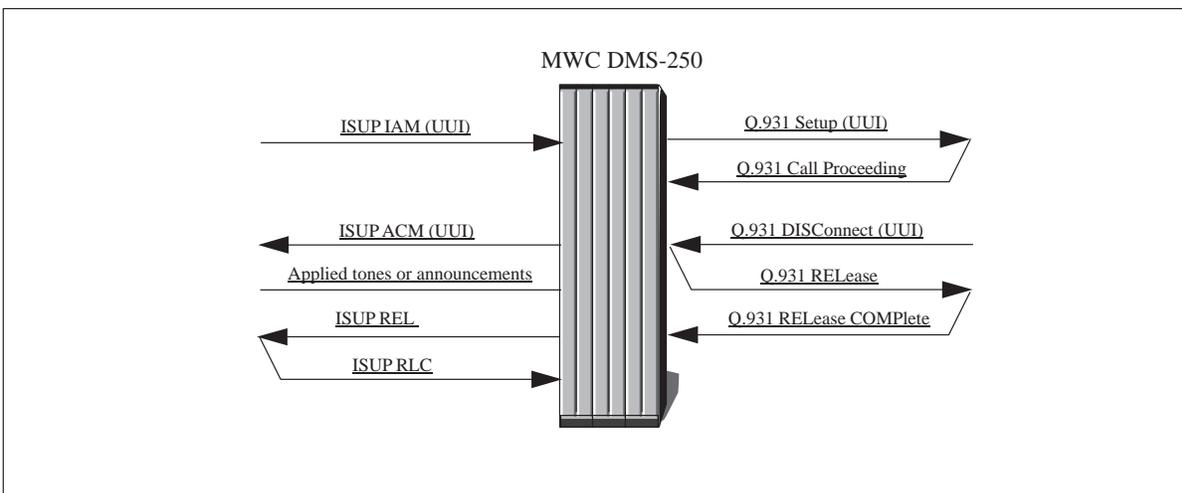
ISUP-PRI Call Clearing After Alerting/Before Connect

There are two scenarios concerning UUI delivery in a call clearing message before the terminator sends an indication of answer. In the first scenario, the originating ISUP agent includes UUI in the ISUP IAM message to invoke the MAUUI service. A Q.931 Setup message with UUI is sent to the terminating PRI agent. The terminating PRI agent responds to this message with a Q.931 Alerting message and an ISUP ACM message is sent to the originating ISUP agent (UUI is included if received in the Q.931 Alerting message). The terminating agent then sends a Q.931 DISConnect message with UUI. If treatment is not applied at this switch, the UUI is transported to the originating ISUP agent in the corresponding ISUP REL message.

The following scenario shows the "ISUP to PRI call clearing before connect when treatment not applied" sceario.

Figure 19-15
ISUP-PRI Call Clearing before Connect when Treatment not Applied
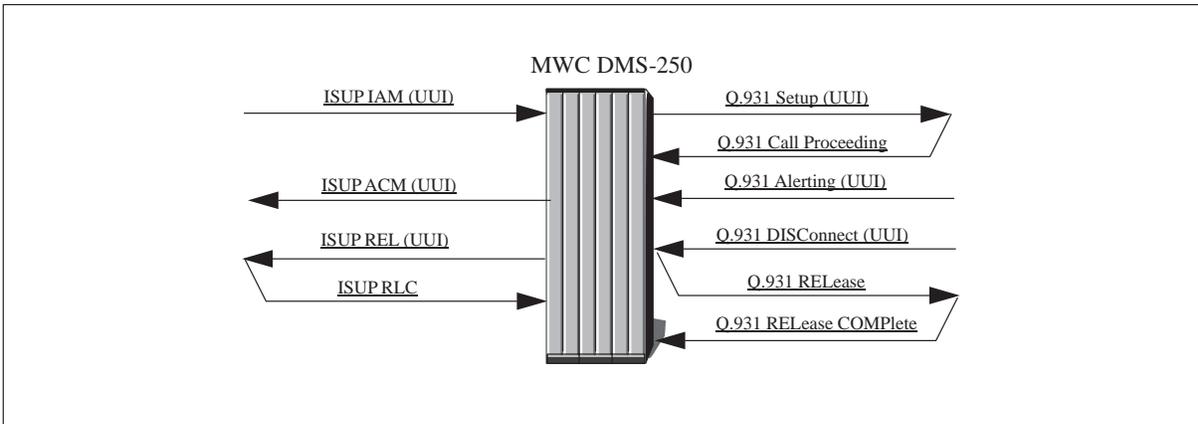
The second scenario is similar to the first scenario except that treatment is applied at this switch. The UUI from the received call clearing message is copied into an ISUP CPG message and transported to the originating ISUP agent before the treatment is applied.

The following scenario shows the "ISUP to PRI call clearing before connect when treatment is applied" scenario.

Figure 19-16
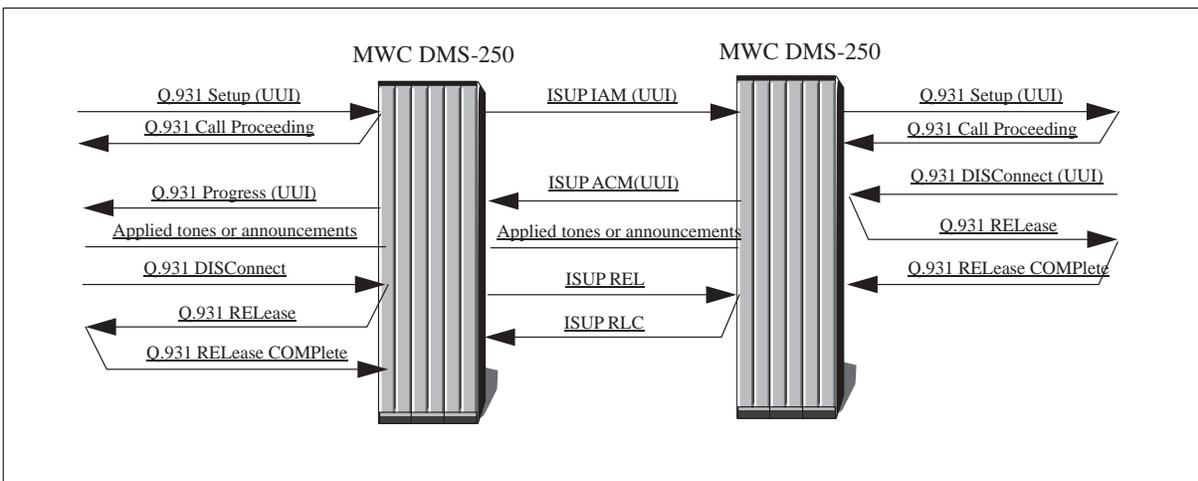**ISUP-PRI Call Clearing before Connect when Treatment Applied**
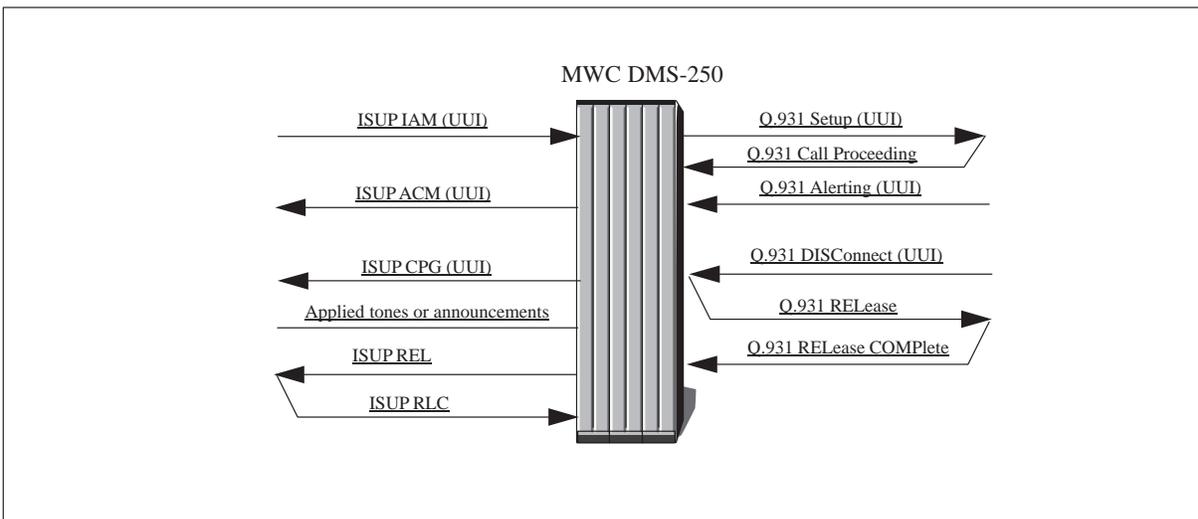
Network Scenarios

This section concentrates on multiple switch scenarios where the terminating switch applies tones/announcements to the originating agent.

PRI-ISUP-PRI Call Clearing Received Before Alerting

The following multiple switch scenario shows the message flow in the instance that the terminator sends a call clearing message with UUI before sending an alert indication and this message causes tones/announcements to be applied at the terminating switch for the originating agent. The UUI from the call clearing message will be sent to the originating switch in the ACM message used to establish voice path. The originating switch, upon receiving this ACM message, sends out a Q.931 Progress message with UUI to the originator to establish voice path. (NOTE: The reason a Q.931 Progress message is sent out instead of a Q.931 Alerting message is because the interworking bit in the Backward Call Indicator of the ACM denotes that interworking was encountered.)

Figure 19-17
PRI-ISUP-PRI Call Clearing Received before Alerting when Treatment Applied

PRI-ISUP-PRI Call Clearing Received Before Connect

The following multiple switch scenario shows the message flow in the instance that the terminator sends a call clearing message with UUI after sending an alert indication but before sending an answer indication. This message causes tones/announcements to be applied at the terminating switch for the originating agent. The UUI from the call clearing message is sent to the originating switch in a CPG message. The originating switch, upon receiving this CPG message, sends out a Q.931 Progress message with UUI to the originator.

Figure 19-18
**PRI-ISUP-PRI Call Clearing Received before Connect**
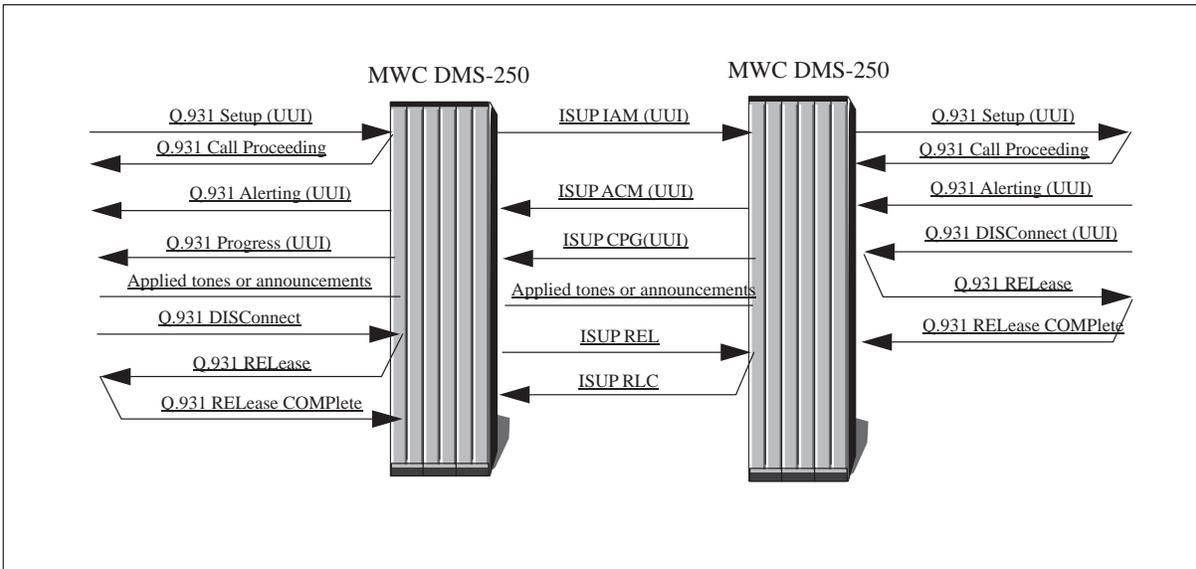

Special Cases

ASE

Answer Supervision Enhancements (ASE) allow MWC DMS-250 switches that are attached to gateway switches to send ACM and ANM, instead of the normal ACM only, to establish voice path for suppcode and/or digit collection. ASE is based on the ASE_ACTIVE boolean in table TRKGRP for the originating agent. ASE functionality was originally introduced for ISUP RLSR OPT2 originating agents (AD7746: Answer Supervision Enhancements), but was later developed for ISUP IMT (AD8380: Answer Supervision Enhancements for ISUP IMTs) and ETSI PRI (AD8728: Answer Supervision Enhancements for ETSI PRI). This feature is not supported for ETSI PRI trunks and concentrate on the interworking of these features with respect to ISUP RSLR OPT2 and ISUP IMT originating agents. The following diagram shows an example of the message flow of a call with ASE active.

Figure 19-19
ASE Messaging Flow
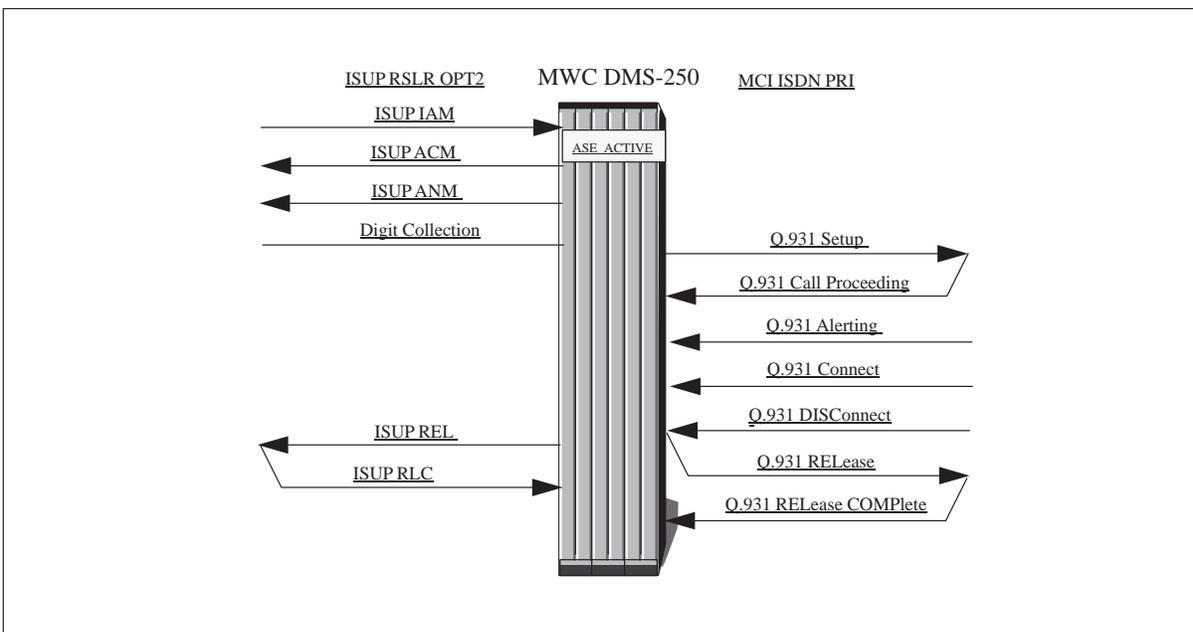
For ASE and MAUUI interworking, if UUI was included in the incoming
IAM and was delivered to the terminating agent in the Q.931 SETUP
message, then MAUUI is invoked for this call. If the terminating agent
responds with a call clearing message with UUI which causes
tones/announcements to be applied to the originating agent, the UUI will not
be delivered to the originating agent. This is because the originating agent
already received an ANM message from the ASE functionality. In this case,
the ASE feature functionality caused an answer indication to be sent out
before an answer indication was received from the terminating agent. The
following diagram shows an example of this interworking.

Figure 19-20
ASE and MAUUI Interworking
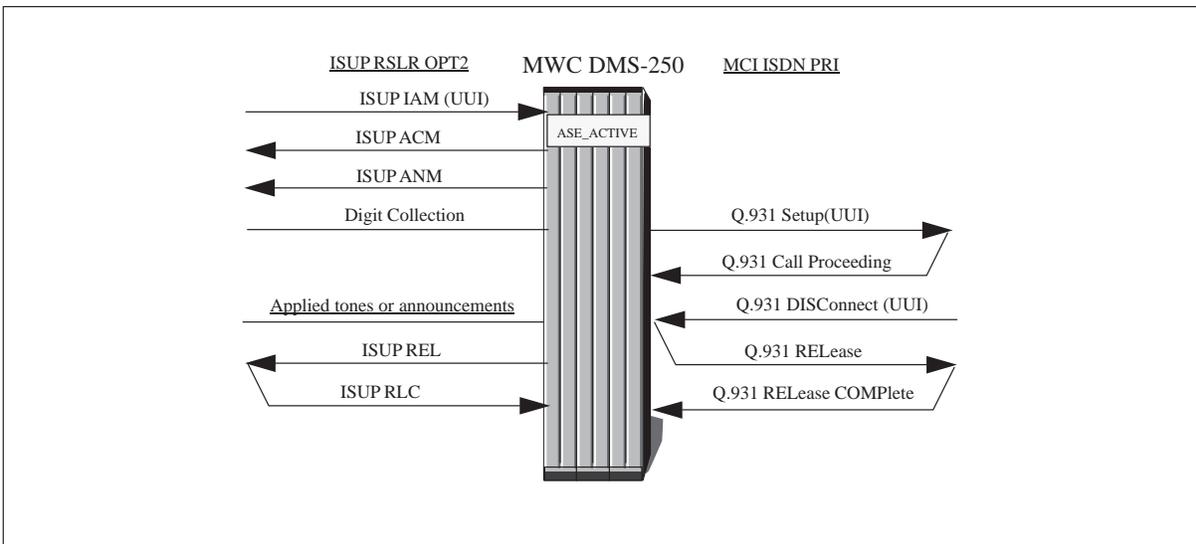
Reorigination
The MAUUI and reorigination user services function as mutually exclusive features. To handle this interaction, the MAUUI functionality takes precedence over reorigination. The originating user can no longer reoriginate during the call if the originating agent is allowed to invoke reorigination and the originating agent invokes MAUUI service by sending UUI in the call setup message and the UUI is delivered to the terminating user.

Overflow
For Direct Termination and Enhanced Overflow scenarios, the overflow switch retains the call setup message contents (including UUI) and ships the stored data in the call setup message of the rerouted call. For MAUUI and overflow interaction, if MAUUI is invoked for a call and the terminating agent sends a call clearing message with UUI which invokes the overflow, the UUI is not sent out to the originating agent.

Suppcode Collection/Digit Collection
Suppcode/Digit Collection is allowed if card or address digits are to be collected from the originating agent. In this case, the DMS-250 switch sends out an ACM to the originating agent to establish voice path for digit collection. The following figure shows an example of digit collection.

Figure 19-21
Suppcode/Digit Collection Example
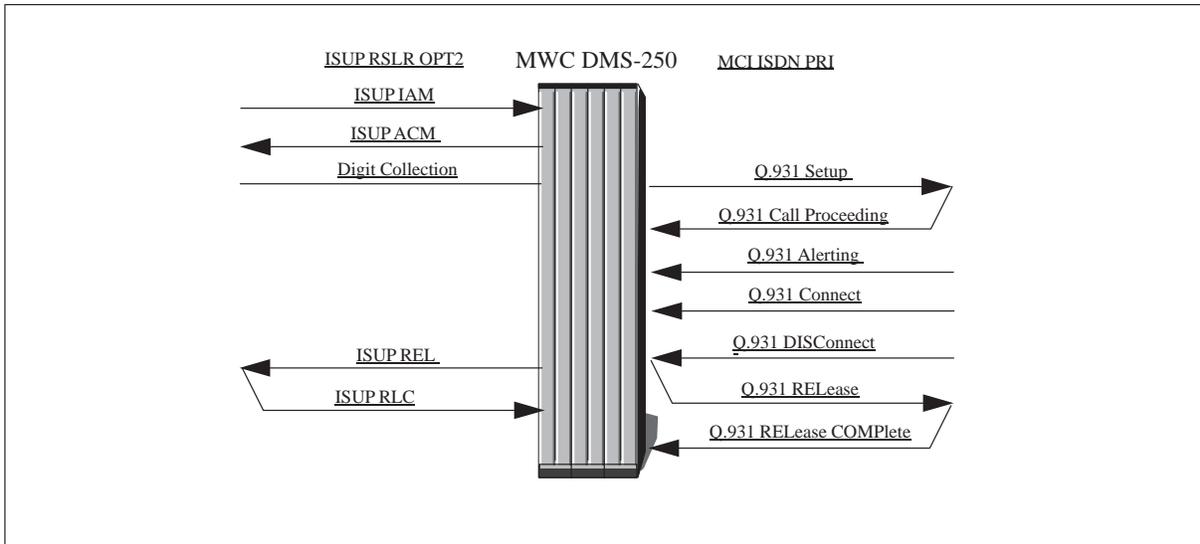
For the previous example showing call message flow, if UUI is included in the call setup message and it is delivered to the terminating agent in the call setup message, MAUUI is invoked for the call. If the terminating agent responds with a call clearing message with UUI which causes tones/announcements to be applied to the originating agent, the UUI is delivered to the originating agent in an ISUP CPG/Q.931 Progress message. In this case, the Digit collection causes the ACM to be sent to the originating agent, independent of whether the terminator sends an alerting indication or not. The following figure shows an example of digit collection with MAUUI interworking.

Figure 19-22
**Suppcode/Digit Collection and MAUUI Example**
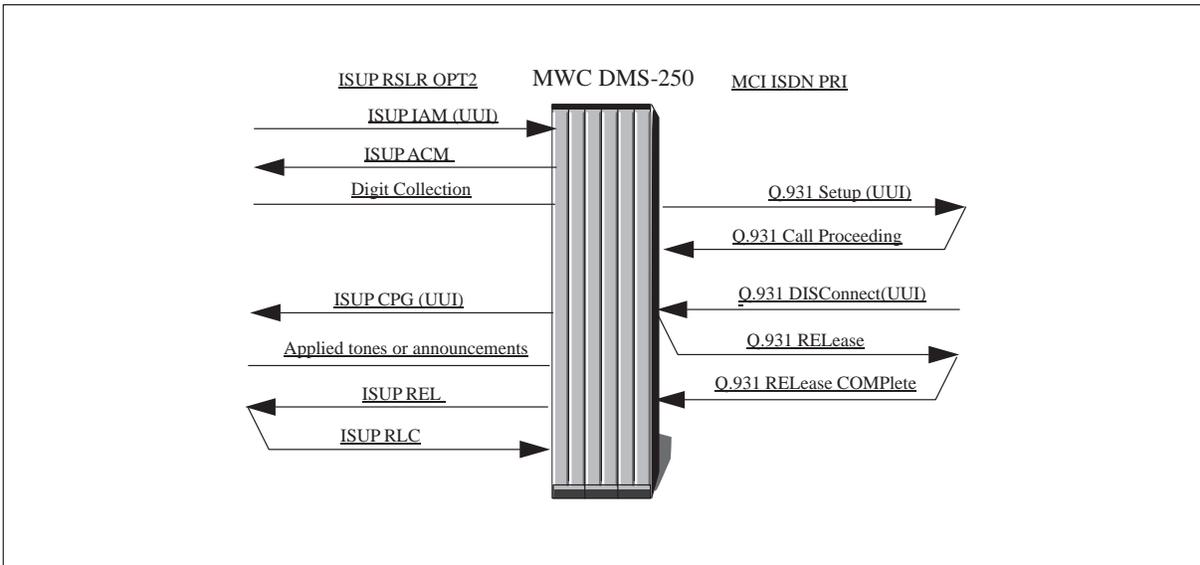
ETSI PRI

ETSI PRI agents do not support the functionality developed for this feature. However, ETSI PRI agents do support MAUUI functionality. This section is used to document how the ETSI PRI agents react to the scenarios described by this feature. Some of the differences between ETSI PRI and ANSI PRI agents MAUUI functionality are listed below:

- ETSI PRI agents are not developed to support or utilize the UUIE_COUNT and UUS_TYPE billing fields

- ETSI PRI agents do not support the UUI IE in the Q.931 PROGress message from the network to user direction

Since ETSI PRI agents do not support the UUI IE in the Q.931 PROGress message, ETSI PRI agents do not receive UUI if tones/announcements are applied and UUI is received from the terminator in a call clearing message.

Figure 19-23
ETSI PRI Functionality
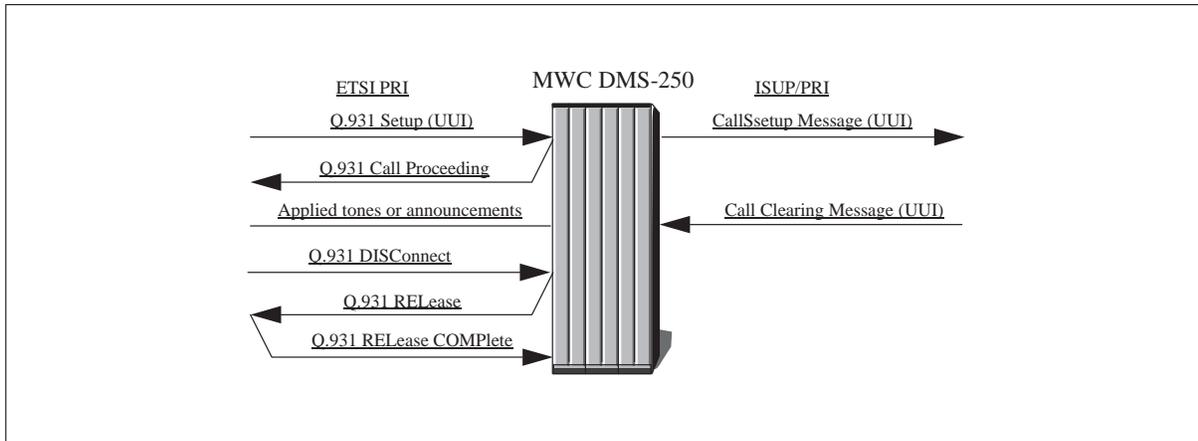
In the sceanrios where tones/announcements are not applied at the switch and a call clearing message is received with UUI from the terminator, the UUI is delivered to the ETSI PRI agents, independent of whether it is before or after answer indication.

Figure 19-24
ETSI PRI Functionality
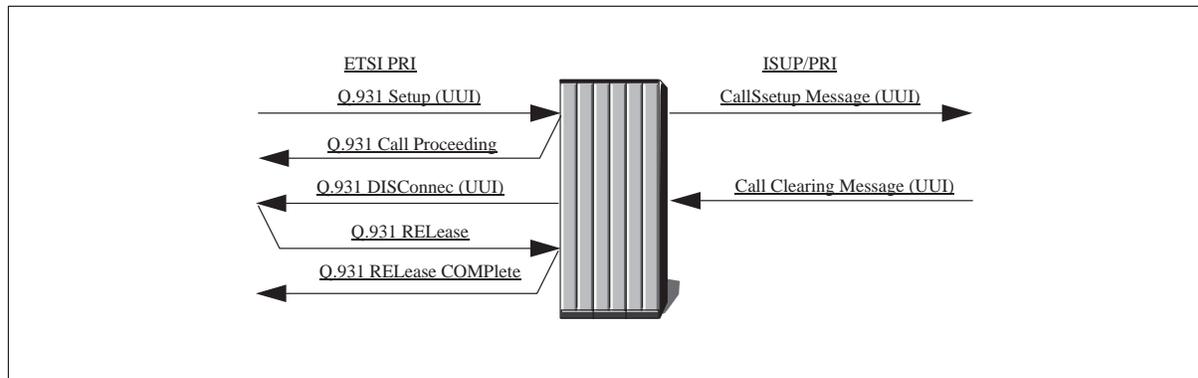
TP7Q is set to indicate either the originator or terminator of the call, depending on which agent releases the call.

Billing

Billing is implemented using existing MAUUI fields and procedures implemented in MCI09 (AD9005). Before this feature, if the called party released a call with MAUUI service before receiving an answer, the TP7Q was set to 7 to indicate a fraud scenario. This feature changes that functionality by setting the TP7Q field to 1 if the call, with MAUUI service,

is cleared by the called party before an answer is received to indicate the called party disconnected the call.

List of terms

AC

action codes

ACM

See address completed message.

address completed message

A Common Channel Signaling 7 protocol message that indicates all the address signals required to route a call to the called party are received and the call can be routed.

ADF

Application Data Field

ADMININF

administration information

all trunks busy

Condition indicated when all the circuits in a group are occupied.

AMA

See automatic message accounting.

ANI

See automatic number identification.

ANM

Answer Message

ANSI

American National Standards Institute

ARU

See audio response unit.

ASEQ

ascending sequence

ATB

> *See* all trunks busy.

ATD

> *See* audio tone detector.

ATP

> Access Transport Parameter

ATR

> automatic trunk routing

ATT

> *See* automatic trunk testing.

audio response unit

> Provides functions as a part of Enhanced Voice Services that include menu routing, announcements, and voice mail. The ARU can record and replay audio messages and detect customer DTMF digits or voice inputs. It can also initiate a call transfer (or extension) to a new destination. *See also* Enhanced Voice Services.

audio tone detector

> A card containing 16 audio tone detector circuits and residing in the maintenance trunk module. The ATD provides call progress tones to the subscriber for calls originating on loop extension.

authorization code

> A multidigit code used to identify a subscriber, bill a call, or screen against unauthorized access to the MWC network.

automatic message accounting

> An automatic recording system that documents all the necessary billing data of subscriber-dialed long distance calls.

automatic number identification

> A system that automatically identifies a calling number and transmits it to the automatic message accounting (AMA) office equipment for billing.

automatic trunk testing

> A set of hardware and software entities that provide automatic testing for outgoing trunks and the outgoing portions of two-way trunks.

B8ZS

> bipolar 8 zero substitution

BC

See bearer capability.

BCI

backward call indicator

BCSI

backward call special indicator

bearer capability

A characteristic associated with a directory number that indicates the type of call (voice or data) and the rate of transmission requested by the user. The bearer capability information element is required in the setup message for functional signaling to indicate the type of call.

BER

bit error rate

BPV

bipolar violation

BSY

busy

call authorization

The verification that an off-hook line is connected to a valid user who is authorized to make the call.

call condense block

A data structure associated with a call from initiation through completion that holds all information about a call. The CCB contains enough information to describe a basic call and can be extended for calls that require more data.

call detail record

Billing information stored in billing files.

call processing busy

The state in which call processing is taking place and the equipment involved cannot be seized for maintenance.

calling line identification

In data transmission, a supplementary service provided by the network that allows a terminating party to be notified of the network address of the originator. Screening of calling line identification is performed during call setup only.

calling party identification
Record indicating information about the originating party.

CA
Call Associated

CAUUI
Call Associated User to User Information

CAMA
See centralized automatic message accounting.

CC
central controller

CCB
See call condense block.

CCS7
See Common Channel Signaling 7.

CCITT
International Telephone and Telegraph Consultative Committee; the international standards body that produced the open systems interconnection (OSI) model. Until March 1993, the CCITT was one of four permanent groups within the International Communications Union (ITU). The CCITT studied technical issues in telecommunications on an international basis, and issued recommendations intended to improve standardization and effectiveness within the industry. The work of CCITT continues in the ITU Telecommunications Standardizations Sector.

CDR
See call detail record.

CR
Connection Request

CREF
Connection REFuse

centralized automatic message accounting
A system that produces itemized billing details for subscriber-dialed long distance calls. Details are recorded at a central facility serving a number of exchanges. In exchanges not equipped for automatic number identification, calls are routed to a CAMA operator who obtains the calling number and enters it into the computer for billing.

channel identification

The channel identification information element identifies the B-channel on a PRI interface that is to be used for a call.

CI

See command interpreter.

CID

See channel identification.

CLID

See calling line identification.

CLLI

See common language location identifier.

Common Channel Signaling 7

A digital, message-based network signaling standard, defined by the CCITT, that separates call signaling information from voice channels so that interoffice signaling is exchanged over a separate signaling link.

common language location identifier

A standard identification method for trunk groups in the following form: aaaa is the city code; bb is the province or state code; xx is the trunk group identifier; and yyyy is the trunk number.

command interpreter

A support operating system component that functions as the main interface between machine and user. Its main roles are to read lines entered by a terminal user, to break each line into recognizable units, to analyze the units, to recognize command item numbers on the input lines, and to invoke these commands.

CPB

See call processing busy.

CPE

See customer premises equipment.

CPI

See calling party identification.

CRC

cyclic redundancy check

customer premise equipment

All telecom equipment located at a customer's premises (except pay phones).

D1

primary D-channel

D2

secondary D-channel

DAL

See dedicated access line.

DAP

data access point; *see* network control system

DBA

database administrator

D-channel

A channel that carries call control mesages between a terminal on an ISDN interface and the exchange termination node. Call control messages are used to set up, maintain, or clear a circuit-switched call on a B-channel. The D-channel also carries low-speed packet data between a terminal on an ISDN interface and a terminal in the packet data network.

DCH

D-channel handler

DDD

See direct distance dialing.

dedicated access line

A trunk interface that connects a PBX, a key system, or a single telephone to a DMS-250 switch.

Dialable Wideband Service

Multi-rate ISDN switched service aimed at satisfying end-user needs for flexible, wideband connectivity in the public-switched telephone network.

DIGMAN

digit manipulation

digital recorded announcement machine

A peripheral module developed for the DMS-250 switch. Voice messages are stored in digital form to provide access to up to 30 different service voice announcements.

digital trunk controller

A peripheral module that connects DS-30 links from the network to digital trunk circuits.

digital signal 0

A protocol for data transmission that is used to represent one channel of a T-span in a 24-channel DS-1 trunk. DS-0 handles a data rate of 56 kbit/s.

digital signal 1

An 8-bit 24-channel 1.544 mbit/s digital signaling format. The North American standard for digital trunks and the standard signal used to interconnect Northern Telecom digital systems. The DS-1 signal carries 24 information channels with 64 kbit/s for each channel (DS-0).

digital signal 30

A link used internally in the DMS-250 switch. DS-30 handles a data rate of 2.54 mbit/s.

direct distance dialing

A telephone exchange service that permits subscribers to call a number outside their local area without operator assistance.

DMB

D-channel manual busy

DNIS

dialed number identification services

DRAM

See digital recorded announcement machine.

DS-0

See digital signal 0.

DS-1

See digital signal 1.

DS-30

See digital signal 30.

DSEQ

descending sequence

DTC

See digital trunk controller.

DTCI

See ISDN digital trunk controller.

DTMF

See dual tone multifrequency signaling.

DTO

direct termination overflow

dual-tone multifrequency signaling

A signaling method that uses set combinations of two specific voice-band frequencies, one of which is selected from a group of four low frequencies, and the other from a group of three or four relatively high frequencies.

DWS

See Dialable Wideband Service.

E.164

ISDN numbering plan (enhances E.163 and retains X.121)

EANT

See equal access network trunk.

ECF

echo canceller failures

EML

See expected measured loss.

Enhanced Voice Services

Services that provide the capability of menu routing, announcements, and voice mail. An enhanced voice services (EVS) switch has a PRI interface to an EVS audio response unit (ARU).

equal access network trunk

Allows access to the trunk side of the equal access end office and also may connect to access tandem switches. These trunks are known as FGD trunks. They support both multifrequency and CCS7 signaling.

ESF

extended superframe format

ETS

enhanced time switch

ETSI

See European Telecommunications Standards Institute.

ETSI PRI

> An adaptation by the ETSI of the International Telecommunication Union (formerly known as CCITT) ISDN primary rate recommendations for European users. The ETSI PRI interface functions solely as a point of connection between the DMS-250 switch, the PBX, and a remote point of presence.

EVS

> *See* Enhanced Voice Services and audio response unit.

expected measured loss

> The expected reading, in decibels, at the test point at one end of a trunk when a sending power of a specified value is applied to a prescribed test point at the other end of the trunk.

FCI

> forward call indicator

FGA

> feature group A

FGB

> feature group B

FGC

> feature group C

FGD

> feature group D

FNAL

> Feature Not Allowed treatment

FPS

> frame pattern sequence

FR

> feature related

GA

> generic address

GD

> Generic Digits parameter

GNCT

> generalized no circuit treatment

HDLC

high-level data link control

HNPA

home numbering plan area

H0

6x64 - 384 kbit/s

H11

24x64 - 1536 kbit/s

IAM

See Initial Address Message.

IDDD

international direct-distance dialing

IDL

idle

IE

See information element.

IEC

See interexchange carrier.

IID

interface identifier

IMT

intermachine trunk

INB

installation busy

information element

Information elements (also called parameters) are contained in signaling messages and hold information for call processing. There are mandatory and optional information elements.

Initial Address Message

The first message in a call (connection-oriented or connection-less). IAM contains information required to route the call to its destination.

Integrated Services Digital Network

A digital communications network that provides users with multiple services through a single access point, and integrates voice, data, image, and messaging across the network.

interexchange carrier

Any carrier authorized to carry customer transmission between local access and transport areas interstate or intrastate.

inward wide area telecommunications service

A data table that stores information on N00 numbers that are translated internally within the DMS-250 switch.

INWATS

See inward wide area telecommunications service.

INSV

in service

integrated services access

A service-based architecture that enables calls originating over an ISA PRI facility to be handled based on the call type. ISA allows any open circuit to originate or terminate any subscribed service.

ISA

See integrated services access.

ISDN

See Integrated Services Digital Network.

ISDN digital trunk controller

A peripheral module that connects DS30 links from the network with ISDN digital trunk circuits.

ISDN user part

A Common Channel Signaling 7 (CCS7) message-based signaling protocol that acts as a transport carrier for the ISDN network services. The ISUP provides the functionality in a CCS7 network for voice and data services.

ISO

International Standards Organization

ISP

ISDN signaling processor

ISTB

in service trouble

ISUP

See ISDN user part.

ITA

integrated trunk access

ITR

information transfer rate

ITU–T

International Telecommunication Union–Telecommunication Standardization Sector

LAPB

See link access procedure on the B-channel.

LAPD

See link access procedure on the D-channel.

LCGA

local carrier group alarm

line trunk controller

Peripheral module that combines the line group controller and the digital trunk controller and provides all of the services offered by both.

link access procedure on the B-channel

The protocol used to carry packet-switched data on B-channels of ISDN access interfaces.

link access procedure on the D-channel

Link access procedure on the D-channel (LAPD)/Q.921 is the protocol used to carry signals on D-channels of ISDN access interfaces.

logical terminal identifier

The unique identifier assigned to a logical terminal when it is datafilled in the ISDN access termination.

LTC

See line trunk controller.

LTID

See logical terminal identifier.

MANB

See manual busy state.

MAUUI

Message Associated User to User Information

manual busy state

A busy state that is manually imposed on a trunk. The state of a trunk circuit that is removed from service.

master processor

The processor containing the instruction set that implements the tasks assigned by the central control software.

message transfer part

A CCITT no. 7 signaling (N7) protocol that provides a connectionless transport system for carrying CCS7 signaling messages between user locations or applications functions.

MB

See manual busy state.

MP

See master processor.

MTCE

maintenance

MTP

See message transfer part.

NACK

not acknowledged

NARS

Network audio response system. *See* Enhanced Voice Services.

NCAUUI

Non–Call Associated User–to–User Information

NCAUUS

Non_call Associated User–to–User Service

NCS

See network control system.

NCTE

network customer terminating equipment

network control system

The NCS/DAP (network control system/data access point) is a remote database owned and operated by MWC. Specified operations are downloaded to this remote database. This downloading decreases the amount of information stored within the DMS-250 switch, increases the number of customers allowed to access the network, and increases the flexibility and speed of the switch.

NOA

nature of address

NPA

See numbering plan area.

NPI

numbering plan indicator

NSF

network-specific facilities

numbering plan area

Any of the designated geograpical divisions of the United States, Canada, Bermuda, the Caribbean, Northwestern Mexico, and Hawaii within which no two telephones have the same seven-digit number. Each NPA is assigned a unique three-digit area code.

NXX

office code

OLI

originating line information

OM

operational measurement

ONAL

off-network access line

ONAT

off-network access trunk

OSI

open systems interconnect

OSID

originating switch identifier

OSR

 operator services record

OST

 operator service trunk

OTC

 originating trunk class

PBX

 See private branch exchange.

PDIL

 partial dial

PRI

 See primary rate interface.

primary rate interface

 A common channel signaling system as defined by International Telecommunication Union-Telecommunication Standardization Sector and by Exchange Carrier Standards Association T1S1 committees. PRI is an internationally standardized architecture for the interface between a customer's equipment and public network switches or other PBXs.

PRISM

 Generic service for public calls translated in-switch. PRISM calls are translated directly using standard HNPA translations.

private branch exchange

 A private telephone exchange, either automatic or attendant operated, serving extensions in an organization and providing access to the public network.

protocol

 The rules for the operation of a communication system that must be followed if commuication is to occur. Protocols may govern portions of a network, types of service, or administrative procedures.

PTS

 per-trunk signaling

Q.921

 CCITT recommendation for layer 2 of ISDN; protocol used to carry signals on D-channels of ISDN access interfaces

Q.931

CCITT recommendation for layer 3 of ISDN. Q.931 defines the content of messages used to control calls over ISDN interfaces and used on the D-channel. Q.931 is a message-oriented, out-of-band signaling protocol that is capable of providing telephony, data, and supplementary services.

Q.932

CCITT recommendation for layer 3 of ISDN; control of ISDN supplementary services

RBOC

See Regional Bell operating company.

RCGA

remote carrier group alarm

Regional Bell operating company

Seven holding or operating companies into which the Bell system's local telephone companies were assigned.

REL

See release message.

release message

A message that flows from the originating switch to the terminating switch.

remote point of presence

A hub PBX connected to other PBXs.

reorigination

Call reorigination allows a caller to make several consecutive calls without losing access to the DMS-250 switch. After entering the octathorpe (#), the caller receives dial tone and may then dial a new destination address and suppcode (if required).

reset

Reset dialing allows the subscriber to correct a misdialed sequence without losing access to the DMS-250 switch. Dial tone is given upon pressing the reset digit (#) so that the subscriber can redial the digit sequence.

RLT

release link trunk

RPOP

See remote point of presence.

RS

    resource shortage

RTS

    return to service

SA

    subsequent address

SAC

    See service access code.

SCP

    See service control point.

SCCP

    Signaling Connection Control Protocol

SCUN

    service currently unavailable

SELSEQ

    selection sequence

service access code

    A service access code (such as 800 and 900) is a three-digit code that uses the same format as an area code. However, there is no geographical link between the number dialed and the terminator's actual geographic location.

service control point

    A node in a CCS7 signaling network that supports application databases. The function of an SCP is to accept a query for information, retrieve the requested information from one of its application data bases, and to send a response message to the originator of the request.

service switching point

    A switch that is capable of interacting with the CCS7 network databases. It contains hardware to support CCS7 signaling, software to create network database query messages, and software to interpret network database response messages.

serving translation scheme

    A three-digit code (000–999) that allows the DMS-250 switch to separate its customers into unique partitions. STS codes are used in the routing tables of the switch for translations. Every call that enters the DMS-250 switch is assigned an STS; the STS indexes the routing information to process the call.

SES

> severe errored seconds

SETUP

> Q.931 message type

SF

> superframe format

SGD

> super generic digits

SID
signaling system 7

> A dual processor device with an 8085-based master processor and an 8031-based data link processor resident in a single card in the message switch and buffer 7 frame.

signaling terminal

> The hardware that performs error checking, coding, and decoding of CCS7 signaling messages.

signal transfer point

> A switch used to provide signaling link connections between switches. STPs transfer messages between incoming and outgoing signaling links. An STP is a tandem node for CCS7 signaling links and contains hardware to support CCS7 hardware and software to route CCS7 messages. It does not contain any software to create or interpret CCS7 messages. STPs are used in pairs. If one STP fails, the mate takes over to ensure that service continues without interruption.

SSP

> *See* service switching point.

ST

> *See* signaling terminal.

STP

> *See* signal transfer point.

STDPRTCT

> standard pretranslator control table

STS

> *See* serving translations scheme.

SUPPCODE

supplementary code

SWACT

See switch of activity.

switch of activity

Activity switch between CPUs for maintenance purposes. A SWACT makes an active device inactive and an inactive device active.

SYSB

See system busy.

system busy state

A busy state that is automatically imposed by equipment in response to a fault condition.

TCAP

See translation capabilities application part.

TIE

trunk connecting two PBXs

TON

type of number

TOPS

traffic-oriented position system

translation

The process by which the switch accesses information in data tables to determine a call's destination based on subscriber plan and dialed digits. Translation enables calls to be set up and taken down through facilities that are defined by datafill The actions the DMS switch performs using data tables after they are datafilled.

translation capabilities application part

A level of CCS7 layered protocol. A service that provides a common protocol for remote operations across the CCS7 network. This protocol consistes of message formatting, content rules, and exchange procedures. TCAP provides the ability for the service switching point (SSP). TCAP is used by the ISDN layer facility message to transport service information for transaction signaling (not associated with an active call) over PRI links.

translation verification

A diagnostic tool that allows the operating company to access and stimulate a telephone call in software and display the tables and tuples used to establish the lines, trunks, or positions to which a call is routed.

TRAVER

See translation verification.

treatment codes

Codes that trigger a set of defined announcements or tones that are audible to the user. Calls are sent to treatment because they cannot be completed or as part of normal call completion. A call terminates in a specified treatement code either because the translations supplied by the operating company lead the call to a specified treatment or because the DMS-250 switch detects certain conditions and prescribes a treatment code without reference to operating company translations. These conditions make it impossible to complete a call. The treatment code can be part of a normal call completion process that includes, for example, an announcement to the originator before the call is completed.

TRK

trunk

TRKGRP

See trunk group table.

TRKSGRP

trunk subgroup table

TRKGRSIZ

trunk group size

trunk test position

A MAP terminal specially equipped to perform trunk testing.

TST

test

TTC

terminating trunk class

TTP

See trunk test position.

TTT

trunk test terminator

trunk group table

A table that defines the trunk groups for the office.

universal tone receiver

An optional service card in the peripheral module that serves as a Digitone receiver for lines and as a multifrequency receiver for trunks. The UTR is a 32-channel receiver. Thirty channels detect dual-tone multifrequency tones and analyze the samples. The results are sent to the signaling processor.

UTR

See universal tone receiver.

UUI

user to user interface

virtual private network

A network of PBXs owned by a private company. These PBXs connect directly to each other and directly to LEC and IEC switches.

VNET

Virtual network; MWC's version of a virtual private network. *See* virtual private network.

VPN

See virtual private network.

WATS

See wide-area telecommunications service.

wide area telephone service

Telephone company service allowing reduced costs for certain telephone call arrangements.

XLAIEC

interexchange carrier translation and routing

XMS peripheral module

An XPM has two processors in a hot-standby configuration: a master processor and a signaling processor.

XPM

See XMS peripheral module.

ZCS

zero code suppression

64R

   64 kbit/s restricted

64C

   64 kbit/s clear (unrestricted)

Digital Switching Systems
DMS-250
ISDN Reference Manual

Information is subject to change without notice. Nortel Networks reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant.
This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules, and the radio interference regulations of Industry Canada. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.
The SL-100 system is certified by the Canadian Standards Association (CSA) with the Nationally Recognized Testing Laboratory (NRTL).
This equipment is capable of providing users with access to interstate providers of operator services through the use of equal access codes. Modifications by aggregators to alter these capabilities is a violation of the Telephone Operator Consumer Service Improvement Act of 1990 and Part 68 of the FCC Rules.
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