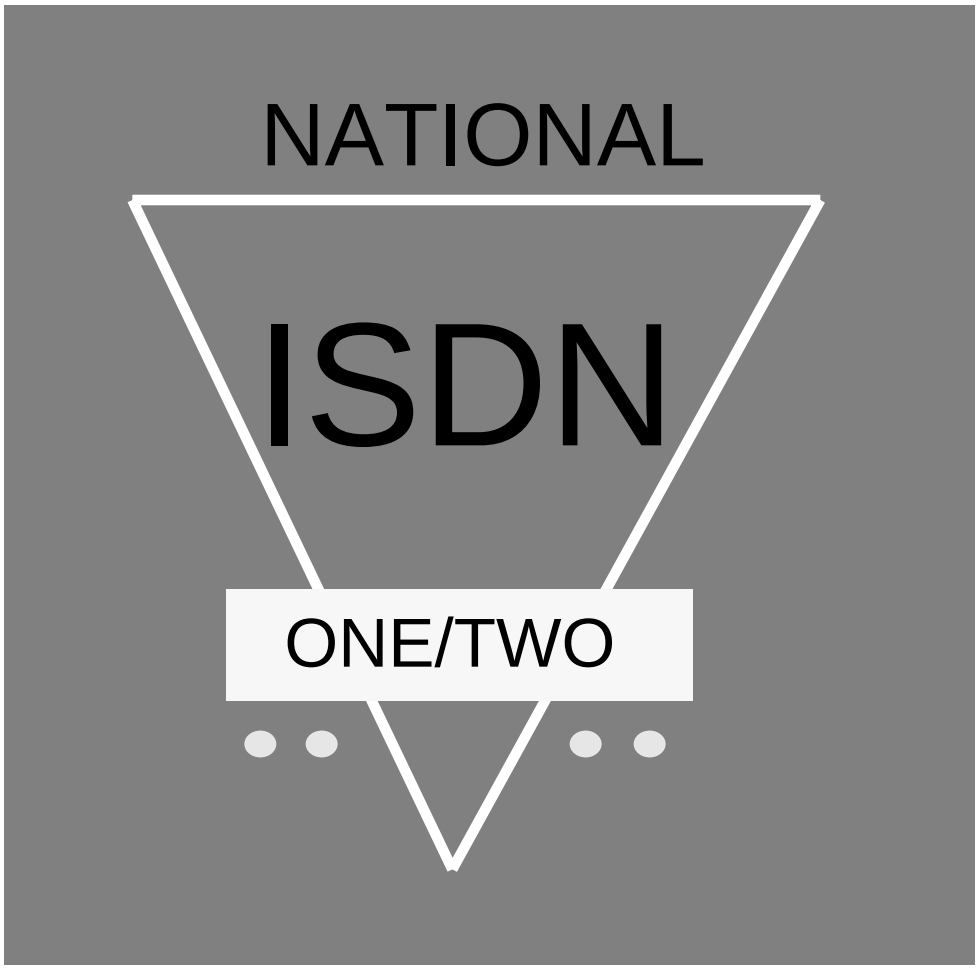
NIS-A221-1

DMS-100 family

DMS Packet Handler (DMS PH)

X.75/X.75' Interface Specifications

NA004B Standard 01.02 July 1996



NORTEL
NORTHERN TELECOM

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Update to Intra-LATA description. Figures 1 and 2 corrected. Remaining references to CCITT changed to ITU.

May 1995

Revisions to include TSC, CSI utilities, change of CCITT to ITU, RPOA and CUG updates.

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Final draft

Contents

About this document

This document applies to the DMS-100 integrated Packet Handler which is implemented within the Link Peripheral Processor(LPP). It describes the X.75 and X.75’ trunk interface services, utilities, and provisioning parameters that are supported in release NA004B. It will apply for the most part to subsequent releases, however, Northern Telecom reserves the right to make changes as progress in the industry warrants.

This document is organized into the following chapters:

1. Introduction
describes the DMS PH and gives a brief overview of its X.75/X.75' interface application, function, and compliances.

2. Service interface
describes the X.75 physical and virtual services provided and supported by the DMS PH, together with the addressing information, utilities supported, and general provisioning information.

3. Network utilities
gives the X.75 and X.75 Prime (X.75') network utilities provided by and supported from DMS PH.

4. X.75 Call routing
provides a network view of X.75/X.75' call routing as it applies to packet calls in the North American market.

5. Error conditions and maintenance actions
describes the X.75/X.75' trunk packet error conditions and how they will affect the DMS PH. It also describes how to take an X.75 trunk out of service, and lists the appropriate clearing cause and diagnostic codes generated by the service.

Appendix A: Layer procedure tables
compares the differences and similarities between the DMS PH X.75/X.75' implementation and the ITU’s *Recommendation X.75* (1988).

Appendix B: Glossary
is a glossary of the acronyms contained in this document.

Chapter 1: Introduction

Purpose

This document gives the DMS Packet Handler interface specifications for X.75 and X.75 Prime (X.75') trunks.

Unless specified in this document and except for the parameters on the Bell operating company (BOC) utilities, all information in this document refers to both X.75 and X.75'. The information on BOC utilities applies only to X.75'.

The DMS Packet Handler (DMS PH) is a product that provides integrated X.25 packet service for the DMS-100 family Integrated services digital network (ISDN).

The DMS PH X.75/X.75' interface connects inter-switch packet calls and provides National ISDN 1 and 2 (NI-1/2) functions as specified in the standard Bellcore technical specifications documents *ISDN digit and routing analysis*, TY-TSY-448 and *PPSN generic requirements*; TR-TSY-301.

Inter-switch calls supported by the DMS PH can be of two types:

- **Intra-LATA calls**
  - — intra-network calls set up between terminals that are on different switches, where those switches are all operated by the same administration within a LATA. X.75’ trunks apply in this case.
  - — inter-network calls between terminals on different switches, where those switches are operated by different administrations (for example, a Bell Operating Company and an Independent telco) within a LATA. X.75 trunks are typically used in this case.
- **Inter-LATA calls**
  - — calls set up between terminals that are on switches in different LATAs. X.75 trunks to Interexchange Carrier networks are used in this case.

Inter-LATA (local access and transport area) calls may be between networks that are connected by inter-exchange carrier (IEC) networks owned by different administrations, known as registered private operating agencies (RPOA). Some LATA networks are connected by more than one RPOA. The LATA administrations are required by U.S. law to allow customers the option of choosing any RPOA on a call-by-call basis.

Trunk access

DMS PH complies with the ITU Recommendations (1988) for X.75. All data packets sent to other LATAs or networks pass through an X.75/X.75' interface.

Within the LATA jurisdiction, calls between switches use X.75 prime protocol (X.75'), which supports the full range of ITU X.75 utilities, together with other utilities as specified for the Bell operating companies (BOC) ISDN connections.

Support

To ensure compliance with US. LATA operations, all access services support both signaled and provisioned RPOA facilities. This allows customers to select an independent exchange carrier (IEC) subscription for pre-select on a call-by-call basis.

The DMS PH supports the E.164 numbering system. It also supports escape to E.164 or X.121 numbering systems and support for RPOA translations.

Packet network description

The DMS PH is designed to be compatible with U.S. LATA networks that offer ISDN packet services. This section shows the U.S. network environment in which the DMS PH can be deployed.

In the United States, there are a number of telephone operating districts that are referred to as local access and transport areas (LATA). Each LATA can consist of a number of sub-networks that can be ISDN or public packet-switched (PPSN). LATAs are interconnected via packet-switched public data networks (PSPDN) operated by Interexchange Carriers.

All customers are given access to the IEC of their choice when making long-distance packet calls.

Intra-LATA traffic may be carried by one local exchange carrier (LEC) although competitive carriers are allowed for local and long-distance Intra-LATA carriage. LATA's are also frequently divided into Bell Operating Company and Independent Telephone Company areas. Figure 1 shows a typical LATA configuration with inter-exchange carriers connected to various configurations of LATA packet switches belonging to one local carrier.

As a result of the LATA routing criteria, the destination LATA has to be determined in relation to the originating LATA before routing decisions can be made. This is discussed in more detail in Chapter 4, *X.75 call routing*.

Figure 1
Typical U.S. packet network configuration

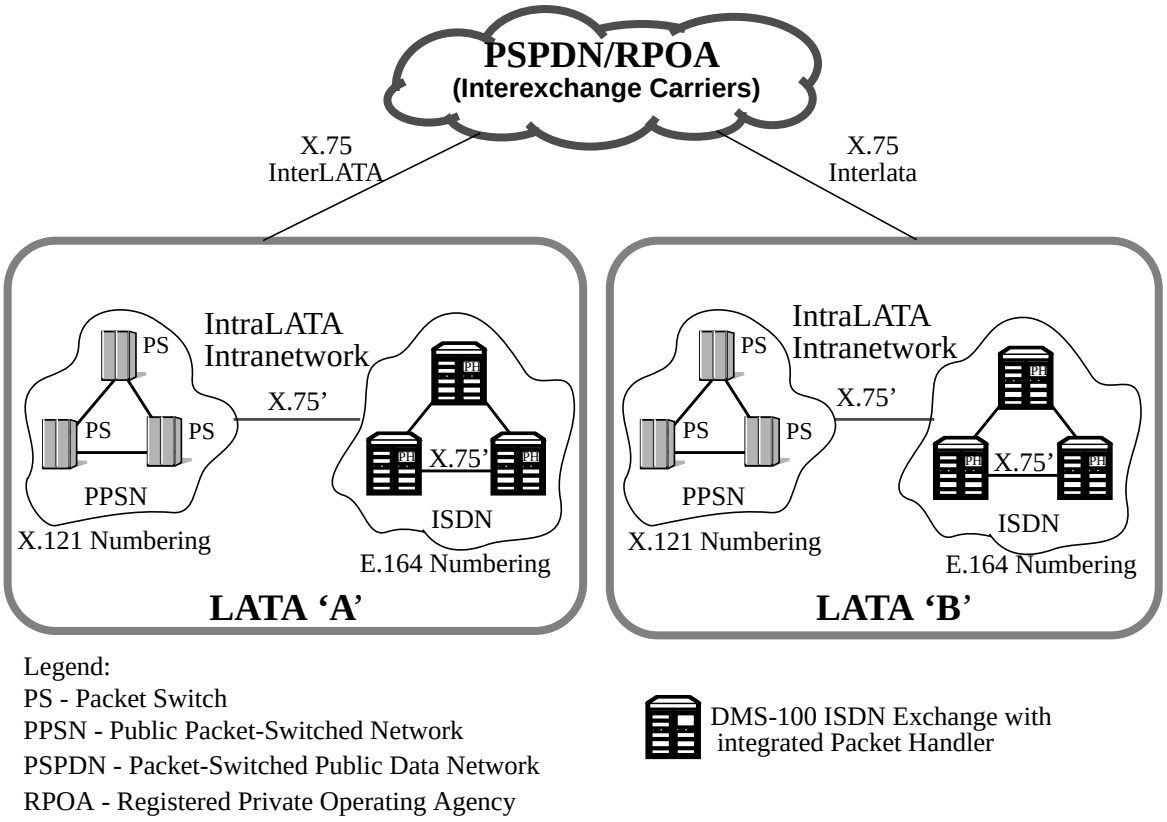


Figure 1 also shows how the DMS PH can be deployed. Different trunk protocols are supported for interconnection with the various packet switches. Calls originating from X.25 data terminal equipment on the DMS PH can terminate on other ISDN or public packet switched network (PPSN) nodes within the same operator's network by way of the X.75' trunks. Calls to other LATAs are routed to Interexchange Carriers (or RPOAs) via X.75 trunks. Data terminals served by the DMS PH are identified by the E.163/4 numbering plan. However, routing to and from X.121 networks is supported.

Chapter 2: Service interface

Service overview

This chapter provides the following information on the DMS PH X.75/X.75' interface:

- physical layer summary
- link layer summary
- packet layer summary
- addressing convention
- services supported
- general provisioning information
- utilities supported

Provisioning on the DMS PH X.75X.75/X.75' interface allows customers to select utilities on outgoing interfaces only. On incoming interfaces, all utilities supported are processed, as appropriate, without having an impact on the settings of the outgoing interface parameters.

Table 1
X.75/X.75' parameters

Parameters	DMS PH	
	Range	**Default**
Link layer:		
Frame sequencing	Mod8 or Mod128	Mod8
Window size K (No. of unacknowledged frames)	1-7 for Mod8 1-127 for Mod128	2 2
Number of I-Frame bits N1	2120	

—continued—

Table 1
X.75/X.75' parameters

Parameters	DMS PH	
	Range	**Default**
Number of re-transmissions N2	2-15	3
Acknowledgment timer (seconds) T1[1]	0.5 -10	3
Response timer (seconds) T2	0 - 0.4	0.2
Idle line timer (seconds) T3[1]	1-30	5
Note 1: T3 must be greater than T1.		
Packet layer:		
Packet level sequencing	Mod8 or Mod128	Mod8
Outgoing maximum window size (No. of packets)	1-7 for Mod8	2
	1-127 for Mod128	2
Incoming maximum window size (No. of packets)	1-7 for Mod8	2
	1-127 for Mod128	2
Outgoing maximum packet size (octets)	128 or 256	128
Incoming maximum packet size (octets)	128 or 256	128
Outgoing default throughput class[3] (b/s)	up to 64000	9600
Incoming default throughput class[3] (b/s)	up to 64000	9600
Logical channel selection sequence	Ascending or Descending	Ascending
3 The throughput classes are: 75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 48000 and 64000 b/s		
ITU utilities:		
A. Mandatory[4]		
— Transit Network Identification Code		
— Call Identifier		
— Throughput Class Indication		
— Window Size Indication		
— Packet Size Indication		
— Fast Select Indication		

—continued—

Table 1
X.75/X.75' parameters

Parameters	DMS PH	
	Range	**Default**
— Closed User Group Indication		
— Called Line Address Modified Notification Indication		
— Transit Delay Indication	Yes or No	Note 6
B. Optional		
— Reverse Charging Indication	Yes or No	Note 6
— Clearing Network Identification Code	Yes or No	Note 6
— Transit Delay Selection	Yes or No	Note 6
— Utility Marker[5]		
— Outgoing Tariffs	Yes or No	Note 6
— Incoming Tariffs	Yes or No	Note 6
— Network User Identification	Yes or No	Note 6
— RPOA Selection[5]		
BOC Utilities:		
— Inter-exchange Carrier Preselection Indication[5]		
— Access Characteristics	Yes or No	Note 6
— Protocol Conversion Permissions	Yes or No	Note 6
— X.75 Interface Identifier	Yes or No	Note 6
— Transit Subnetwork Count	0 to 14	14 (Note 7)
— Clearing Subnetwork Identification	0000 to 9999	9999 (Notes 7, 8)

Table 1
X.75/X.75' parameters

Parameters	DMS PH	
	Range	**Default**
4 With the exception of the Transit Delay Indication parameter, the ITU mandatory utilities are not provisionable. They will be inserted (call originating), passed (tandem calls), or processed on incoming X.75/X.75' interfaces		
5 The utility is not provisionable. It is always enabled when the trunk type is set to X.75'.		
6 In the DMS PH 'Range' column; — For calls originating from the DMS SuperNode; Yes (On) = Insert / No (Off) = Not inserted. — For tandem calls; Yes (On) = Pass / No (Off) = Not passed No default is provided. The utility has to be specifically turned on (Yes) and off (No).		
7 Provisioned switch-wide in Table SVCDATA. Enabled on trunk sub-group basis in Table TRKSGRP.		
8 The value 9999 is an initial value that should be changed by the subnetwork administrators to identify each network element.		

Physical layer procedures

The physical layer of the X.75 protocol consists of the transmission facilities and a set of mechanical, electrical, functional, and procedural interface characteristics that allow information transfer between two signaling terminals.

The X.75 physical layer consists of a single, full duplex, synchronous transmission facility. In the DMS PH implementation, data rates of 56 kb/s or 64 kb/s per DS-0 channel are supported on a DS-1 basis on the NT6X50AB version of the DS-1 card. For 56 kb/s, the ZCS line code option is specified in Table CARRMTC at provisioning time. For 64 kb/s, the B8ZS bipolar line code is specified in Table CARRMTC.The NT6X50AA version of the DS-1 interface card supports the 56 kb/s, ZCS combination only. The DS-1 interfaces are mounted in an ISDN digital trunk controller (DTCI) - a DMS SuperNode peripheral.

Link layer procedures

The link layer of the X.75 protocol operates over the physical circuits and provides a mechanism for reliable transport of control information and user data in unit of frames.

The DMS PH supports the single link procedure (SLP) as specified in the ITU's *Recommendation X.75* (1988). Frame sequencing of both modulo 8 and modulo 128 are supported. Service data selectable options allow the network administration to configure either the extended mode (modulo 128) or the non-extended mode (modulo 8) on each physical circuit. The choice of mode is independent of the packet layer procedures and is a matter of bi-lateral agreement between network administrations.

Frame structure

All link layer transmissions are in frames conforming to the ITU's *Recommendation X.75*, (1988).

Elements of procedures

The actions that occur on receipt of the various link layer frames conform to the ITU's *Recommendation X.75*, (1988).

Link layer parameters

With the exception of the N1 parameter, all of the ITU link-layer parameters are provisioned separately for each trunk.

Parameter K

This parameter indicates the maximum number of outstanding unacknowledged information frames that are permitted on the link.

For modulo 8, the allowable range is from 1 to 7, with one-unit increments.

For modulo 128, the allowable range is from 1 to 127, with one-unit increments

For both modulo 8 and modulo 128, the default value is 2.

Parameter N2

This parameter specifies the maximum number of attempts allowed to complete a successful transmission of a frame. The allowable range is from 2 to 15, with one-unit increments. The default value is 3.

Parameter N1

This parameter specifies the maximum number of bits in an I-frame between flags (including the frame header). This parameter cannot be changed. The DMS PH supports a N1 value of 2120 bits.

Parameter T1

This parameter specifies the period of time after which a frame may be retransmitted. The allowable range is from 0.5 to 10 seconds with increments of 0.1 second. The default is 3 seconds.

Parameter T2

This parameter specifies the amount of time before acknowledgment frames must be initiated. If the acknowledgment is not received by the other Signaling terminal equipment (STE), the Timer T1 will run out at the distant STE. The allowable range is from 0 to 0.4 seconds, in increments of 0.1 seconds. The default is 0.2 seconds.

Parameter T3

This parameter specifies the maximum allowed time for a channel to be in an idle state. At the end of this time period, a notification of the idle state is passed to the packet-layer level.

The DMS PH implements a link-layer idle-probing mechanism which is functionally equivalent to the T3 timer defined in the ITU's *Recommendation X.75,* (1988). After the link has been idle for the period of the T3 timer (and frames are not being sent or received on the link), a polling-level command [Receive ready/Receive not ready (RR/RNR)] frame is sent to the remote end of the link to solicit a response. If the remote end does not respond within T1 seconds, the frame is retransmitted N2 times, after which the link resetting procedure is attempted. If the link resetting procedure fails, the system considers the link to be down.

The allowable range for the T3 value is from 1 to 30 seconds, with one-second increments. The default is 5 seconds.

Packet layer procedures

The packet layer of the X.75 protocol uses the link-layer procedures to exchange user traffic in packets between two STEs. The user traffic includes both call-control information and user data.

The packet layer of the X.75 protocol complies with the ITU's *Recommendation X.75,* (1988). This section details various aspects of the packet layer.

Logical channels

To enable simultaneous virtual calls, permanent virtual circuits, or both, on a data link, logical channels are used. Each virtual call or permanent virtual circuit is assigned a logical channel number. The DMS PH allows logical channel numbers in the range of 1 to 4095.
For virtual calls, the logical channel numbers are assigned at call setup time. For permanent virtual circuits, the logical channel numbers are assigned at subscription time. The ranges of logical channels that are available for virtual calls and for permanent virtual circuits are a matter of bilateral agreement between network administrations.

The DMS PH supports a maximum of 512 logical channels on an X.75 interface (trunk). Any combination of numbers of PVCs and two-way virtual circuits up to 512 is allowed. To minimize the risk of call collision, the network administrators must choose between the link-layer and packet-layer for the beginning logical channel number (base LCN) and the order in which the logical channel selection on the X.75 interface is made. The order can either be set to ‘ascending’ (start the search at the lowest numbered logical channel available), or ‘descending’ (start the search at the highest numbered logical channel available).

Packet layer timers

The DMS PH implementation of X.75 supports the time-out duration of the timers specified in ITU’s *Recommendation X.75*, (1988):

- Restart timer T30 — 180 seconds
- Call timer T31 — 200 seconds
- Reset timer T32 — 180 seconds
- Clear timer T33 — 180 seconds

Virtual call service

The following sections explain the steps involved in virtual call service:

- Call setup and clearing
- Sequenced data transfer
- D-bit, M-bit and Q-bit
- Interrupt data transfer
- Flow control
- Call reset

Call setup and clearing

The DMS PH sends a call-request packet specifying a logical channel number to the remote STE to indicate a call request. This moves the logical channel state from ‘ready’ to ‘call request’.

The DMS PH sends a call-connected packet (specifying the same logical channel number as that in the call-request packet previously received from the remote STE), to indicate acceptance of the call. This moves the logical channel state from ‘call request’ to ‘data transfer’.

In the event of call collision (for example, if the DMS PH receives a call-request packet specifying a logical channel which is already in the “call request” state), the DMS PH clears both virtual calls. To minimize the risk of call collision, inverse ordering of logical channels may be used on either end of the X.75 interface. The DMS PH provides the service-selectable option of either ‘ascending’ or ‘descending’ in the search order of logical channels for each X.75 interface. The logical channel order option is a matter of bi-lateral agreement between network administrations.

The DMS PH sends a clear-request packet specifying a logical channel to the remote STE to request clearing of the logical channel. The specified logical channel may be in any state.

Data transfer may continue between the DMS PH and the remote STE until a clear-confirm packet is received from the remote STE.

The DMS PH sends a clear-confirm packet (specifying the same logical channel as that in the clear-request packet previously received from the remote STE), to indicate a clear confirmation.

When the DMS PH receives a clear-request packet specifying a logical channel which is already in the ‘clear request’ state, the DMS PH assumes that the clearing is complete and will not send a clear confirm to the remote STE.

Sequenced data transfer

The DMS PH transparently passes all user data in the X.75 data packets. Each data packet transmitted in a virtual call is sequentially numbered for each direction of transmission. The DMS PH supports both the modulo 8 and modulo 128 numbering schemes. For modulo 8, the maximum window size ranges from 1 to 7 packets, for modulo 128, the maximum window size ranges from 1 to 127 packets. The packet level sequencing is a service-selectable option provisionable on a per X.75 interface basis.

The DMS PH supports a maximum packet size of 128 or 256 bytes. This is a service-selectable option set with bilateral agreement between network administrations. The maximum packet size may also be negotiated for each virtual call using an optional network utility in the call-request packet. The DMS PH resets the virtual call upon the receipt of a data packet exceeding the maximum length.

D-bit, M-bit and Q-bit

The DMS PH validates and processes received packets for proper use of D-bit, M-bit, and Q-bit. These fields are not be set or changed within the DMS PH. DMS PH does not perform segmentation or combination of data packets, which is required in conjunction with setting M-bit.

Interrupt data transfer

The DMS PH supports the transfer of interrupt data when the logical channel is in the flow control ready state. The interrupt packet has no effect on the transfer and flow control of user data on the virtual call.

The DMS PH responds with an interrupt-confirm packet when an interrupt packet is received from the remote STE. If a second interrupt packet is received before the first has been confirmed, the DMS PH resets the virtual call.

The DMS PH resets the virtual call upon the receipt of an interrupt packet with more than 32 octets of user data.

Flow control

The DMS PH supports the flow-control procedures specified in the ITU's *Recommendation X.75*, (1988).

Call reset

The DMS PH supports the reset procedures for logical channels in the data transfer state. When resetting a specified logical channel, the DMS PH re-initializes the lower window edge to zero and purges any data packets that may have been queued up for the specified channel.

The DMS PH waits for the reset-confirm packet after a reset-request packet specifying a logical channel has been sent to the remote STE. While the logical channel is in the reset-request state, the DMS PH will discard data, interrupt, RR, and RNR the packet destined to that channel.

The reset procedures are complete when the reset-confirm packet is received from the remote STE. The specified logical channel is then placed in the flow control state.

Reset collision occurs whenever both STEs transmit simultaneously reset-request packets. In such cases, the DMS PH considers the resetting complete without waiting for the reset-confirm packet.

Permanent virtual circuit service

Permanent virtual circuits (PVC) do not have call setup and clearing phases. PVCs are established when an X.75 interface is initialized.

If PVCs are present on an X.75 interface, the DMS PH exchanges restart and restart-confirm packets with the remote STE. Once this exchange is complete, the DMS PH establishes the PVCs on its sub-network according to the provisioned parameters.

If the remote STE starts transferring data over a PVC before its establishment on the DMS PH side is complete or if the network, for other reasons, has a temporary inability to handle data traffic, the DMS PH sends a reset packet to the remote STE with the resetting cause "`network out of order`".

When the network is able to handle data traffic, the DMS PH again resets the PVC with the cause "`network operational`". In the case of momentary failure within the network, the DMS PH resets the PVC with cause "`network congestion`" and then continues to handle data traffic.

The DMS PH provides the following service-selectable options (which can be provisioned for each PVC) to specify those negotiations normally handled by call-setup procedures in a virtual call:

- the local and remote logical channel number (within the DMS PH network)
- the send and receive throughput class
- the send and receive window size
- the send and receive packet size

Associated with the PVC endpoints, there is a master/slave relationship for billing purposes. The specification of a PVC endpoint as one or the other is also a service-selectable option.

All PVC options are a matter of bi-lateral agreement between network administrations. In the event that the above options have not been specified, the following default values are in effect:

- Master-end send throughput class — 9600 b/s
- Master-end receive throughput class — 9600 b/s
- Master-end maximum sending packet size — 128 bytes
- Master-end maximum receiving packet size — 128 bytes
- Master end-sending window size — 2 (for unacknowledged packets)
- Master end-receiving window size — 2 (for unacknowledged packets)
- LATA status of PVC — intra-LATA (unless one {at least} of the end-points is an X.75 interface).
- billing enabled — Yes
- network user interface or normal billing — normal

Procedure for restart

On receipt of a restart-request packet from the remote STE, the DMS PH does the following:

1 clears all virtual calls

2 resets all PVCs

3 places all logical channels for virtual calls in the ready state

4 places all logical channels for PVCs in the flow control ready state

5 returns a restart-confirmation packet

Restart collision occurs when both STEs simultaneously transfer restart-request packets. In these cases, the DMS PH does not send the restart-confirmation packet.

Cause codes and diagnostic code mappings

The ITU's *Recommendation X.75,* (1988) requires that when the cause code in a clear-request, reset-request or a restart-request packet is "`network congestion`", a range of network-specific diagnostic codes supported in X.25 should be mapped into less specific codes in X.75. The diagnostic code mappings at the X.75 interface are shown in Table 2:

Table 2
Diagnostic code mapping

Decimal diagnostic code originally generated	Decimal diagnostic code passed
0	0
1 to 111	114
112 to 127	same
128 to 255	113

Diagnostic code mappings at the X.75' interface are as specified by ITU's *Recommendation X.75,* (1988) with the exception that the BOC-specific diagnostic codes in the range of 211 to 220 are passed without mapping.

Table 3 gives the BOC specific X.75' diagnostic codes that have been defined in the range of 211 to 220:

Table 3
X.75' Diagnostic codes

Code	Cause	Error Condition
211	network congestion	X.75' protocol/procedural violation
212	network congestion	Invalid/excessive looping within network detected/assumed

Note: The DMS PH does not generate the diagnostic code 212 but passes it transparently when acting as a transit network.

Network utilities

The DMS PH clears the virtual call if the network utility field in a packet received from the remote STE has one or more of the following:

- invalid field length (longer than 64 bytes)
- invalid format (network utilities which are invalid or not supported)
- nonallowed facility (as defined in the ITU's *Recommendation X.75*, 1988; section 5)

The clearing cause is "`network congestion`" and the diagnostic code is "`65-facility code not allowed`".

Chapter 3: X.75/X.75' Network Utilities

ITU mandatory utilities

The following is a list of ITU X.75 mandatory network utilities supported on DMS PH:

- Transit Delay Indication
- Transit Network Identification Code
- Call Identifier
- Throughput Class Indication
- Window Size Indication
- Packet Size Indication
- Fast Select Indication
- Closed User Group Indication
- Closed User Group With Outgoing Access Indication
- Called Line Address Modification Notification

With the exception of Transit Delay Indication, these mandatory utilities are not provisionable on DMS PH.

Transit Network Identification Code

The Transit Network Identification Code (TNIC) utility is used to name a transit network controlling a portion of a virtual call. A transit network is identified by either its data network identification code (DNIC) or its ISDN network identification code (INIC).

The TNIC utility is an ITU mandatory utility and is always enabled on an X.75/X.75' interface.

The DMS PH supports the Transit Network Identification Code utility as follows:

- When the DMS PH is acting as a transit network, it includes the TNIC utility (with the parameter field equal to the DNIC/INIC of the DMS PH) in the X.75 call-request packet transmitted to the remote STE, provided that a TNIC with the same DNIC/INIC has not already been inserted.
- The DMS PH transparently passes a sequence of up to fifteen TNICs in the X.75 call-request packet transmitted to the remote STE.
- For an X.75 call-request packet received from the remote STE that includes a sequence of up to fifteen TNICs, the DMS PH includes the received TNIC(s) in either the X.75 call-connect packet or the X.75 clear-request packet transmitted to the remote STE as a response to the received X.75 call-request packet.

  Note: If the remote STE is connected to the DMS PH by an X.75' interface, the Access Characteristics utility must be enabled for the TNIC utility to function properly.

- An X.75 call-request packet, X.75 call-connect packet or X.75 clear-request packet received from a remote STE that includes more than fifteen TNICs, are cleared by the DMS PH.
  Clearing cause: `network congestion`
  Diagnostic code: `120-temporary routing problem`
- For an X.75 call-request packet, an X.75 call-connect packet or an X.75 clear-request packet received from the remote STE that includes duplicate DNIC/INIC in its sequence of TNIC utilities, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `66-facility parameter not allowed`
- For an X.75 call-connect packet or an X.75 clear-request packet received from the remote STE as a direct response to an X.75 call-request packet, if it includes a sequence of TNICs which does not match the sequence included in the X.75 call-request packet previously transmitted to the remote STE, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `98-TNIC mismatch`

Call Identifier

The Call Identifier is generated by the originating network and is an identifying name for each virtual circuit established. Used in conjunction with the calling Customer premises equipment (CPE), it uniquely identifies the virtual call and used for billing purposes.

The Call Identifier utility is an ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Call Identifier utility as follows:

- The DMS PH includes the Call Identifier utility in an X.75 call-request packet transmitted to the remote STE. The Call Identifier is generated by the DMS PH when it is the source network. The Call Identifier used in conjunction with the calling CPE address is guaranteed unique for a period of time.
- For an X.75 call-request packet received from the remote STE that does not include the Call Identifier utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `76-facility missing`
- For an X.75 call-connect packet received from the remote STE, if it contains a Call Identifier utility that does not match the Call Identifier included in the X.75 Call request previously transmitted to the remote STE, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `99-Call Identifier mismatch`

  If the packet does not include the Call Identifier utility, DMS PH allows the call to be proceed to the data transfer state.

Throughput Class Indication

The Throughput Class Indication utility may be used by any STE to specify the throughput classes to be applied to the call being set up. If not explicitly requested, the STE is assumed to request the default throughput class values agreed upon by the administrations. The actual throughput class of a virtual call is dependent on the traffic conditions and patterns existent in the switch. The DMS PH does not attempt to allocate resources in order to guarantee a specified throughput class.

The Throughput Class Indication utility is an ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Throughput Class Indication utility as follows:

- The DMS PH includes the Throughput Class Indication utility in an X.75 call-request packet transmitted to a remote STE. The DMS PH requests the specified values for the throughput class for both directions of transmission.

- In an X.75 call-connect packet received from the remote STE that includes the Throughput Class Indication utility, the DMS PH clears the call if the throughput class as indicated by the received Throughput Class Indication utility is higher than that included in the X.75 call-request packet previously transmitted to the remote STE.
  Clearing cause: `network congestion`
  Diagnostic code: `100-bad utility parameter`

  If the throughput value received in Call connect is the same or lower than the value requested, then that is the throughput value adopted by the DMS PH for the virtual call.
- In an X.75 call-connect packet received from the remote STE that does not include the Throughput Class Indication utility, the DMS PH assumes that the remote STE is requesting the default throughput class. The DMS PH uses the lesser of the default throughput class, and that included in the X.75 call-request packet.
- In an X.75 call-request packet received from the remote STE that includes the Throughput Class Indication utility, the DMS PH may accept the requested throughput class value, or it may lower the throughput class value. The DMS PH confirms the throughput class value to be applied to the virtual call by including the Throughput Class Indication utility in an X.75 call-connect packet transmitted to the remote STE. That value is the lesser of the default throughput class, and the value requested by the terminating CPE.
- In an X.75 call-request packet received from the remote STE that does not include the Throughput Class Indication utility, the DMS PH assumes that the remote STE is requesting the default throughput class to be applied to the virtual call. DMS PH confirms the throughput class to be applied to the virtual call by including the Throughput Class Indication utility in the call-connect packet transmitted to the remote STE. The throughput value is the lesser of the default throughput class, and the value requested by the terminating CPE.

Window Size Indication

The Window Size Indication may be used by any STE to negotiate the window sizes on a specified logical channel at the gateway interface for both directions of transmission.

The Window Size Indication utility is an ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Window Size Indication utility as follows:

- The DMS PH always includes the Window Size Indication utility in an X.75 call-request packet transmitted to the remote STE.The DMS PH requests the specified window size for both directions of transmission.

- In an X.75 call-connect packet received from the remote STE that includes the Window Size Indication utility, the DMS PH clears the call if the window size as indicated by the received Window Size Indication utility is higher than that included in the X.75 call-request packet previously transmitted to the remote STE.
  Clearing cause: `network congestion`
  Diagnostic code: `100-bad utility parameter`

  If the Window size received in the call-connect packet is the same or lower than the value requested in the call-request packet, then the window size adopted for the virtual call is the lesser value of the two.
- In an X.75 call-connect packet received from the remote STE that does not include the Window Size Indication utility, the DMS PH assumes that the default window size applies to the virtual call. The default is either the standard value of 2 packets, or a service data selectable option agreed upon between both administrations. The supported window sizes are 1 - 7 packets for Modulo 8, and 1 - 127 packets for Modulo 128.
  The DMS PH clears the call if the default window size is larger than that included in the X.75 call-request packet previously transmitted to the remote STE.
- In an X.75 call-request packet received from the remote STE that includes the Window Size Indication utility, the DMS PH may accept the requested window size, or it may reduce the window size value. The DMS PH confirms the window size to be applied to the virtual call by including the Window Size Indication utility in an X.75 call-connect packet transmitted to the remote STE. That window size is the lesser of the default value, and the value requested.
- In an X.75 call-request packet received from the remote STE that does not include the Window Size Indication utility, the DMS PH assume that the remote STE is requesting the default window size to be applied to the virtual call.
  DMS PH confirms the window size to be applied to the virtual call by including the Window Size Indication utility in the call-connect packet transmitted to the remote STE. The window size value used is the default value specified for the X.75 trunk.

Packet Size Indication

The Packet Size Indication may be used by any STE to negotiate the maximum data-field length of data packets on a specified logical channel at the gateway interface for both directions of data transmission.

The Packet Size Indication utility is an ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Packet Size Indication utility as follows:

- The DMS PH includes the Packet Size Indication utility in an X.75 call-request packet transmitted to the remote STE. The DMS PH requests the specified packet size for both directions of transmission.
- In an X.75 call-connect packet received from the remote STE that includes the Packet Size Indication utility, the DMS PH clears the call if the packet size as indicated by the received Packet size utility is higher than that included in the X.75 call-request packet previously transmitted to the remote STE.
  Clearing cause: `network congestion`
  Diagnostic code: `100-bad utility parameter`

  If the packet size received in the call-connect packet is the same or lower than the packet size requested in the call-request packet, then the packet size adopted for the virtual call is the lesser of the value requested in the two packets.
- In an X.75 call-connect packet received from the remote STE that does not include the Packet Size Indication utility, the DMS PH assumes that the default packet size applies to the virtual call. The default packet size is either the standard value of 128 octets, or a service-data selectable option agreed upon by both administrations. The DMS PH clears the call if the default packet size is higher than that included in the X.75 call-request packet previously transmitted to the remote STE.
- In an X.75 call-request packet received from the remote STE that includes the Packet Size Indication utility, the DMS PH may accept the requested packet size, or it may lower the packet size value. The DMS PH confirms the packet size to be applied to the virtual call by including the Packet Size Indication utility in an X.75 call-connect packet transmitted to the remote STE.
  If the packet size requested in the call-request packet is greater that the standard value of 128 octets, then the packet size to be confirmed is the lesser of the default packet size, and the packet size requested by the terminating CPE; otherwise, the packet size to be confirmed is the greater of the default packet size, and the packet size requested by the terminating CPE.

- In an X.75 call-request packet received from the remote STE that does not include the Packet Size Indication utility, the DMS PH assume that the remote STE is requesting the default packet size to be applied to the virtual call. DMS PH confirms the packet size to be applied to the virtual call by including the Packet Size Indication utility in the call-connect packet transmitted to the remote STE.
  If the packet size requested in the call-request packet is greater that the standard value of 128 octets, then the packet size value is the lesser of the default packet size, and the packet size value requested by the terminating CPE; otherwise, the packet size to be confirmed is the greater of the default packet size, and the packet size requested by the terminating CPE.

Fast Select Indication

The Fast Select Indication utility is used to indicate that fast-select applies to the virtual call. There are two types of fast-select calls: restricted fast-select (RFS) and unrestricted fast-select (UFS) call.

The Fast Select Indication utility is an ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Fast Select Indication utility as follows:

- In an X.75 call-request packet transmitted to the remote STE that includes the Fast Select Indication utility, the DMS PH indicates that fast select applies to the virtual call. The DMS PH may then include up to 128 octets of user data in this X.75 call-request packet.
- When restriction on the response is indicated in the X.75 call-request packet (an RFS call), the only valid response from the remote STE is a clear-request packet which includes up to 128 octets of user data. Any other type of packets issued by the remote STE as a response to the RFS call is cleared by the DMS PH.
  Clearing cause: `network congestion`
  Diagnostic code: `32-packet not allowed`
- When no restriction on response is indicated in the X.75 call-request packet (an UFS call), the remote STE is allowed to issue as a direct response to the X.75 call-request packet; that is, an X.75 call-connect packet with up to 128 octets of user data, or at any time a clear-request packet with up to 128 octets of user data.
  Once the virtual call has been connected, the DMS PH may issue a clear-request packet with up to 128 octets of user data to be transmitted to the remote STE.
- For an X.75 call-request packet, call-connect packet or clear-request packet in a fast-select call that includes a user data field longer than 128 octets, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `39-packet too long`

- For an X.75 call-connect packet or an X.75 clear-request packet received from the remote STE that includes the Fast Select Indication utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

Closed User Group Indication

The Closed User Group Indication utility is used to enable the establishment of virtual calls by CPEs which are members of international closed user groups (ICUGs).

The Closed User Group Indication utility is an ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Closed User Group Indication utility as follows:

- In an X.75 call-request packet transmitted to the remote STE, the DMS PH includes the Closed User Group Indication utility. When it is present, the DMS PH indicates that the international virtual call is requested on the basis of a valid international closed user group membership.
- For an X.75 call-request packet received from the remote STE that includes the Closed User Group Indication utility, the DMS PH clears the call if the ICUG code is missing, or if the ICUG code is invalid. The ICUG code is compared to the terminating DN's or the outgoing trunk's CUG list to determine if the call is allowed to proceed.
  Clearing cause: `access barred`
  Diagnostic code: `0-no further information`
- For an X.75 call-request packet received from the remote STE that includes both the Closed User Group Indication utility and the Closed User Group With Outgoing Access Indication utility, the DMS PH clears the call.
  Clearing cause: `invalid facility request`
  Diagnostic code: `65-facility code not allowed`
- Closed user group screening can be turned on or off for a particular trunk group.
- CUG screening is performed on outgoing calls over trunk interfaces. Incoming CUG calls from trunks are screened against the subsequent outgoing trunk's or the terminating DN's CUG list.

Closed user group with outgoing access Indication

The Closed User Group With Outgoing Access Indication utility is used to enable the establishment of virtual calls by CPEs which are members of International Closed user groups (ICUGs).

The Closed User Group With Outgoing Access Indication utility is an ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Closed User Group Indication utility as follows:

- In an X.75 call-request packet transmitted to the remote STE, the DMS PH includes the Closed User Group With Outgoing Access Indication utility. When it is present, the DMS PH indicates that the international virtual call is requested on the basis of a valid international closed user group membership with outgoing access capability.
- For an X.75 call-request packet received from the remote STE that includes the Closed User Group With Outgoing Access Indication utility, the DMS PH clears the call if the ICUG code is missing, or if the ICUG code is invalid. The ICUG code is compared to the terminating DN's or the outgoing trunk's CUG list to determine if the call is allowed to proceed.
  Clearing cause: `access barred`
  Diagnostic code: `0-no further information`
- For an X.75 call-request packet received from the remote STE that includes both the Closed User Group Indication utility and the Closed User Group With Outgoing Access Indication utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

Called Line Address Modification Notification

The Called Line Address Modification Notification (CLAMN) utility is used to indicate the reason when the called address in the packet is different from that specified in the call-request packet.

The Called Line Address Modification Notification utility is a ITU mandatory utility and is always enabled on the X.75/X.75' interface.

The DMS PH supports the Called Line Address Modification Notification utility as follows:

- In an X.75 call-connect packet transmitted to the remote STE that includes the Called Line Address Modification Notification utility, the DMS PH indicates that the called CPE address is different from that specified in the corresponding X.75 call-request packet previously received from the remote STE. The reason code for the address change is provided with this utility and is passed transparently.

- In an X.75 clear-request packet transmitted to the remote STE that includes the Called Line Address Modification Notification utility, the DMS PH indicates that the call is cleared by a CPE whose address is different from that specified in the corresponding X.75 call-request packet previously received from the remote STE. The reason code for the address change is provided with this utility.
- For an X.75 call-connect packet received from the remote STE with a called CPE address different from that specified in the X.75 call-request packet previously transmitted to the remote STE, that does not include the Called Line Address Modification Notification utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `67-bad called dn`
- For an X.75 clear-request packet received from the remote STE that includes the Called Line Address Modification Notification utility and is not the direct response to an X.75 call-request packet previously transmitted to the remote STE, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`
- For an X.75 call-request packet received from the remote STE that includes the Called Line Address Modification Notification utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

Transit Delay Indication

The Transit Delay Indication utility is used to signal the expected nominal transit delay of a virtual circuit. The transit delay parameter is dependent on the traffic conditions and patterns existent in the switch. The DMS PH does not attempt to allocate resources in order to guarantee the transit delay indicated.

The Transit Delay Indication utility is a service-data selectable option. The expected transit delay is the sum of the delay incurred in the DMS PH and the delay incurred on the link. The former of these two delays is a provisionable switch-wide parameter, the later is a provisionable parameter which takes into consideration the characteristics of the link.

When the Transit Delay Indication utility is enabled on the X.75/X.75' interface, it is supported as follows:

- When the DMS PH is acting as an out-going transit network, it adds to the parameter field of the Transit Delay Indication utility the expected nominal delay applicable to the virtual call in the X.75 call-request packet transmitted to the remote STE.

- When responding to an X.75 call-request packet received from the remote STE that includes the Transit Delay Indication utility, the DMS PH includes the Transit Delay Indication utility in the X.75 call-connect packet transmitted to the remote STE to indicate the accumulated transit delay applicable to the virtual call.
- For an X.75 call-connect packet received from the remote STE that does not include the Transit Delay Indication utility, but is a direct response to an X.75 call-request packet that included the Transit Delay Indication utility, the DMS PH sets all the bits in the transit delay parameter field to '1'.
- For an X.75 call-connect packet received from the remote STE that includes the Transit Delay Indication utility as a response to an X.75 call-request packet that did not include the Transit Delay Indication utility, the DMS PH discards the utility and the call proceeds without it.
- For an X.75 clear-request packet received from the remote STE that includes the Transit Delay Indication utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

If the Transit Delay Indication utility is not enabled on the DMS PH, the following applies:

- The DMS PH does not include the Transit Delay Indication utility in the X.75 call-request packet transmitted to the remote STE.
- For an X.75 call-connect packet received from the remote STE that includes the Transit Delay Indication utility, the DMS PH discards the utility.

Optional international utilities

The following optional international utilities are supported on DMS PH. With the exception of the Utility marker, they are all provisionable on the outgoing interface. On the incoming interface, all utilities are processed as appropriate:

- Reverse Charging Indication
- Clearing Network Identification Code
- Transit Delay Selection
- Utility Marker
- Tariffs
- Network User Identification

Reverse Charging Indication

The Reverse Charging Indication utility is used to enable virtual calls to be established internationally, when the reverse charging facility applies.

The Reverse Charging Indication utility is a service data selectable option. When it is enabled on the X.75/X.75' interface it is supported as follows:

- The DMS PH includes the Reverse Charging Indication utility in the X.75 call-request packet transmitted to the remote STE. When it is present, the DMS PH indicates a request for reverse charging for the virtual call.
- For an X.75 call-request packet received from the remote STE that includes the Reverse Charging Indication utility, the DMS PH performs the required screening and applies reverse-charging to the virtual call.
- For an X.75 call-connect packet or an X.75 clear-request packet received from the remote STE that includes the Reverse Charging Indication utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`
- If the Reverse Charging Indication utility is not enabled on the interface, the DMS PH clears all calls which include this utility.
  Clearing cause: `reverse charging not subscribed`
  Diagnostic code: `0-no further information`

Clearing network identification code

The Clearing network Identification Code (CNIC) utility provides additional information on the origin of the clear-request packet. It indicates the DNIC and INIC of the network originating the clear request.

The Clearing Network Identification Code utility is a service-data selectable option. If it is enabled on the X.75/X.75' interface, it is supported as follows:

- The DMS PH includes the Clearing Network Identification Code utility containing the DNIC or INIC of the DMS PH in the X.75 clear-request packet transmitted to the remote STE if the call is in the connected state and the clear is initiated by the DMS PH.
  The CNIC utility is not inserted if the call clear is initiated by the CPE.
- The DMS PH passes this utility transparently in the X.75 clear-request packet transmitted to the remote STE.
- For the X.75 call-request packet or the X.75 call-connect packet that includes the Clearing Network Identification Code utility, the DMS PH clears the call.
  Clearing code: `network congestion`
  Diagnostic code: `65-facility code not allowed`

If the Clearing Network Identification Code utility is not enabled on the X.75/X.75 interface:

- The DMS PH does not include this utility in the X.75 clear-request packet transmitted to the remote STE.

- For an X.75 clear-request packet received from the remote STE that includes the Clearing Network Identification Code utility, the DMS PH discards the utility.

Transit delay selection

The Transit Delay Selection utility signals that the transit delay is requested by the calling CPE.

The Transit Delay Selection utility is a service-data selectable option. When it is enabled on the DMS PH, it is supported as follows:

- The DMS PH includes the Transit Delay Selection utility in the X.75 call-request packet transmitted to the remote STE.
- For an X.75 call-connect packet or an X.75 clear-request packet received from the remote STE that includes the Transit Delay Selection utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

If the Transit Delay Selection utility is not enabled on the DMS PH, the following applies:

- The DMS PH does not include the Transit Delay Selection utility in the X.75 call-request packet transmitted to the remote STE.

Utility marker

The Utility Marker utility is used to separate ITU and non-ITU utilities in the X.75 packets.

The Utility Marker is not a provisionable utility. It is always enabled on an X.75' interface. The DMS PH supports the Utility Marker utility as follows:

- When transmitting the X.75 call-request packet, X.75 call-connect packet or X.75 clear-request packet to the remote STE, the DMS PH precedes the Bell operating companies (BOC) specific utilities with the Utility Marker if one or more of these utilities are included in the packet.
  The BOC specific utilities are:
  - IC Preselection indication
  - Access Characteristics
  - Protocol Conversion Permissions
  - X.75 Interface Identifier
  - Transit Subnetwork Count
  - Clearing Subnetwork Identification

- When receiving the X.75 call-request packet, X.75 call-connect packet or the X.75 clear-request packet from the remote STE that includes one or more of the BOC specific utility but does not include the Utility Marker, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`
- When receiving the X.75 call-request packet, X.75 call-connect packet or the X.75 clear-request packet from the remote STE that includes one or more of the BOC specific utility placed prior to the Utility Marker, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`
- When receiving the X.75 call-request packet, X.75 call-connect packet or the X.75 clear-request packet from the remote STE that includes one or more utility placed after the Utility Marker which is not one of the BOC specific utilities named above, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

Tariffs

The Tariffs utility is used to pass information from one network to one or more other networks participating in the call for the purpose of implementing billing, accounting, or tariff arrangements that may exist among the respective administrations.

The Tariffs utility is a service-data selectable option. If the Tariffs utility is enabled on an X.75' interface, it is supported as follows:

- In the X.75 call-request packet or the X.75 call-connect packet transmitted to the remote STE, the DMS PH includes the Tariffs utility in order to convey billing information regarding the calling party and the called party respectively.
- The DMS PH includes the Tariffs utility in the clear-request packet in order to convey the billing information of the called party, if the packet is a direct response to an X.75 call-request packet received from the remote STE.
- For an X.75 call-request packet or an X.75 call-connect packet received from the remote STE that includes the Tariffs utility, the DMS PH enters the conveyed billing information in the AMA record for the inter-network call.
- For an X.75 clear-request packet received from the remote STE that includes the Tariffs utility and is the direct response to an X.75 call-request packet previously transmitted to the remote STE, the DMS PH enters the conveyed billing information in the AMA record for the inter-network call.

If the Tariffs utility is not enabled on the X.75 interface:

- The DMS PH does not include the Tariffs utility in the X.75 call-request packet, the X.75 call-connect packet or the X.75 clear-request packet transmitted to the remote STE.
- For the X.75 call-request packet, the X.75 call-connect packet or the X.75 clear-request packet that includes the Tariffs utility, the utility is discarded before the packet is transmitted to the remote STE.

Network user identification

The Network User Identification (NUI) utility is used to facilitate billing and other financial arrangements among networks by providing a mechanism for passing user identification information.

For an X.75 call-request packet received from the remote STE that includes the Network User Identification utility which is not in the ITU standardized format, the DMS PH generates a clear-request packet.
Clearing cause: `access barred`
Diagnostic code: `84-nui problem`

The Network User Identification utility is a service data selectable option. If the Network User Identification utility is enabled on the X.75 interface, it is supported as follows:

- For an X.75 call-request packet received from the remote STE that includes the Network User Identification utility, the DMS PH passes this utility transparently.
- For an X.75 call-connect packet or X.75 clear-request packet received from the remote STE that includes the Network User Identification utility, the DMS PH generates a clear-request packet.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

If the Network User Identification utility is not enabled on the X.75 interface, it is supported as follows:

- For an X.75 call-request packet received from the remote STE that includes the Network User Identification utility, the DMS PH checks the utility parameters to determine whether the NUI is in ITU format and if it has been verified. If the utility has been verified, then the call-request packet is passed without the utility. If the utility has not been verified, then the DMS PH generates a clear-request packet.

Clearing cause: `network congestion`
Diagnostic code: `211-protocol or procedural violation detected`
— if the interface is X.75', or
Clearing cause: `access barred`
Diagnostic code: `84-nui problem`
— if the interface is X.75.

Optional national utilities

The Optional national utilities consist of the RPOA selection utility, which is not provisionable and is always enabled for an X.75' interface.

RPOA selection

The Recognized Private Operating Agency (RPOA) Selection utility is used by network CPEs to specify the transit network of their choice for inter-network calls. This utility carries an RPOA transit network DNIC or INIC specified by the calling CPE.

DMS PH supports the RPOA utility as follows:

- The DMS PH includes the RPOA Selection utility in the call-request packet transmitted to the remote STE on the out-going X.75' interface, to request the specified transit network to be used to route the call. The DMS PH supports a single RPOA Selection utility in an X.75’ call-request packet.
- The DMS PH deletes the RPOA Selection utility from the call-request packet transmitted to the remote STE on an out-going X.75 interface. If the call cannot be routed over the DNIC/INIC specified in the RPOA utility, the DMS PH clears the call.
  Clearing cause: `RPOA out of service`
  Diagnostic code: `77-international routing problem`
- For an X.75 call-request packet received from the remote STE on the X.75 interface that includes the RPOA Selection utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`
- For an X.75 call-request packet received from the remote STE that includes both the RPOA Selection utility and the Inter-exchange Preselection Indication utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`
- For an X.75 call-connect packet or an X.75 clear-request packet received from the remote STE that includes the RPOA Selection utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

BOC specific utilities

The following BOC specific utilities apply to X.75' trunks and are supported on DMS PH. The BOC specific utilities are placed after the Utility Marker:

- Inter-exchange Carrier Preselection Indication
- Access Characteristics
- Protocol Conversion Permissions
- X.75 Interface Identifier
- Transit Subnetwork Count
- Clearing Subnetwork Identification

Inter-exchange carrier preselection indication

The Inter-exchange Preselection Indication utility is used by network CPEs to indicate the preselection of a transit-network to be used to route inter-network calls when the need arises. The Inter-exchange Preselection Indication utility carries the transit-network DNIC/INIC specified by the calling CPE.

The Inter-exchange Preselection Indication utility is not provisionable. It is always enabled on an X.75' interface.

The DMS PH supports the Inter-exchange Preselection Indication utility as follows:

- The DMS PH includes the Inter-exchange Preselection Indication utility in the X.75 call-request packet transmitted to the remote STE on the outgoing X.75' interface, provided that a RPOA utility has not already been included. The DMS PH supports one Inter-exchange Preselection Indication utility in an X.75 call-request packet.
- The DMS PH deletes the Inter-exchange Preselection Indication utility from the X.75 call-request packet on the X.75 outgoing interface.
- For an inter-LATA call, the DMS PH may replace the Inter-exchange Preselection Indication utility with the RPOA utility using the same DNIC/INIC in the X.75 call-request packet transmitted to the remote STE, if the DMS PH does not have direct access to the specified IEC and the call is determined to be inter-LATA.
- For an intra-LATA call, the DMS PH ignores the Inter-exchange preselection utility included in the X.75 call-request packet received from the remote STE.
- For an X.75 call-request packet received from the remote STE that includes both the RPOA utility and the Inter-exchange Preselection Indication utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

- For an X.75 call-connect packet or an X.75 clear-request packet received from the remote STE that includes the Inter-exchange Preselection Indication utility, the DMS PH clears the call.
  Clearing cause: `network congestion`
  Diagnostic code: `65-facility code not allowed`

Access Characteristics

The Access Characteristics utility is used between sub-networks to pass the access or Gateway interface-type and sensor identifier to convey billing information regarding the called and calling parties. The Access Characteristics utility carries the interface type of the originating interface and the sensor identifier on X.75' interfaces only.

If both the X.75 Interface Identifier utility and the Access Characteristics utility are received from a remote STE in a call-request packet or a call-connect packet, the DMS PH verifies that the interface type specified by the Access Characteristics utility specifies X.75. In this case, if the interface type does NOT indicate X.75, then the DMS PH generates a clear-request packet.
Clearing code: `network congestion`
Diagnostic code: `65-facility code not allowed`

If both the X.75 Interface Identifier utility and the Access Characteristics utility are received from a remote STE in a clear-request packet which is in direct response to a call-request packet, the DMS PH verifies that the interface type specified by the Access Characteristics utility indicates X.75.
In this case, if the interface type does NOT indicate X.75, then the DMS PH generates a clear-request packet.

The Access Characteristics utility is a service-data selectable option. If it is enabled on the X.75' interface and is supported as follows:

- In the X.75 call-request packet or the X.75 call-connect packet transmitted to the remote STE, DMS PH includes the Access Characteristics utility in order to convey the originating interface type and the sensor identifier of DMS PH.
- DMS PH includes the Access Characteristics utility in the clear-request packet in order to convey the originating interface type and the sensor identifier of the DMS PH if the packet is a direct response an X.75 call-request packet received from the remote STE.
- For an X.75 call-request packet or an X.75 call-connect packet received from the remote STE that includes the Access Characteristics utility, the DMS PH enters the conveyed billing information in the AMA record for the inter-network call.

- For an X.75 clear-request packet received from the remote STE that includes the Access Characteristics utility and is in direct response to an X.75 call-request packet previously transmitted to the remote STE, the DMS PH enters the conveyed billing information in the AMA record for the inter-network call.

If the Access Characteristics utility is not enabled on the X.75' interface, it is supported as follows:

- The DMS PH does not include the Access Characteristics utility in the X.75 call-request packet, the X.75 call-connect packet or in the X.75 clear-request packet transmitted to the remote STE.
- For the X.75 call-request packet, the X.75 call-connect packet, or the X.75 clear-request packet that includes the Access Characteristics utility, the utility is discarded before the packet is transmitted to the remote STE

Protocol conversion permissions

The Protocol Conversion Permissions utility is used to supplement the protocol information passed in the Access Characteristics utility to perform protocol screening. The Protocol Conversion Permissions utility should reflect the permissions configured for the originating access or gateway interface. It is supported on X.75' only, and is not generated by the DMS PH.

If the Protocol Conversion Permissions utility is received from a remote STE in an X.75 call-connect packet or an X.75 clear-request packet, the DMS PH generates a clear-request packet.
Clearing cause: `network congestion`
Diagnostic code: `65-facility code not allowed`

The Protocol Conversion Permissions utility is a service-data selectable option. If the Protocol Conversion Permissions utility is enabled on the X.75' interface and is received in a X.75 Call-request packet, then the utility is passed transparently to the remote STE.

If the Protocol Conversion Permissions utility is not enabled on the X.75' interface and is received in a X.75 Call-request packet, then the utility is discarded before the packet is transmitted to the remote STE.

X.75 Interface identifier

The X.75 Interface Identifier utility is used to pass the X.75 Interface identifying information between sub-networks over X.75' interfaces. The X.75 Interface Identifier utility is used in cases where the Access Characteristics utility specify X.75 as the interface type for the network boundary interface.

If both the X.75 Interface Identifier utility and the Access Characteristics utility are received from the remote STE in a call-request packet or call-connect packet, the DMS PH verifies that the interface type specified by the Access Characteristics utility indicate X.75.
In this case, if the interface type does NOT indicate X.75, then the DMS PH generates a clear-request packet.
Clearing cause: `network congestion`
Diagnostic code: `65-facility code not allowed`

If both the X.75 Interface Identifier utility and the Access Characteristics utility are received from the remote STE in a clear-request packet which is in direct response to a call-request packet, the DMS PH verifies that the interface type specified by the Access Characteristics utility indicates X.75.

The X.75 Interface Identifier utility is a service-data selectable option. If the X.75 Interface Identifier utility is enabled on the X.75' interface, it is supported as follows:

- In the X.75 call-request packet or the X.75 call-connect packet transmitted to the remote STE, the DMS PH includes the X.75 Interface Identifier utility if the incoming interface is X.75.
- DMS PH includes the X.75 Interface Identifier utility in a X.75 clear-request packet if the packet is a direct response to an X.75 call-request packet received from the remote STE.

If the X.75 Interface Identifier utility is not enabled on the X.75' interface, it is supported as follows:

- DMS PH does not include the X.75 Interface Identifier utility in the X.75 call-request packet, the X.75 call-connect packet or the X.75 clear-request packet transmitted to the remote STE.

For the X.75 call-request packet, the X.75 call-connect packet or the X.75 clear-request packet that includes the X.75 Interface Identifier utility, the utility is discarded before the packet is transmitted to the remote STE.

Transit Subnetwork Count

The Transit Subnetwork Count(TSC) utility is specified for BOC networks to detect call routing errors resulting in looping through multiple X.75’ interfaces in a subnetwork. A threshold TSC value (between 0 and 14) is provisioned on a switch-wide basis in DMS PH Table SVCDATA. Each time a Call Request is passed out over an X.75’ interface, the count in the utility parameter field is increased by one, if:

- the TSC utility is enabled for the outgoing X.75’ interface, and
- the provisioned TSC threshold value for the DMS PH has not been reached.

At the first routing of a call over an X.75’ interface, the utility is inserted in the Call Request packet after the utility marker. Two octets are used for the TSC utility. The first identifies the utility and is coded “00100000” with bit 8 to the left. Bits 4 to 1 of the second octet are used for the TSC parameter field with bit 4 being the most significant. At the first X.75’ interface, the TSC value of “0000” is entered in the parameter field. At subsequent routings of the Call Request packet over an X.75’ interface, the parameter field is augmented by ‘one’ and the utility is passed on, provided the conditions listed above are met.

The use of the TSC utility is enabled on a X.75’ trunk group basis in Table TRKSGRP. The default value is ‘N’ which means the TSC utility is not enabled on an X.75’ trunk group unless it is specifically provisioned with a ‘Y’ in each X.75’ entry in Table TRKSGRP.

The TSC utility is not passed:

- in Clear Request or Call Connect packets
- over an X.75 or a X.25 interface
- if the outgoing X.75’ interface does not have the utility enabled in Table TRKSGRP. The utility will be removed from a Call Request packet received over an X.75’ interface before routing the call over an outgoing X.75’ interface that does not have the utility enabled.
- if the value of the TSC parameter field equals or exceeds the provisioned threshold for TSC. In this case, the call is cleared with:
  - Cause code: Network congestion
  - Diagnostic code: #212

Clearing Subnetwork Identification

The Clearing Subnetwork Identification(CSI) utility is specified for BOC networks to identify the network element or subnetwork that prematurely clears a call. The unique network element or subnetwork identity is provisioned in DMS PH Table SVCDATA. This utility allows a higher level of resolution than the CNIC utility which only identifies a “network” in terms of its DNIC or INIC.

When an X.25 Virtual Call is prematurely cleared with a cause code of Network Congestion, the CSI utility with the network element identity is inserted in the Clear Request packet, provided that the CSI utility is enabled for the particular X.75’ interface. The CSI utility is passed transparently across any subsequent X.75’ interfaces after its insertion. It is passed in Clear Request packets only and only over X.75’ (not X.75) interfaces.

The CSI utility is not used if a call is offered to the destination DTE and the DTE initiates a Clear Request.

The utility is inserted in the Clear Request packet after the utility marker. Three octets are used for the CSI utility. The first identifies the utility and is coded "01100000" with bit 8 to the left. Two octets are used for the parameter field which represents a four-digit value from 0000 to 9999.

The value 0000 is reserved for future use, therefore, a warning message is issued if this value is provisioned in Table SVCDATA. The DMS PH default (or initial) value for the CSI is set at 9999. The use of the range 0001 - 9999 for the unique identification of a network element or a subnetwork is at the discretion of the network administrators.

The use of the CSI utility is enabled on a X.75' trunk group basis in Table TRKSGRP. The default value is 'N' which means the CSI utility is not enabled on an X.75' trunk group unless it is specifically provisioned with a 'Y' in each X.75' entry in Table TRKSGRP.

Chapter 4: X.75 Call Routing

DMS PH X.75 call routing complies with the National ISDN 1 and 2 (NI-1/2) standards contained in the Bellcore technical specifications: *ISDN digit and routing analysis,* TR-TSY-448 and: *PPSN generic requirement*s, TR-TSY-301.

There are a number of different cases to consider for call routing. The following call-routing types are supported by the DMS PH:

- **Intra-switch calls**
  calls set up between terminals on the same DMS switch
- **Intra-LATA calls**
  - — intra-network calls set up between terminals that are on different switches, where those switches are all operated by the same administration within a LATA. X.75' trunks apply in this case.
  - — inter-network calls between terminal on different switches, where those switches are operated by different administrations (for example, a Bell Operating Company and an Independent telco) within a LATA. X.75 trunks are typically used in this case.
- **Inter-LATA calls**
  calls set up between terminals that are on switches in different LATAs. X.75 trunks to Interexchange Carrier networks are used in this case.

Inter-LATA (local access and transport area) calls may be between networks that are connected by inter-exchange carrier (IEC) networks owned by different administrations, known as registered private operating agencies (RPOA). Some LATA networks are connected by more than one RPOA. The LATA administrations are required by U.S. law to allow customers the option of choosing any RPOA on a call-by-call basis.

Numbering plan

Since X.75 trunks can use either E.164 or X.121 as the default numbering format, digit translations are performed according to the default format used. The following factors have been considered when translations are done on calls terminating (incoming) from X.75 trunks.

E.164

- all standard E.164 prefixes (‘1’, ‘011’, and so on) are no longer present
- all E.164 addresses are in international format

The following algorithm describes how the digits are normally analyzed for incoming trunks using E.164 format.

- **00**
  invalid address
- **01 to 07**
  the ‘0’ is treated as the escape code to X.121, and the next four digits following the ‘0’ are treated as a DNIC of an X.121 address.
- **08**
  invalid address
- **09**
  double escape code. A TELCO can either disallow the call or route it elsewhere for further translations.
- **1**
  North American destination. The following 3 digits are treated as the NPA code.
- **2 to 9**
  call destined for outside of the North American continent

X.121

The following algorithm describes how the digits are analyzed for incoming trunks using X.121 format.

- **0**
  escape to E.164 address format
- **1 to 7**
  the next four digits are treated as a DNIC
- **8**
  invalid address
- **9**
  escape to E.164 address format

Address format

The called-party address is represented as a series of digits contained in the X.25 layer 3 procedures. To support inter-working with public packet-switched and other networks, DMS PH supports the translation of identified escape codes.

North American numbering plan

All packet-mode terminals supported on the DMS PH are assigned E.164 North American numbering plan addresses. This address has the following format:

CC-NPA-NXX-XXXX

where:

- **CC** (country code)
  is a 1- to 3-digit code used to identify a country.
  The world is divided into 9 zones (North America is zone 1, Africa is zone 2, Europe is zones 3 and 4...). The first digit of the country code identifies the zone to which the country is assigned. The other digits identify the country.

  For example, the United Kingdom is in Europe (zone 4) and is country 4 in that zone. Therefore, its country code is 44.

  All North America has the same country code, ‘1’.
- **NPA** (number plan area)
  a 3-digit code that defines the geographical regions within a country. The NPA is commonly called the area code.
- **NXX**
  a 3-digit code that identifies the serving central office
- **XXXX**
  a 4-digit code that identifies a line or terminal within the central office. For POTS, each line is normally associated with a terminal.

The following E.164 call formats are allowed for the different types of calls:

- **NXX-XXXX**
  a local call. Only the 7-digit subscriber number needs to be dialed for a local call. The DMS PH translates correctly dialed 7-digit addresses.
- **1-NXX-XXXX** or **1-NPA-NXX-XXXX**
  a long distance call.
  - — The 1 + 7-digit code is used for long distance calls within the originating terminal's immediate geographic region.
  - — The 1 + 10-digit code is used for long distance calls outside of the originating terminal's immediate geographic terminal.

- **011-CC-NPA-NXX-XXXX**
  an international call. The subscriber dials 011 followed by the country code and any subsequent digits.

  Note: Not all countries use the North American numbering plan format.

The maximum number of digits in an E.164 address is 15.

Note: Data calls cannot be made with operator assistance, therefore '0+' and '01+' call formats can be used as the escape code for calls to X.121 (PPSN) networks.

X.121 numbering plan

The address format of the X.121 numbering plan is:

DNIC-NTN

where:

- **DNIC**
  is a four-digit network identifier
- **NTN**
  is a 10-digit national number code that has a form as follows:

DNPA-DCO-XXXX

where:

— **DNPA**
is a 3-digit data numbering plan area code that is equivalent to the area code in the E.164 numbering plan

— **DCO**
is a 3-digit code that identifies the serving data network central office

— **XXXX**
is a 4-digit code that identifies a line within the central office. For POTS, each line is normally associated with a terminal.

DMS PH supports partial translation of X.121 format addresses. In all cases when the DMS switch determines that the called address is X.121 format, the call is routed directly to a gateway for a public packet-switched network (PPSN).

Equal access

DMS PH supports Equal access for E.164 calls, with escape to X.121 format.

RPOA

In the voice networks, the long distance carriers that are used to connect individual administrations (LATA) are called inter-exchange carriers (IEC).

In the packet networks, the interconnection of LATAs is provided by agencies called registered private operating agencies (RPOA). RPOAs are identified in the packet by an address field of four digits that can be interpreted in two different ways:

- X.121 DNIC: The RPOA is identified by the DNIC of the inter-exchange carrier. The first digit can be 2 to 7 while the second, third and fourth digits can be 0 to 9. The first three digits represent the Data Country Code. The last digit represents the Data Network Number. The Data Country Code for the U.S. is 31X, where X can be 0 to 9.
- ISDN Network Identification Code (INIC): The RPOA is identified by the ISDN identification code (INIC) of an inter-exchange carrier. These types of RPOAs have an initial digit of 0 or 9 (indicating an INIC), followed by a three digit inter-exchange carrier code.

Customers can select RPOAs for DMS PH service. They can decide to use a default RPOA that has been entered into service data, or they can change the default as required by signalling in a call request.

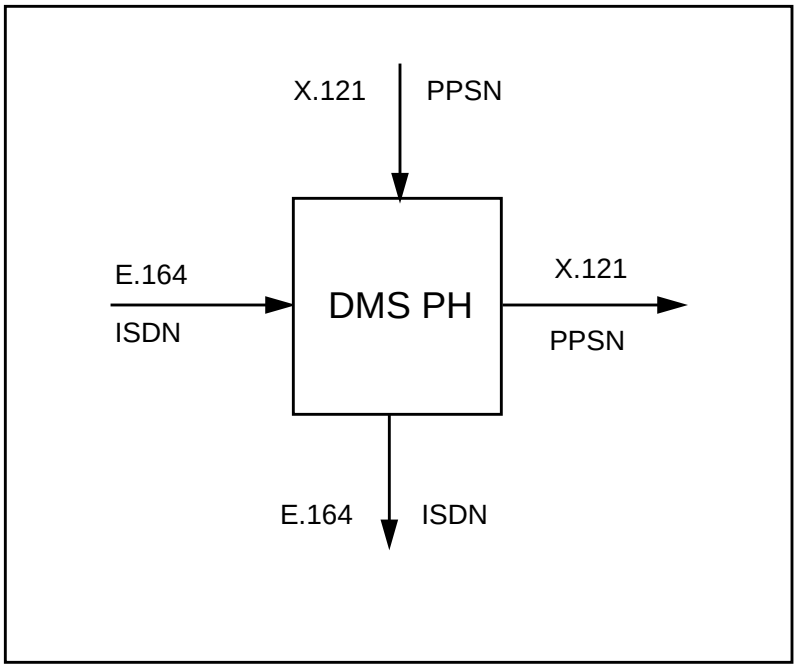
If no RPOA is specified in the service datafill or in the call setup, the call is cleared once the DMS PH determines the call to be E.164 inter-LATA. However, if an X.121 number is dialed, the call will be routed regardless.

Mixed address handling

DMS PH can be utilized to interface both E.164 and X.121 trunks, as illustrated in Figure 2.

A trunk service data table provides the incoming and outgoing trunk address format, together with the escape code that helps the mixed address routing.

Figure 2 DMS PH mixed address handling



Chapter 5: Maintenance actions and error conditions

X.75 Interface takedown

The DMS PH supports two features for taking an X.75 interface (trunk) out of service. Each individual trunk belonging to the same trunk group may be taken out of service using either method:

- X.75 Interface Takedown Through Deloading
- X.75 Interface Takedown Through Forced Release

X.75 Interface Takedown Through Deloading

This feature allows the operating company personnel to take an X.75' trunk out of service only after all existing virtual calls on the interface have cleared. When this feature is invoked, the X.75 trunk is placed in a deload state where new calls are not allowed to use the trunk. New outgoing virtual calls are prevented from being set up on the X.75 trunk, and incoming virtual call requests are rejected with the clearing cause "`network congestion`" and the diagnostic code "122-`maintenance action`".

The X.75 trunk remains in the deload state until all virtual calls on the trunk have cleared or a forced release procedure is invoked.When all calls on the trunk have cleared, the trunk is taken out of service by initiating the link-level disconnect procedure for the X.75 trunk.

> ***Note:*** X.75 trunks with PVCs have to use the X.75 Interface Takedown Through Forced Release feature for the trunk to be taken out of service.

X.75 Interface Takedown Through Force Release

This feature allows the operating company personnel to take the X.75 trunk out of service unconditionally. Existing virtual calls on the X.75 trunk are cleared and PVCs are reset. When the feature is invoked the DMS PH clears each virtual call on the trunk with clear-request packets and the clearing cause "`network congestion`" and the diagnostic code "`122-maintenance action`".

When all calls have been cleared, the DMS PH initiates a link-level disconnect procedure on the X.75 trunk and the trunk is taken out of service. Each PVC is reset toward the CPE on the DMS PH with the reset cause "`network congestion`" and diagnostic code "`122-maintenance action`".

STE action upon packet errors

Upon receipt of the following invalid packets on the X.75/X.75' interface, the DMS PH discards the packet without further action:

- packets less than two octets in length
- packets with incorrect general format identifier
- packets with unassigned logical channel
- packets other than the restart or registration packet with logical channel number equal to zero

For the following data packet errors, the DMS PH sends a reset-request packet to the remote STE with the reset cause "`network congestion`":

- M-bit violation
- inconsistent Q bit setting
- incorrect sequence number P(S) or P(R).

Appendix A: Layer procedure tables

This section compares the DMS PH X.75/X.75' implementation with the ITU's *Recommendation X.75*, (1988).

The implementation is detailed in the following tables:

- Link layer procedures between signaling terminals
- Packet layer procedures between signaling terminals

Table 4:
Link layer: procedures between signaling terminals

ITU part No.	Description	DMS PH X.75 implementation
2.1	Scope and field of application:	
2.1.1		Implemented as specified
2.1.2		Implemented as specified (MLP not supported)
2.1.3		Implemented as specified
2.1.4		SLP LAPB is implemented as specified. MLP and old LAP procedures are not supported. LAP-B may act as either STE-A or STE-B (subscription time options) at the link-access procedure level
2.1.5		Implemented as specified
2.2	Frame structure:	
2.2.1	Frame formats	Implemented as specified
2.2.2	Flag sequence	Implemented as specified
2.2.3	Address field	Implemented as specified
2.2.4	Control field	Implemented as specified

—continued—

Table 4:
Link layer: procedures between signaling terminals

ITU part No.	Description	DMS PH X.75 implementation
2.2.5	Information field	Implemented as specified
2.2.6	Transparency	Implemented as specified
2.2.7	Frame checking sequence (FCS) field	Implemented as specified
2.2.8	Order of bit transmission	Implemented as specified
2.2.9	Invalid frames	Implemented as specified
2.2.10	Frame abortion	Implemented as specified
2.2.11	Interframe time fill	Implemented as specified
2.2.12	Link channel states:	
2.2.12.1	Active channel state	Implemented as specified
2.2.12.2	Idle channel state	An idle probe mechanism is used to ensure that the remote is present and responding.
2.3	Elements of procedures:	
2.3.1		Implemented as specified
2.3.2	Control field formats and parameters:	
2.3.2.1	Control field formats	Implemented as specified
2.3.2.1.1	Information transfer format - I	Implemented as specified
2.3.2.1.2	Supervisory format - S	Implemented as specified
2.3.2.1.3	Unnumbered format - U	Implemented as specified
2.3.2.2	Control field parameters:	
2.3.2.2.1	Modulus	Implemented as specified
2.3.2.2.2	Send state variable V(S)	Implemented as specified
2.3.2.2.3	Send sequence number N(S)	Implemented as specified
2.3.2.2.4	Receive state variable V(R)	Implemented as specified
2.3.2.2.5	Receive sequence number N(R)	Implemented as specified
2.3.2.2.6	Poll/Final (P/F) bit	Implemented as specified
2.3.3	Function of the Poll/Final bit	Implemented as specified

—continued—

Table 4:
Link layer: procedures between signaling terminals

ITU part No.	Description	DMS PH X.75 implementation
2.3.4	Commands and responses:	
2.3.4.1	Information (I) command	Implemented as specified
2.3.4.2	Receive ready (RR) command and response	Implemented as specified Idle probe note: The DMS PH employs an idle probe mechanism to ensure that the remote is present and responding. After the link has been idle (no frames sent or received) for a period of time (an adjustable service-data parameter) a polling command level RR/RNR is sent over the link to the remote end to solicit some response from the remote. If the remote does not respond within T1 time, the timer recovery procedure is entered.
2.3.4.3	Receive not ready (RNR) command and response	Implemented as specified See idle probe note (2.3.4.2)
2.3.4.4	Reject (REJ) command and response	Implemented as specified
2.3.4.5	Set asynchronous balanced mode (SABM) command and Set asynchronous balanced mode extended (SABME) command	Implemented as specified
2.3.4.6	Disconnect (DISC) command	Implemented as specified
2.3.4.7	Unnumbered acknowledge (UA) response	Implemented as specified
2.3.4.8	Disconnected mode (DM) response	Implemented as specified
—continued—		

Table 4:
Link layer: procedures between signaling terminals

ITU part No.	Description	DMS PH X.75 implementation
2.3.4.9	Frame reject (FRMR) response	The DMS PH implementation follows the recommendation for X.25 (1988) DMS PH generates an FRMR for the following conditions: 1. Receipt of command or response control field that is undefined or not implemented. 2. Receipt of an I-frame which exceeds the maximum established length (N1) 3. Receipt of invalid N(R) 4. Receipt of frame with an information field which is not permitted Note: DMS PH does not generate a FRMR frame for conditions 5, 6, and 7 as stated in recommendation X.75 (LAPB)
2.3.5	Exception condition reporting and recovery:	
2.3.5.1	Busy condition	Implemented as specified
2.3.5.2	N(S) sequence error condition	Implemented as specified
2.3.5.2.1	REJ recovery	Implemented as specified
2.3.5.2.2	Time-out recovery	Implemented as specified
2.3.5.3	Invalid frame condition	Implemented as specified
2.3.5.4	Frame reject condition	Implemented as a specified subject in ITU part No. 2.3.4.9
2.3.5.5	Excessive idle channel state condition on incoming channel	An Idle probe mechanism is used to insure that the remote is present and responding. See the Idle probe note in 2.3.4.2.
2.4	Description of the procedures:	
2.4.1	Extended and non-extended modes of operation	Implemented as specified
2.4.2	Procedure for addressing	Implemented as specified
2.4.3	Procedure for the use of the P/F bit	Implemented as specified

—continued—

Table 4:
Link layer: procedures between signaling terminals

ITU part No.	Description	DMS PH X.75 implementation
2.4.4	Procedure for link set up and disconnection:	
2.4.4.1	Link set up	Implemented as specified
2.4.4.2	Information transfer phase	Implemented as specified
2.4.4.3	Link disconnection	Implemented as specified
2.4.4.4	Disconnected phase:	
2.4.4.4.1		Implemented as specified
2.4.4.4.2		Implemented as specified
2.4.4.5	Collision of unnumbered commands	Implemented as specified
2.4.5	Procedures for information transfer:	
2.4.5.1	Sending an I-frame	Implemented as specified
2.4.5.2	Receiving an I-frame:	
2.4.5.2.1		Implemented as specified
2.4.5.2.2		Implemented as specified with the following handling: DMS PH, while in busy condition ignores the information field in an I-frame.
2.4.5.3	Receipt of invalid frames	Implemented as specified
2.4.5.4	Receipt of out-of-sequence I-frames	Implemented as specified
2.4.5.5	Receiving acknowledgment	Implemented as specified
2.4.5.6	Receiving an REJ frame	Implemented as specified
2.4.5.6 (i)		Implemented as specified
2.4.5.6 (ii)		Implemented as specified
2.4.5.6 (iii)		On the DMS PH, LAPB completes the transmission of the currently transmitting I-frame before commencing transmission of the requested I-frame.
2.4.5.6 (iv)		Implemented as specified
2.4.5.7	Receiving an RNR frame	Implemented as specified

—continued—

Table 4:
Link layer: procedures between signaling terminals

ITU part No.	Description	DMS PH X.75 implementation
2.4.5.8	STE busy condition	Implemented as specified
2.4.5.9	Waiting acknowledgment	Implemented as specified If timer T1 times out while waiting for acknowledgment, the DMS PH transmits an appropriate supervisory command frame with the P-bit set to one.
2.4.6	Conditions for Link resetting or Link re-initializing (Link setup)	Implemented as specified
2.4.7	Procedures for Link resetting	Implemented as specified
2.4.8	List of system parameters	All system parameter values are obtained from the service data for the link. Note: The parameter values are based on TR-TSY-000301
2.4.8.1	Timer T1	Implemented as specified. The period of the timer at the end of which transmission of a frame may be initiated is an adjustable parameter (1 to 30 seconds) with a default of three seconds.
2.4.8.2	Parameter T2	Implemented as specified. Note: The mechanism for acknowledgment of incoming I-frames allows a high percentage of 'piggybacking'. An acknowledgment task is available to avoid long delays in acknowledgment.
2.4.8.3	Timer T3	Implemented with the interpretation described in 2.3.5.5. The idle probe timer is an adjustable parameter (1 to 30 seconds) with a default of five seconds.
2.4.8.4	Maximum number of attempts to complete a transmission N2	Implemented as specified. The maximum number of attempts to complete a transmission is an adjustable parameter (2 to 15) with a default of three.
—continued—		

Table 4:
Link layer: procedures between signaling terminals

ITU part No.	Description	DMS PH X.75 implementation
2.4.8.5	Maximum number of bits in an I-frame N1	Implemented as specified. The maximum number of bits in an I-frame is an adjustable parameter which defaults to 2120 bits.
2.4.8.6	Maximum number of outstanding I-frames K	Implemented as specified. The maximum number of outstanding I-frames (1 to 7 for modulo 8 operation, 1 to 127 for modulo 128 operation) with a default of seven.
2.5	Multi-link procedure (MLP)	DMS PH does not currently support MLP.

Table 5:
Packet Layer: procedures between signaling terminals

ITU part No.	Description	DMS-PH X.75 implementation
3.	Packet-layer procedures between signaling terminals	Implemented as specified with the following interpretation: The DMS PH interprets the combined logical-channel group number and the logical-channel number as a single 12-bit logical-channel number (LCN) field.
3.1	Procedures for virtual call setup and clearing:	
3.1.1	Ready state	Implemented as specified
3.1.2	call-request packet	Implemented as specified
3.1.3	call-connected packet	Implemented as specified
3.1.4	call-collision	Implemented as specified
3.1.5	call-request packet	Implemented as specified
3.1.6	call-confirmation packet	Implemented as specified
3.1.7	Call collision	Implemented as specified
3.2	Procedures for permanent virtual circuit service	Implemented as specified
3.3	Procedure for data and interrupt transfer	Implemented as specified

—continued—

Table 5:
Packet Layer: procedures between signaling terminals

ITU part No.	Description	DMS-PH X.75 implementation
3.3.1	States for data transfer	Implemented as specified
3.3.2	Numbering of data packets	Implemented as specified
3.3.3	Data field length of data packets	Implemented as specified
3.3.4	Delivery confirmation, more data, and qualifier bits	Implemented as specified
3.3.5	Interrupt procedure	Implemented as specified
3.4	Procedure for flow control and for reset:	
3.4.1	Procedure for flow control	Implemented as specified
3.4.1.1	Window description	Implemented as specified
3.4.1.2	Flow control principles	Implemented as specified
3.4.1.3	STE receive-ready (RR) packet	Implemented as specified
3.4.1.4	STE receive not ready packet	Implemented as specified
3.4.2	Procedure for reset:	
3.4.2.1	Reset-request packet	Implemented as specified
3.4.2.2	Reset collision	Implemented as specified
3.4.2.3	Reset-confirmation packet	Implemented as specified except under timeout condition for permanent virtual circuit. Upon the first reset timeout, DMS PH sends a reset request packet to the link, but does not send a reset request to the network. On the second reset timeout, DMS PH sends a request confirmation towards the network and places the permanent virtual circuit back in flow control ready state.
3.4.2.4	Effect of reset procedure on data and interrupt packets	Implemented as specified

—continued—

Table 5:
Packet Layer: procedures between signaling terminals

ITU part No.	Description	DMS-PH X.75 implementation
3.5	Procedure for restart:	
3.5.1	Restart by the STE	Implemented as specified The remote STE can initiate a restart by sending a restart-request packet to the local STE. The X.75 interface, on receipt of a restart request enters a remote re-starting state and clears the virtual calls on all active logical channels. Once this operation completes, the local STE sends a restart confirmation packet to the remote STE.
3.5.2	Restart collision	Implemented as specified.
3.6	Relationship between layers	Implemented as specified.

Appendix B: Glossary

The following table is a glossary of the acronyms contained in this document.

Table 5-1
Glossary of terms

Term	Definition
ACCS	Automatic calling card services
AM	Access module - a component of a DPN packet switch
AMA	Automatic message accounting
AT	Access tandem
BNM	Business network management
BRA	Basic rate access
BRI	Basic rate interface
CCB	Call condense block
CCITT	International Telegraph and Telephone Consultative Committee
CCS7	Common channel signaling system number 7
CLAMN	Called line address modification notification
CM	Computing module
CP	Call processing
CPE	Customer premises equipment
CUG	Closed user group
DCH	D-channel handler
DDM	Distributed data manager
DIU	Digital interface unit

Table 5-1
Glossary of terms

Term	Definition
DMS	Digital multiplex system
DMS PH	DMS Packet handler
DN	Directory number
DNA	Digital network address
DPN	Data packet network
DTC	Digital trunk controller
EAEO	Equal access end office
EO	End office
ET	Exchange termination
EUM	End-user manager
FBUS	Frame transport bus
FRS	Frame relay service
HDLC	High-level data link controller
HFP	HDLC Frame processor
ICUG	International closed user group
IEC	Inter-exchange carrier
IPF	Integrated processor and FBUS
ITU	International Telecommunication Union
ISDN	Integrated services digital network
ISG	ISDN Service group
LAPB	Link access procedures (balanced)
LAPD	Link access procedures (used for ISDN D-channel)
LCME	Enhanced line concentrating module for ISDN
LATA	Local access and transport area
LCN	Logical channel number
LGC	Line group controller
LIDB	Line information data base
LIM	Link interface module (synonym for LMS)

Table 5-1
Glossary of terms

Term	Definition
LIS	Link interface shelf
LIU	Link interface unit
LMS	Local message switch (synonym for LIM)
LPP	Link peripheral processor
LTC	Link and trunk controller
LTID	Logical terminal identifier
MAP	Maintenance and administration position for DMS
MIT	Management information tree
NIU	Network interface unit
NUI	Network user identifier
NXCP	Non-cross threaded call processing
OAM	Operations, administration and maintenance
OSS	Operational support system
PCP	Printed circuit pack
PH	Packet handler
PPSN	Public packet switched network
PSPDN	Public switched packet data network
PSTN	Public switched telephone network
PRI	Primary rate interface
PVC	Permanent virtual circuit
Q.921	An ITU standard for level 2 protocol
Q.931	An ITU standard for level 3 protocol
RM	Resource module (a DPN packet switch component)
RPOA	Recognized private operating authority
SERVORD	Service order interface
SOS	Support operating system
STE	Signaling terminal equipment
STP	Signaling transfer point for CCS7 networks

Table 5-1
Glossary of terms

Term	Definition
SVC	Switched virtual circuit
TA	BellCore Technical advisory
TELCO	Telephone operating company
TR	BellCore Technical requirements
VC	Virtual circuit
XLIU	X.25/X.75 Link interface unit
X.25	ITU Packet switch access protocol standard
X.31	ITU recommendation for support of terminal equipment by ISDN
X.75	ITU Packet switch trunk protocol standard
X.75'	X.75 prime The Bellcore ISDN packet protocol extension to X.75 for connections between ISDN nodes and supporting PPSNs
X.121	ITU standard for data network address

DMS 100

DMS Packet Handler (DMS PH)

X.75/X.75' Interface Specifications

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