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ATIS-1000611.1991(R2013)

Signalling System Number 7 (SS7) – Supplementary Services for Non-ISDN Subscribers

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ATIS-1000611.1991(R2013), *Signalling System Number 7 (SS7) – Supplementary Services for Non-ISDN Subscribers*

Is an American National Standard developed by the **Signaling, Architecture, and Control (SAC)** Subcommittee under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

American National Standard
for Telecommunications –

Signalling System Number 7 (SS7) – Supplementary Services for Non-ISDN Subscribers

Secretariat

Exchange Carriers Standards Association

Approved January 4,1991

American National Standards Institute, Inc.

Abstract

This standard describes thirteen services for non-integrated services digital network (non-ISDN) subscribers along with their supporting SS7 protocols. They provide enhanced functionality for users with non-ISDN interfaces who access SS7 capable networks.

Contents

Foreword (This foreword is not part of American National Standard T1 611-1990)

The document contains fourteen services for non-ISDN subscribers along with their supporting SS7 protocols. Each service consists of three "stages":

- Stage 1 describes the service from a user perspective;
- Stage 2 describes the information flows and functional allocations to realize the service;
- Stage 3 provides the protocols to support the stage 1 and 2 descriptions (in this case the SS7 protocols).

Suggestions for improvement of this standard will be welcome. They should be sent to the Exchange Carriers Standards Association, 5430 Grosvenor Lane, Bethesda, MD 20814-2122.

This standard was processed and approved for submittal to ANSI by the Accredited Standards Committee on Telecommunications, T1. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the T1 Committee had the following members:

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National Communications System	Charles D. Bodson D. D. Wilson (Alt.)
National Institute of Standards and Technology	Robert Rountree, Jr. Michael D. Hogan (Alt.)

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Organization Represented	Name of Representative
Hekimian Laboratories	Mike F. Toohig
	J. P. Drzewiecki (Alt.)
Hewlett-Packard	Richard van Gelder
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	Ralph Guenther (Alt.)
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	Nancy Poon (Alt.)
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	Ken Felix (Alt.)
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	David Su (Alt.)
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	Phillip E. Belevre (Alt.)
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	T. K. Lala (Alt.)
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	Peter Sommerer (Alt.)
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	Bruce Stevenson (Alt.)
NTT America, Inc.	Ken-Ichi Aihara
	Takashi Nishimura (Alt.)
NYNEX Service Company	Jim Papadopoulos
	V. Arabagian (Alt.)
Pacific Bell	R. S. Schwab
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	William Northup (Alt.)
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	Kang-Sen Lu (Alt.)
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	David Wolfe (Alt.)
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	Ben Wagner (Alt.)
Southern New England Telephone	J. A. Yanosy
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	Thomas Gajeski (Alt.)
United Telecommunications, Inc.	Sam Samra
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U. S. Intelco Networks, Inc.	Bill Cronin
	Ben Jarvis (Alt.)
U S Sprint	Joe Christie
	Peter J. May (Alt.)
U S WEST	Earl Manchester
	Ann Merrell (Alt.)

These descriptions have been developed by T1S1.3 over the last three years. At the time of the production of the document, the T1S1.3 Non-ISDN Services Group had the following participants:

Peter Hill, Convener & Editor
Joan Powell, Assistant Editor

Cathy Addison	Janine Meadors
Jim Aldrich	Ann Merrell
H. Appenzeller	Wu Ming-Jong
Victor Arabagian	Nilo Mitra
Renee Berkowitz	Urbashi Mitra
Loraine Beyer	Hal Munsell
Lawrence J. Bowen	C. Peter Musgrove
Dave Breeding	Nina Namdar
Feza Buyukdura	Sadik Okar
Diana Carter	Ashraf S. Patel
Pete Castleton	Yatendra Pathak
Kenneth Chao	Mike Pierce
A. Chatterjee	Russell Prielipp
Anthony Chu	Ed Reid
J. R. Dobbins	Walt Roehr
Christine Douglas	John Roquet
Wesley Dowman	Carol Ross
Doug Finney	Deirdre Ryan
Larry Forni	Chris L. Samelson
Stu Goldman	Niranjan Sandesara
George Gwinn	Ron Schwartz
Rich Heisey	Charles Scott
Rich Hemmeter	Gyan Shamker
Jay R. Hilton	Y-Shang Shen
Nicholas S. Huslak	Greg Sidebottom
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Chuck Johnson	San-Wei Sun
Peter Kelleher	Ken Sympson
Jia-Shu Kuo	Whitey Thayer
Czes Kwiatkouska	Shaji Thomas
Ginny Lacker	Ray Tourzani
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Anne Marie Livingstone	Steve Wilson
Jerry Mahood	Joel K. Young
Marcus Maranhao	James Yu
Robin Marks	Mike Zunno

American National Standard
for Telecommunications –

Signalling System Number 7 (SS7) – Supplementary Services for Non-ISDN Subscribers

1. Scope, purpose, and application

This standard describes the signalling system 7 (SS7) based supplementary services for non-integrated services digital network (non-ISDN) subscribers. It provides the user perspective, information flows, and SS7 protocol for the provision of fourteen public, local exchange, and inter-exchange carrier services. These new services are enabled by the additional information transfer capabilities of SS7. They provide enhanced functionality for users with non-ISDN interfaces who access SS7 capable networks.

The non-ISDN user-network interfaces are the analog, or equivalent digital, interfaces specified in, ANSI/EIA/TIA 464-A-1989 and ANSI T1.401-1988.

The ISDN user part, and the SS7 transaction capability application part are the foundations upon which the protocols contained within this standard are built. The ISDN user part is described in ANSI T1.113-1988. The transaction capability application part is described in ANSI T1.114-1988.

2. Introduction

This standard describes the following fourteen services: 950+ Call, Assist, Call Forwarding, Carrier Selection, Directory Assistance with Call Completion, Interworking with Non-ISDN Private Networks, Multi-location Business Group (MBG) Basic Call, MBG Three Way Calling, MBG Call Transfer, MBG Call Waiting Originating and Dial Call Waiting, MBG N-Way Conferencing, MBG Automatic Recall and Automatic Callback, User-Network Interaction, and Voice Message Waiting Indication Control. Each service description consists of three "stages". The first stage describes the service from a user perspective. The second stage describes the information flows and functional allocations to realize the service. The third stage provides the SS7 protocols to support the stage-1 and stage-2 descriptions.

The three stage methodology utilized in this standard is based on the CCITT three-stage methodology described in CCITT recommendation I.130. The Symbolic Description Language (SDL) conventions followed in SDL diagrams in this standard are described in the CCITT Z.100 series of recommendations. The Abstract Syntax Notation (ASN.1) method of TCAP protocol specification utilized in this standard is described in CCITT recommendations X.208 and X.209.

3. Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. This standard shall be used in conjunction with the following publications:

ANSI T1.110-1987, Telecommunications-Signalling system number 7 (SS7)-General information

ANSI T1.112-1988, <u>Telecommunications-Signalling system number 7 (SS7)-Signalling connection control part (SCCP)</u>

ANSI T1.113-1988, <u>Telecommunications-Signalling system number 7 (SS7)-Integrated services digital network (ISDN) user part.</u>

ANSI T1.114-1988, <u>Telecommunications-Signalling system number 7 (SS7)-Transaction capability application part (TCAP)</u>

CCITT Recommendation E.163, <u>Numbering Plan for the International Telephone Service</u>[1]

CCITT Recommendation E.164, <u>Numbering Plan for the ISDN Era</u>[1]

CCITT Recommendation I.130, <u>Method for the Characterization of Telecommunication Services Supported by an ISDN and Network Capabilities of an ISDN</u>[1]

CCITT Recommendation T.61, <u>Character Repertoire and Coded Character Sets for International Teletex Service</u>[1]

CCITT Recommendation X.208, <u>Specification of Abstract Syntax Notation One (ASN.1)</u>[1]

CCITT Recommendation X.209, <u>Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)</u>[1]

CCITT Z 100 Series, <u>Functional Specification and Description Language. Volume X Fascicle X.1</u>[1]

4. Definitions

This standard utilizes the general SS7 terminology provided in ANSI T1.110. Within this standard, terminology specific to an individual service is defined with that service. In this standard the terms switch and exchange are used interchangeably.

5. 950+ Call

5.1. 950+ call, Stage-1 description

This service is provided by one network for another network and is not visible to the end user. This service is the transfer from the originating network to a transit network of the information that the 950+ call originated from either a local exchange carrier public phone, a hotel or motel line, or a non-equal access end office (non-EAEO).

(The information provided will not distinguish between the three types listed.)

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[1] Available from the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

5.2. 950+ call, Stage-2 description (Information Flows)

The Stage-2 for 950+ Call is trivial and is covered by the information flow given in figure 1.
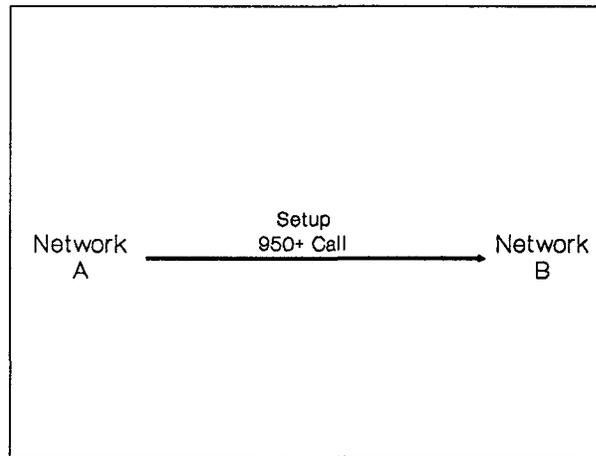
Figure 1
950+ Call information flow

5.3. 950+ call, Stage 3 description (SS7 protocols)

5.3.1. Formats and codes

The indication that a 950+ Call originated from a local exchange carrier public phone, hotel or motel line, or non-EAEO is carried in the Nature of address indicator field in the Called Party Number parameter, as defined in 3.6 of Chapter T1.113 of ANSI T1.113. This is illustrated table 1.

Table 1

Format for called party number parameter

	8	7	6	5	4	3	2	1
1	Odd/Even	Nature of address indicator						
2	Spare	Numbering Plan			Reserved			
3 : n	Address Information							

Nature of address indicator:

1110110 950+ call from local exchange carrier public phone, hotel or motel line, or non-EAEO

(The coding of the other fields in the called party number parameter are determined by the called party number and are not related to this service.)

5.3.2. Procedures

If 950-XXXX digits are received from a public station or a hotel or motel line, the exchange should be able to code the Nature of address indicator field of the Called Party Number parameter "950+ call from local exchange carrier public phone, hotel or motel line, or non-EAEO" instead of

the usual "subscriber number". (Note, this special coding of the nature of address indicator field provides the information of the "Distinctive ST" currently available in MF signalling for such a call.)

If 950-XXXX, 50-XXXX or 0-XXXX digits are received from a non-EAEO at an intermediate exchange (access tandem), the exchange should code the Nature of address indicator field of the called party number parameter as "950+ call from local exchange carrier public phone, hotel or motel line, or non-EAEO". In addition, the intermediate exchange should optionally prefix the 9 or 95 digit(s) (if necessary) and include the seven 950-XXXX digits in the Called Party Number parameter. Otherwise, the digits received are included in the Called Party Number parameter.

6. Assist

6.1. Assist, Stage-1 description (User perspective)

6.1.1. Definition

This network service is not visible to the user and is used to allow a user service to take place. Thus, there is a "layering" of services, the visible user services needing the Assist service to complete. Play Announcement & Collect Digits is the visible service described in this Stage-1 description.

6.1.2. Description

6.1.2.1. General description

As the Assist service is a network service, the user shall see no change in his phone service, nor shall he be required to interact in any way with the network in order to provide the service. The Assist service is used in order to provide a user visible service such as Play Announcement & Collect Digits. In this service, a call setup is interrupted, the user is prompted to dial one or more digits, and the network collects these digits for routing or authorization purposes.

6.1.2.2. Specific terminology

None.

6.1.2.3. Qualifications on the applicability to telecommunication services

This service can be used by user services such as Play Announcement or Play Announcement and Collect Digits. This service will most likely be of use in any number of services where it is necessary to deploy capabilities at only certain points in the network, rather than ubiquitously.

6.1.3. Procedures

6.1.3.1. Provision and withdrawal

This network service is either provided or not. The user shall not have to subscribe, nor shall he be aware that Assist is being used to provide the service that is visible to him.

6.1.3.2. Normal procedures

6.1.3.2.1. Activation, deactivation, and registration

Activation, deactivation, and registration shall be handled automatically by the network.

6.1.3.2.2. Invocation and operation

Invocation of this network service shall be handled by the network, as shall the operation. The normal procedures for the Assist services, as seen by the user, are shown in figure 2 in Symbolic Description Language (SDL) form.

6.1.3.3. Exception procedures

6.1.3.3.1. Activation, deactivation, and registration

None identified.

6.1.3.3.2. Invocation and operation

Handling of exceptional procedures is determined by the service that is utilizing the Assist service.

6.1.3.4. Alternate procedures

6.1.3.4.1. Activation, deactivation, and registration

None identified.

6.1.3.4.2.   Invocation and operation

None identified.

6.1.4.   Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

6.1.5.   Interworking considerations

None, this service shall not be used in an interworking environment.

6.1.6.   Interaction with other supplementary services

Since this is a network service, it may be used by other services, transparently to the user.

```
            ┌──────────────┐
           (     IDLE       )
            └──────┬───────┘
                   │
                   │
            ┌──────┴───────┐
           >  Incoming       │
            │ Call from A    │
            └──────┬───────┘
                   │
                   ▼
            ┌──────────────┐          ┌─────────────────┐
            │  Consult      │          │ Here it will     │
            │ Network for   │·········│ determine if     │
            │  Service      │          │ Assist service   │
            └──────┬───────┘          │ is needed        │
                   │                   └─────────────────┘
                   ▼
            ┌──────────────┐
           <   Provide       │
            │  Service       │
            └──────┬───────┘
                   │
                   ▼
            ┌──────────────┐
           (     IDLE       )
            └──────────────┘
```
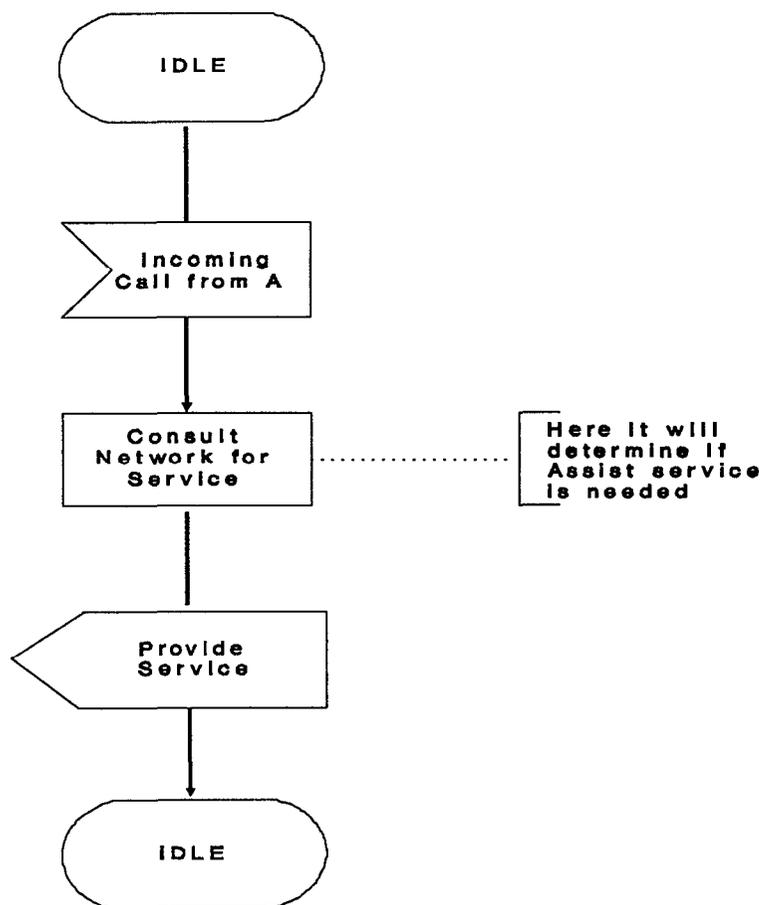
Figure 2
SDL from user perspective

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6.2. Assist, Stage -2 Description (Information Flows)

6.2.1. Functional Model

This service allows a serving exchange without the required capabilities to provide certain call processing functions to the user by requesting the assistance of another exchange with the required capabilities (i.e., the Assist service may be performed by an exchange where a call is currently held and that does not possess the capabilities to serve the call).

6.2.1.1. Specific terminology

6.2.1.1.1. Exchange A

This is the network node that is requesting the assistance of another exchange with the required capabilities. Exchange A is therefore an entity that recognizes that it does not have the capability to serve the call and sends a query to the database. Exchange A also responds to connection requests from the database.

6.2.1.1.2. Exchange B

This is the network node that is requested to provide the required capabilities. Exchange B is an entity that sends a query to the Database in response to a connection request from Exchange A, and performs the required functions.

6.2.1.1.3. Database (DB)

This is the node that can identify the need of the Assist service. The Database is a network entity that sends a message in response to the query from Exchange A or B, and provides instructions to these exchanges.

6.2.2. Normal procedures

6.2.2.1. General description

When Exchange A does not possess the capabilities to fulfill a necessary function, an Assist may have to occur. An Assist consists of a request to another exchange that possesses the necessary capabilities. This Assist is initiated by the database that requests Exchange A to temporarily relinquish control to another "capable" exchange. Exchange A then connects with the other "capable" exchange. When the "capable" exchange is connected, it requests more information from the database. Any requested functions are then performed by Exchange B and the control returned to Exchange A.

When Exchange A receives a request to set up a call, if help from the database (DB) is needed, Exchange A shall send a query to the DB to establish a transaction. Later, whenever Exchange A does not have the required capabilities to continue service to the call, it shall be informed by the DB to request the assistance from the other exchange (namely, Exchange B). Once Exchange B receives a call setup message from Exchange A, it shall take the place of Exchange A by establishing a new transaction with the DB associated with the earlier transaction and providing the requested capabilities. Upon receiving the notification from the DB of the completion of the requested capabilities, Exchange A shall continue processing the call.

6.2.2.2. Information flows

The information flows are illustrated in figures 3 and 4. One case of use of Assist with the Play Announcement and Collect Digits service is shown in figure 3. A second case of Assist with the Play Announcement service is shown in figure 4.

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Calling User   Switch A   Database   Switch B

Setup

Query [Provide Instructions-
Start (Dialed Digits)]

Conversation (Connection
Control-Temporary Connect
(Address B, Reference ID,
DB Address)]

Setup (Transaction Request Parameter)

Report (Alerting)

Report (Alerting)

Query [Provide Instructions-
Assist (Reference ID)]

Conversation [Caller
Interaction-Play Announcement
and Collect Digits] (Note)

*Performing
Requested
Capabilities*

Conversation
[Return Result] (Note)

Conversation or Response
[Connection Control -
Forward Disconnect]

Response [Procedural -
Report Assist Termination]

Note: Only the Play Announcement & Collect Digits
parts are marked.

Figure 3
One assist case: Play announcement & collect digits service

Calling User   Switch A   Database   Switch B

Setup

Query [Provide Instructions-
Start (Dialed Digits)]

Conversation (Connection
Control-Temporary Connect
(Address B, Reference ID,
DB Address)]

Setup [Transaction Request Parameter]

Report (Alerting)

Report (Alerting)

Query [Provide Instructions-
Assist (Reference ID)]

Conversation [Play Announce-
ment and Enunciate the
New Directory Number] [Note]

*Performing
Requested
Capabilities*

Conversation or Response   Response [Procedural-
[Connection Control-   Report Assist Termination]
Forward Disconnect]

Note: This example assumes the capability missing from
      Exchange A is the announcement capability for specific
      directory number announcement.
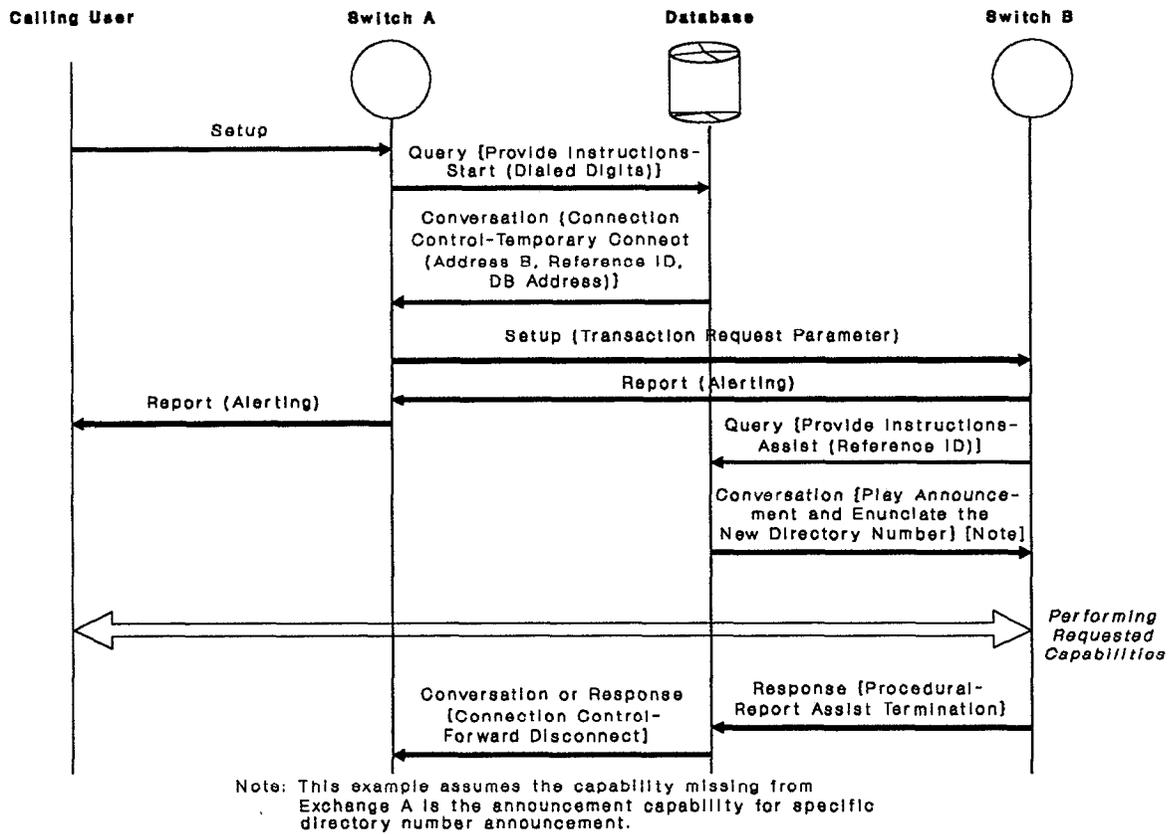
Figure 4
A second assist case: Play announcement service

6.2.2.3.   Activation and deactivation

When Exchange A receives a request from the DB to perform an assist, it shall set up a call to Exchange B. The address and reference ID of the DB are included in the setup request.

Upon receiving a request to provide an Assist service, Exchange B should send a message to Exchange A with the indication that in-band information is available or that user network interaction may take place so that the transmission paths are cut-through at preceding exchanges. Then, Exchange B can send information to the DB with the reference ID contained in the received call setup to allow the DB to identify the original transaction and begin a new transaction between Exchange B and the DB. After Exchange B finishes providing the requested capabilities, the new transaction between itself and the DB shall be terminated by the DB. This case is shown in figure 3. It is also possible for Exchange B to terminate the new transaction after it has provided the requested capabilities. This case is shown in figure 4. In either case a message shall be sent from the DB to Exchange A to continue the original transaction. Upon receiving the notification of the completion of the requested capabilities, Exchange A shall resume the control of the call and either release or keep the connection between Exchanges A and B.

6.3.   Assist, Stage-3 description (SS7 protocols)

6.3.1.   Assist Application Service Element (ASE)

6.3.1.1.   TCAP usage

The Assist ASE describes the four operation macros that are used by the Assist Network Service. The operations and their parameters, errors, and linked operations (if any) are required to perform the Service. These operations are "Connection Control - Temporary Connect", "Provide Instructions - Assist", "Procedural - Report Assist Termination", and "Connection Control - Forward Disconnect".

The first operation mentioned ("Connection Control - Temporary Connect") shall be carried in a TCAP Conversation Package (see ANSI T1.114). The operation "Provide Instructions - Assist" appears in a Query Package and "Procedural - Report Assist Termination" is carried in a response package. The "Connection Control - Forward Disconnect" operation may appear in either a conversation or response package, depending on the needs of the originating exchange and the database.

6.3.1.2.   TCAP operations

6.3.1.3.   Connection Control - Temporary Connect operation

This operation is used to invoke a temporary connect of the two exchanges in the Assist procedure. It is an operation where only errors are reported. It is invoked by the Database, which provides its own SCCP called party address, the routing number of the requested exchange (Exchange B), plus a reference ID to refer to the current transaction between the database and the serving exchange (Exchange A).

The following description utilizes the ASN.1 method of protocol description that is described in CCITT recommendations X.208 and X.209.

```
connectionControl-TemporaryConnect        OPERATION
PARAMETER                                  SEQUENCE {
                                           routingNumber  [4] IMPLICIT RoutingNumber,
                                           SCCPAddress    [7] IMPLICIT SCCPAddress,
                                           referenceID   [20] IMPLICIT ReferenceID }
ERRORS                                     { unexpectedDataValue, taskRefused }

RoutingNumber                              ::= OCTET STRING
SCCPAddress                                ::= OCTET STRING
ReferenceID                                ::= OCTET STRING
```

```
unexpectedDataValue                      ERROR
PARAMETER                                SET{}
::= 2


taskRefused                              ERROR
PARAMETER                                SET{}
::= 7


::= (0402)hex                            --family = 00000100, specifier = 00000010
```

The errors that may be reported for unsuccessful completion of this operation are given in table 2. The "Unexpected Data Value" error is used if any of the parameters are not as expected (e.g.,routing number expected but billing number received). "Task Refused" is used if the serving exchange (A) cannot perform the operation due to unavailable resources or the inability to route the call to Exchange B.

Table 2

Error code table for connection control - temporary connect operation

Error name	Error code
unexpected Data Value	00000010
task Refused	00000111

6.3.1.3.1. Provide Instructions - Assist operation

This operation is used to request instructions upon detection of an Assist situation. It is an operation where only errors are reported.

The Exchange B detects an Assist situation with the arrival of an ISDN-UP initial address message (IAM), (see 1.25 of chapter T1.113.2 of ANSI T1.113 for a definition of IAM) carrying the Transaction Request Parameter (TRP), and uses the SCCP Address found in the TRP to send this operation to the Database. The operation carries one parameter, the Reference ID, to enable correlation with the transaction between the database and Exchange A.

```
provideInstructions-Assist               OPERATION
PARAMETER                                SEQUENCE {
                                         referenceID [20] IMPLICIT ReferenceID }
ERRORS                                   {unexpectedDataValue, taskRefused}
ReferenceID ::= OCTET STRING

unexpectedDataValue                      ERROR
PARAMETER                                SET{}
::= 2


taskRefused                              ERROR
PARAMETER                                SET{}
::= 7


::= (0302)hex                            -- family = 00000011, specifier = 00000010
```

The error codes used to report unsuccessful completion of this operation are shown below. The "Unexpected Data Value" error is used if the received parameter cannot be correlated with an ac-

tive transaction between the Database and Exchange A. "Task Refused" is used if the database cannot or chooses not to do the task at this time (e.g., due to overload).

Table 3

Error code table for provide instruction - assist operation

Error name	Error code
unexpected Data Value	00000010
task Refused	00000111

6.3.1.3.2. Procedural - Report Assist Termination operation

This operation is used to indicate the end of an Assist between Exchange B and the database. There are no required parameters.

It is an operation where no response is expected.

```
procedural-ReportAssistTermination          OPERATION
PARAMETER                                    SEQUENCE {}
::= (0802)hex                                --family [00001000] specifier [00000010]
```

6.3.1.3.3. Connection Control Forward Disconnect operation

This operation is used to indicate to Exchange A that the connection to assisting Exchange B is to be terminated. There are no required parameters. It is an operation where no response is expected.

```
connectionControl-ForwardDisconnect          OPERATION
PARAMETER                                     SEQUENCE { }
::= (0404)hex                                 -- family = [00000100], specifier = [00000100]
```

6.3.1.4. TCAP parameters

6.3.1.4.1. Routing Number

The Routing Number identifies Exchange B that shall be used in the Assist Service. It is a variable length parameter and is of type OCTET STRING. For exact coding, see 5.4 of chapter T1.114.3 of ANSI T1.114 for the definition of the digits parameter with type of digits "routing number".

Table 4

Format for routing number

Parameter name	Identifier code
routing Number	10000100
Contents	
The Routing Number for Exchange B. See 5.4, chapter T1.114.3, ANSI T1.114.	

The ASN.1 definition of Routing Number is:

RoutingNumber ::= OCTET STRING

6.3.1.4.2. SCCP Address

SCCP Address (called party) identifies the Database controlling the Assist service. It is of type OCTET STRING. For exact coding, see 5.7 of chapter T1.114.3 for the definition of SCCP called party address.

Table 5

Format for SCCP address

Parameter name	Identifier code
SCCP Address	10000111
Contents	
The SCCP address (called party) of the Database. See 5.7, chap T1.114.3, ANSI T1.114.	

The ASN.1 definition of SCCP address is:

SCCPAddress ::= OCTET STRING

6.3.1.4.3. Reference ID

This parameter is used to identify the transaction between the database and Exchange A. It is an application level reference. It is 4 octets long and its contents are assigned by the database.

Table 6

Format for reference ID

Parameter name	Identifier code
reference ID	10010100
Contents	
4 Octet Number	

The ASN.1 definition of Reference ID is:

ReferenceID ::= OCTET STRING

6.3.2. ISDN-UP usage

6.3.2.1. General

During call setup, the Assist or hand-off is invoked whenever a serving exchange does not have the required capabilities to continue processing a call. The Assist or hand-off allows that serving exchange (Exchange A) to request the assistance of another exchange (Exchange B) with capabilities to provide those required call processing functions. This network feature permits the u

For the Assist, the control of the call is returned to the Exchange A as soon as those required call processing functions are completed by Exchange B. For the hand-off, the control of the call is relinquished to Exchange B.

The Assist or hand-off is currently used for call processing functions involved in a Transaction Capabilities transaction. As such, Exchange B continues call processing, using Transaction Capabilities, in association with a previous Transaction Capabilities transaction established by the Exchange A. Other uses of the Assist or hand-off are for further study.

6.3.2.2. Actions at the requesting exchange

6.3.2.2.1. Initial actions

The Assist or hand-off is initiated upon the reception of an instruction to request the assistance from a certain exchange, the requested exchange. An initial address message with the ISDN-UP preference indicator set to "ISDN-UP required", including the transaction request parameter, shall be sent to the requested exchange.

6.3.2.2.2. Subsequent actions

For the Assist, the requesting exchange resumes control of the call upon notification through Transaction Capabilities of the completion of those required call processing functions by the requested exchange.

6.3.2.3. Actions at the requested exchange

The Assist or hand-off is initiated upon the reception of an Initial Address Message containing appropriate routing digits and the Transaction Request parameter. Signalling using Transaction Capabilities shall be established with the Transaction Capabilities Application Specific Entity identified by the SCCP address in the Transaction Request parameter. The transaction identification in that parameter is sent to the Application Specific Entity to help associate those call processing activities.

6.3.3. ISDN-UP parameters

6.3.3.1. Transaction Request

This parameter contains information sent in the Initial Address Message (IAM) to help continue call processing, using Transaction Capabilities (TC), associated with a given call during an Assist or hand-off procedure. The name code of the parameter is 11100011. The format of the Transaction Request parameter field is shown below:

Table 7

Format for transaction request

	8	7	6	5	4	3	2	1
1 to 4	Transaction ID								
5 to n	SCCP Address								

The Transaction ID field is used to identify a TC transaction to be associated with further call processing using TC by that TC Application Specific Entity (ASE) indicated by the SCCP address field. It is coded in accordance with 3.5 of chapter T1.114.3 of ANSI T1.114.

The SCCP address field is used to identify a TC ASE in a signalling point. It is coded in accordance with 3.4 of chapter T1.112.3 of ANSI T1.112.

7. Call Forwarding

7.1. Call Forwarding Unconditional, Stage-1 description (User perspective)

For information on Call Forwarding Unconditional interactions with other services, see Annex A.

7.1.1. Definition

Call Forwarding Unconditional (CFU) permits a served user to have the network send all incoming calls for the served user's number to another number. The served user's originating service is unaffected. If this service is activated, calls are forwarded no matter what the condition of the access. Other Call Forwarding services provide for call forwarding based on condition i.e., Call Forwarding Busy (CFB) and Call Forwarding No Reply (CFNR).

7.1.2. Description

7.1.2.1. General description

Call Forwarding Unconditional as supported by Signalling System 7 (SS7) offers two advantages over traditional Call Forwarding Unconditional:

— Multiple sequential forwardings can be limited inter-switch;

— Forwarded-to parties can receive the originally called number, the calling party number, the cause for original forwarding, the last forwarding number, and the cause for last forwarding, if they are served by a suitable interface (e.g., Simple Message Desk Interface or Digital Subscriber Signalling System Number 1 (DSS1)). However, the description of these user network interfaces is outside the scope of this standard.

7.1.2.2. Specific terminology

7.1.2.2.1. Served User:

The user who is requesting that calls to his number be forwarded. This user may also be referred to as the forwarding user or called user.

7.1.2.2.2. Forwarded-to User:

A user to whom the call shall be forwarded.

7.1.3. Procedures

7.1.3.1. Provision and withdrawal

CFU shall be provided after prearrangement with the service provider.

7.1.3.2. Normal procedures

The normal procedures for CFU are described below and shown in figures 5 through 9 as dynamic descriptions (SDLs).

7.1.3.2.1. Activation, deactivation, and registration

If the served user has subscribed to CFU, the served user can use the activation procedure.

To activate CFU, the served user shall supply the forwarded-to number. This is accomplished by dialling an access code after which a second dial tone shall be received. The user then inputs the forwarded-to number. Verification of the forwarded-to number shall be accomplished by establishing a call to the forwarded-to user. A call is setup to that number and upon called party answer CFU is active. If there is no answer, the served user can hang up, pick up the receiver to receive dial tone, redial the access code, receive dial tone again, and input the exact same Forwarded-to Number again. CFU shall then become active.

When the served user activates CFU, the service provider shall return notification of acceptance or rejection of the request. (See exceptional procedures for list of possible causes for rejection, 7.1.3.3.1.)

CFU can be deactivated by dialling an access code. When the served user deactivates CFU, the service provider shall return notification of acceptance or rejection of the request (see exceptional procedures, 7.1.3.3) .

7.1.3.2.2. Invocation and operation

The following example clarifies the CFU procedures. Assume that A calls B1, who forwards the call to B2, ..., Bm, ..., Bx. The final receiver of the call is C.

A --> B1 --> ... Bm --> ... Bx --> C

Served User Bm's View:

When CFU is active, all incoming calls shall be forwarded without being offered to the served user Bm.

Forwarded-to User C's View:

If the forwarded-to user C is capable of receiving information on the call that has been forwarded (e.g., he may be served by a message desk interface), he may receive some or all of the following information.

- originally called number B1;

- calling party number A;

- cause for original forwarding;

- last forwarding number Bx;

- cause for last forwarding.

7.1.3.3. Exceptional procedures

7.1.3.3.1. Activation, deactivation, and registration

If the system cannot accept an activation request, the served user receives a notification that Call Forwarding activation was unsuccessful. The notification takes the form of re-order tone unless otherwise indicated. Possible causes are:

- service not subscribed;

- forwarded-to number invalid (activation call shall fail as an ordinary outgoing call would);

- use of an operator access prefix;

- forwarded-to number violates subscribed constraints (e.g., group restrictions - activation call shall fail as an ordinary outgoing call would);

- forwarded-to number is a special service code (e.g. police);

- forwarded-to number is served user's number.

If the served user requests to deactivate CFU when it was not activated the network simply returns dial tone as if CFU was successfully deactivated.

7.1.3.3.2. Invocation and operation

If the CFU forwarded call cannot be completed to the forwarded-to destination, the call shall be released back towards the calling user with the appropriate reason for the noncompletion of the call.

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Within the SS7 network or tandem SS7 networks the total number of all forwardings for each call should be limited. The maximum number of such connections shall not be greater than 5 for each call. This is to prevent infinite looping. If the limit is reached, no attempt is made to forward the call an additional time. (Networks allowing multiple call forwardings should exercise caution to ensure acceptable transmission and post dial delay performance.)

7.1.3.4. Alternate procedures

7.1.3.4.1. Activation, deactivation, and registration

None identified

7.1.3.4.2. Invocation and operation

None identified

7.1.4. Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

7.1.5. Interworking considerations

If an incoming call that is to be forwarded has interworked with another signalling system (e.g., Multifrequency) then an interworking situation exists. An SS7 switch, which is to forward a call, should not forward a call that has experienced interworking, if a Call Forwarding for the served user is already active (i.e., a call has been forwarded for the served user and has not been answered yet). This prevents infinite looping in interworking situations by disallowing multiple simultaneous forwardings from a served user.

Forwarding
_Idle

'Incoming
Call
Successfully
Arrived'

Invoke
CFU

CF — Yes — Is CFU
Activated

No

Yes — Is User
Busy

No

K

'Is
CFB
Activated' — No
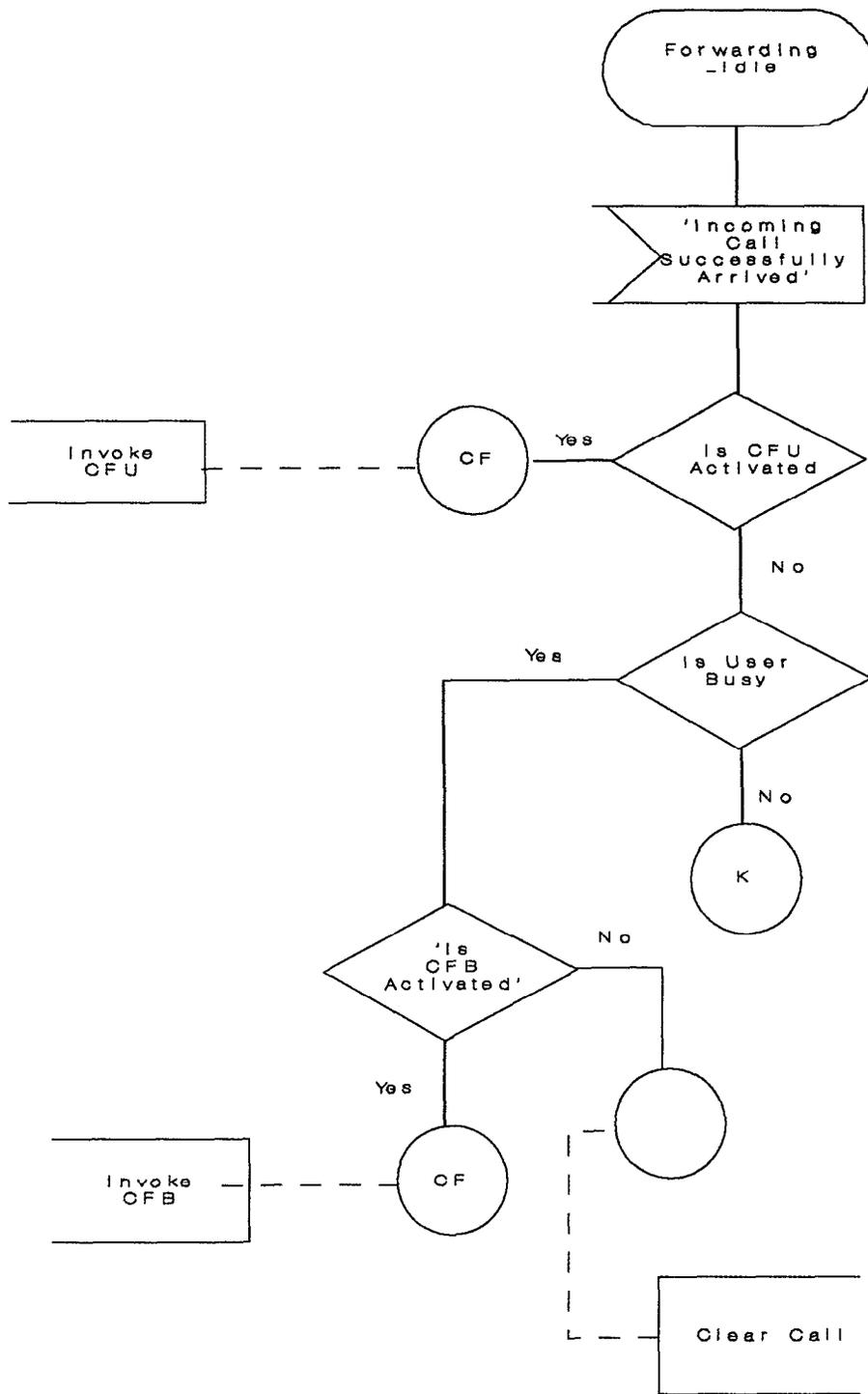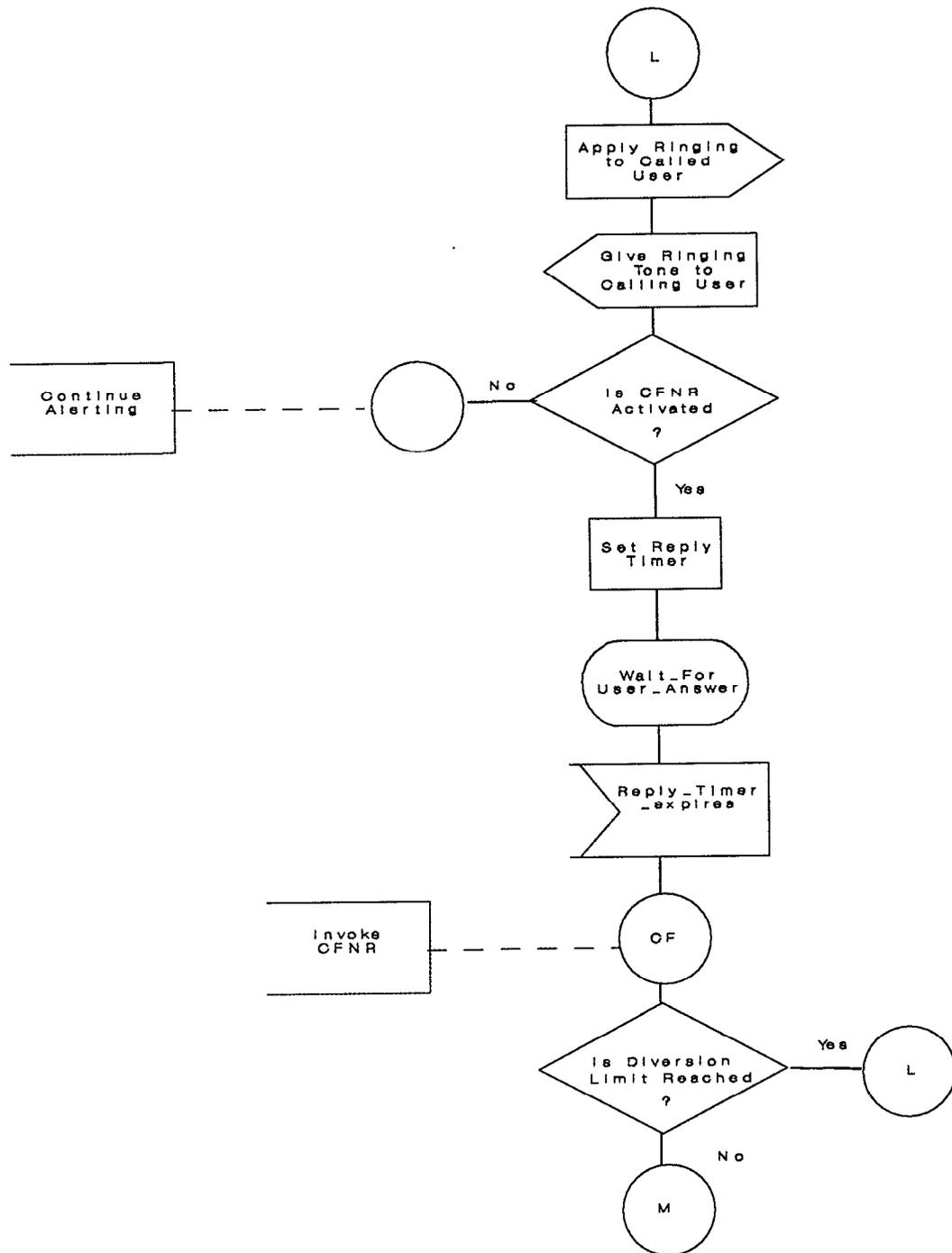
Yes

Invoke
CFB

CF

Clear Call

Figure 5

Call forwarding SDL at served user's exchange

Figure 6
Call forwarding SDL at served user's exchange
(Part 2)
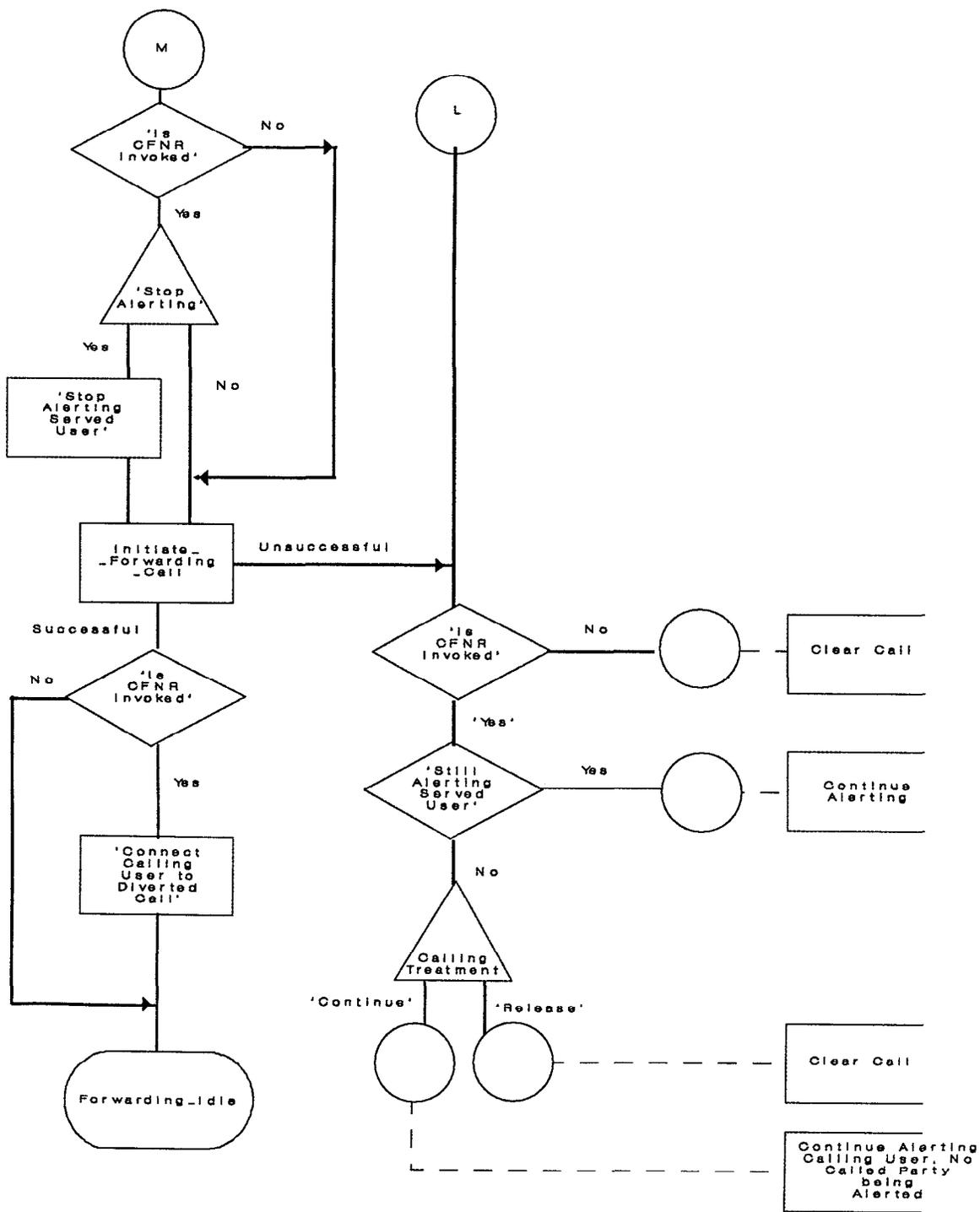
Figure 7
Call forwarding SDL at served user's exchange
(Part 3)
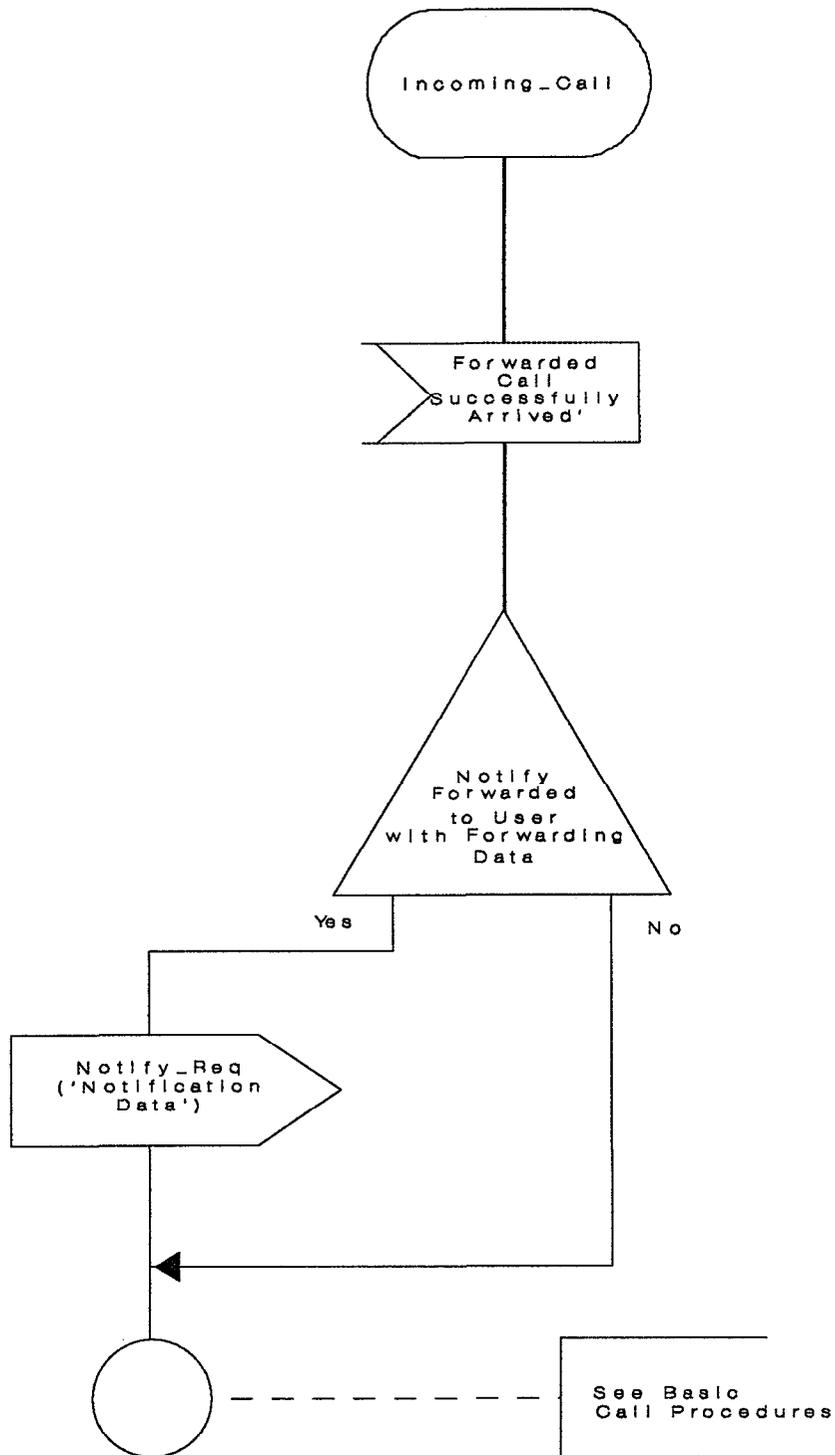
Figure 8
Call forwarding SDL at forwarded-to user's exchange

7.2. Call Forwarding Busy, Stage-1 description (User perspective)

For information on Call Forwarding Busy interactions with other services, see annex B.

7.2.1. Definition

Call Forwarding Busy (CFB) permits a served user to have the network send all incoming calls for the served user's number that meet Busy to another number. The served user's originating service is unaffected.

7.2.2. Description

7.2.2.1. General description

Call Forwarding Busy as supported by SS7 offers two advantages over traditional Call Forwarding Busy:

- — Multiple sequential forwardings can be limited inter-switch

- — Forwarded-to parties can receive the originally called number, the calling party number, the cause for original forwarding, the last forwarding number, and the cause for last forwarding, if they are served by a suitable interface (e.g., Simple Message Desk Interface or DSS1). However, the description of these user-network interfaces is outside the scope of this standard.

7.2.2.2. Specific terminology

7.2.2.2.1. Served User:

The served user is the user who is requesting that calls to his number be forwarded. This user may also be referred to as the forwarding user or called user.

7.2.2.2.2. Forwarded-to User:

The forwarded-to user is a user to whom the call is forwarded.

7.2.3. Procedures

7.2.3.1. Provision and withdrawal

CFB shall be provided after prearrangement with the service provider.

7.2.3.2. Normal procedures

The normal procedures for CFB are described below and shown in Figures 5 through 9 (CFU description).

7.2.3.2.1. Activation, deactivation, and registration

The forwarded-to number is supplied at subscription time and then stored in the network, or at the service provider's option, the user can turn the service on, or off, or modify the forwarded-to number using their phone.

7.2.3.2.2. Invocation and operation

The following example clarifies the CFB procedures. Assume that A calls B1, who forwards the call to B2, ..., Bm, ..., Bx. The final receiver of the call is C.

A --> B1 --> ... Bm --> ... Bx --> C

Served User Bm's view:

If CFB is active and the served user is Busy, then an incoming call to the served user shall be forwarded.

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<u>Forwarded-to User C's view:</u>

If the forwarded-to user C is capable of receiving information on the call that has been forwarded (e.g., he may be served by a message desk interface), he may receive some or all of the following information.

1) originally called number B1

2) calling party number A

3) cause for original forwarding

4) last forwarding number Bx

5) cause for last forwarding

7.2.3.3. Exceptional procedures

7.2.3.3.1. Activation, deactivation, and registration

Not applicable.

7.2.3.3.2. Invocation and operation

If the CFB forwarded call cannot be completed to the forwarded-to destination, the call shall be released back towards the calling user with the appropriate reason for the noncompletion of the call.

Within the SS7 network or tandem SS7 networks the total number of all forwardings for each call should be limited. The maximum number of such connections shall not be greater than 5 for each call. This is to prevent infinite looping. If the limit is reached, no attempt is made to forward the call an additional time. (Networks allowing multiple call forwardings should exercise caution to ensure acceptable transmission and post dial delay performance.)

7.2.3.4. Alternate procedures

7.2.3.4.1. Activation, deactivation, and registration

None identified.

7.2.3.4.2. Invocation and operation

None identified.

7.2.4. Network capabilities for charging

Same as Call Forwarding Unconditional (CFU).

7.2.5. Interworking considerations

Same as CFU.

7.3. Call Forwarding No Reply, Stage-1 description (User perspective)

For information on Call Forwarding No Reply interactions with other services see annex C.

7.3.1. Definition

Call Forwarding No Reply (CFNR) permits a served user to have the network send all incoming calls for the served user's number that meet No Reply to another number. The served user's originating service is unaffected.

7.3.2. Description

7.3.2.1. General description

Call Forwarding No Reply as supported by SS7 offers two advantages over traditional Call Forwarding No Reply:

– Multiple sequential forwardings can be limited inter-switch

– Forwarded-to parties can receive the originally called number, the calling party number, the cause for original forwarding, the last forwarding number and the cause for last forwarding if they are served by a suitable interface (e.g., Simple Message Desk Interface or DSS1). However, the description of these user network interfaces is outside the scope of this standard.

7.3.2.2. Specific terminology

7.3.2.2.1. Served User:

The user who is requesting that calls to his number be forwarded. This user may also be referred to as the forwarding user or called user.

7.3.2.2.2. Forwarded-to User:

A user to whom the call shall be forwarded.

7.3.3. Procedures

7.3.3.1. Provision and withdrawal

CFNR shall be provided after prearrangement with the service provider. The service is offered with one served user timer option (for which only one value can be selected):

No Reply Condition Timer: 1-60 Seconds

7.3.3.2. Normal procedures

The normal procedures for CFNR are described below and shown in figures 5 through 9 (CFU description).

7.3.3.2.1. Activation, deactivation, and registration

The Forwarded-to Number and the No Reply Condition Timer values are supplied at subscription time and these values are then stored in the network, or the service provider's option, the user can turn the service on, or off, or modify the forwarded-to number using their phone.

7.3.3.2.2. Invocation and operation

The following example clarifies the CFNR procedures. Assume that A calls B1, who forwards the call to B2, . . ., Bm . . ., Bx. The final receiver of the call is C.

A -->   B1   -->   . . . Bm   -->   . . . Bx -->   C

Served User Bm's view:

When CFNR is active, incoming calls shall be offered to the served user. If the served user does not reply within a subscribed time interval, the call shall be forwarded.

When CFNR occurs, the service provider should cease alerting the served user before the forwarding is attempted or optionally continue alerting the served user as the forwarding is attempted. If the served (forwarding) user is still being alerted, the call shall reach the active state if the served user answers.

Forwarded-to User C's view:

If the Forwarded-to user C is capable of receiving information on the call that has been forwarded (e.g., it may be served by a message desk interface), it may receive some or all of the following information.

- originally called number B1;

- calling party number A;

- cause for original forwarding;

- last forwarding number Bx;

- cause for last forwarding.

7.3.3.3. Exceptional Procedures

7.3.3.3.1. Activation, Deactivation, and Registration

Same as CFU.

7.3.3.3.2. Invocation and Operation

If the CFNR forwarded call cannot be completed to the forwarded-to destination, one of the following should occur:

a) If the service provider continued alerting the served user (i,e., continued providing ringing) as the forwarding was attempted, the served user should continue to be alerted and the calling user continue to receive alerted;

b) If the service provider stopped alerting the served user before the forwarding was attempted, the service provider has two options:

1) Maintain the call in its current state, the calling user shall continue to receive ringing tone;

2) Release the call causing the calling user to go from ringing tone to some other treatment (e.g., busy tone).

Within the SS7 network or tandem SS7 networks, the total number of all forwardings for each call should be limited. The maximum number of such connections shall not be greater than 5 for each call. This is to prevent infinite looping. If the limit is reached, no attempt is made to forward the call an additional time. (Networks allowing multiple call forwardings should exercise caution to ensure acceptable transmission and post dial delay performance.)

7.3.3.4. Alternate Procedures

7.3.3.4.1. Activation, Deactivation, and Registration

None identified.

7.3.3.4.2. Invocation and Operation

None identified.

7.3.4. Network Capabilities for Charging

Same as CFU.

7.3.5. Interworking Considerations

Same as CFU with one additional item: If the network cannot determine that the forwarded call cannot be completed (i.e., the progress of the call is provided in-band), the network shall cease alerting at the forwarding termination and connect the calling user to the forwarded call in order to receive these in-band supervisory indications.

7.4. Call Forwarding, Stage-2 description (Information flows)

This stage-2 description provides for the SS7 supported Call Forwarding Unconditional (CFU), Call Forwarding Busy (CFB), and Call Forwarding No Reply (CFNR) services for non-ISDN accesses.

7.4.1. Functional model

7.4.1.1. Specific Terminology

7.4.1.1.1. User A:

The calling user.

7.4.1.1.2. User B:

The forwarding or served user.

7.4.1.1.3. User C:

The forwarded-to user.

7.4.1.1.4. Switch A:

The switching node that User A is connected to.

7.4.1.1.5. Switch B:

The switching node that User B is connected to.

7.4.1.1.6. Switch C:

The switching node that User C is connected to.

7.4.1.2. Network configurations in the realization of the service

In this description Switches A, B, and C are shown as three separate entities. The same switch could serve two or even all three of the users. Such cases are trivial, however, and well described by the information flows shown here.

7.4.1.3. Limiting assumptions

None.

7.4.2. Normal procedures

7.4.2.1. General description

As shown in figures 10 and 11, there is one basic information flow uniquely associated with call forwarding. This is the information that is carried forward with the call setup. Much of this information may ultimately be delivered to the forwarded-to user (useful for Voice Message Storage and Retrieval (VMSR) systems, for example).

| User A | Switch A | Switch B | User B | Switch C | User C |

User A
Finishes
Dialling

Setup →

Call is not Offered
to User B, it is
Forwarded
immediately & the
switch path
connected

Setup →

Ringing Applied
at User C
User C may
get Additional
Information

← **Report (Alerting)**

Report
(Alerting) ←

User A
Receives Ringing

← **Answer**
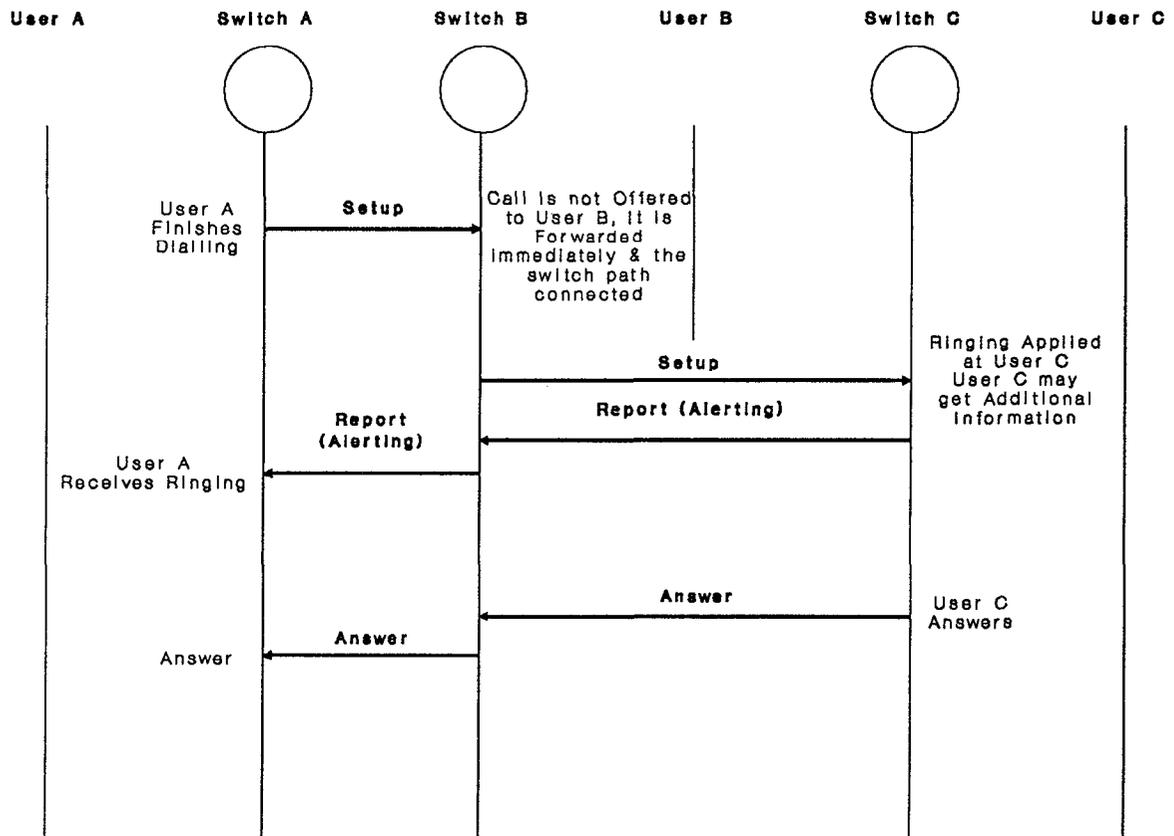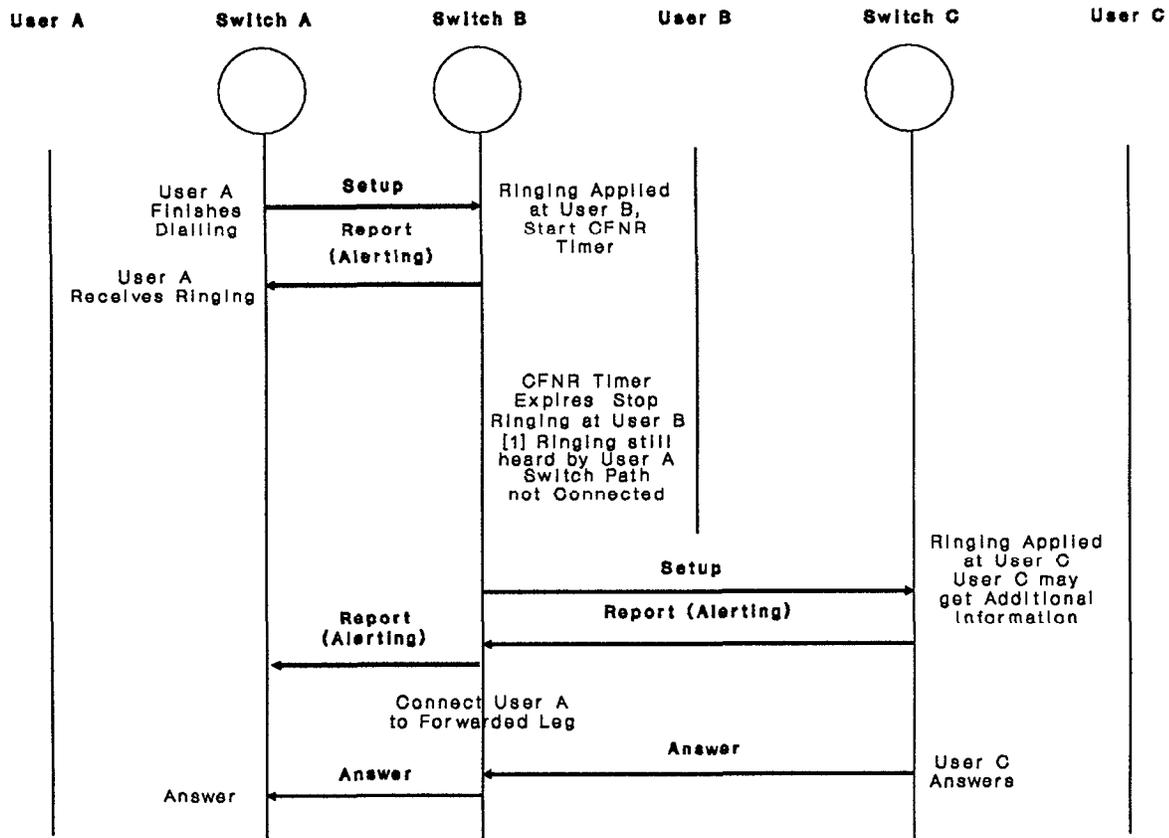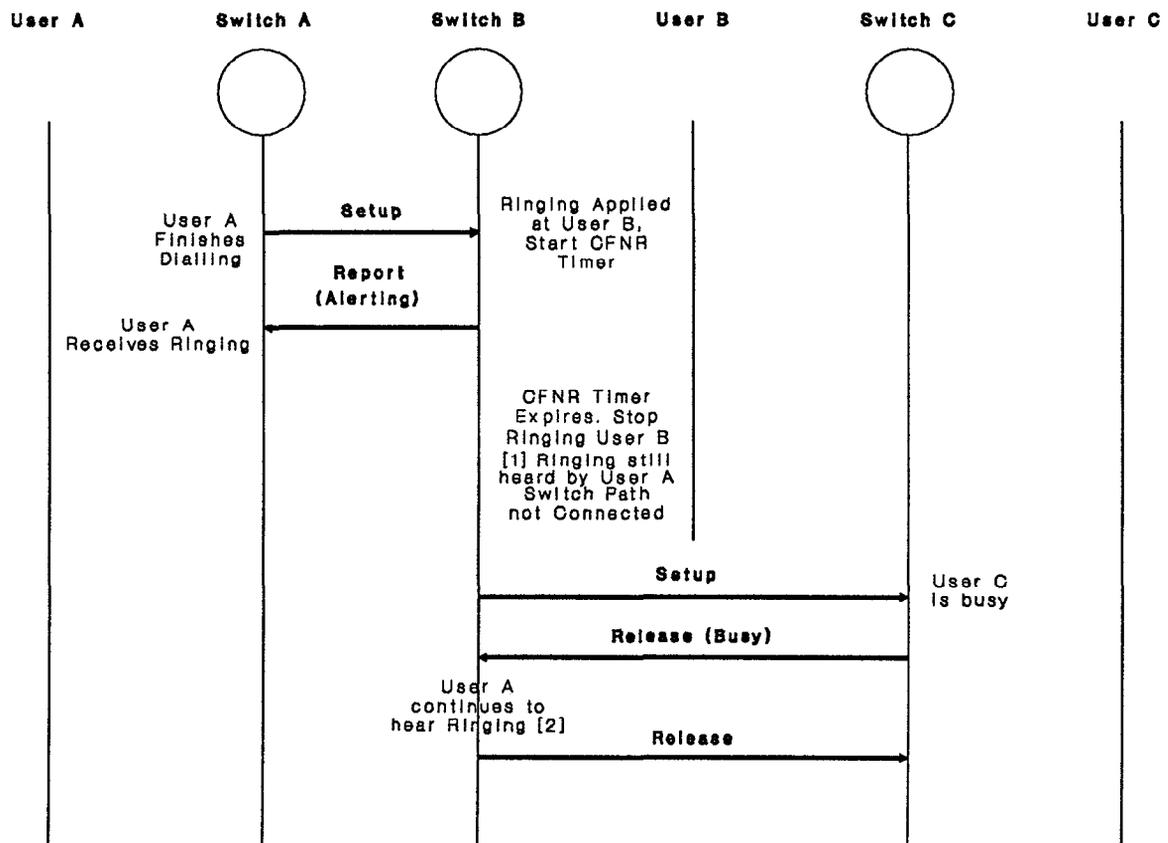
User C
Answers

Answer ←

Answer

**Figure 9
CFU and CFB - normal case**

Note [1]: As a service provider option, ringing can continue

Figure 10
CFNR - normal case

Note [1]: As a service provider option ringing can continue
Note [2]: As a service provider option, release may occur

**Figure 11
CFNR when User C is busy**

7.4.2.2.   Detailed Description of the Two Information Flows

Assume that A originally calls B and that a call undergoes multiple forwardings (see table 8).

A-hop1-> B-hop2-> C-hop3-> D-hop4-> E-hop5-> F-hop6-> G-hop7

Table 8

Information carried in the setup

	hop 1	hop2	hop3	hop4	hop5	hop6
Calling party number	A	A	A	A	A	A
Called party number	B	C	D	E	F	G
Last forwarding number			C	D	E	F
Original called number		B	B	B	B	B
Forwarding counter		1	2	3	4	5
Last forwarding cause		V(B)	V(C)	V(D)	V(E)	V(F)
Original forwarding cause		V(B)	V(B)	V(B)	V(B)	V(B)
Note: V(X) indicates the reason for diversion from party X with a value equal to unknown/not available, user busy, no reply, or unconditional.						

7.5.   Call Forwarding, Stage-3 description (SS7 protocols)

7.5.1.   General description

The Call Forwarding services involve the redirection of a call originally intended for one destination, towards another destination. The stage-1 definitions for the Call Forwarding services are given in 7.1, 7.2, and 7.3. The stage-2 description is given in 7.4. This section gives the ISDN User Part procedures to support the Call Forwarding Unconditional, Call Forwarding Busy, and Call Forwarding No Reply services. The functional description, basic formats and codes and general procedures for the ISDN User Part, are contained in ANSI T1.113.

7.5.1.1.   Definition

The Call Forwarding Unconditional service permits a served user to have the network send all incoming calls addressed to the served user's directory number (DN) to another DN. This forwarding occurs regardless of the condition of the termination (busy or idle) and without the subscriber being given the opportunity to answer the call.

The Call Forwarding Busy service permits a served user to have the network send all incoming calls addressed to the served user's DN to another DN if the served user is in the busy state.

The Call Forwarding No Reply service permits a served user to have the network send all incoming calls to the served user's DN to another DN if the served user does not answer the call within a specified time period.

A terminating exchange that determines that Call Forwarding may occur shall not discard the Initial Address Message Information until the exchange determines that Call Forwarding will not occur in this particular instance.

7.5.2.   ISDN User Part formats and codes

7.5.2.1.   Messages

One new message shall be added to the ISDN User Part to support non-ISDN Call Forwarding - the Call Progress Message (CPG). One other message, the IAM is affected. The format of the IAM is shown in chapter T1.113.3 of ANSI T1.113. Additional parameters are allowed in the IAM to support non-ISDN Call Forwarding. The following two subclauses provide the formats and codes for the CPG message and identify the additional parameters allowed in the IAM.

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7.5.2.1.1. Call Progress Message

The message type code for Call Progress is 00101100. The format for the Call Progress parameter is shown in table 9.

Table 9

Format for call progress

Parameter	Reference clause	Type	Length (octets)
Message type	2.1, T1.113.3	F	1
Event Information	7.5.2.2.1	F	1
Backward call indictators	3.3, T1.113.3	O	4
NOTE: Other parameters received in an ACM as specified in 7.5.3.3.3 shall be included in this message.			

7.5.2.1.2. Initial Address Message (IAM)

The additional parameters described in table 10 are allowed in the IAM for non-ISDN Call Forwarding:

Table 10

Format for initial address message

Parameter	Reference clause	Type	Length (octets)
Original called number	7.5.2.2.3	O	5-12
Redirecting number	7.5.2.2.4	O	5-12
Redirection information	7.5.2.2.5	O	4

7.5.2.2. Parameters

The format and codes for the Called Party Number parameter are given 3.6 of chapter T1.113.3 of ANSIT1.113.

7.5.2.2.1. Event Information Indicators

The format for the Event Information Indicators parameter is shown in table 11 and the parameter name code is 00100100. It conveys information about the type of event that caused the message to be sent to the originating exchange. The following codes are used in the Event Information Indicators parameter field:

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Table 11

Format for even informatin indicators

8	7	6	5	4	3	2	1
Restrict.	Event Information Indicators						

a) *Event indication:*

0000001	ALERTing
0000010	PROGress
0000011	inband information or appropriate pattern is now available

b) *Restrict:* Event presentation restricted indicator

0	no indication
1	presentation restricted

7.5.2.2.2. Original Called Number

The format for the Original Called Number parameter field is given in table 12 and the parameter name code is 00101000.

Table 12

Format for original called number

8	7	6	5	4	3	2	1
Odd/Even	Nature of address indicator						
Spare	Numbering plan			Presentation		Reserved	
2nd address signal				1st address signal			
:				:			
Filler (if necessary)				nth address signal			

The following codes are used in the subfields of the original called party number parameter field:

a) *Odd/even indicator:* See 3.6(1) of chapter T1.113.3 of ANSI T1.113.

b) *Nature of address indicator:*

0000001	unique subscriber number
0000010	spare, reserved for national use
0000011	unique national (significant) number
0000100	unique international number
1110001	non-unique subscriber number
1110010	spare, reserved for national use
1110011	non-unique national (significant) number
1110100	non-unique international number
1111000 to 1111110	reserved for network-specific use

c) *Numbering plan*

    000   unknown (default)
    001   ISDN (telephone) numbering plan (CCITT Recommendations E.164 and E.163)

d) *Address presentation restricted indicator:* See Chapter 3.7(4) of T1.113.3 of ANSI T1.113.

e) *Address signal:* See Chapter 3.6(4) of T1.113.3 of ANSI T1.113.

f) *Filler:* See Chapter 3.6(5) of T1.113.3 of ANSI T1.113.

7.5.2.2.3. Redirecting Number

The format of the Redirecting Number parameter field is identical to that of the Original Called Number parameter given in table 12 and the parameter name code is 00001011. The codes used in the Redirecting Number parameter field are also identical to those used in the Original Called Number parameter.

7.5.2.2.4. Redirection Information

The format of the Redirection Information parameter field is given in table 13 and the parameter name code is 00010011.

Table 13

Format for redirection information

8	7	6	5	4	3	2	1
Original redirecting reason				Reserv	Redirecting indicator		
Redirecting reason				Redirection counter			

The following codes are used in the redirection information parameter field:

a) *Redirecting indicator:* No procedures specified in US networks.

b) *Reserv:* Reserved

c) *Original redirecting reason*

    0000   unknown or not available
    0001   user busy
    0010   no reply
    0011   unconditional

d) *Redirection counter:* Number of redirections that the call has undergone expressed as a binary number

e) *Redirecting reason*

    0000   unknown or not available
    0001   user busy
    0010   no reply
    0011   unconditional

7.5.3. ISDN user part procedures

The ISDN User Part procedures are further divided into three parts. The first part gives a high-level view of the procedures and contains a figure that shows the parameters and parameter values that

occur in an Initial Address Message as a call undergoes a series of call forwardings. The second part gives procedures for an exchange that determines that a call it has received should be forwarded. The third part gives the procedures for notification of the calling user.

7.5.3.1. Call Forwarding related parameters in the Initial Address Message during multiple forwardings

Assume that A originally calls B and that a call undergoes multiple forwardings (see table 14).

A --> hop1--> B --> hop2--> C --> hop3--> D --> hop4--> E --> hop5--> F --> hop6--> G

Table 14

Parameter information for multiple redirection

	hop1	hop2	hop3	hop4	hop5	hop6
Number information						
Calling party number	A	A	A	A	A	A
Called party number	B	C	D	E	F	G
Redirecting indicator						
Redirecting number			C	D	E	F
Original called number		B	B	B	B	B
Redirection information						
Redirection counter		1	2	3	4	5
Redirecting reason		V(B)	V(C)	V(D)	V(E)	V(F)
Original redirection reason		V)B)	V(B)	V(B)	V(B)	V(B)
Note: V(X) indicates the reason for diversion from party X with a value equal to unknown/not available, user busy, no reply, or unconditional.						

7.5.3.2. Initial procedures for an exchange that determines that a call it has received should be forwarded

7.5.3.2.1. General overview

When an exchange determines that it must forward a call, it shall first check to see if forwarding the call would result in the call exceeding the number of forwardings allowed within the network. The second action that shall be undertaken, given that the limit was not exceeded, is the setting of the parameters that would be used in an Initial Address Message (IAM) for the forwarded call. Even if the forwarding is intra-exchange, this parameter information is set and retained. The reason for the retention is that, if subsequent forwarding occurs, the information shall guarantee that the forwarding completes correctly. Finally, the exchange shall attempt to set up the forwarded call. Any parameters received in the Initial Address Message not associated with forwarding (e.g., Calling Number, etc.) are normally included unchanged in the Initial Address Message used to set up the forwarded call. (The Charge Number and Originating Line Information parameters are exceptions to this rule; others are for further study.)

The next subclause gives the procedures to be followed when checking the forwarding limit. The subsequent two subclauses give the procedures to be followed for: a) the case where this call is the first forwarding (7.5.3.2.3) and b) the case where this call is the second or greater forwarding that the call has undergone (7.5.3.2.4). The parameters to be set depend upon the number of forwardings that the call has undergone.

7.5.3.2.2. Checking the forwarding limit

If the call has already undergone forwarding, the redirection counter is examined to see if another forwarding would take the counter above the network-specified limit. If it would, the procedures in 7.5.3.5 are followed.

7.5.3.2.3. First forwarding that call has undergone

There are three parameters to set; the Redirection Information, the Called Party Number, and the Original Called Number. Their values shall be set as follows:

- *The Redirection Information.* The redirection counter is one. The original redirecting reason and redirecting reason are identically set according to the forwarding conditions.

- *The Called Number.* This is equal to the number that the call is to be forwarded to.

- *The Original Called Number.* This is equal to the number causing this first redirection.

In addition, if the charge number is to be provided, it should be set to the charge number of the party causing this first redirection. In general, the charge number is included in the IAM for inter-network calls, but it may also be included in the IAM for calls within the same network.

7.5.3.2.4. Second or greater forwarding that call has undergone

If an IAM is received with the redirection counter in the redirection information parameter set to one or more and the call is to be forwarded again, it is determined that this is at least the second forwarding of the call.

There are three parameters to set; the Redirection Information, the Called Party Number, and the Redirecting Number. Their values shall be set as follows:

- *The Redirection Information:* The redirection counter is incremented by one. The redirecting reason is set according to the forwarding conditions.

- *The Called Number:* This is equal to the number that the call is to be forwarded to.

- *The Redirecting Number:* This is equal to the number that is doing the redirecting.

In addition, the original called number and original redirecting reason are included in the outgoing IAM as they were received in the incoming IAM.

If a charge number has been received in the IAM, it should not be included for the outgoing call. If the Charge Number parameter is to be included in the outgoing IAM, the charge number of the current redirecting party should be placed in the Charge Number parameter.

7.5.3.3. Forwarding procedures at the forwarding exchange

The exchange continues based on the service that is causing the forwarding. The procedures to be followed if the cause of the forwarding was either Busy or Unconditional are given in 7.5.3.3.1. These are followed by the procedures for No Reply (7.5.3.3.2).

7.5.3.3.1. Call Forwarding Unconditional or Busy

The exchange continues in the following way:

a) If the number that the call is to be forwarded to resides at another exchange, an IAM is sent to continue the call on to that exchange (the served user shall receive no indication of the call having arrived and subsequently been forwarded). The incoming trunk or line should be connected to the chosen outgoing trunk immediately. The IAM includes the parameter information as given in 7.5.3.2.3 and 7.5.3.2.4.

b) If the number resides in the same exchange, the exchange tries to set up a call to that number. If the attempt is successful (calling party ringing applied) and neither Call Forwarding Busy nor Call Forwarding Unconditional occurs, the incoming line or trunk

should be connected to the destination line. If Call Forwarding Busy or Call Forwarding Unconditional occurs when the attempt is made, the Call Forwarding procedures should be repeated.

7.5.3.3.2.   Call Forwarding No Reply

The exchange should either stop the alerting of the served (forwarding) user before the forwarding is attempted or continue the alerting of the served user. A switch option should be set to either allow the calling user to hear a change of tones or to attempt to prohibit the calling user from hearing a change in tones (by keeping current connections intact) if the call cannot be completed to the forwarded-to destination. The switch should then proceed as follows:

a)   If the number that the call is to be forwarded to resides at another exchange, an IAM is sent to continue the call on to that exchange. The IAM includes the parameter information as shown in 7.5.3.1.

1)   If the switch is set to allow the calling user to get a change in tones and if the served (forwarding) user should not continue to be alerted, the incoming trunk or line should be immediately connected in the backward direction to the chosen outgoing trunk. Subsequent actions by the switch follow normal call control procedures, except if the exchange receives an Address Complete Message (ACM) on the outgoing trunk. In this case, the procedure outlined in 7.5.3.3.3 should be used.

2)   If either the switch is set to prohibit the calling user from receiving changing tones or the served (forwarding) user should continue to be alerted, the incoming trunk or line is not connected to the chosen outgoing trunk and audible ringing, if provided, is continued. Subsequent actions by the switch are determined by the following:

   —   If the exchange receives an ACM on the outgoing trunk, it should examine the contents of the message to determine the appropriate action. If the ACM does not indicate that the call cannot be completed (e.g., ACM sent to indicate called line is idle or interworking encountered, or ACM gives no indication of called line status), the exchange should connect the incoming trunk or line to the outgoing trunk in the backwards direction at a minimum. In addition, the exchange should stop any alerting of the served user and clear any interface with that user. The exchange should follow the procedure outlined in 7.5.3.3.3.

   —   If the ACM indicates that the call cannot be completed (e.g., intercept treatment), the current connections should be left intact until the calling party disconnects, or if the served (forwarding) user is still being alerted, until an answer indication is received from the served user. In addition, the exchange should send a Release Message for the outgoing trunk.

   —   If the exchange receives an answer indication on the outgoing trunk, it should connect the incoming trunk or line to the outgoing trunk in both directions. In addition, the exchange should stop any alerting of the served (forwarding) user and clear any interface with that user.

   —   If the exchange receives a release indication on the outgoing trunk (e.g., called party busy) the current connections should be left intact. These connections would remain intact until calling user disconnect. If the served (forwarding) user is still being alerted, the call shall reach the active state if the served user answers. The exchange should send a Release Complete Message for the outgoing trunk.

b)   If the number resides in the same exchange, the exchange tries to set up a call to that number.

If the called line is idle, the exchange should stop any alerting of the served user and clear any interface with that user. The incoming line or trunk is then connected to the destination line.

If the exchange cannot complete the call (e.g., destination busy and no Call Forwarding Busy active), one of two actions may take place.

1) If the switch is set to allow the calling user to receive a change in tones, any normally generated tones or announcements should be sent to the calling user. In addition, the exchange should stop alerting the served (forwarding) user and clear any interface with the served user.

2) If the switch is set to prohibit the calling user from receiving changing tones, the incoming trunk or line is not connected to the destination line and audible ringing, if provided, is continued. The current connections are left intact until the calling user disconnects or if the served (forwarding) user is still being alerted, the call shall reach the active state if the served user answers.

If Call Forwarding Busy or Call Forwarding Unconditional occurs when the attempt is made, the Call Forwarding procedures should be repeated.

7.5.3.3.3. Early return of Address Complete Message (ACM) from an intermediate exchange

If it had been necessary for an intermediate exchange to return an Address Complete Message (ACM) prior to receipt of an ACM from the succeeding exchange, e.g., during user-network interaction or Call Forwarding No Reply, on receipt of an ACM, the intermediate exchange shall stop the awaiting address complete timer (T7), if applicable, and return a Call Progress Message to the preceding exchange as follows:

a) If the ACM contains the Called Party's Status Indicator set to "subscriber free", then the Event Indicator in the Call Progress Message is set to "ALERTing";

b) If the ACM contains the Called Party's Status Indicator set to "no indication", the Interworking Indicator set to "no interworking encountered," and the Inband Information Indicator set to "inband information is now available", then the Event Indicator in the Call Progress Message is set to "inband information is now available";

c) Otherwise, the Event Indicator in the Call Progress Message is set to "PROGress".

In each of these cases the event presentation restricted indication should be coded "no indication".

The Call Progress Message shall contain all the parameters received in the Address Complete Message. The Backward Call Indicators included in the Call Progress Message correct the settings of the same indicators that were included in the previous Address Complete Message.

7.5.3.4. Error treatment

If a forwarded call cannot be completed because the limit on forwardings has been reached due to Call Forwarding No Reply, one of three actions may occur:

— If the served user was still being alerted as the forwarding was attempted, both the served user and the calling user should continue to be alerted.

— If the switch stopped alerting the served user when the forwarding was attempted and if the switch is set to allow the calling user to receive a change in tones, the subsequent action depends on whether interworking occurred between the switch and the calling user's switch. If no interworking was encountered, the call is cleared back to the preceeding exchange. Busy tone is provided to the calling user.

— If the switch stopped alerting the served user when the forwarding was attempted and if the switch is set to prohibit the calling user from receiving changing tones, the call is left in its current state with the calling party continuing to receive ringing.

If a forwarded call cannot be completed because the limit on forwardings has been reached due to Call Forwarding Unconditional or Call Forwarding Busy, then one of the following actions occur:

— If interworking has been encountered, the switch may clear back to the preceding exchange with cause "user busy" or, optionally, may apply busy tone to the calling user.

— If interworking has not been encountered, the switch shall clear back to the preceding exchange.

(See 7.5.3.3.2 for procedures on receiving cause value "user busy" at a Call Forwarding No Reply exchange.)

If a forwarded call cannot be completed for a reason other than the limitation on the number of forwardings allowed, the error treatment appropriate to the call failure cause is applied in accordance with normal call control procedures.

7.5.4. Interactions

No interactions that have SS7 impact have been identified.

7.5.5. Interworking

If Multifrequencey (MF) interworking is encountered, certain call forwarding information (e.g., Original Called Number) will be lost.

7.5.6. Message flow diagrams

Call release procedures are as described for a normal call.

The Non-ISDN Call Forwarding message flows for the information that is carried with the Call Setup may be mapped exactly to the Stage-2 information flows. (See table 15).

Table 15

Mapping of stage-2 information flows into stage-3 protocol

	Stage 2	Stage 3
Message Mapping	SETUPreq.ind	Initial address message
	REPORT(alerting req.ind	Address complete message
	SETUPresp.conf	Answer message
	RELEASE (busy) req.ind	Release message
	RELEASEresp.conf	Release complete message
Parameter Mapping	Calling party number	Calling party number
	Called party number	Called party number
	Last forwarding number	Redirecting number
	Original called number	Original called number
	Original forwarding cause	Original redirecting reason
	Forwarding counter	Redirection counter
	Last forwarding cause	Redirecting reason
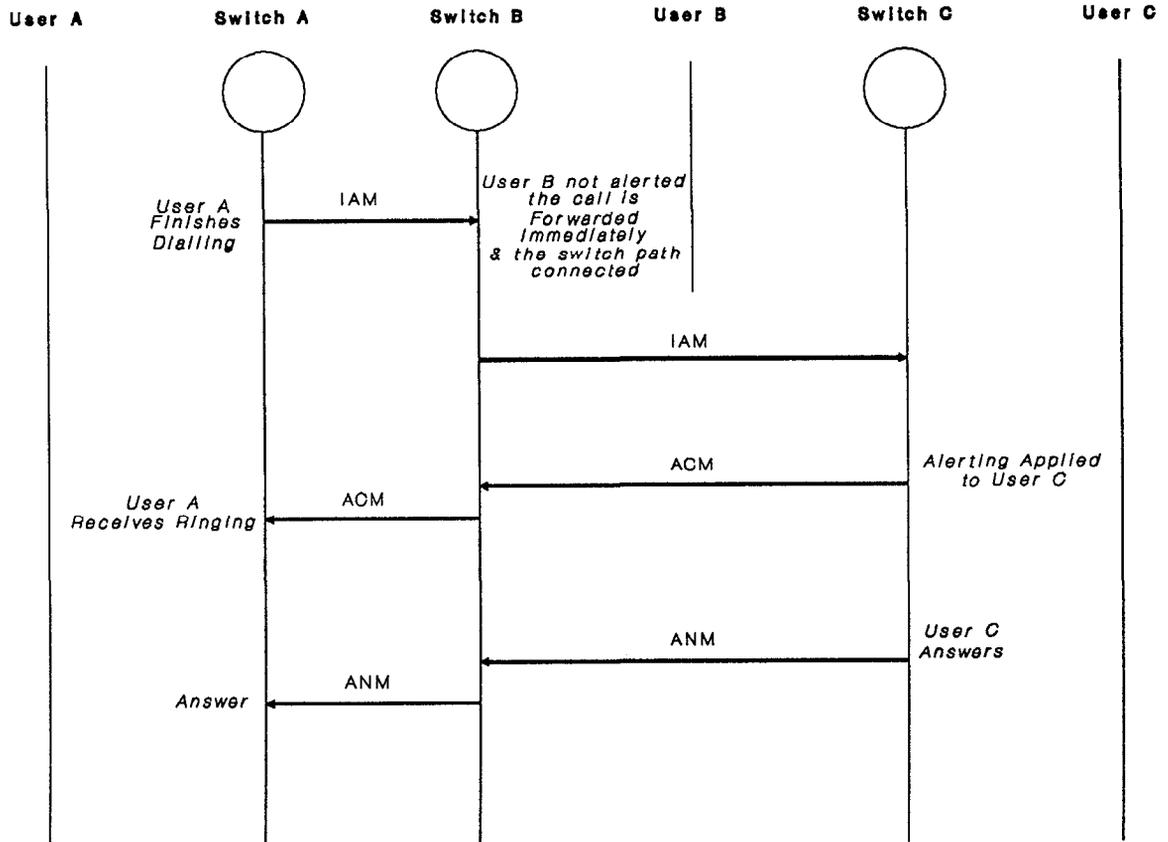
Figure 12
CFU and CFB normal case

User A	Switch A	Switch B	User B	Switch C	User C

User A
Finishes
Dialling   IAM →

Alerting Applied to
User B
Start CFNR Timer

User A
Receives Alerting   ← ACM

CFNR
Timer Expires
Alerting at
User B stops [1]
Ringing still
heard by User A
Switch Path not
Connected

IAM →

Alerting Applied
to User C.

← ACM

Call Progress ←

Connect two calls

← ANM

User C
Answers

Answer ←   ANM
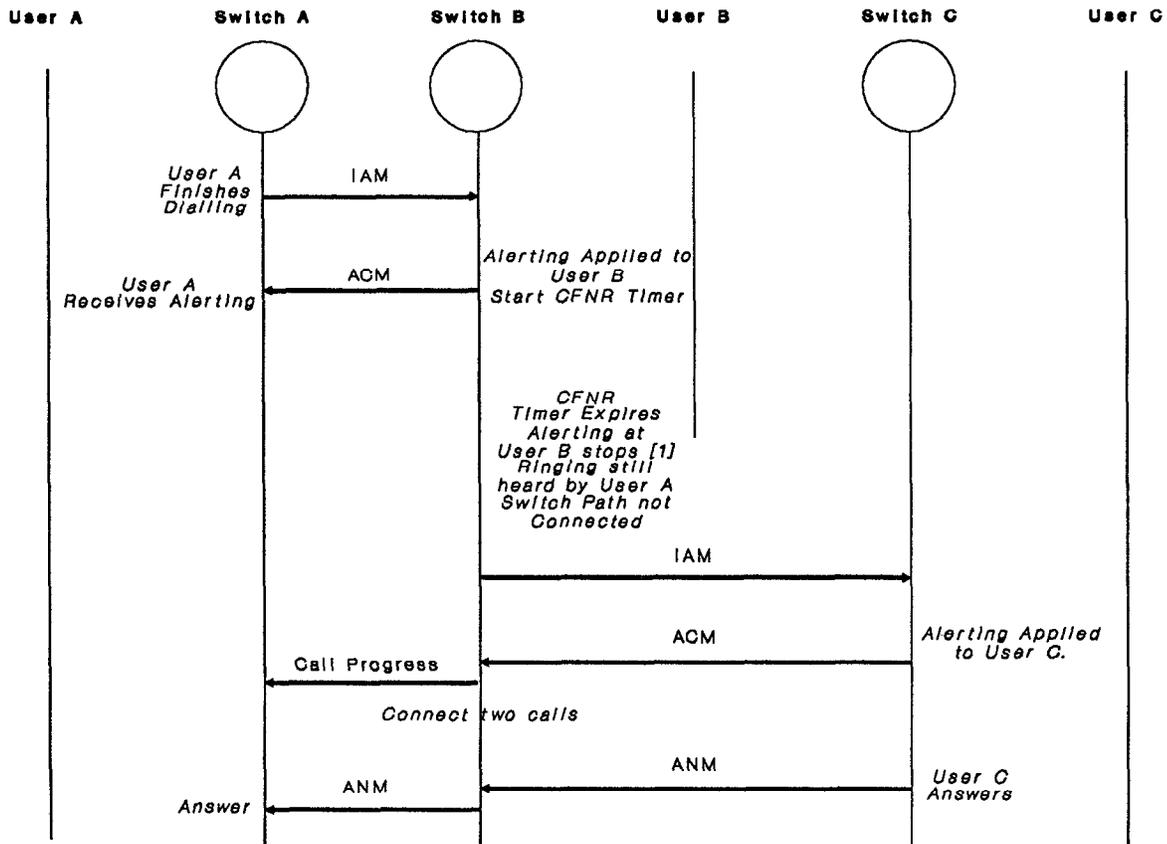
Note [1]: As a service provider option ringing can continue

Figure 13
CFNR normal case
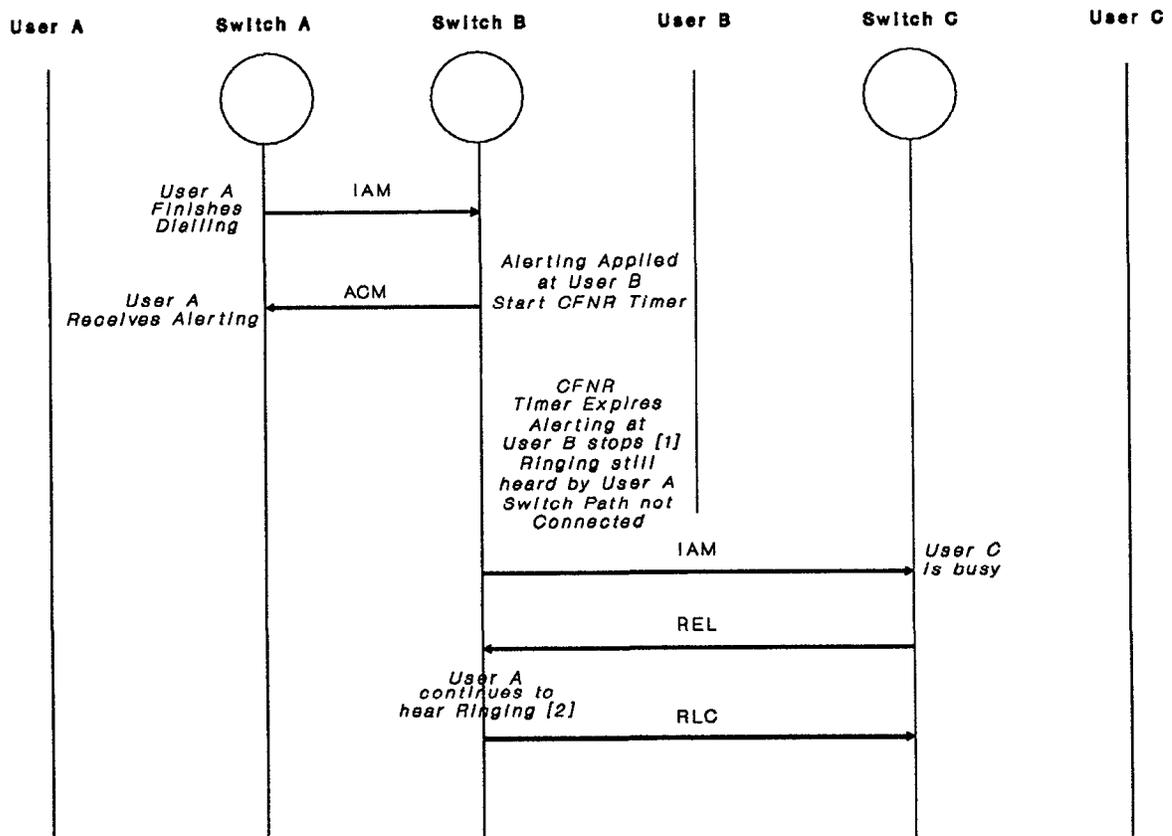
40

Figure 14

CFNR when user C is busy normal case

Note [1]: As a service provider option ringing can continue

Note [2]: As a service provider option, Call can be Released

8. Carrier Selection

8.1.   Carrier Selection, Stage-1 description (User perspective)

This service is the transfer from one network to another of the reason for the selection of the carrier identification code used for delivering a call to a transit network. This carrier identification code is referred to here as the "selected carrier identification code." Reasons currently envisioned for the selection of this carrier identification code include:

  a)   selected carrier identification code presubscribed and not input by calling party;

  b)   selected carrier identification code presubscribed and input by calling party;

  c)   selected carrier identification code presubscribed, no indication of whether input by calling part;

  d)   selected carrier identification code not presubscribed and input by calling party.

In the future, reasons identifying selection resulting from local exchange carrier operator services processing may be added.

Note that the above reasons imply that the determination of presubscription is by carrier identification code rather than by transit network in the case where a transit network has multiple carrier identification codes.

Typically, the carrier selection parameter would be sent to the transit network by the network originating the call. The parameter would also be available, however, for transfer between other networks associated with the call, should the need arise. For example, the information might be passed from a transit network to a terminating network.

8.2.   Carrier Selection, Stage-2 description (Information flows)

The stage-2 for carrier selection is trivial and is covered by the information flow given in figure 15.
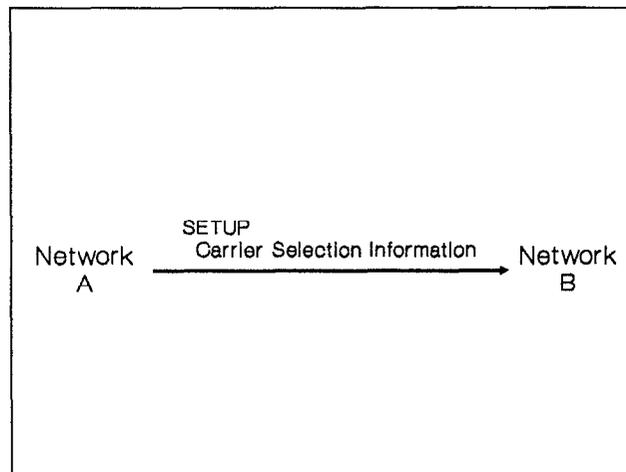
Figure 15
Carrier selection information flow

8.3. Carrier Selection, Stage-3 description (SS7 protocols)

8.3.1. General Description

This stage-3 description provides the ISDN User Part protocol to support the Carrier Selection service.

8.3.2. ISDN User Part formats and codes

The format of the Carrier Selection parameter field is shown in table 16.

Table 16

Carrier selection parameter

8	7	6	5	4	3	2	1
Carrier selection information							

The following codes are used in the carrier selection parameter field.

00000000   no indication (default)

00000001   selected carrier identification code presubscribed and not input by calling party

00000010   selected carrier identification code presubscribed and input by calling party

00000011   selected carrier identification code presubscribed, no indication of whether input by calling party

00000100   selected carrier identification code not presubscribed and input by calling party

8.3.3. ISDN User Part procedures

A network completing a call to a transit network should optionally include a carrier selection parameter in the Initial Address Message. Whether the carrier selection parameter is included would be an option of the networks involved and, possibly, call specific information.

The codes would be used as follows: (Note that presubscription is associated with the originating access in the following codes since they are for use for direct-dialled calls, i.e., the codes listed in this subclause do not address presubscription based on operator services processing)

a)   *Selected carrier identification code presubscribed and not input by calling party:* Informs the receiving network that the carrier identification code selected for delivering the call to the receiving network is the presubscribed code associated with the originating access for the call and that the carrier identification code was not input to the exchange during call setup by the calling party.

b)   *Selected carrier identification code presubscribed and input by calling party:* Informs the receiving network that the carrier identification code used for delivering the call to the receiving network is the presubscribed code associated with the originating access for the call and the carrier identification code was input to the exchange during call setup.

c)   *Selected carrier identification code presubscribed, no indication of whether it was input by calling party:* Informs the receiving network that the carrier identification code used for delivering the call to the receiving network is the presubscribed code associated with the originating access for the call when no information is to be provided on whether the carrier identification code was input to the exchange during call setup. (This code could be used, for example, at a tandem where an inband indication is received that the transit network is the presubscribed carrier.)

d)   *Selected carrier identification code not presubscribed and input by calling party:* Informs the receiving network that the carrier identification code used for delivering the call to the receiving network is not the presubscribed code associated with the originating access for the call and the carrier identification code was input to the exchange during call setup.

Note that the usage described implies that presubscription is by carrier identification code, not transit network. Thus, for example, if:

- a transit network has two carrier identification codes;

- originating access D is presubscribed to carrier A;

- call on originating access D is direct-dialled 10-carrier identification code for carrier B+, and;

- the carrier identification code for carrier B is used for delivering the call to the transit network.

then the carrier selection parameter would be coded "selected carrier identification code not presubscribed and input by the calling party."

9. Interworking with Non-ISDN Private Networks

The following description covers the Intra-LATA service.

9.1. Interworking with Non-ISDN Private Networks, Stage-1 description (User perspective)

9.1.1. Definition

Interconnection of private networks via the public-switched network (PSN) allows a customer with multiple private networks to make calls among those private networks. Furthermore, this service allows the major features associated with private network calls to function transparently across the PSN.

9.1.2. Description

9.1.2.1. General description

The description of interconnection of private networks via the public-switched network can be divided into the following categories:

a) *Private numbering plan:* The public-switched network accepts a private network number from an originating private network and sets up a call to a point of egress associated with the destination private network. At the point of egress, the public-switched network delivers, to the destination private network, a private number.

b) *Travelling class mark:* The public-switched network accepts a travelling class mark (TCM) along with a private network number from an originating private network and, in association with the call, delivers, to the destination private network, the travelling class mark.

c) *Accounting codes:* The public-switched network accepts an account code along with a private network number from an originating private network and, in association with the call, delivers, to the destination private network, the account code.

d) *Authorization codes:* The public-switched network accepts an authorization code along with a private network number from an originating private network and, in association with the call, delivers to the destination private network, the authorization code. Figure 16 provides a useful model for understanding the interconnection of private networks via the public-switched network.
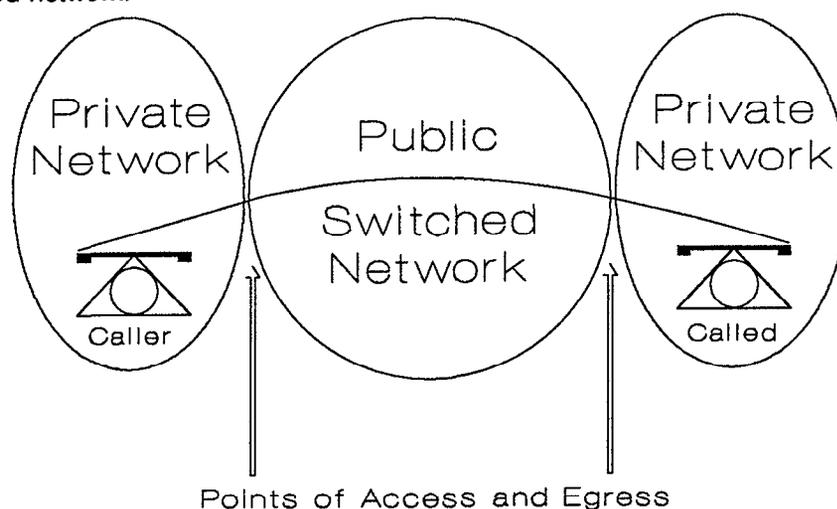
Points of Access and Egress
Figure 16
Interconnection of private network via the public-switched network

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9.1.2.2. Specific terminology

9.1.2.2.1. Private Network:

A private network is a dedicated network shared by one or more customers. The single user, in general, has numerous stations in several geographically diverse locations.

9.1.2.2.2. Account Codes:

The account codes allow the private network user to provide a special digit sequence (the account code) for inclusion in an accounting record. This allows the customer to allocate telecommunication charges, per call, from the record made.

9.1.2.2.3. Authorization Codes:

Authorization codes provide the capability for a station user to enter a special digit sequence (the authorization code) and thereby replace, for a single call, the restrictions assigned to the station with the restrictions assigned to the authorization code.

9.1.2.2.4. Private Network Numbering:

Numbers may be assigned for use within a private network that have no meaning to the routing functions in the public network.

9.1.2.2.5. Travelling Class Mark:

travelling class mark (TCM) provides a mechanism for network class of service. The purpose of the TCM is to allow the passage of class-of-service information through the private network and thereby influence call routing.

9.1.3. Procedures

9.1.3.1. Provision and withdrawal

At the interface of the private network and the public switched network, the public switch shall have access to all of the following subscription options for interface (physical or simulated).

Table 17

Subscription options for interworking with non-ISDN private networks

SUBSCRIPTION OPTIONS (per private network)	VALUE
Private network number (acceptance)	Yes/No
TCM (acceptance)	Yes/No
Account code (acceptance)	Yes/No
Authorization code (acceptance)	Yes/No

9.1.3.2. Normal procedures

9.1.3.2.1. Activation, deactivation, and registration.

Not required.

9.1.3.2.2. Invocation and operation

9.1.3.2.2.1. Originating User Point-of-view

A call between stations on a private network interconnected by the public switched network should be transparent to a user in comparison to a call to a station on a private network interconnected by private facilities, if the private network wishes such transparency.

9.1.3.2.2. Terminating User Point-of-view

A call terminating to a station on a private network interconnected by the public switched network should be transparent to a user in comparison to a call terminating to a station on a private network interconnected by private facilities, if the private network wishes such transparency.

9.1.3.3. Exceptional procedures

9.1.3.3.1. Originating user point-of-view

An originating user's call shall be rejected, and an appropriate indication of the rejection shall be returned, if one of the following events occurs: the private network number cannot be mapped to a known private network or the interworking encountered in the public switched network during call setup results in the loss of "vital" information (i.e., the private network number) (see 9.1.5).

9.1.3.3.2. Terminating user point-of-view

No indication is sent to the terminating party in the event of a call setup failure.

9.1.3.4. Alternate procedures

9.1.3.4.1. Activation, deactivation, and registration

Not identified.

9.1.3.4.2. Invocation and operation

Not identified.

9.1.4. Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

9.1.5. Interworking considerations

There are three interworking scenarios:

a) The first involves signalling System 7 and MF interworking. If SS7-MF interworking is encountered during call setup in the public switched network, since public MF trunks cannot carry all the necessary information for this service, the call should be dropped and the originating user should receive an appropriate cause indication.

b) The second interworking scenario concerns spanning multiple networks in the public switched network. A network may not transport all the necessary signalling information for interworking of private networks. As a result, at the interface of the public switched network and the terminating private network, necessary information may be absent, causing the call to be dropped and the originating user should receive an appropriate cause indication.

c) The third interworking scenario concerns varying signalling capabilities of switches in a single public switched network. Some switches in a network may not transport all the necessary signalling information for interworking of private networks. As a result, at the interface of the public switched network and the terminating private network, necessary information may be absent, causing the call to be dropped and the originating user should receive an appropriate cause indication.

9.1.6. Interaction with other supplementary services

9.1.6.1. MBG Basic Call

See 10.1.6.2 for interactions with MBG Basic Call.

9.2.   Interworking with Non-ISDN Private Networks, Stage-2 description (Information flows)

9.2.1.   Functional model

This stage 2 service description describes two cases of interconnection of private networks via the PSN:

Case 1. The access node also has direct access to the service logic needed to direct the call to the destination private network (see Figure 17 for an illustration of this case).

Case 2. A special service node is used in conjunction with the access node to support the service (see Figure 18 for an illustration of this case).

9.2.1.1.   Specific terminology

9.2.1.1.1.   Private Network

The private network includes switching nodes and circuits between them. Two examples of switching nodes in a private network are a PBX and a Centrex.

9.2.1.1.2.   travelling Class Mark

When two interconnected switches provide network service to a single customer, the originating switch should be arranged to signal more than just called-number information to the terminating switch. The TCM represents this additional information and consists of one or more digits.

9.2.1.2.   Functional description of the access to the public switched network

For the PSN access node to support this service, the node needs to be able to receive certain defined information from the private network, invoke the necessary service logic, and to include additional information supporting the service in the initial public switched network call setup.

9.2.1.2.1.   Information receivable from a private network

The access node should be able to receive the following from a private network:

- — a private network number;

- — a travelling class mark;

- — an account code;

- — an authorization code;

- — indication of service;

- — private network identification.

9.2.1.2.2.   Service processing

For case 1, the access node should be able, based on information received from the private network and service logic (both resident and non-resident), to formulate a routing number, that can then be used by the public switched network to route the call to the point of egress to the destination private network. The service logic should also create or modify an account code, an authorization code, or a travelling class mark associated with the call.

For case 2, the access node should be able, based on information received from the private network and service logic (both resident and nonresident), to route the call to the service node.

9.2.1.2.3.   Initial PSN call Setup

For case 1, the access node should be able to include the following information in the initial PSN call setup:

- a routing number, which can be used by intermediate switches to route the call to the point of egress to the destination private network;

- an indication of the service;

- an indication that interworking with a private network is needed;

- indication of the destination private network;

- a private network number;

- a travelling class mark, which may have been received from the private network or formulated by the service logic;

- an account code, which may have been received from the private network or formulated by the service logic; and

- an authorization code, which may have been received from the private network or formulated by the service logic.

For case 2, the access node should be able to include the following information in the initial PSN call setup:

- a routing number that can be used by intermediate switches to route the call to the service node;

- an indication of the service;

- an indication that more service processing is needed (optional);

- private network identification;

- a private network number;

- a travelling class mark received from the private network;

- an account code received from the private network; and

- an authorization code received from the private network.

9.2.1.3. Functional description of the Case-2 Service Node

For the service node to support this service, the node shall be able to receive certain additional information from the PSN related to private network calls, invoke the necessary service logic, and continue PSN call setup including the additional information to support the service.

9.2.1.3.1. Additional information receivable from a PSN

The service node should be able to receive the following additional information related to this service from the PSN (beyond the basic call setup info):

- a routing number that identifies the call to be other than a Plain Old Telephone Service (POTS) call;

- an indication that service processing is needed (optional);

- a private network number;

- a travelling class mark;

- an account code; and

- an authorization code.

9.2.1.3.2.   Service processing

The service node should be able, based on information received from the PSN call setup and service logic (both resident and non resident), to formulate a routing number, which can then be used by the public switched network to route the call to the point of egress to the destination private network. The service logic may also create or modify an account code, an authorization code, or a travelling class mark associated with the call. The service logic may also instruct the node to record the account code.

9.2.1.3.3.   Continued PSN Call Set-Up

The service node should be able to continue PSN call setup, including the following information in the call setup:

  -   a routing number that can be used by intermediate switches to route the call to the point of egress to the destination private network;

  -   an indication of the service;

  -   an indication that interworking with a private network is needed;

  -   an indication of the destination private network;

  -   a private network number;

  -   a travelling class mark that may have been received from the private network or formulated by the service logic;

  -   an account code, which may have been received from the private network or formulated by the service logic; and

  -   an authorization code, which may have been received from the private network or formulated by the service logic.

9.2.1.4.   Functional description of the egress from the PSN

For the egress node to support this service, the node shall be able to receive certain defined information from the public switched network, invoke the necessary service logic, and initiate a call into a private network based on the information included in the PSN call setup.

9.2.1.4.1.   Additional information receivable from the PSN

The egress node should be able to receive the following additional information related to this service from the PSN (beyond the basic call setup info):

  -   a routing number that identifies the call to be other than a POTS call;

  -   an indication of the service;

  -   an indication that interworking with a private network is needed;

  -   an indication of the destination private network;

  -   a private network number;

  -   a travelling class mark;

  -   an account code; and

  -   an authorization code.

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9.2.1.4.2. Service processing

The egress node should be able, based on information received from the PSN and service logic (both resident and non resident), to initiate a call into a private network. The service logic should use the authorization code and travelling class mark to select the correct facilities. The service logic should also instruct the node to record the account code.

9.2.1.4.3. Initiating call Setup into a private network

In initiating call setup into a private network, the egress node should be able to:

- transfer a private network number to the private network;

- transfer a travelling class mark to the private network;

- transfer an account code to the private network; and

- transfer an authorization code to the private network.

9.2.1.5. Functional description of intermediate PSN nodes

For an intermediate node to support this service, the node shall:

a) pass the additional information (which should include selecting only ISDN-UP trunks for the outgoing circuit);

b) use normal call procedures to route the call.

9.2.2. Information flows

There are two information flows given in figures 17 and 18. The first provides for when the access node also has direct access to the service logic needed to direct the call to the destination private network (i.e., case 1). The second provides for when a special service node is used in conjunction with the access node to support the service (i.e., case 2).
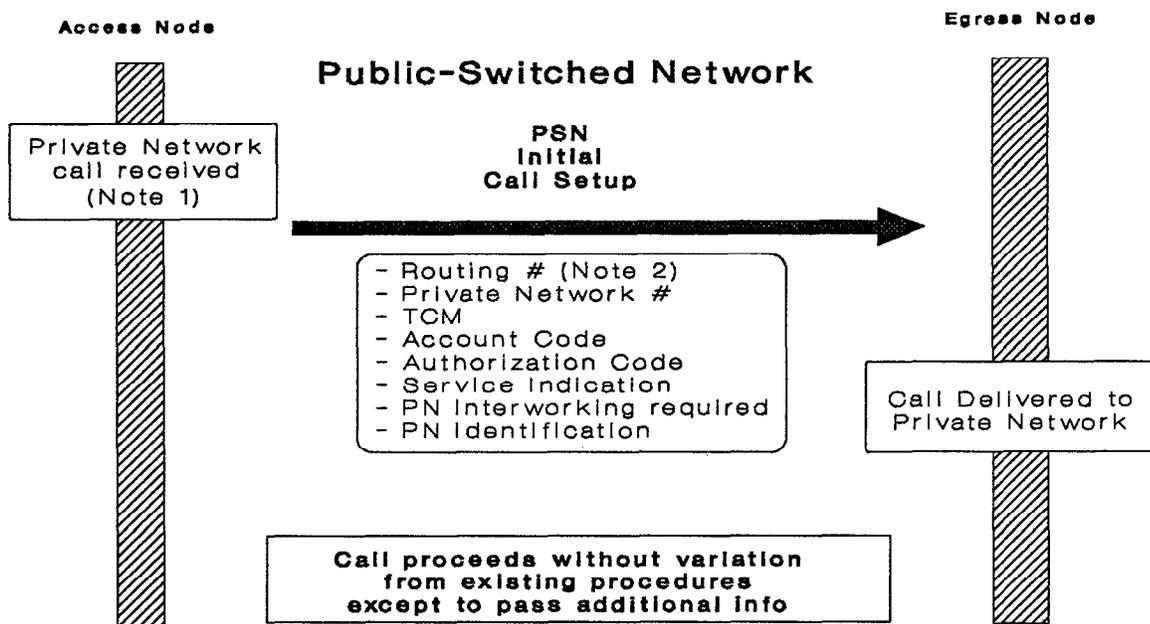
Access Node   **Egress Node**

Public-Switched Network

**Private Network
call received
(Note 1)**

**PSN
Initial
Call Setup**

- Routing # (Note 2)
- Private Network #
- TCM
- Account Code
- Authorization Code
- Service Indication
- PN Interworking required
- PN Identification

**Call Delivered to
Private Network**

**Call proceeds without variation
from existing procedures
except to pass additional info**

Notes

1) A private network call can include the following options
   - private network number;
   - TCM;
   - Account code;
   - Authorization code.

2) The Routing number is used to traverse the public
   switched network to the point of access and egress with the
   destination private network.

**Figure 17
Information flow for case 1**

Public Switched Network

Figure 18
Information flow for case 2

Notes

1) A private network call can include the following options:
   - Private network number;
   - TCM;
   - Account code;
   - Authorization code.

2) The routing number is used to traverse the public switched network to the point of access and egress with the destination private network.

9.2.3. Exceptional procedures

If the additional information related to a private network call cannot be successfully passed end-to-end through the public switched network, the call should be dropped.

9.3. Interworking with non-ISDN private networks, Stage-3 description (SS7 protocols)

9.3.1. General description

Interworking with private networks is a service that entails the interconnection of private networks via the public switched network. This service allows the major features associated with private network calls to function transparently across the public switched network. The functional description, basic formats and codes, and general procedures for the ISDN User Part are contained in ANSI T1.113.

9.3.2. ISDN User Part formats and codes

9.3.2.1. Messages

The only ISDN User Part Message that is relevant to this service is the Initial Address message. This format and coding of this message is defined in chapter T1.113.3 of ANSI T1.113..

9.3.2.2. Parameters

All parameters listed in 9.3.2.2.1 - 9.3.2.2.6 are included in the initial address message to support this service. Only the codings relevant to this service are described; other codings are performed according to normal ISDN User Part procedures.

9.3.2.2.1. Called Party Number parameter

The Called Party Number parameter is coded according to normal ISDN User Part procedures.

9.3.2.2.2. Business Group parameter

The business group identifier type should be coded "1" to indicate "interworking with private networks." The business group identifier subfield contains the private network identifier.

9.3.2.2.3. Forward Call Indicators parameter

Bits HG of the forward Call Indicators parameter are coded"10" to indicate "ISDNUP required all the way."

9.3.2.2.4. Generic Address parameter

The format of the generic address parameter is illustrated in table 18:

Table 18

Format of Generic Address parameter

	8	7	6	5	4	3	2	1
1	Type of address							
2	Odd/even	Nature of address indicator						
3	Spare	Numbering Plan			reserved			
4 : n	Address information							

The following codes are used in the Generic Address parameter for this service:

    a)   <u>Type of Address</u>

        00000000   dialled number
        00000001   destination number

    b)   <u>Odd/even indicator</u>

        0 even number of address digits
        1 odd number of address digits

    c)   <u>Nature of address indicator</u>

        00000001   subscriber number

    d)   Numbering Plan Indicator

        101   private numbering plan

    e)   Address Information

This subfield is coded as in the Called Party Number parameter.

9.3.2.2.5.   Generic Digits parameter

The format of the Generic Digits parameter is illustrated in table 19:

<p align="center">Table 19</p>

<p align="center">Format of Generic Digits parameter</p>

	8	7	6	5	4	3	2	1
1	Encoding Scheme			Type of Digits				
2 : n	Digits							

The following codes are used in the Generic Digits parameter for this service:

    a)   <u>Type of digits</u>

        00000   Account code
        00001   Authorization code
        00010   Private network travelling class mark

    b)   Encoding scheme

        000   BCD even
        001   BCD odd
        010   IA5
        011   binary

9.3.2.2.6.   Special Processing Request parameter

The format of the Special Processing Request Parameter is illustrated in table 20:

Table 20

Format of Special Processing Request parameter

8	7	6	5	4	3	2	1
service processing requested							

The parameter value "service processing requested" is coded "01111111".

9.3.3. ISDN-UP procedures

The ISDN-UP procedures associated with this service involve the sending of service-specific information in the forward direction in the Initial Address Message (IAM) between

- the access node and the service node; and

- the service node; and

- the egress node.

The access node performs interworking between a private network and the public network, and the egress node provides interworking between the public network and a private network. If a service node is present, it may provide functions related to a private network service (e.g. private network number translation, verification of authorization codes). Service-specific information may be modified by the service node; otherwise, normal ISDN-UP procedures apply to the service node and to other nodes involved in the call between the access and egress nodes.

If no service node exists within the public switched network, the information flow between the access and egress nodes is identical to the information flow described below between the service node and the egress node.

9.3.3.1. Call setup between the access node and the service node

The access node includes the following service-specific information in the IAM sent toward the service node:

- the Called Party Number parameter containing a routing number for the service node (this routing number may be dedicated to the service, and thus, represents an indication of the private network). As a network option, a business group parameter may be sent to identify the private network;

- a Generic Address parameter containing the dialled private network number;

- a Generic Digits parameter containing a private network travelling class mark;

- a Generic Digits parameter containing a private network account code;

- a Generic Digits parameter containing a private network authorization code;

- optionally, the Special Processing Request parameter containing a "service processing requested" indication;

- the Forward Call Indicators parameter containing an indication "ISDN-UP required all the way."

9.3.3.2. Call setup between the service node and the egress node

The service node includes the following service-specific information in the IAM sent toward the egress node:

- the Called Party Number parameter containing a routing number for the egress node (this routing number may be dedicated to the service, and thus, provides a service indication to the terminating exchange as well as an indication that private network interworking is required). As a network option, a business group parameter may be sent to identify the private network;

- a Generic Address parameter containing the destination private network number;

- a Generic Digits parameter containing a private network travelling class mark;

- a Generic Digits parameter containing a private network account code;

- a Generic Digits parameter containing a private network authorization code;

- the Forward Call Indicators parameter containing an indication "ISDNUP required allthe way."

9.3.3.3. Exceptional procedures

If no outgoing SS7-supported circuits are available for routing an Inter Working with Private Networks (IWPN) call from an access node or service node, the exchange releases the incoming circuit (REL with cause indicators parameter containing cause value "no circuit available").

9.3.4. Interactions

9.3.4.1. MBG Basic Call

When the user subscribes to both IWPN and the MBG Basic Call services, there is a single business group identifier value that serves to identify the customer. That is, a single business group identifier value serves as the IWPN private network identifier and as the MBG identifier. The business group identifier type should be coded "0" to indicate MBG.

9.3.5. Interworking

Because ISDN User Part is required for this service, there are no interworking considerations (except for releasing the call if no SS7-supported circuits are available).

9.3.6. Message flow diagrams

Figure 19 and figure 20 illustrate the message flows for interworking with private networks.

The stage two Call Setup message maps to the Initial Address Message in stage three. The following list details the mapping between stage two information and stage-three parameters:

- "Routing number" is carried in the Called Party Number parameter;

- "Private network number" is carried in the Generic Address parameter;

- "Travelling class mark" is carried in the Generic Digits parameter;

- "Account code" is carried in the Generic Digits parameter;

- "Authorization code" is carried in the Generic Digits parameter;

- "Service indication" is carried in either the Called Party Number parameter (tied to routing number) or the Business Group parameter;

- "Service processing required" is carried in the Special Processing Request parameter;

- "Private network interworking required" is carried in either the Called Party Number parameter (tied to routing number) or in the Business Group parameter;

—   "Private network identification" is carried in either the Called Party Number parameter (tied to routing number) or in the Business Group parameter;

Initial Address Message

Called party number
　　　　　　- Routing number for service node
Identification of private network (Implicit from Routing
　　　　　　Number or carried in Business Group
　　　　　　parameter)
Generic Address parameter - Dialed private network number
Generic Digits parameter
　　　　　　- Private network travelling class mark
Generic Digits parameter - Account codes
Generic Digits parameter - Authorization codes (Optional)
Special processing request - Service processing requested
　　　　　　(Optional)
Forward call indicators - ISDNUP required all the way

Access Node
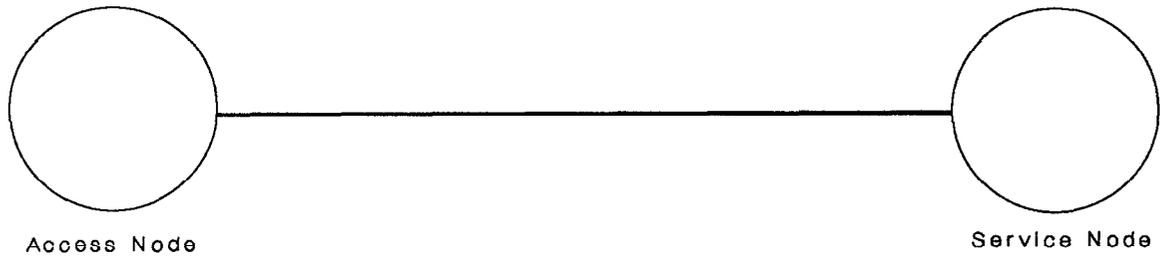
Service Node

Figure 19

Message flow from Access note to Service

Initial Address Message

Called party number
    - Routing number for service node
Identification of private network (implicit from Routing
        number or carried in Business Group
        parameter - BGP)
Indication that private interworking is required (implicit
        from routing number or carried in BGP)
Generic Address parameter
    - Destination private network number
Generic Digits parameter
    - Private network travelling class mark
Generic Digits parameter - Account codes
Generic Digits parameter - Authorization codes
Forward call indicators - ISDNUP required all the way

Access/Service Node   Egress Node

Figure 20

Message Flow from Service Node to Egress Node or Access Node to Egress Node

10. Multilocation Business Group (MBG) Basic Call

For examples of Customer Defined Line Privileges and MBG screening, see Annex D.

The following description covers the Intra-LATA service.

10.1. MBG Basic Call, Stage-1 description (User perspective)

10.1.1. Definition

Multilocation Business Group (MBG) is a grouping mechanism that allows users belonging to a customer but resident at diverse locations to subscribe to a variety of business services. It enables multilocation customers to coordinate their telephone services and operate uniformly. The Multilocation Business Group Basic Call is a service in which an MBG line originates a call to another MBG line using the MBG dialing plan.

10.1.2. Description

10.1.2.1. General description

MBG Basic Call service provides a grouping mechanism to associate users belonging to a customer. The customer can choose to group users into subgroups in order to create different levels of line privileges and for feature operations. Access and routing restrictions are assigned by the customer to individual lines using the Line Privileges.

Features that must operate within the context of an MBG are addressed as specific interactions between MBG Basic Call service and those features.

10.1.2.2. Specific terminology

10.1.2.2.1. Multilocation Business Group (MBG)

A Multilocation business group provides a structure in which a group of lines are recognized as belonging to the same MBG. A variety of features can be made available to MBG lines.

10.1.2.2.2. Multiocation Business Group Identifier (MBG ID)

The MBG identifier is used to uniquely identify an MBG in the network. A customer's line shall belong to one and only one MBG.

10.1.2.2.3. Subgroup Identifier (SG ID)

A subgroup identifier uniquely identifies a group of lines within an MBG. If an MBG has subgroups, an MBG line shall belong to one and only one subgroup within an MBG. In addition to grouping lines for administrative purposes, the subgroup can be used for performing line privileges and feature operations (e.g., for only accepting or forwarding calls from callers belonging to specific subgroups). Examples of subgroup might be: an Engineering department or accounting department within a company.

10.1.2.2.4. Line Privileges (LP)

Line Privileges specify the line privileges associated with an MBG line. Certain feature operation decisions may be based upon line privileges. Line Privileges may be assigned as Fixed Line Privileges or Customer Defined Line Privileges. Line Privileges are defined as follows:

a) <u>Fixed Line Privileges</u>: Line privileges may be assigned to MBG lines from a set of fixed restrictions. Each line is associated with a single originating restriction and a single terminating restriction. Note that the phrase "parties outside the MBG" used in the definitions below includes parties that are not in the MBG as well as intragroup parties that are accessed via the public network.

    1) <u>Originating restrictions</u>: Originating restrictions designate the type of calls that may be set up by a specific station, whether the calls are within or outside the caller's

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MBG. There are five types of originating restrictions that are needed for an MBG station.

— Denied Originating (DO): The effect of the DO restriction is to block all calls that originate from the line.

— Semi-Restricted Originating (SRO): The effect of the SRO restriction is to block direct outgoing access to parties outside the MBG, but to allow indirect outgoing access to parties outside the MBG via an attendant, call forwarding, Three-Way Calling, call transfer, and conference calling. An SRO line may originate any call, except a direct call to outside the MBG.

— Fully Restricted Originating (FRO): The effect of the FRO restriction is to block direct and indirect outgoing access to parties outside the MBG. A FRO line may originate intra-group calls except to the attendant.

— Unrestricted Originating (URO): The effect of URO is to allow direct and indirect outgoing access to parties outside the MBG. A URO line may originate intra-group calls as well as calls to outside the MBG.

— Fully Restricted Originating Intra-switch (FROI): The effect of the FROI restriction is to block direct and indirect outgoing access to parties outside the MBG, and to block all direct and indirect inter-switch calls that originate from the line. A FROI line may originate intra-group, intra-switch calls except to the attendant.

2) Terminating Restrictions: The terminating restrictions of a station describe its ability to terminate or receive calls. The ability to receive calls either from within or outside the MBG depends on which of the following five restrictions a station may have.

— Denied Terminating (DT): The effect of DT restriction is to block all calls that terminate to the line.

— Semi-Restricted Terminating (SRT): The effect of the SRT restriction is to block direct incoming access from parties outside the MBG, but to allow incoming access from parties outside the MBG via an attendant, call forwarding, call pickup, Three-Way Calling, call transfer, and conference calling. An SRT line may receive all calls, except direct calls that originated outside the MBG.

— Fully-Restricted Terminating (FRT): The effect of the FRT restriction is to block direct and indirect incoming access from parties outside the MBG. A FRT line may receive intragroup calls (direct and indirect), except from an attendant.

— Unrestricted Terminating (URT): The effect of URT is to allow direct and indirect incoming access from parties outside the MBG. A URT line may receive all calls.

b) Customer-Defined Line Privileges: Customer-Defined Line Privileges would be controlled by the MBG service provider. Uses for these customer-defined values are varied, and pertain to the MBG customer's call screening and routing requirements. Customer-Defined Line privileges can utilize the MBG ID, Subgroup ID, Line Privileges, and Attendant Status of each party in an MBG call.

Some examples illustrating the usage for Customer-Defined Line Privileges are given in Annex D.

All switches that provide MBG service shall support the Fixed Line Privileges. Support of Customer-Defined Line Privileges is optional. Mapping from Customer-Defined Line Privileges to Fixed Line Privileges shall be available if an MBG supports Customer-Defined Line Privileges, and encompasses switch(es) that only support Fixed Line Privileges.

10.1.2.2.5. Relationship among MBG, subgroups, and line privileges.

There are four combinations of MBG ID, Subgroup ID (SG ID), and line privileges (LP) that are valid:

- MBG ID only (no SG ID or LP)

- MBG ID and SG ID (no LP)

- MBG ID and LP (no SG ID)

- MBG ID, SG ID, and LP.

If SG IDs are present, they are unique within an MBG. If fixed LPs are present, the restrictions specified by the LPs are based on the MBG ID and the attendant status. If customer-defined LPs are present, the restrictions specified by the LPs may also be based on the SG ID. If an MBG customer does not subscribe to LPs, all of the MBG customer's lines are unrestricted.

10.1.2.2.6. MBG Attendant Line

An MBG line can be an ordinary or an attendant line. This information is used to perform the calling restrictions associated with the fixed line privileges, semi-restricted and fully-restricted both originating and terminating.

10.1.2.2.7. Numbering Plan

Each MBG has a numbering plan that associates a unique address with each line in the MBG. This address may or may not have an appearance in the public network numbering plan.

10.1.2.2.8. AttendantStatus

The status indicates whether a line is an attendant line or not.

10.1.3. Procedures

Each MBG customer is assigned a unique MBG ID. This MBG ID is used to identify each of the customer's MBG lines.

10.1.3.1. Provision and withdrawal

The subscription options for provision and withdrawal are outlined in table 21.

Table 21

MBG subscription options

SUBSCRIPTION OPTIONS	VALUES
Line	
Subgroup identifier (optional)	assigned by MBG customer
Line privileges (optional)	assigned by MBG customer
Attendart status (optional)	yes, no
LINE PRIVELEGES	
either,	
Fixed originating restrictions	DO, FRO, SRO, URO, or FROI
Fixed terminating restrictions	DT, FRT, SRT, URT, or FRTI
or,	
Customer-defined restriction	Customer-defined

10.1.3.2. Normal procedures

The normal procedures for the MBG Basic Call are described below and shown in Figure 21 as a dynamic description (SDL).

10.1.3.2.1. Activation, deactivation, and registration

Not required.

10.1.3.2.2. Invocation and operation

10.1.3.2.2.1. Originating User's Point of View

An MBG user originates a call if allowed according to restrictions, by dialing the called party using the appropriate numbering plan. The actual digits dialled depends on the originating user's dialing plan. The originating user should receive originating treatment, e.g., the user hears ringing once the called party has begun alerting.

10.1.3.2.2.2. Terminating User's Point of View

If the network determines that an MBG call is allowed to terminate to an MBG line, the terminating user should receive alerting.

10.1.3.3. Exceptional procedures

10.1.3.3.1. Activation, deactivation, and registration

Not required.

10.1.3.3.2. Originating user's point of view

An originating user's MBG call shall be rejected if MBG originating or terminating restrictions are violated.

When an MBG call is rejected, an appropriate indication of the reason for rejection is returned to the originating user.

10.1.3.3.3. Terminating user's point of view

No indication is sent to the terminating user in the event of a call setup failure.

10.1.3.4. Alternate procedures

None identified.

10.1.4. Network capabilities for charging

It should be possible for the service provider to charge accurately for the service.

10.1.5. Interworking considerations

10.1.5.1. Calls to outside of MBG

Calls to outside of MBG, (e.g., the public network) can be made if the originating restriction of the originating MBG line permits it. Such calls lose the MBG specific information.

10.1.5.2. Calls from outside of MBG

Calls from outside of MBG, (e.g., the public network) shall be allowed to terminate on an MBG line if the terminating restriction of the line permits it.

10.1.5.3. Protocol interworking

Interworking between SS7 and other signalling protocols should not occur for MBG calls (unless interactions occur with private facilities). As a per-MBG option, an MBG customer may originate

calls via an MBG dialing plan that traverse non-SS7 facilities; however, these calls are treated as non-MBG calls for screening related to other services (e.g., Three-Way Calling and call transfer).

10.1.6. Interaction with other supplementary services

10.1.6.1. Non-ISDN Call Forwarding

The MBG ID, SG ID, Attendant Status, and LPs of the original calling party are sent to the forwarded-to switch if each leg of the call from the originating station to the forwarded-to station is an MBG call.

Redirecting MBG information, sufficient to identify the MBG ID, SG ID, Attendant Status, and LPs of the last forwarding MBG station, is sent to the forwarded-to switch if the call from the redirecting station to the forwarded-to station is an MBG call.

Original called MBG information, sufficient to identify the MBG ID, SG ID, Attendant Status, and LPs of the original called station, may be sent to the switch to which the call is forwarded if each leg of the call from the original-called station to the forwarded-to station is an MBG call.

10.1.6.2. Interworking with Non-ISDN Private Networks

When an MBG customer also subscribes to the Interworking with Non-ISDN Private Networks service, the calling party's MBG ID may provide a method of identifying the customer's calls in the network.

The Stage 2 for the Interworking with Non-ISDN Private Networks service identifies a "service node" that can provide additional call processing for customers. These functions include call routing decisions and inspection and alteration of private network call information, e.g., account codes. The invocation of service node capabilities can be based on the calling party's MBG information and other private network information described in Interworking with Non-ISDN Private Network service. These functions partially overlap those for MBG service, but are combined by the following, optional, service node capabilities:

a) The service node can inspect any MBG information, or information related to Interworking with Non-ISDN Private Networks such as travelling Class mark, associated with an incoming call for use in the performance of service node based services to which the customer subscribes.

b) The service node can alter the MBG line privileges of a call dependent on the customer's requirements.

c) The service node can generate MBG ID and SG ID for the outgoing leg of a call if these were not present in the call incoming to the service node.
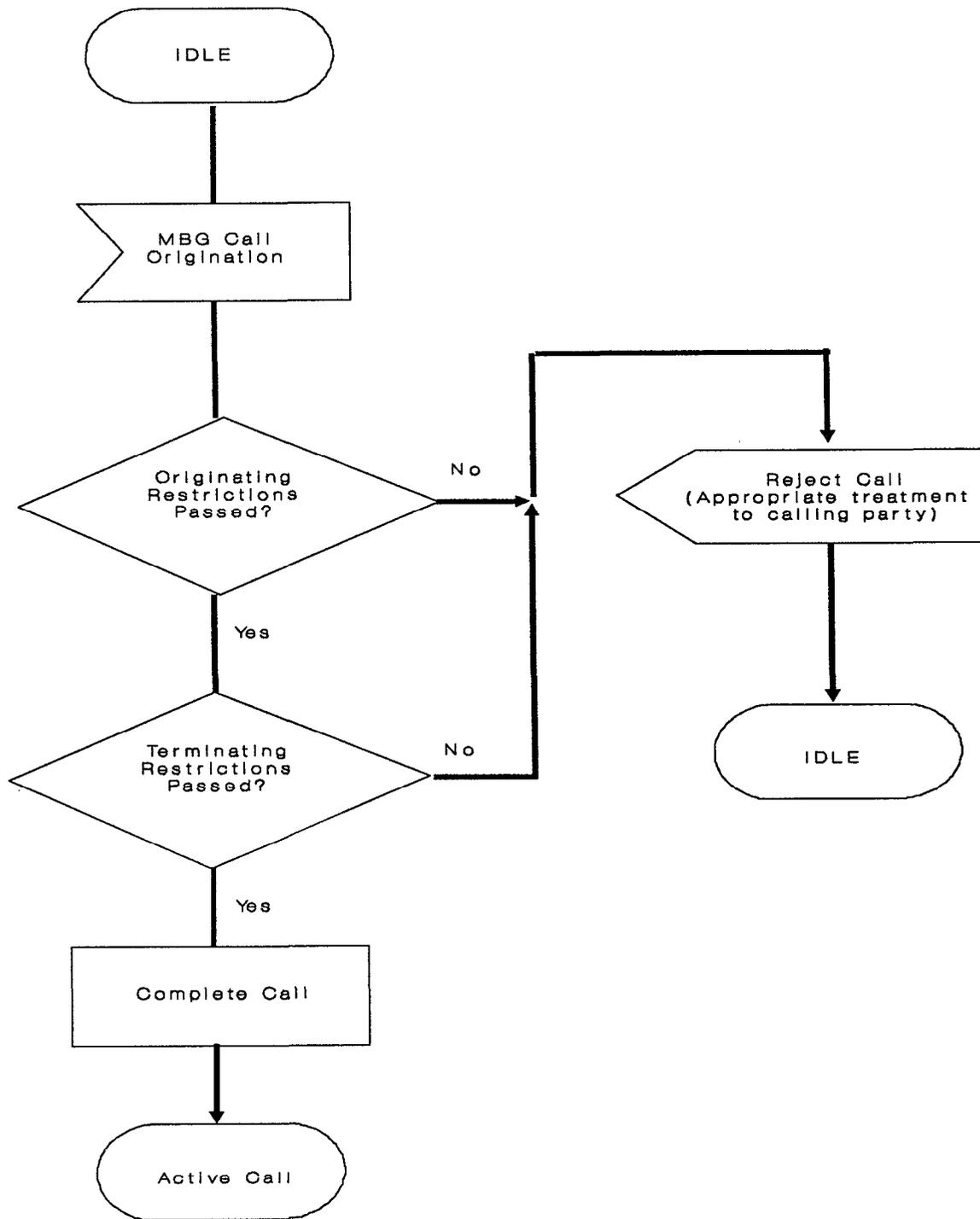
Figure 21
MBG Basic Call

10.2. MBG Basic Call, Stage-2 description (Information flows)

This contribution provides the Stage-2 description for MBG Basic Call service. The service is independent of whether users are located on one or many switches or networks.

10.2.1. Functional model

This subclause describes the functionality required to realize MBG service. Figure 35 illustrates the functional model for MBG Basic Call. The components of the model are further described in the following subclauses.

10.2.1.1. Specific terminology

10.2.1.1.1. Multilocation Business Group (MBG)

A Multilocation Business Group (MBG) provides a structure in which a switch recognizes a group of lines belonging to the same MBG. The MBG lines can be located on one or more switches within the MBG. For example, an MBG may be used to combine various basic business groups (single switch business groups) on different switches. A variety of features can be made available to MBG lines.

10.2.1.1.2. Multilocation business group identifier (MBG IDs)

The MBG ID is a number that uniquely identifies an MBG customer's lines and calls throughout all networks in which it has subscribed to MBG service.

10.2.1.1.3. Subgroup identifier (SG ID)

A SG ID is a customer-defined number that identifies a subgroup of users within the MBG.

10.2.1.1.4. Line privileges (LP)

Line privileges identify the communications privileges (that may be fixed or customer-defined) associated with an MBG user.

10.2.1.1.5. AttendantStatus

Attendant stations used to indicate whether an MBG line is an attendant.

10.2.1.1.6. MBG Info

For an identified party, this consists of the MBG ID, SG ID, LP, and Attendant Status.

10.2.1.1.7. Intra-MBG call

A call from an MBG line to another line in the same MBG via MBG dialing plan.

10.2.1.1.8. Inter-MBG call

A call from an MBG line to another line in a different MBG via a prearranged dialing plan (agreed between the two MBGs).

10.2.1.1.9. MBG call

A call that is either an Intra-MBG call or an Inter-MBG call.

10.2.1.1.10. Non-MBG call

A call that is neither an Intra-MBG call nor an Inter-MBG call. Non-MBG calls include all calls from an MBG line dialled with a code to escape the MBG dialing plan.

10.2.1.1.11. MBG Attendant Line

An MBG line could be an ordinary or an attendant line. Since an attendant line may have some unique capabilities associated with it, an attendant status indication should be included in call setup when an attendant originates a call to another MBG line.

10.2.1.2.   Functionality required to realize MBG service

Non-MBG and MBG exchanges that act as tandems on calls between functional entities should not inspect or alter MBG message flows. Their sole responsibility is to pass-along this MBG information to further exchanges. Since they do not contain MBG functions themselves they are not discussed in stage-2 and are not considered functional entities.

If the MBG customer's uniform numbering plan addresses MBG stations differently than the public numbering plan (i.e., a private numbering plan) and there are one or more non-MBG exchanges between functional entities, the following actions are taken: FE1 shall keep the private called number and MBG information in the Call Setup message, but uses a public number to allow routing by non-MBG exchanges. FE2 and FE3, to perform MBG services, shall inspect the private called number to determine the true destination. This action is identical to that for the Interworking With Non-ISDN Private Networks service (see figure 22).

(Case 1)

(Case 2)
Figure 22
Functional model for MBG Basic
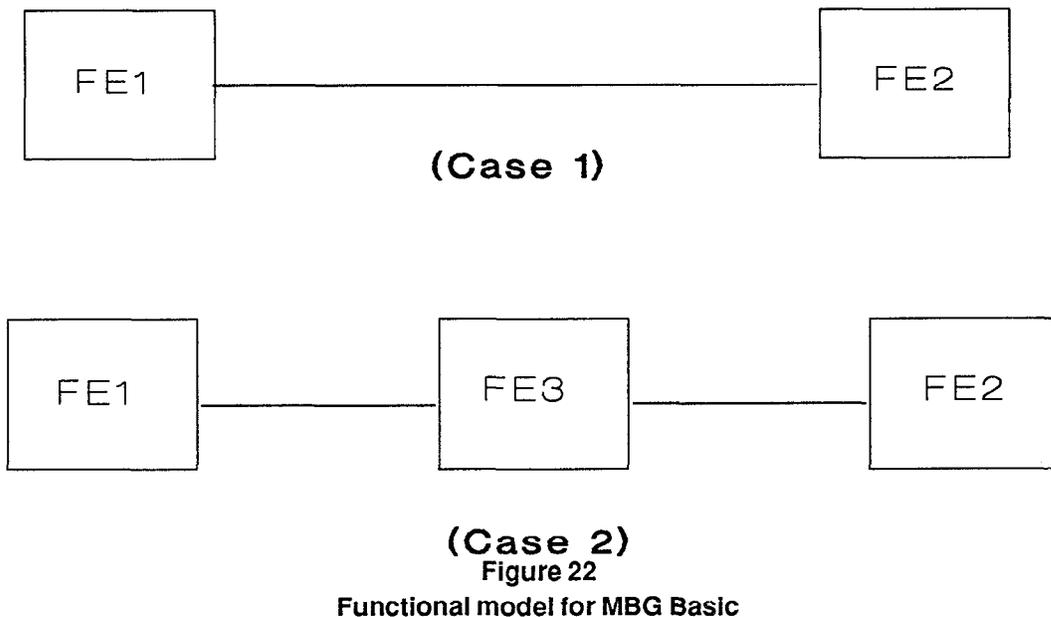
10.2.1.2.1.   Functionality of FE1

FE1 recognizes an MBG call origination, validates originating line privileges, and performs route selection. The MBG info for the calling party is inserted in the outgoing Call Set-Up Message. FE1 determines whether the call is Non-MBG, Intra-MBG, or Inter-MBG, and records this information for the duration of the call. This is needed in case any additional features are activated during the call.

10.2.1.2.2.   Functionality of FE2

FE2 recognizes an incoming MBG call, validates originating and terminating line privileges, and provides normal call termination treatment to the called party. FE2 determines whether the call is Non-MBG, Intra-MBG, or Inter-MBG, and records this information for the duration of the call. This is needed in case any additional features are activated during the call.

If FE2 only supports fixed LP, then FE2 can optionally map any incoming customer-defined LP to a fixed LP.

10.2.1.2.3. Functionality of FE3

FE3 recognizes an MBG call and performs route selection and access control. Additionally, FE3 can be a service node where the customer also subscribes to Interworking With Non-ISDN Private Networks service.

If FE3 only supports fixed LP then FE3 can optionally map any incoming customer-defined LP to a fixed LP.

10.2.1.3. Limiting assumptions

If an MBG call set-up involves more than one network, passing the MBG-related information across network boundary and possibly translating MBG-related information at the gateway switch would be based on bilateral agreement between networks.

10.2.2. Normal procedures

10.2.2.1. General description

The MBG call originates at FE1. FE1 recognizes that the call is MBG by, for example, the calling line's dialing plan. Prior to inserting the calling line's MBG info into the outgoing Call Set-Up Message, FE1 performs MBG originating line privileges and any required outgoing route selection. If either the line privileges or route selection fails, the call is denied.

If there is an intermediate MBG switch before reaching FE2, it is designated FE3. FE3 can optionally be a service node for the Interworking With Non-ISDN Private Networks service. As a service node, FE3 has available to it the incoming MBG Info for any operations that it performs. Incoming MBG info for all identified parties is sent with the outgoing Call Set-Up Message. As in FE1, an outgoing route is selected, and if this fails, the call is denied and a Call Disconnect Message with an appropriate cause value is returned to FE1.

FE2, the switch that terminates the MBG call, receives and recognizes an MBG call from either FE1 or FE3. If originating or terminating line privileges fail, the call is denied and a Call Disconnect Message with an appropriate cause value is returned to FE1 (via FE3 if necessary). Otherwise, the call terminates normally to the called party.

10.2.2.2. Information flows

Figures 23 and 24 describe the information flows for the normal operation of an MBG Basic Call.
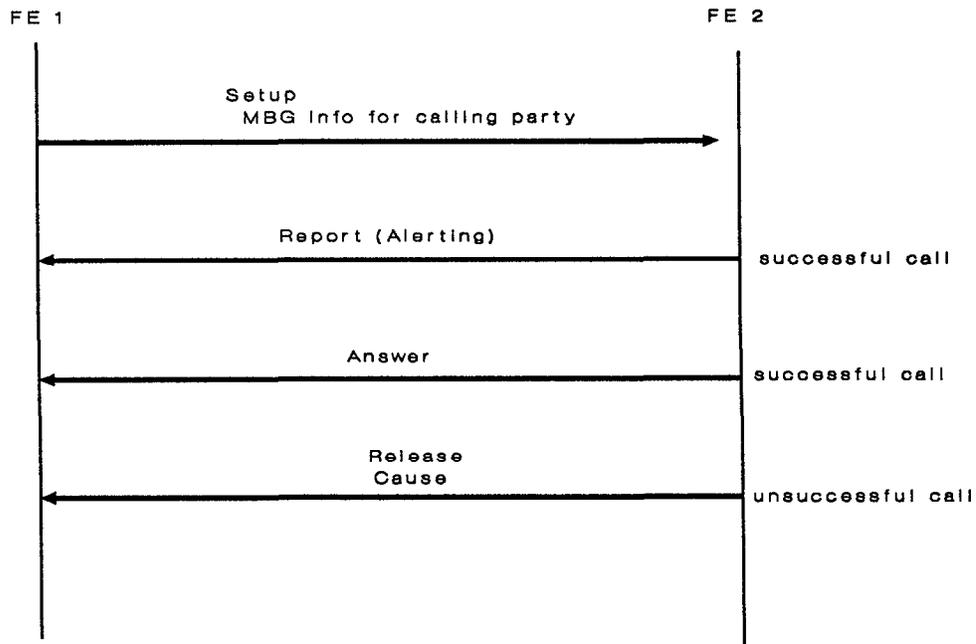
Figure 23
Information flow - FE3 not involved
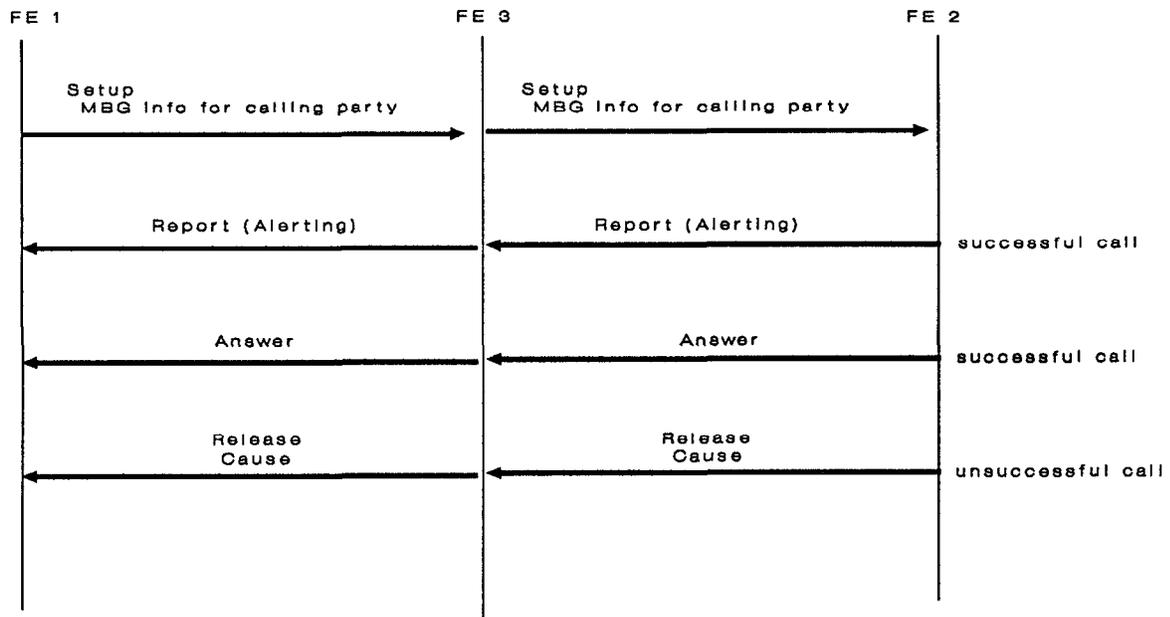
Figure 24
Information flow - FE3 involved

10.2.3. Exceptional procedures

Because of the "ISDN-UP required" indication in the call setup message, interworking between SS7 ISDN-UP and other network signalling protocols should not occur for MBG calls (unless interactions occur with private facilities). As a per-MBG option, an MBG customer may originate calls, via an extension number dialing plan, that traverse non-SS7 facilities. However, these calls are treated as non-MBG calls for screening related to other services (e.g., Three-Way Calling and call transfer).

10.2.4. SDL diagrams for Functional Entities

See figures 25 through 27.

```
                    ┌──────────────┐
                    │     Idle     │
                    └──────────────┘
                           │
                    ┌──────────────┐
                    │ Normal call  │
                    │   request    │
                    └──────────────┘
                           │
          NO         ╱─────────────╲
    ◄────────────────    MBG        
                     ╲    call      ╱
                      ╲     ?      ╱
                       ╲─────────╱
                           │ YES
                    ┌──────────────┐
                    │   Validate   │
                    │ originating  │
                    │   access     │
                    │ restrictions │
                    └──────────────┘
                           │
              ╱─────────────╲        NO      ┌──────────────┐
              │  Validation  │──────────────►│   CAUSE=     │
              ╲   passed?    ╱                │   access     │
               ╲───────────╱                 │ restrictions │
                    │ YES                     │    failed    │
             ┌──────────────┐                 └──────────────┘
             │   Select     │
             │  allowable   │
             │    route     │
             └──────────────┘
                    │
          ╱─────────────╲       NO       ┌──────────────┐
          │   Allowed    │──────────────►│   CAUSE=     │
          ╲    route     ╱               │ Allowed route│
           ╲ available? ╱                │ not available│
            ╲─────────╱                  └──────────────┘
                │ YES
        ╱─────────────╲      NO
        │  Orig MBG Id │────────────────────┐
        ╲      =       ╱                     │
         ╲ Term MBG Id╱                      ▼
          ╲─────────╱                 ┌──────────────┐
               │ YES                  │   Call is    │
        ┌──────────────┐              │  Inter-MBG   │
        │   Call is    │              └──────────────┘
        │  Intra-MBG   │                     │
        └──────────────┘                     │
               │◄────────────────────────────┘
        ┌──────────────┐
        │ Include MBG ID,│
        │ SG ID, LP and  │
        │ attendant status│
        │ in Set-up message│
        └──────────────┘
               │
        ┌──────────────┐
        │   Set-up     │
        │   message    │
        └──────────────┘                ┌──────────────┐
               │                        │ Call denial  │
        ┌──────────────┐                │  treatment   │
        │ Normal call  │                │(provide cause)│
        │  treatment   │                └──────────────┘
        └──────────────┘
               │
        ┌──────────────┐
        │     Idle     │
        └──────────────┘
```

Figure 25
SDL Diagram at FE1

```
        ┌────────────────┐
        │      Idle      │
        └────────────────┘
                │
                ▼
          ╱─────────────╲
         ╱   Set-up      ╲
         ╲   message     ╱
          ╲─────────────╱
                │
                ▼
            ╱───────╲
 NO        ╱   MBG   ╲
◄─────────╱    call   ╲
          ╲     ?     ╱
           ╲─────────╱
                │ YES
                ▼
          ╱──────────╲        YES      ╱──────────╲      NO
         ╱  Customer  ╲───────────────╱ Customer-  ╲────────────┐
         ╲ defined LP ╱               ╲ defined LP ╱            │
          ╲    ?     ╱                 ╲ supported ╱            ▼
           ╲────────╱                   ╲    ?    ╱      ┌──────────────┐
                │ NO                      ╲──────╱       │ Map customer-│
                │                           │ YES        │ defined LP to│
                │                           │            │   fixed LP   │
                │                           ▼            └──────────────┘
                ▼◄──────────────────────────────────────────────┘
          ╱────────────╲       NO
         ╱  Orig MBG Id ╲──────────────────┐
         ╲      =       ╱                   │
         ╲  Term MBG Id ╱                   │
          ╲────────────╱                    ▼
                │ YES                  ┌──────────────┐
                ▼                      │   Call is    │
          ┌──────────────┐            │  Inter-MBG   │
          │   Call is    │            └──────────────┘
          │  Intra-MBG   │                   │
          └──────────────┘                   │
                │◄───────────────────────────┘
                ▼
          ┌──────────────────────┐
          │ Validate originating │
          │   and terminating    │
          │  access restrictions │
          └──────────────────────┘
                │
                ▼
          ╱────────────╲      NO
         ╱  Validation  ╲─────────────────┐
         ╲   passed     ╱                 │
          ╲     ?      ╱                  ▼
           ╲──────────╱            ┌──────────────────┐
                │ YES              │     CAUSE=        │
                │                  │Access restrictions│
   ┌────────────┘                  │     failed       │
   │            ▼                  └──────────────────┘
   │     ╱──────────────╲                  │
   └────╱  Normal call   ╲          ╱──────────────╲
       ╱   termination    ╲        ╱  Call denial   ╲
       ╲    treatment     ╱        ╲   treatment     ╱
        ╲────────────────╱         ╲ (provide cause) ╱
                │                   ╲───────────────╱
                │◄──────────────────────────┘
                ▼
        ┌────────────────┐
        │      Idle      │
        └────────────────┘
```

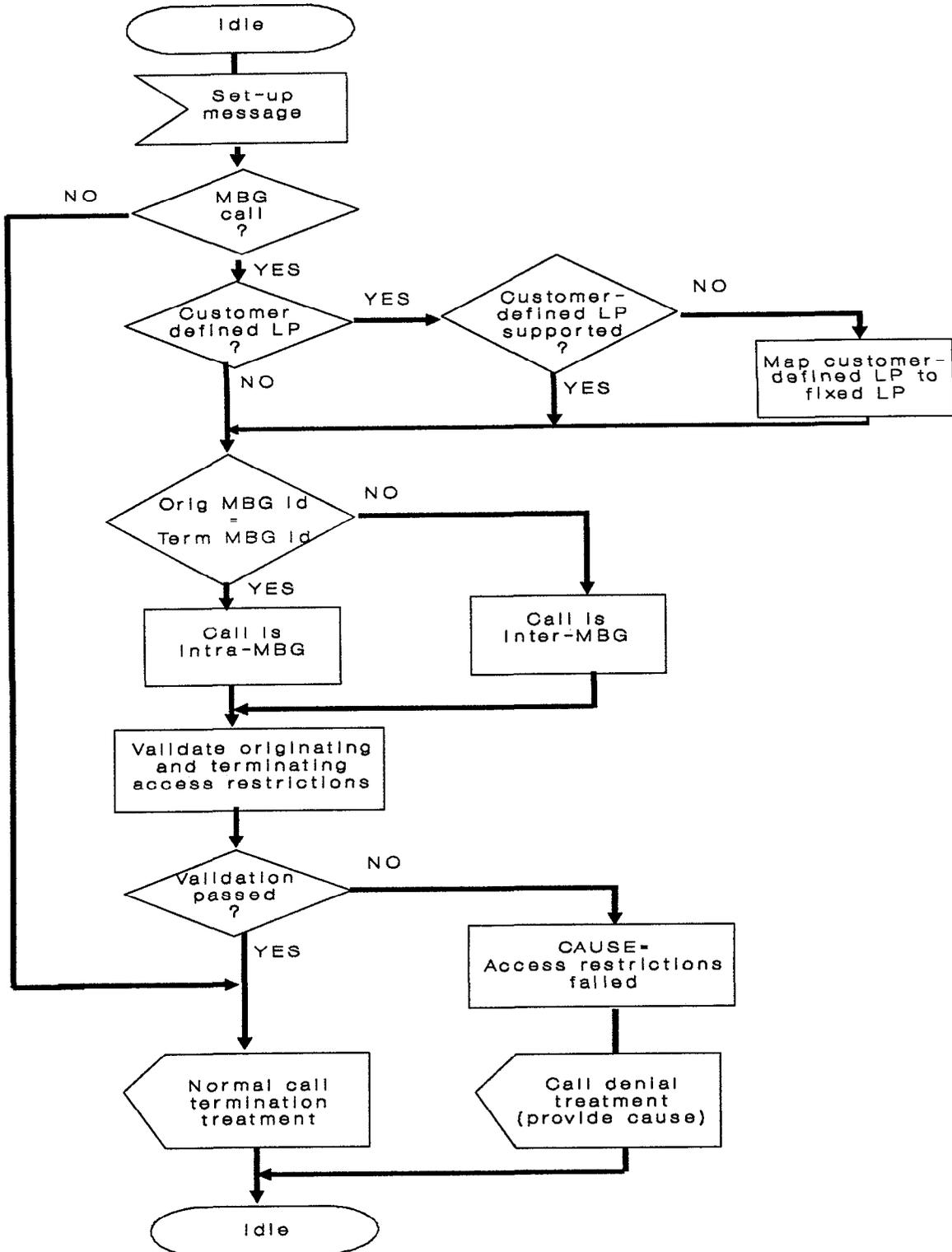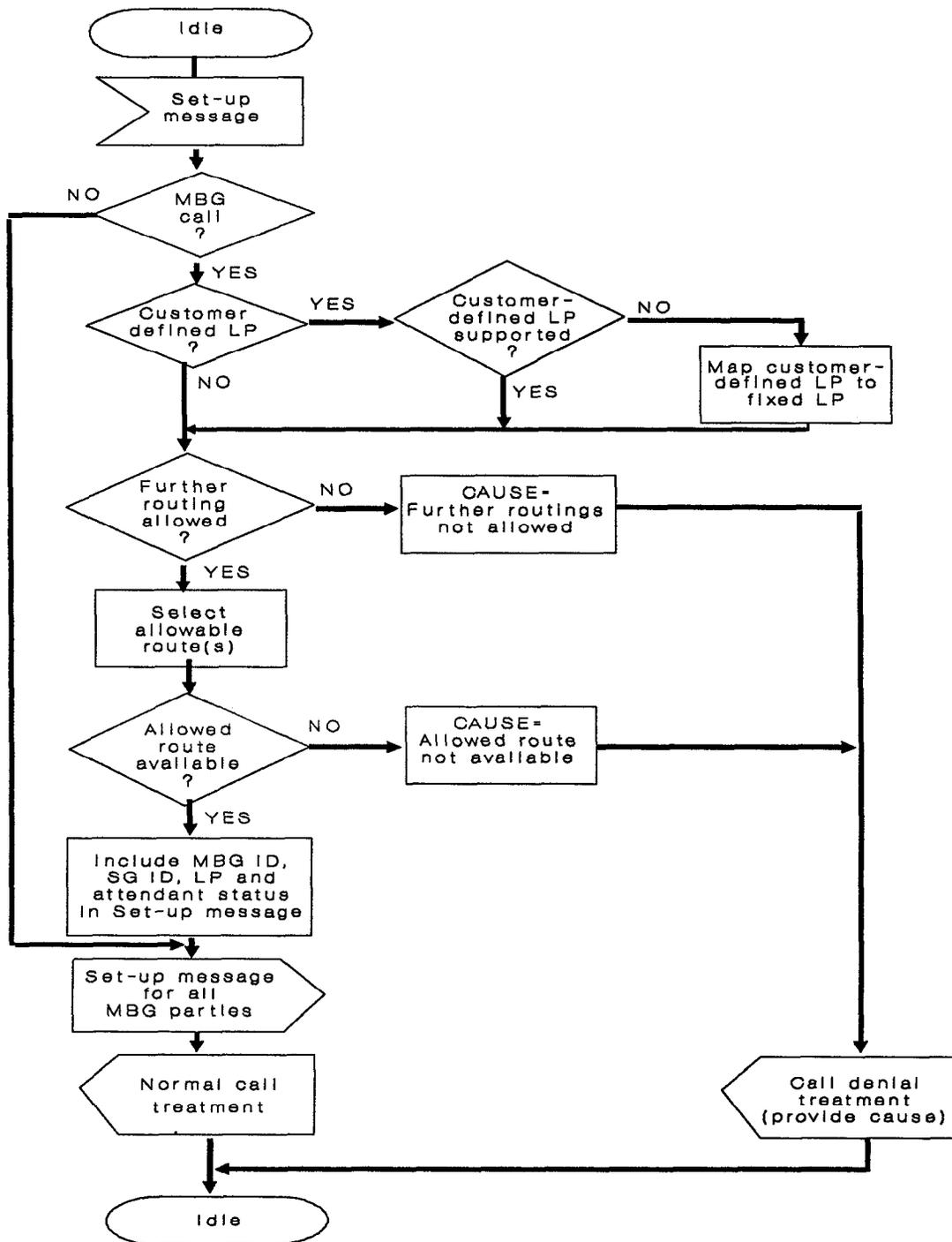**Figure 26**

SDL Diagram at FE2

**Figure 27
SDL Diagram at FE3**

10.3. MBG Basic Call, Stage-3 description (SS7 protocols)

10.3.1. General description

The main elements of stage-3 are:

- a new parameter, Business Group, to describe each MBG party in a call,

- the use of the Generic Address parameter for MBG calls that transit non-MBG exchanges and where the MBG customer uses a private numbering plan that differs from the public numbering plan, and

- a cause Indicators parameter in the Release Message to support MBG call setup failures.

10.3.2. ISDN User Part formats and codes

10.3.2.1. Messages

The ISDN User Part Message in which the Business Group parameter appears for MBG Basic Call service is:

- Initial Address Message (IAM)

Interaction of MBG Basic Call with other features requires the inclusion of this optional parameter in the following messages as well.

- Address Complete Message

- AnswerMessage

- Information Request Message

- Information Message

- Call Progress Message

10.3.2.2. Parameters

10.3.2.2.1. Business Group parameter

The Business Group parameter is used as required to identify MBG information associated with each type of number identified in the message.

The numbers to which the Business Group parameter can apply are:

- Calling Party Number

- Called Party Number

- Connected Party Number

- Redirecting Number

- Original Called Party Number

The MBG information for each identified party is repeated in the Business Group parameter, as required, for each party that has associated MBG information. The optional appearance of Business Group ID and subgroup ID is supported by the use of "No Indication" codes (all 0's) for these items. Instead of a "No Indication" code for Line Privileges, the all 0's value, which indicates Unrestricted access (no MBG line privileges), should be used.

Business Group Parameter Encoding is shown in Table 22.

Table 22

Business Group parameter format

	8	7	6	5	4	3	2	1
1	Spare	AttSt	BGID tp	LPII	Party Selector			
2-4	Business Group Id (3 octets)							
5-6	Sub-Group Id (2 octets)							
7	Line privileges (1 octet)							

Octets 1 - 7 are repeated as required to identify MBG information for multiple parties.

Attendant Status (AttSt in Table 22): A 1-bit field that indicates whether the party identified by the Party Selector is an attendant.

0	No indication
1	Attendant line

Business Group Identifier Type (BGID tp in Table 22): A 1-bit field that indicates the service associated with the Business Group identifier. The following coding is used for this subfield:

0	MBG Identifier
1	IWPN Identifier

LP Information Indicator (LP II in Table 22): An MBG customer can select either conventional Centrex restrictions or customer-defined MBG restrictions. The format of the LP field depends on the coding for this field (see "Line Privileges" below).

0	Fixed Line Privileges
1	Customer-defined Line Privileges

Party Selector: A 4-bit code that selects the number to which the Business Group information applies.

0000	No indication
0001	Calling Party Number
0010	Called Party Number
0011	Connected Party Number
0100	Redirecting Number
0101	Original Called Party Number

Business Group ID: A 3-octet field to indicate which business group the party identified by the Party Selector belongs to. Business Group IDs are uniquely assigned to customers across all networks in which the MBG customer subscribes to MBG service.

000...000	No indication
000...001	Public network
000...010	
to	Assigned Business Group codes
111...111	

subgroup ID: A 2-octet field defined by the customer to indicate the subgroup membership of the party, identified by the Party Selector, within the customer's organization. If the customer does not subscribe to subgroups, this field is coded as '000...000' (No Indication).

000...000	No indication
000...001	

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to	Customer-defined subgroup codes
111...111	

Line Privileges: A 1-octet field to indicate the Line Privileges of the party identified by the Party Selector.

If the "LP II" field is coded '0' Fixed Line Privileges, the LP field is divided into two sub-fields. Bits 8-5 represent the originating restriction and bits 4-1 represent the terminating restriction. The LP sub-fields are coded as follows:

0000	Unrestricted
0001	Semi-restricted
0010	Fully-restricted
0011	Fully-restricted intraswitch
0100	Denied

If the "LP II" field is coded '1' Customer-defined LPs, the LP field is coded as follows:

00000000	
to	Customer-defined Line Privileges codes
11111111	

10.3.2.2.2. Generic Address parameter

Type of Address

00000001	Destination Number

Other Generic Address parameter fields are coded as required, depending on the format and characteristics of the private destination address.

The nature of address indicator should be coded "abbreviated number" (value '6' = 0000110), and the numbering plan field should be coded "101" for private numbering plan.

10.3.2.2.3. Cause Indicators

To support reasons for MBG call failures, Cause Indicator parameter values to identify these are required. This subclause contains three course values that are added by MBG; call blocked due to group restrictions, unknown business group, and unallocated destination number. The former is used if subgroup or line privilege restriction screening failure occurs. Unknown business group is used if the IAM for a call contains an unknown business group identifier. The latter is used if an unassigned intercom dialing code is dialled from within the group. The class of call blocked due to group restrictions is "service or option not available." The class of the other two causes is "normal." All other cause values already exist. The Cause Indicators parameter appears in the Release Message.

0010111(23)	unallocated destination number
0011000(24)	unknown business group
0110110(54)	call blocked due to group restrictions

10.3.3. ISDN User Part Procedures

10.3.3.1. Normal procedures

10.3.3.1.1. Originating End Office (OEO)

When a member of an MBG initiates a call, the originating end office (OEO) determines if the call is an intra-MBG call by the dialled digits. For allowed intra-MBG calls, the OEO shall insert a Business Group parameter into the outgoing IAM for call setup along with an "ISDN-UP required" indication in the ISDN-UP preference indicator of the Forward Call Indicators parameter. The attendant status field shall be coded "1" for attendant initiated calls and "0" otherwise. The Business Group Identifier Type field should be coded "0" to indicate an MBG identifier. The line privileges in-

formation indicator will be coded "0" if fixed line privileges are used and "1" if customer-defined line privileges are used. The party selector field will be coded "0001" to indicate the information relates to the calling party. The Business Group Identifier and subgroup Identifier fields are coded with appropriate values for the calling party, or "00..00" if the identifiers are not used. The line privileges field is coded to indicate the access restrictions of the calling party. If Line Privileges are not used, the Line Privileges Information Indicators field is coded "0", for fixed line privileges, and the Line Privileges field is coded as "unrestricted" for both originating and terminating privileges.

If the OEO performs a translation of the dialled private numbering plan number into a public number corresponding to the terminating line (or if the MBG's private numbering plan coincides with the public numbering plan), the OEO places the public number in the Called Party Number Parameter, and the dialled private numbering plan number is not sent. If the OEO does not perform a translation of the dialled private numbering plan number to a public number corresponding to the terminating line, the OEO derives a public routing number to be used for routing the call to the terminating end office (TEO), places this public routing number in the Called Party Number parameter, and places the dialled private numbering plan number in a Generic Address parameter. the type of address field in the Generic Address parameter is coded 00000001 for a destination number.

10.3.3.1.2. Terminating End Office (TEO)

When a TEO receives an IAM, it determines if it is an intra-MBG call by the presence of a business group parameter with a valid business group identifier and the fact that the business group identifier type is coded "0". Then it shall examine the Called Party Number, and the Generic Address parameter if present, to determine the call's destination. The TEO shall use the information in the Business Group parameter for the calling party to determine if the call is allowed to terminate. If allowed, the call terminates normally.

10.3.3.1.3. Intermediate MBG Office (IMO)

If the IAM for an incoming MBG call is received, the Called Party Number parameter contains a routing number for this office, and the call is not destined for the user connected to this office, the call should be sent through to another office.

The IMO should select an outgoing route which supports MBG service and construct an IAM for the outgoing call. Parameter coding should be as specified in 10.3.3.1.1.

10.3.3.2. Exceptional procedures

10.3.3.2.1. Subgroup or Line Privileges failure

The "call blocked due to group restrictions" cause value is used in all restriction failure scenarios (line privileges screening and subgroup screening) for the MBG call. This cause value will allow for network provision of an unambiguous indication to the calling user when a call screening failure occurs. If the originating restrictions of the calling party prohibit calls outside the MBG, the OEO shall release the call. An originating exchange that receives the cause value in a cause indicators parameter in a Release Message may provide a special intercept announcement to the calling user.

10.3.3.2.2. Undefined dialled code

The "unallocated destination number" cause value is used when an exchange receives an MBG call but is unable to terminate the call because the recieved destination number corresponds to an unassigned code within the MBG numbering plan. If the TEO receives an IAM with a generic address with a "destination number" for which no translation is available, it shall release the call with a location of "local local network" and cause value "unallocated destination number."

10.3.3.2.3. Unknown business group

If the IAM for an incoming MBG call contains an unknown business group identifier, the call should be cleared with cause value "unknown business group".

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10.3.3.2.4. Subgroup not subscribed

If the IAM for an incoming MBG call contains a Subgroup Identifier that is not coded "no indication" and the MBG does not subscribe to subgroups, the Subgroup Identifier should be ignored. Call setup should then proceed normally.

10.3.3.2.5. Line Privileges not subscribed

If the IAM for an incoming MBG call contains a Line Privileges field that is not coded "unrestricted" for both originating and terminating calls and the customer does not subscribe to line privileges, the Line Privileges Information Indicator and Line Privileges should be ignored. Call setup should then proceed normally.

10.3.4. Interactions

10.3.4.1. Non-ISDN Call Forwarding

MBG information for the original called and redirecting parties should be included in the Business Group parameter for call forwarding call legs that are MBG calls.

A single Business Group parameter can contain the MBG information for all identified parties. For original called and redirecting parties, the party selector in the Business Group parameter should be coded "original called party" and "redirecting party", respectively. MBG information for the parties in a one or multi-leg call forwarding scenario should correspond to the number parameters, as described in 7.5.3.1. If one or more of the initial call legs in a call forwarding chain are non-MBG, no MBG information for the non-MBG parties should be carried.

10.3.4.2. Interworking with Private Networks

See 9.3.4.1.

11. Multilocation Business Group (MBG) Three-Way Calling

The following description covers the Intra-LATA service.

11.1. MBG Three-Way Calling, Stage-1 description (User perspective)

11.1.1. Definition

The MBG Three-Way Calling feature allows an MBG party already participating in a two-party call to add on a third party.

11.1.2. Description

11.1.2.1. General description

Three-Way Calling is a feature that allows an MBG party to add on a third party to an existing two-party call, line privileges permitting, to form a three-way connection.

11.1.2.2. Specific terminology

11.1.2.2.1. Three-way controller

The three-way controller is the MBG party that activates the Three-Way Calling feature.

11.1.2.2.2. Add-on party

The add-on party is the party that the three-way controller adds to the existing two-party connection.

11.1.2.2.3. Existing party

The existing party is the party to which the three-way controller is connected before Three-Way Calling is activated.

11.1.2.2.4. Line privileges

Line privileges are limitations placed on calls originating from, or terminating to, an MBG line.

11.1.3. Procedures

11.1.3.1. Provision and withdrawal

An MBG party must subscribe to the Three-Way Calling service. There are at least six variations of Three-Way Calling to which an MBG party which subscribe:

- A Three-Way Calling subscriber may be allowed to establish a three-way connection only if the subscriber is engaged in an incoming call from the public network before a three-way call is initiated. The add-on party shall be within the MBG;

- A Three-Way Calling subscriber may be allowed to establish a three-way connection involving any type of existing call (call may be incoming or outgoing in direction, inside or outside MBG); however, the third party shall be inside the MBG;

- A Three-Way Calling subscriber may be allowed to establish a three-way connection involving any type of existing call (incoming or outgoing, inside or outside MBG) and a third party inside or outside the MBG.3;

- A Three-Way Calling subscriber may be allowed to establish a three-way connection with any type of existing call (incoming or outgoing, inside or outside the MBG) and a third party outside the MBG;

- A Three-Way Calling subscriber may be allowed to establish a three-way connection with any type of existing call and an attendant as the third party;

    — A Three-Way Calling subscriber may be allowed to establish a three-way call with only intra-MBG parties involved.

11.1.3.2. Normal procedures

The normal procedures for MBG Three-Way Calling are described below and shown in figure 28 as a dynamic description (SDL).

11.1.3.2.1. Activation, deactivation, and registration

There are two methods used to activate Three-Way Calling for non-ISDN subscribers:

    — the first method involves a single flash (switchhook, tap button, etc.);

    — the second method involves a single flash followed by the dialing of an activation code.

In either case, after the feature is activated, the existing party is placed on consultation hold, and the controller receives dial tone.

11.1.3.2.2. Invocation and operation

On receipt of dial tone, the three-way controller may originate a call to the add-on party if the subscription options of the three-way controller allow the add-on (see options in 11.1.3.1). This call may be an intra-MBG call, an inter-MBG call, or a non-MBG call (depending on the line privileges of the controller and the add-on party). In the consultation phase of the call (i.e., when the controller is engaged in a two-party call with the add-on party), the line privileges of the existing party do not affect the two-way call between the controller and the add-on party.

A second flash by the three-way controller results in either

    - a three-way connection if the add-on party and the existing party are allowed to communicate (i.e., if line privileges of these parties are not violated);

    - a three-way connection regardless of whether the add-on party and existing party are allowed to communicate (in this case, restrictions are checked when a transfer occurs).

These options exist as network options for restriction checking (not subscriber options).

Optionally, a third flash by the three-way controller after a three-way call is active results in actions such as the following examples:

    - release of the last party added;

    - return of a recall dial tone to allow the controller to input a function code for further feature operation (e.g., cancel call waiting).

11.1.3.3. Exceptional procedures

11.1.3.3.1. Activation, deactivation, and registration

None Identified.

11.1.3.3.2. Invocation and operation

If subscription options of the controller or line privileges of the controller and add-on parties do not allow the controller to originate a call to the add-on party, the controller should be able to either

    — originate a new call to another add-on party (while the existing party remains on hold;

    — reestablish a two-party connection with the existing party.

If line privileges of the existing and add-on parties do not allow the three-way connection when the controller initiates the add-on signal (second flash), the controller should have access to a recovery procedure. There are at least three alternatives for recovery:

- the controller is reconnected to the add-on party, and the controller toggles between the add-on party and the existing party by flashing;

- the connection to the add-on party is released, and the controller is reconnected to the existing party;

- the add-on party is placed on hold and an announcement is provided to the controller requesting dual tone multifrequency (DTMF) input for specifying one of multiple options provided in the announcement.

Specification of a preferred method is unnecessary because there are no SS7 impacts (other than the normal release of a connection) associated with the choice of one method over another.

11.1.3.4. Alternate procedures

None Identified.

11.1.4. Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

11.1.5. Interworking considerations

The same interworking considerations that apply to the MBG Basic Call apply to the setup of the call between the controller and the add-on party.

11.1.6. Interactions with other services

11.1.6.1. MBG Basic Call

When a call is established between the three-way controller and the add-on party, all rules associated with the MBG Basic Call are upheld. For example, if the three-way controller and the add-on party are not allowed to communicate in a basic call, they shall not be allowed to communicate in the consultation phase of a three-way call.

11.1.6.2. Three-Way Calling

The Three-Way Calling service of the controller may interact with the Three-Way Calling service of the existing party (e.g., three-way call chaining). If the existing party on a three-way call is also a three-way controller and had added a fourth party, and if the existing party is served by an exchange different from the original three-way call controller, the existence of a fourth party in the chain does not affect the access restriction screening associated with the original three-way call. However, if the existing party and the controller are served by the same exchange, and if the existing party is connected (via interexchange three-way call chaining) to a fourth party served by a remote exchange, the restrictions imposed by the fourth party affect the restriction screening for the original three-way call. As a network option, the controller's exchange may check the restrictions of the existing party and the add on party only. In other words, access restriction screening in Three-Way Calling involves screening of the existing party, the add-on party, any other parties involved in the call at the exchange serving the original three-way call controller, and the first remote party in the direction of the existing party.

11.1.6.3. Conference Calling

If the existing party on a three-way call is also a conference controller, only the restrictions of the conference controller are used in restriction screening for the three-way call. The existence of multiple parties on the conference call does not affect the restriction screening associated with the three-way call. If the conference controller disconnects, the restrictions of the conference controller are still used for restriction screening purposes in the three-way call.

11.1.6.4. Call Transfer

If the existing party on a three-way call performs a call transfer, the transferred party becomes the new existing party for restriction screening purposes.

11.1.6.5. Call Forwarding

If the add-on party in a three-way call forwards a call (via Call Forwarding Variable, Call Forwarding Busy, or Call Forwarding No Answer), the restrictions of the forwarded-to party are used for screening related to the three-way call.
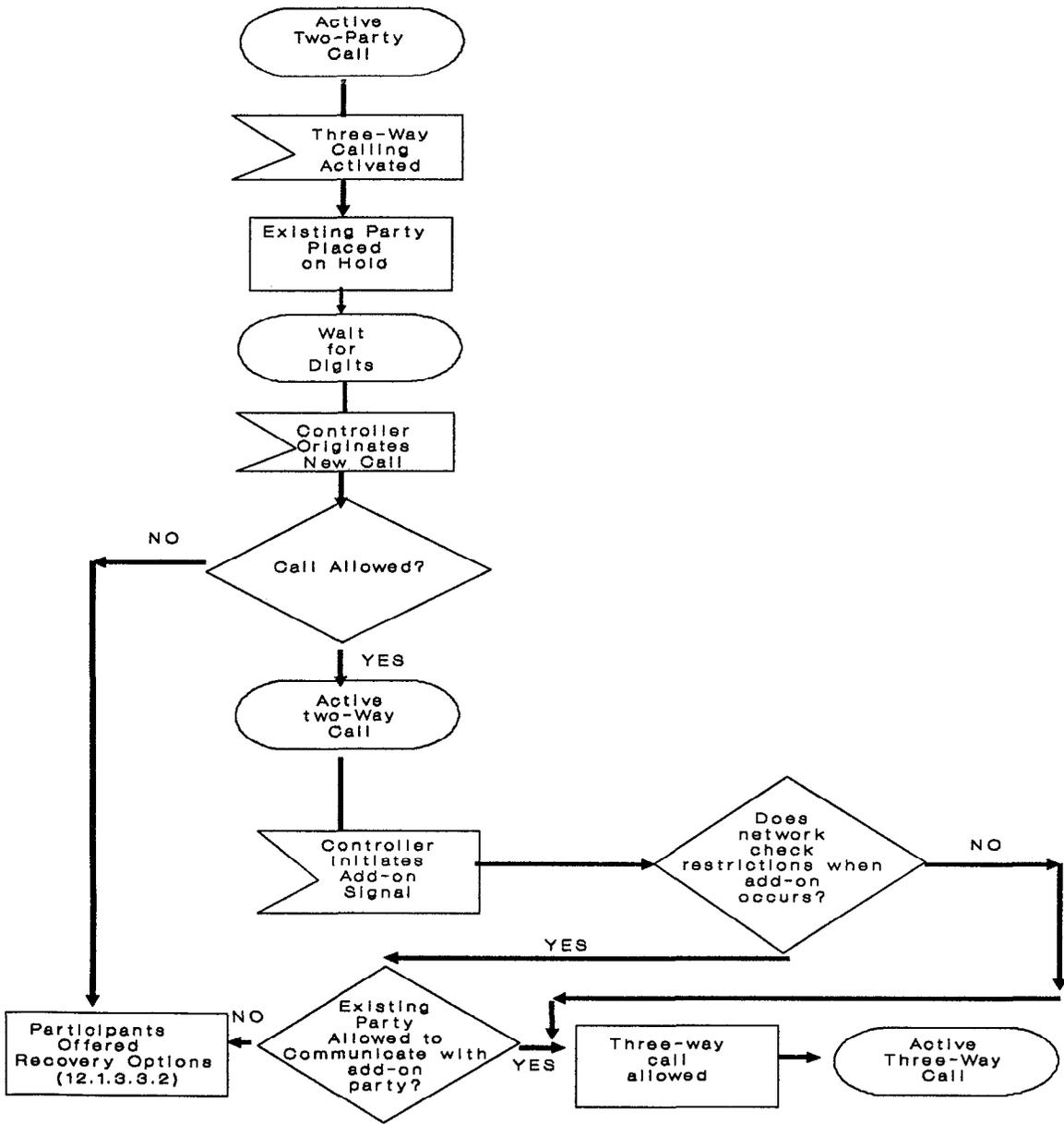
Figure 28
Three-Way Calling

11.2. MBG Three-Way Calling, Stage-2 Description (Information Flows)

The stage-2 service description for Three-Way Calling relies on the MBG architecture specified in the stage-2 service description for the MBG Basic Call. Additionally, this contribution defines three Functional Entities (FEs) and the information flow between them to support the Three-Way Calling service.

11.2.1. Functional Model

11.2.1.1. Specific Terminology

11.2.1.1.1. Three-way controller

The three-way controller is the MBG party that activates the Three-Way Calling service.

11.2.1.1.2. Existing Party

The existing party is the party to which the three-way controller is connected before Three-Way Calling is activated.

11.2.1.1.3. Add-on Party

The add-on party is the party that the three-way controller adds to the existing two-party connection.

11.2.1.1.4. Functional Entity A (FE A)

This entity is the MBG exchange serving the three-way controller.

11.2.1.1.5. Functional Entity B (FE B)

This entity is the MBG exchange serving the existing party.

11.2.1.1.6. Functional Entity C (FE C)

This entity is the MBG exchange serving the add-on party.

11.2.2. Normal Procedures

The information flow for Three-Way Calling is shown in figure 29 and the dynamic description (SDL) is in figures 30 to 33.

11.2.2.1. General Description

When the controller activates Three-Way Calling, FE A places the existing party on hold, and the controller is allowed to originate a new call. FE A follows the procedures for an MBG Basic Call in establishing a call between the controller and the add-on party. In addition, if the call to the add-on party is an MBG call, the call setup message also includes a request for MBG information concerning the add-on party.

If the previously established call between the controller and the existing party is an MBG call, simultaneously with the setup of the call between the controller and the add-on party, FE A sends a message to FE B requesting MBG information for the existing party.

When FE B receives the request for MBG information about the existing party, it responds to FE A, sending only MBG information about the existing party (even if the existing party is involved in a three-way call or conference call at FE B).

When FE C receives a request for MBG information about the add-on party in an incoming call setup message, FE C should include the MBG information for the add-on party in report alerting and optionally in the Call Connect Message sent to FE A. (See note on figure 29.)

When FE A collects MBG information about the existing party and the add-on party, it stores this information until it is needed at the occurrence of the add-on signal (second flash) from the con-

troller. In the interim, the controller and the add-on party are engaged in a call (or FE C is alerting the add-on party), and the existing party is on consultation hold. When the controller requests the add-on (via second flash), FE A performs screening using the MBG information for the existing party and the add-on party to determine whether or not the three-way call is allowed. As a network option, FE A may delay this screening process until a call transfer takes place. FE A need not retain the MBG information about the existing party and the add-on party after this screening process occurs.
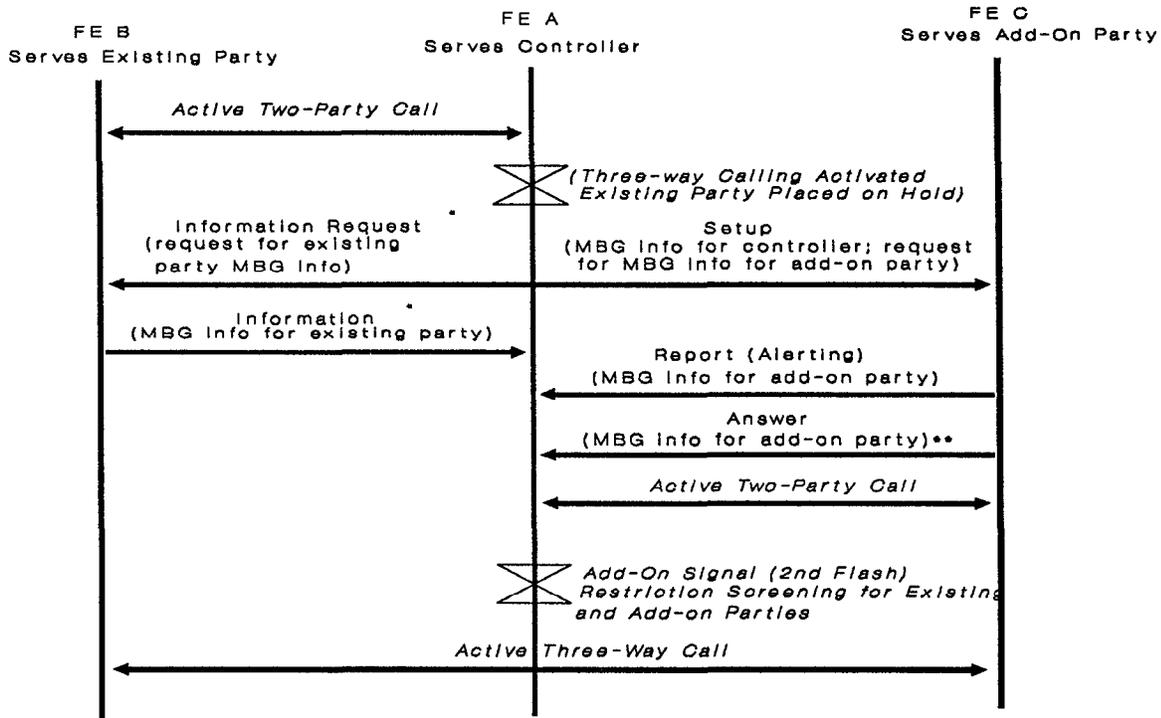
NOTE: • Message Sent only If Existing Party Is an MBG Party
NOTE: •• MBG Infor need only be Included If It
       has changed since Report Alerting or If no Report
       Alerting sent.

Figure 29
Information Flow for Three-Way Calling

11.2.3.   Exceptional Procedures

If FE A does not receive the MBG information concerning the existing party or the add-on party by the time the controller flashes to request a three-way connection, FE A should allow the three-way connection until FE A receives the MBG information needed for screening from FE B and FE C. If MBG information for the existing and add-on parties is not received by a network-specific period of time after the sending of the requests for MBG information, FE A should assume that the legs for which information is missing are non-MBG legs (i.e., calls to outside the MBG).

If screening due to subscription options or screening due to Line Privileges indicates that a three-way call is not allowed, the controller should have access to the recovery procedures in 11.1.3.3.2 of the stage-1 service description for Three-Way Calling. The recovery options in stage-1 do not have inter-FE impact; therefore, no stage-2 descriptions are needed.

Existing
Two-Way
Call

Three-Way
Calling
Activated

Existing Party
Placed on
Hold

State
X

Create
New
Process

Normal Call
Origination From
Controller

MBG Call
Between Existing
Party and
Controller?

MBG Call ?   NO

YES

Request Existing
Party MBG Info

Include request for
Add-On Party MBG
Info in Setup Message

Establish
Non-MBG Call

Wait for
MBG Info

Formulate Setup
Message via MBG
Basic Call Procedures

Receive MBG
Info for
Existing Party

Send Setup Message
to FE C

IDLE

Wait for
MBG Info

Receive MBG
Info about
Add-On (If Any)

Active
Two Way
Call

NO

YES

Figure 30
SDL at FE A

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**Figure 31
SDL at FE A
(Part 2)**

Figure 32
SDL at FE B

```
              ╭─────────────────╮
              │      I d l e     │
              ╰─────────────────╯
                       │
                       │
                       │
       ╭───────────────────────────────╮
       ╲   Call Setup Request from     │
        ╲   FE A with Request for      │
        ╱  Add-On Party MBG Info.      │
       ╱────────────────────────────────╯
                       │
                       │
                       ▼
       ╭────────────────────────────────╮
      ╱                                  │
     ╱    Provide Add-On                 │
     ╲    Party MBG Info                 │
      ╲                                  │
       ╰────────────────────────────────╯
                       │
                       │
                       ▼
              ╭─────────────────╮
              │     Active      │
              │   Two-Way       │
              │     Call        │
              ╰─────────────────╯
```

Figure 33
SDL at FE C

11.3.   MBG Three-Way Calling, Stage-3 description (SS7 protocols)

11.3.1.   General description.

The MBG Three-Way Calling service allows an MBG party already participating in a two-party call to add on a third party to form a three-way connection. The major impact of this service on ISDN User Part involves a service-controlling exchange requesting MBG information (group identifier, subgroup identifier, attendant status, and line privileges) for MBG parties served by remote exchanges for access restriction screening purposes. The functional description, basic formats and codes, and general procedures for the ISDN User Part are contained in ANSI T1.113.
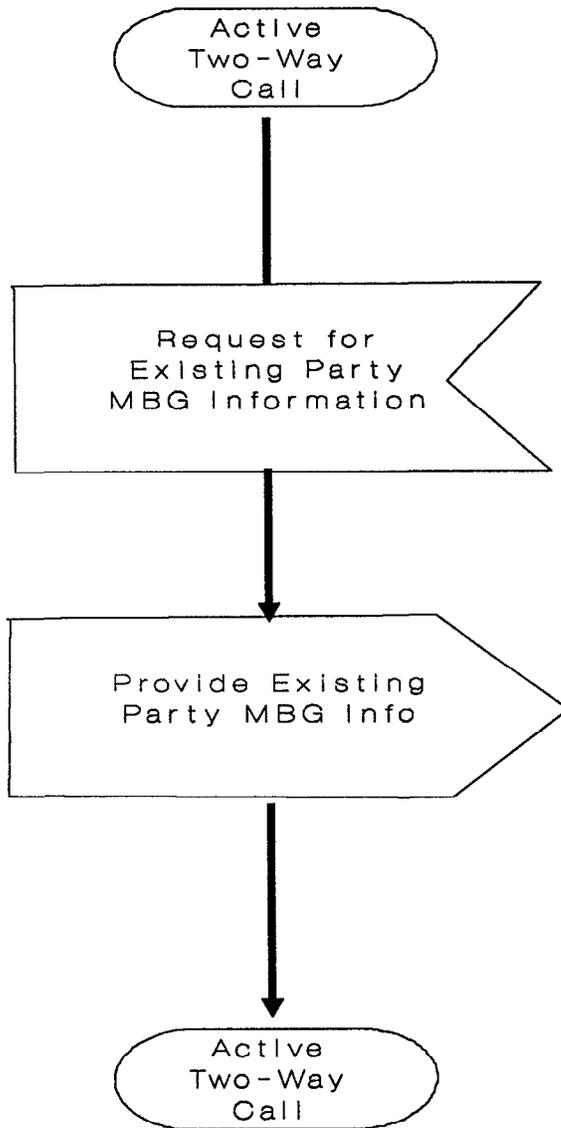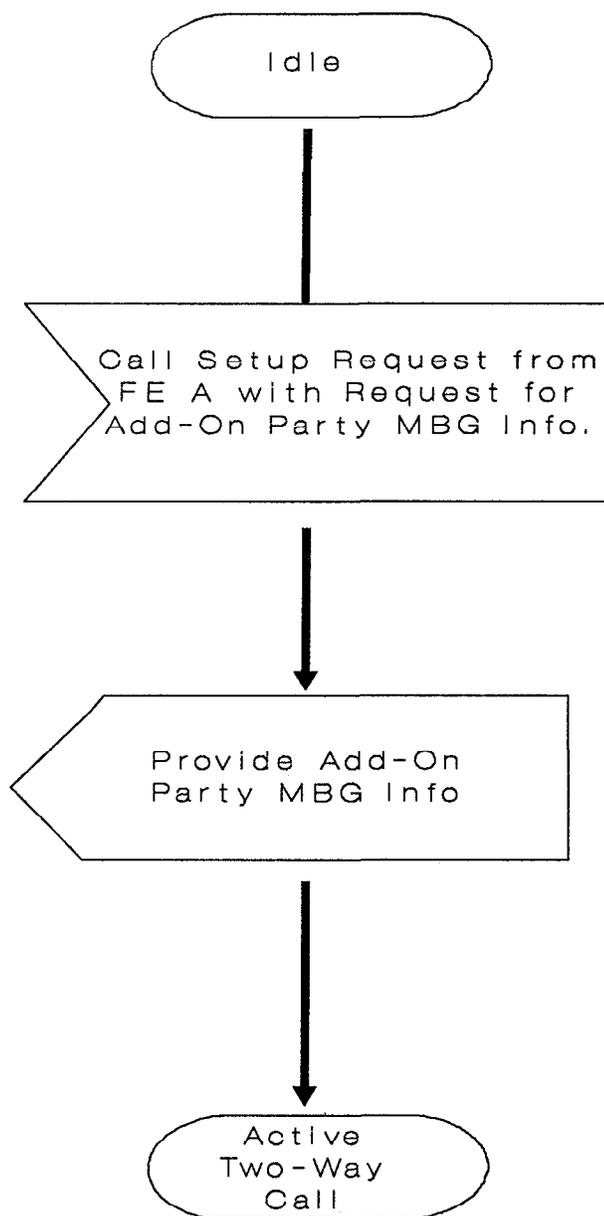
11.3.2.   ISDN User Part formats and codes

The list below summarizes the ISDN User Part protocol additions to support the MBG Three-Way Calling service:

- The list of IAM parameters includes the Information Request Indicators parameter.

- The list of ACM, ANM, and CPG parameters includes the Information Indicators parameter.

- The format of the Information Request Indicators parameter and the information indicators parameter is illustrated in Table 23:

Table 23

Format of Information Request Indicators Parameter and Information Indicators Parameter

	8	7	6	5	4	3	2	1
1	H	G	F	E	D	C	B	A
2	P	O	N	M	L	K	J	I

The following indication is included in the Information Request Indicators parameter:

Bit P:

- 0: MBG information not requested.

- 1: MBG information requested.

The following indication is included in the Information Indicators parameter:

Bit P:

- 0: MBG information not included.

- 1: MBG information included.

11.3.3.   ISDN User Part procedures

11.3.3.1.   Background on MBG   restriction screening procedure

In a three-way call, the controlling exchange obtains MBG information for a limited number of the total number of parties involved in a call connection to perform access restriction screening. A call connection may involve more than three parties because of three-way call chaining (e.g., party A adds party B, party B adds party C, party C adds party D, and so on). The add-on party is the party added to an existing two-way connection by the three-way call controller. The existing party is the party to which the controller is connected before Three-Way Calling is initiated.

The restriction screening philosophy for Three-Way Calling is as follows: Screen all parties in a continuous call connection at the controlling exchange ("continuous" means that parties involved in the call connection due to double-trunking are not included), plus the add-on party (that may or may not be served by the controlling exchange), plus the existing party, plus one party served by a remote exchange in the direction of the existing party (e.g., from the controller toward the existing party). The latter party exists in a connection only if the existing party and the controller are served by the same exchange AND the existing party is connected via three-way call chaining to a party served by a remote exchange.

The add-on party call leg is defined to be a connection between the controller and the add-on party. Because of interexchange three-way call chaining (see paragraph above), the definition of the existing party call leg is more complex. The existing party call leg is defined to be a connection between the controller and the first party served by a remote exchange in the call connection in the direction of the existing party. If the existing party and the controller are served by different exchanges, the "first party in the call connection served by a remote exchange in the direction of the existing party" is the existing party.

A summary of the scope of MBG restriction screening is as follows: The controlling exchange obtains MBG information along the add-on party call leg and the existing party call leg. If the add-on party is served by the same exchange as the controller, no ISDN User Part procedures are needed along the add-on party leg. If the controller and the add-on party are served by different exchanges, the controlling switch obtains MBG information for the add-on party via the procedures in 11.3.3.2.

If any interexchange circuits are involved in the call connection from the controller toward the existing party, the controlling exchange obtains MBG information for the first party served by a remote exchange in the direction of the existing party (that may or may not be the existing party). The procedures for obtaining MBG information along the existing party call leg are described in 11.3.3.3.

11.3.3.2. Obtaining MBG information for the add-on party call leg

The procedures in this subclause apply only if the add-on party is served by a remote exchange (i.e., an exchange different from the controlling exchange).

The controlling exchange requests MBG information for the add-on party in the Initial Address Message (IAM) used for call establishment from the controller to the add-on party. The IAM includes the information request indicators parameter with bit J coded "1" to indicate "MBG information requested." This procedure applies only to MBG calls between the controller and the add-on party; if the call is a non-MBG call, the controlling exchange does not include the MBG information request in the IAM.

After receiving an IAM with the above request, the exchange serving the add-on party includes the following parameters in the first of Address Complete Message (ACM), Answer Message (ANM), or Call Progress Message (CPG) when those messages are sent toward the controlling exchange:

- the Information Indicators parameter with all bits coded "0", except bit L which is coded "1" to indicate "MBG information included," and

- the Business Group parameter includes MBG information about the add-on party. The Party Selector within this parameter should be coded to indicate "called party."

When the controlling exchange receives the above information, the exchange associates the contents of the Business Group parameter with the interexchange circuit until the information is used for MBG screening for Three-Way Calling or call transfer. After screening takes place, the controlling exchange may discard the information.

11.3.3.3.   Obtaining MBG Information for the existing party call leg

The procedures in this subclause apply only if the existing party call leg includes a party served by a remote exchange (i.e., an exchange different from the controlling exchange).

Simultaneously with the setup of the call to the add-on party, the controlling exchange requests information for the existing party call leg in an Information Request Message (INR) sent toward the exchange serving the remote MBG party. The INR includes an Information Request Indicators parameter with bit J coded "1" to indicate "MBG information requested."

The procedure above applies only to MBG calls between the controller and the existing party; if the call is a non-MBG call, the controlling exchange does not send the INR.

After the remote exchange receives the INR, the exchange sends an Information Message (INF) toward the controlling exchange with the following parameters:

-   the Information Indicators parameter with all bits coded "0", except bit L which is coded "1" to indicate "MBG information included"; and

-   the Business Group parameter includes MBG information for the connected party. The Party Selector within this parameter should be coded to indicate "connected party."

When the controlling exchange receives the INF with the above information, the exchange associates the contents of the Business Group parameter with the interexchange circuit until the information is used for MBG screening for Three-Way Calling or call transfer. After screening takes place, the controlling exchange may discard the information.

11.3.3.4.   Exceptional Procedures

If MBG information for the existing and add-on parties is not received after a network-specific period of time after the sending of the requests for MBG information, the controlling exchange should assume that the legs for which information is missing are not MBG legs (i.e., calls to outside the MBG).

11.3.4.   Interactions

None identified.

11.3.5.   Interworking

Because this service requires ISDN User Part, there are no interworking considerations (other than the release of MBG call legs if no SS7-supported facilities are available).

11.3.6.   SDLs

Not required.

11.3.7.   Message Flow Diagrams

Figure 34 illustrates the message flows for MBG Three-Way Calling.

—

INR (MBG Info. Requested)

IAM (MBG Info. Requested)

ACM (MBG Info.)

INF (MBG Info.)

ANM (MBG Info.)

Existing Party

Controller

Add-On Party
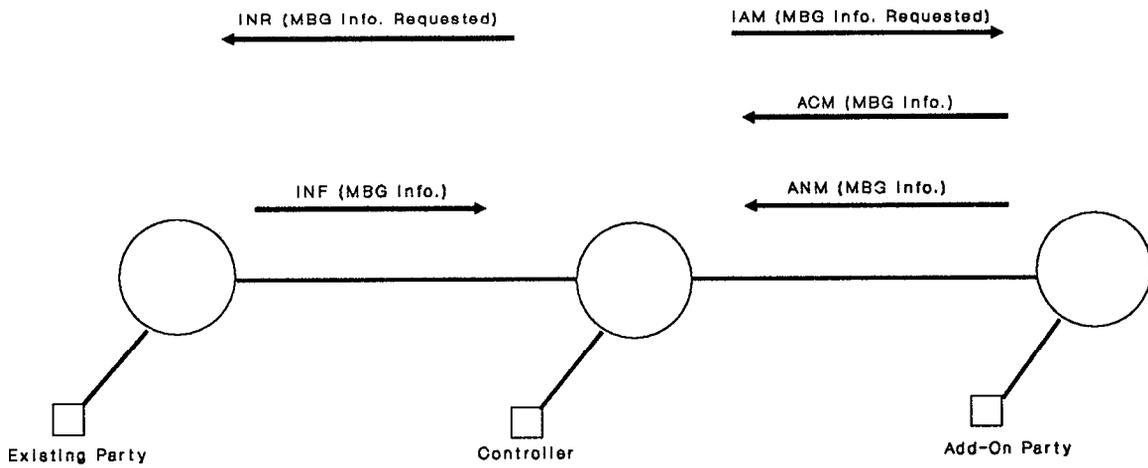
*NOTE: MBG Info need only be sent if it has changed since
the sending of the ACM.

Figure 34
MBG Three-Way Calling

12.   Multilocation Business Group (MBG) Call Transfer

The following description covers the Intra-LATA service.

12.1.   MBG Call Transfer, Stage-1 description (User perspective)

12.1.1.   Definition

MBG call transfer is a service in which an MBG customer, either already on a stable, answered three-way call or in the process of setting up a three-way call, may disconnect from the call, leaving the remaining parties in a two-party connection.

12.1.2.   Description

12.1.2.1.   General description

Call transfer is a service composed of two parts: the first part involves the establishment of a three-way call; the second involves the disconnection of the three-way controller. After the disconnection of the three-way controller, the remaining parties are allowed to continue in a two-party connection.

12.1.2.2.   Specific terminology

12.1.2.2.1.   Transfer controller

The transfer controller is the MBG party performing the call transfer.

12.1.2.2.2.   Existing party

The existing party is the party to which a three-way controller is connected before Three-Way Calling is activated.

12.1.2.2.3.   Add-on party

The add-on party is the party that the three-way controller adds to the existing two-party connection.

12.1.3.   Procedures

12.1.3.1.   Provision and withdrawal

An MBG party shall subscribe to the call transfer service. There are at least six variations of call transfer to which an MBG party may subscribe.

- A call transfer subscriber may be allowed to establish a three-way connection and transfer a call only if the transfer subscriber is engaged in an incoming call from the public network before a three-way call is initiated. The add-on party shall be within the MBG.

- A call transfer subscriber may be allowed to establish a three-way connection and transfer all calls (incoming or outgoing, inside or outside MBG) to an add-on party inside the MBG.

- A call transfer subscriber may be allowed to establish a three-way connection and transfer all calls (incoming or outgoing, inside or outside MBG) to an add-on party inside or outside the MBG.

- A call transfer subscriber may be allowed to establish a three-way connection and transfer all calls (incoming or outgoing, inside or outside the MBG) to a third party outside the MBG.

- A call transfer subscriber may be allowed to establish a three-way connection and transfer all calls (incoming or outgoing, inside or outside the MBG) to an attendant.

- A call transfer subscriber may be allowed to establish a three-way connection and transfer an existing party inside the MBG to an add-on party inside the MBG.

12.1.3.2. Normal procedures

The normal procedures for the MBG call transfer service are described below and shown in figure 35 as dynamic descriptions (SDLs).

12.1.3.2.1. Activation, deactivation, and registration

An MBG party performs a call transfer by disconnecting from an established three-way call, or by disconnecting in the process of establishing a three-way call.

12.1.3.2.2. Invocation and operation

A transfer subscriber shall initiate a three-way call before a transfer is performed. After a call transfer subscriber performs an add-on to obtain a three-way connection, the transfer subscriber may disconnect to perform the transfer. If a transfer subscriber disconnects while in the process of establishing a three-way call, one of the two remaining parties shall be in the answered state. For example, the transfer subscriber may perform the transfer if the add-on line is alerting and the existing party is off-hook; however, the transfer subscriber may not perform a transfer in which the two remaining lines are in the alerting state.

If the controller disconnects with an answered existing party on hold, a transfer should occur regardless of whether the add-on party is in an alerting or answered state. As a network option the transfer request may be ignored, the add on party is dropped and the controller given ringback. If ringback occurs, the controller may go off-hook and be reconnected to the non-alerting party.

12.1.3.3. Exceptional procedures

12.1.3.3.1. Activation, deactivation, and registration

None Identified.

12.1.3.3.2. Invocation and operation

When a three-way controller performs a transfer, at least one of the remaining legs shall be an off-hook line, an incoming trunk, or an answered inter-switch call that did not encounter interworking. If the above is not satisfied when a controller disconnects, the transfer is not allowed, and the remaining legs are released.

There are two network options:

- A controller receives ringback and is reconnected to the three way call;

- The two remaining legs are released at the time of the transfer if the line privileges of either of the remaining parties are violated.

12.1.3.4. Alternate procedures

None Identified.

12.1.4. Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

12.1.5. Interworking considerations

None Identified.

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12.1.6. Interactions with other supplementary services

12.1.6.1. Three-Way Calling

Because of the tightly-coupled relationship between Three-Way Calling and call transfer, the inter-actions between the two services are detailed in the text for the stage-1 and stage-2 service descriptions for call transfer.
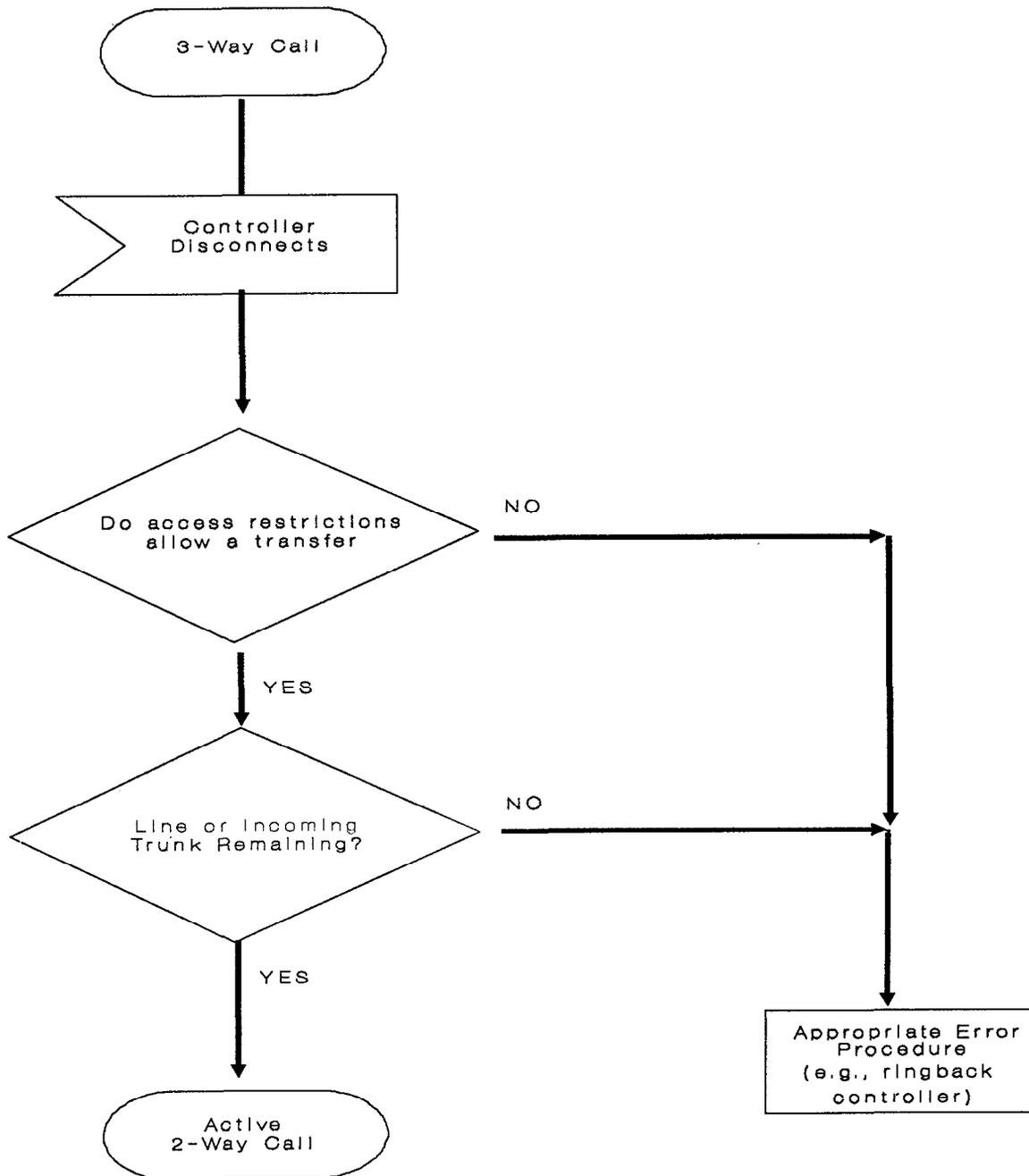
Figure 35
Call Transfer

12.2. MBG Call Transfer, Stage-2 description (Information flows)

MBG Call Transfer is a service in which an MBG customer, either already on a stable, answered three-way call or in the process of setting up a three-way call, may disconnect from the call, leaving the remaining parties in a two-party connection.

12.2.1. Functional model

The architecture that supports the MBG Call Transfer service is the same as the MBG architecture described in the stage-2 service description for the MBG Basic Call. The functional model for the three-way call that exists before call transfer takes place is described in the stage two service description for Three-Way Calling. Additionally, the procedures below are specified to support the Call Transfer service.

12.2.1.1. Specific terminology

12.2.1.1.1. Controlling Functional Entity (FE A)

The controlling FE is the FE serving the transfer-controlling party. The controlling FE is labelled FE A.

12.2.1.1.2. Functional Entity B (FE B)

This entity is the MBG exchange serving the existing party.

12.2.1.1.3. Functional Entity C (FE C)

This entity is the MBG exchange serving the add-on party.

12.2.2. Normal procedures

The information flow for MBG call transfer is shown in figures 36 and 37, and the dynamic description (SDL) is in figures 38 through 41.

12.2.2.1. General description

When a three-way call controller disconnects to perform a transfer, the controlling FE determines whether or not a line or incoming trunk is involved in the resulting connection (if neither exists, the call is dropped) and whether or not at least one of the remaining legs is answered (if both are unanswered, the call is dropped).

As a network option, the controlling FE may perform restriction checking to insure that the two parties remaining after the transfer are allowed to communicate. This option is provided because of the network option to not check restrictions when a three-way call is established. If the remaining parties are not allowed to communicate, the controller may receive ringback or the remaining legs may be released.

When a controller successfully performs a transfer, if one of the remaining call legs is an MBG leg (intra-MBG or inter-MBG) and the other is a non-MBG leg, the controlling FE notifies the FE serving the other end of the MBG leg that a non-MBG party is connected. This update should be sent only after the add-on party has answered. The FE receiving this indication updates the previous information associated with the leg for use in future service screening (e.g., for Three-Way Calling or conference calling). This scheme allows the appropriate information to be obtained by a transfer-controlling FE without the need for real-time queries when a three-way call controller disconnects to perform a transfer.

FE B
Serves Existing Party

FE A
Serves Controller

FE C
Serves Add-On Party

Active Three - Way Call

Controller Disconnection

Active Two - Way Call

Update
(Non-MBG Party Connected) +
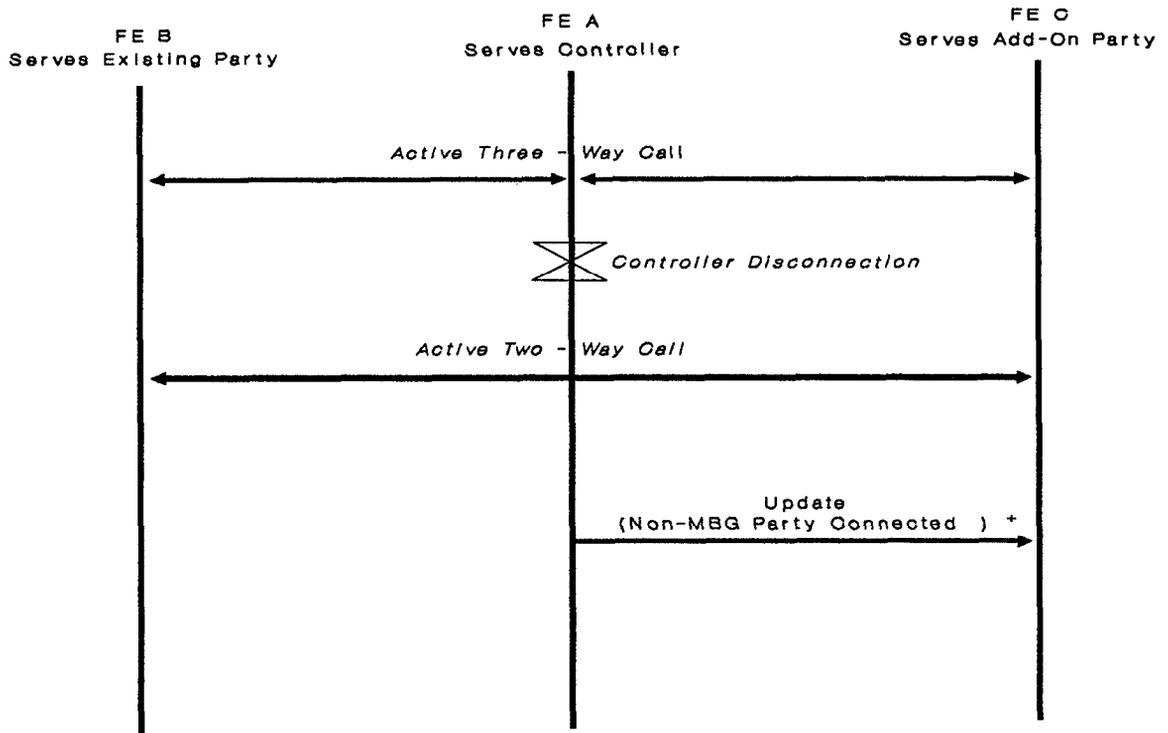
NOTE: + Message Sent Only If Existing Party Is Non-MBG Party

**Figure 36
Information Flow for Call Transfer
(All three parties are answered)**

FE B
Serves Existing Party

FE A
Serves Controller

FE C
Serves Add-On Party

Active Two-Party Call

Three-way Calling Activated
(Existing Party Placed on Hold)

Information Request
(request for existing
party MBG Info)

Setup
(MBG Info for controller; request
for MBG Info for add-on party)

Information
(MBG Info for existing party)

Report (Alerting)
(MBG Info for add-on party)

Restriction screening for
Existing and Add-on Parties.
Controller Disconnection

Two-Way Call Established

Inband Alerting

Answer
(MBG Info for add-on party) **

Restriction Screening for
Existing and Add-on Parties **

Update
(Non-MBG Party Connected ***)

NOTES: * Message Sent only if Existing Party is an MBG Party
   ** MBG Info need only be included and
      Restriction Screening only performed if
      It has changed since Report Alerting or no
      Report Alerting sent.
   *** Message Sent only if Existing Party is a Non-MBG Party

Figure 37
Information flow for call transfer
(Add-on party alerting when transfer invoked)

12.2.3. Exceptional procedures

The stage-1 service descriptions for Three-Way Calling and call transfer describe various recovery scenarios when a three-way call or call transfer is not allowed. None of these have inter-FE impact beyond the normal release of a connection. Therefore, no exceptional procedures are needed in the stage-2 description for Call Transfer.

12.2.4. Interactions with other services

12.2.4.1. Three-Way Calling

If an MBG party successfully transfers a call, and later, the transfer-controlling FE receives a query from another FE requesting restriction information, the transfer-controlling FE propagates the query to the adjacent FE involved in the connection (as if the exchange operates in a tandem capacity after a transfer takes place). The controlling FE does not need to "remember" that a transfer took place.
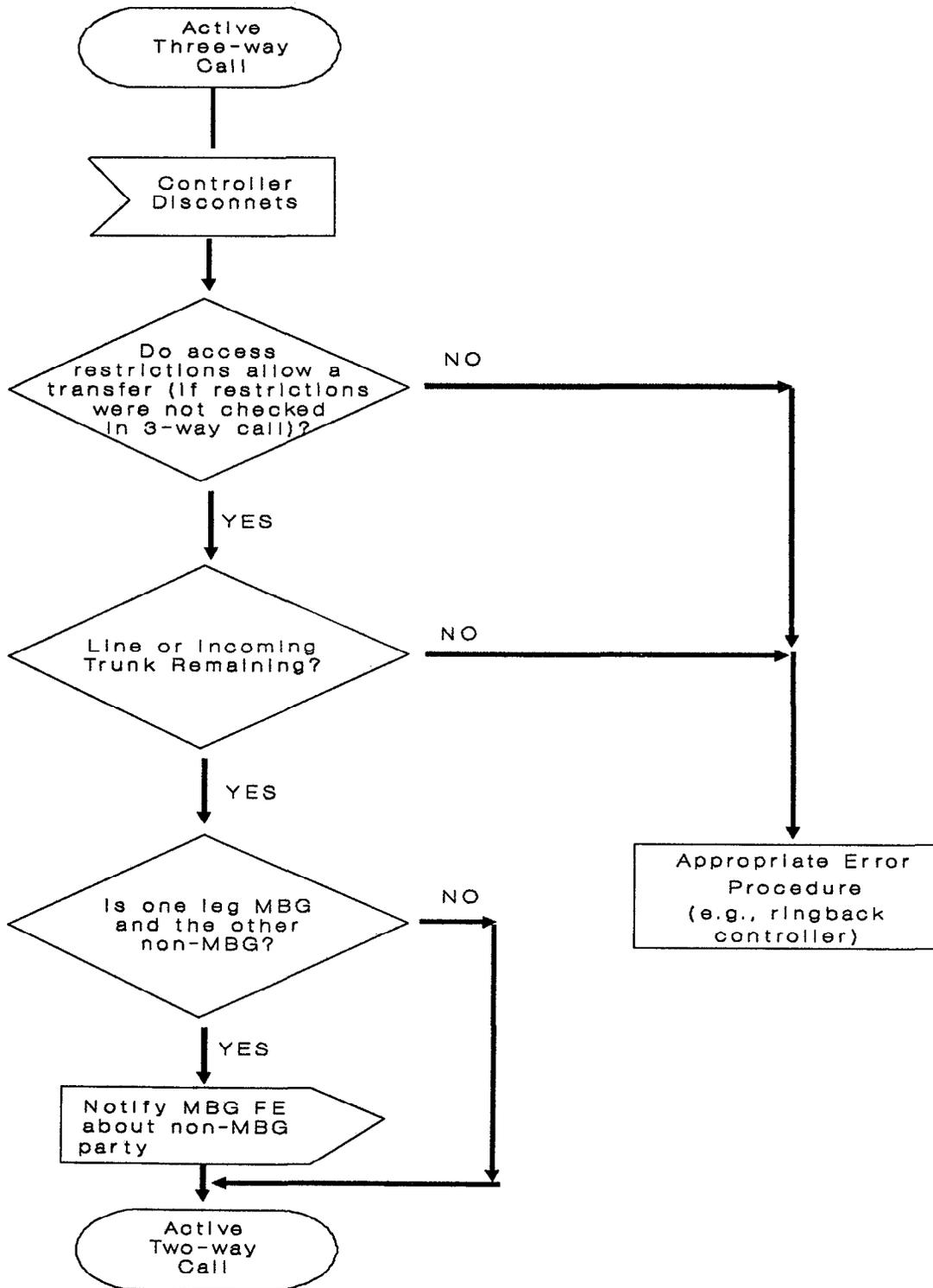
Figure 38
SDL at FE A
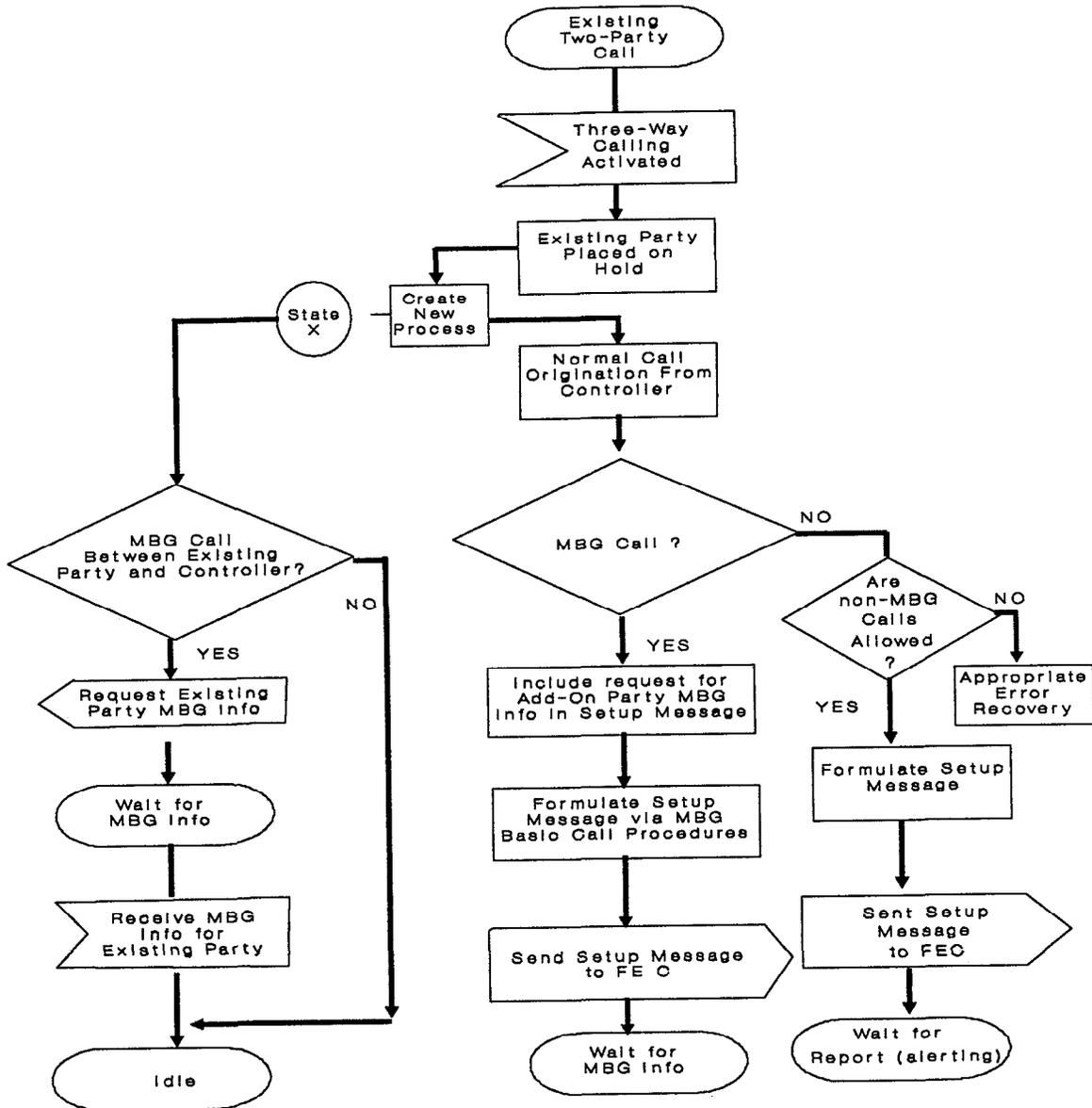**(3-way call exists when transfer invoked)**

Figure 39
SDL at FE A
(Add-on party alerting when transfer invoked)

[Note: MBG call to add-on party]

```
      ┌─────────────┐
      │   Wait for  │
      │   MBG info  │
      └──────┬──────┘
             │
   ┌─────────▼─────────┐
   │ Receive MBG Info  │
   │ (Report Alerting) │
   └─────────┬─────────┘
             │
          ╱MBG╲                NO
      ╱restrictions╲──────────────────────┐
      ╲satisfied?╱                         │
          ╲ ╱                              │
           │ YES                           │
      ┌────▼─────┐                         │
      │ Wait for │                         │
      │Controller│                         │
      │Disconnect│                         │
      └────┬─────┘                         │
           │                               │
   ┌───────▼────────┐                      │
   │  Controller    │                      │
   │  Disconnect    │                      │
   └───────┬────────┘                      │
           │                     ┌─────────▼─────────┐
        ╱Line or╲         NO     │   Appropriate     │
      ╱Incoming Trunk╲───────────│      Error        │
      ╲ Remaining  ╱             │    Recovery       │
          ╲  ?  ╱                └─────────▲─────────┘
           │ YES                           │
      ┌────▼─────┐                         │
      │ Wait for │                         │
      │Add-on party                        │
      │ Answer   │                         │
      └────┬─────┘                         │
           │                               │
   ┌───────▼────────┐                      │
   │  Add-on Party  │                      │
   │    Answer      │                      │
   └───────┬────────┘                      │
           │                               │
        ╱MBG╲                  NO          │
      ╱restrictions╲───────────────────────┘
      ╲satisfied?╱
          ╲ ╱
           │ YES
      ┌────▼─────┐
      │Active 2-Way call│
      │existing party and│
      │  add-on party   │
      └─────────────────┘
```

[Note: Non-MBG call to add-on party]

```
      ┌─────────────┐
      │   Wait for  │
      │Report Alerting│
      └──────┬──────┘
             │
   ┌─────────▼─────────┐
   │  Receive Report   │
   │     Alerting      │
   └─────────┬─────────┘
             │
      ┌──────▼──────┐
      │   Wait for  │
      │  Controller │
      │  Disconnect │
      └──────┬──────┘
             │
   ┌─────────▼─────────┐
   │    Controller     │
   │    Disconnect     │
   └─────────┬─────────┘
             │
          ╱Line or╲           NO
      ╱Incoming Trunk╲──────────────►(Appropriate Error Recovery)
      ╲ Remaining  ╱
          ╲  ?  ╱
           │ YES
      ┌────▼─────┐
      │ Wait for │
      │Add-on Party│
      │ Answer   │
      └────┬─────┘
           │
   ┌───────▼────────┐
   │  Add-on Party  │
   │    Answer      │
   └───────┬────────┘
           │
   ┌───────▼────────┐
   │Active 2-Way call│
   │existing party and│
   │  add-on party   │
   └─────────────────┘
```
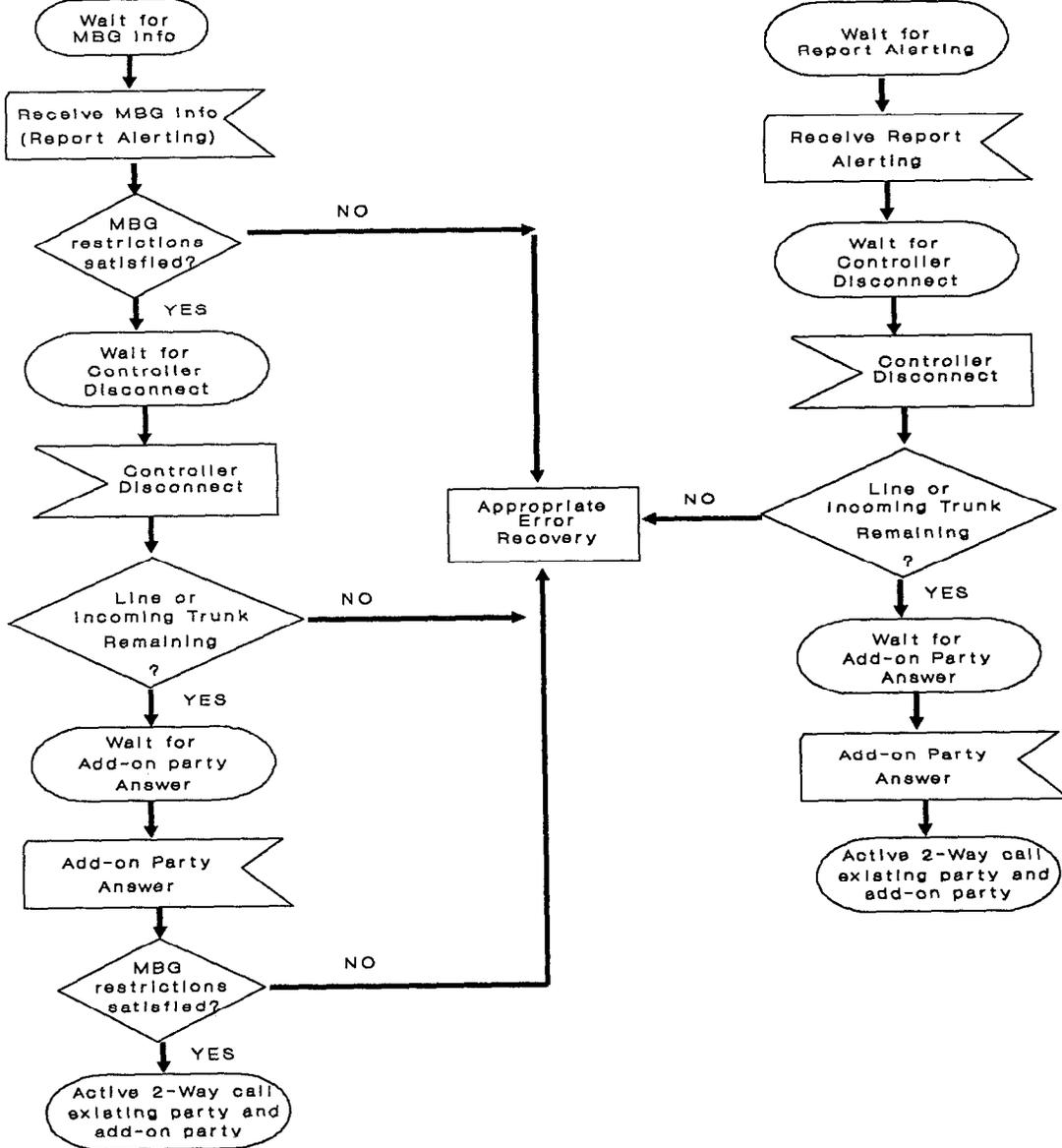
Figure 40
SDL at FE A
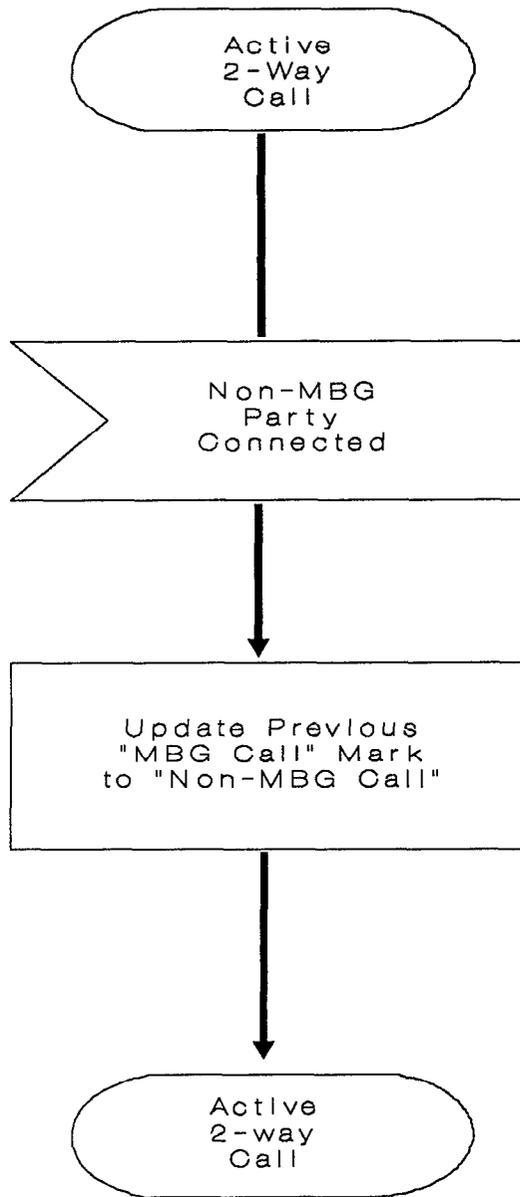**(Part 2)**

Figure 41
SDL at FE C

12.3. MBG Call Transfer, Stage-3 description (SS7 protocols)

12.3.1. General description

MBG Call Transfer is a service in which an MBG party, either already on a stable, answered three-way call or in the process of establishing a three-way call, may disconnect from the call, leaving the remaining parties in a two-party connection. The major impact of this service on the ISDN User Part is the sending of an Call Process Message (CPG) from the controlling MBG exchange to another MBG exchange to perform an update related to restriction screening. The functional description, basic formats and codes, and general procedures for the ISDN User Part are contained in ANSI T1.113-1988.

12.3.2. ISDN User Part formats and codes

The CPG carries the Event Information Indicators parameter and the Business Group parameter to support MBG Call Transfer. The Business Group parameter format is given in the stage-3 service description for the MBG Basic Call. The Event Information Indicators parameter format is given in the Stage 3 Call Forwarding Service.

Bit 8 is coded 0 to indicate "no indication," and the remainder of the octet is coded "1101111" to indicate "service information included."

12.3.3. ISDN User Part procedures

If the transfer controller has disconnected to perform a transfer, and when MBG information for the add-on party is received in an ACM, CPG, or ANM, restriction screening is performed to determine if the transfer is allowed.

When the following conditions are satisfied:

- a transfer controller disconnects to perform a transfer;

- the controlling exchange has received an ANM for the add-on party leg, and

- one of the remaining legs in the two-way connection is an MBG leg and the other is a non-MBG leg,

the controlling exchange sends an CPG toward the exchange serving the MBG party. The CPG includes the following parameters:

- the Event Information Indicators parameter containing an event indication "service information included" (coding 1101111) and an event presentation restricted indicator "no indication" (coding 0);

- the Business Group Parameter with a party selector coded to indicate "connected party" and a Business Group Identifier coded "0000...0001" to indicate "public network."

The MBG exchange receiving the CPG coded as above updates the mark associated with the interexchange circuit to indicate "non-MBG call."

12.3.4. Interactions

None identified.

12.3.5. Interworking

Because this service requires ISDN User Part, there are no interworking considerations (other than the release of a call if no SS7-supported facilities are available).

12.3.6. Message flow diagrams

Figure 42 illustrates the message flows for MBG call transfer.

CPG (Public Network Party Update)

Existing Party
(Public Network Party)

Controller In MBG
(Disconnects to Perform Transfer)
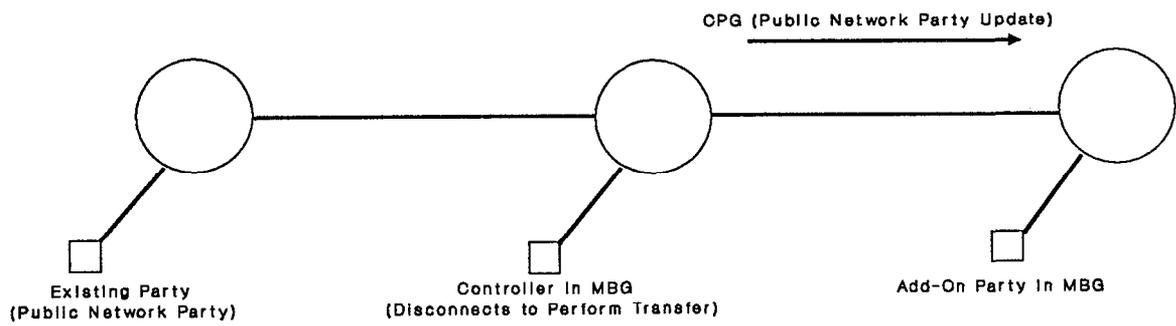
Add-On Party In MBG

**Figue 42
MBG Call Transfer Message Flow**

13. Multilocation Business Group (MBG) Call Waiting Originating and Dial Call Waiting

The following description covers the Intra-LATA service.

13.1. MBG Call Waiting Originating and Dial Call Waiting, Stage-1 description (User perspective)

13.1.1. Definition

These two call waiting features allow call waiting treatment to be provided to calls to busy non-ISDN stations in the same MBG even if the busy called station does not subscribe to the call waiting terminating feature.

(Note: Call waiting terminating is a terminating switch feature for non-ISDN stations that alerts the terminating station about an incoming call when the station is busy.)

These two call waiting features allow members in a multilocation business group (MBG) that are in geographically distant locations to have the call waiting originating (CWO) and dial call waiting (DCW) services as though they were at one locality.

13.1.2. Description

13.1.2.1. General description

MBG CWO is an originating feature for non-ISDN stations that automatically applies call waiting treatment for calls to busy non-ISDN stations in the user's MBG.

MBG DCW is an originating feature for non-ISDN stations that allows the user to invoke call waiting treatment for calls to busy non-ISDN stations in the user's MBG.

If the calling non-ISDN station has subscribed to MBG CWO or has invoked MBG DCW for an MBG call and the called non-ISDN station is busy, the called user shall be given a call waiting tone. The called user can toggle between the original call and the new call by flashing the switch-hook. When the called station flashes the switch-hook the first time, the original call is placed on hold and the called station is connected with the new call.

13.1.2.2. Specific terminology

13.1.2.2.1. CWO (DCW) User

This is a user who is subscribed to CWO (DCW).

13.1.2.2.2. Called party

This is the member who is to receive a call from the user.

13.1.3. Procedures

13.1.3.1. Provision and withdrawal

The user shall subscribe to have or drop the CWO or DCW feature. Only one feature, CWO or DCW, is normally subscribed per user.

13.1.3.2. Normal procedures

13.1.3.2.1. Activation, deactivation, and registration

Activation for CWO feature is handled automatically by the network. The CWO feature is always activated until the CWO user withdraws the feature.

The DCW feature is normally deactivated. The DCW user can activate the DCW feature on a per-call basis by dialing an access code after getting the dial tone. After hearing the second dial tone,

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the DCW user then dials the desired called number. The DCW feature is deactivated when the call is disconnected.

13.1.3.2.2. Invocation and operation

When the CWO user originates an MBG call (see clause 10) or the DCW user invokes the DCW feature for an MBG call to the called party, CWO or DCW shall be invoked. CWO and DCW feature differentiation is required because the CWO or DCW feature interacts differently with other features such as Call Forwarding Unconditional (CFU). DCW has precedence over CFU and CFU has precedence over CWO. DCW should therefore have precedence over CWO. When the call arrives at the terminating end, it is first determined if the call is allowed to terminate and whether it is an intragroup call. Then, if the called party is busy and does not have any feature in activation that may precede the CWO or DCW feature, a call waiting tone shall be applied to the called party.

The called party may or may not have subscribed to any terminating call waiting features such as the call waiting terminating feature. But when the called party hears a call waiting tone, indicating that either CWO or DCW is being applied to the called line, the called party can place the original call on hold and talk to the CWO or DCW user.

These two call waiting features may be impacted by the MBG structure (e.g., the call waiting treatment for CWO or DCW shall be applied to a busy called party only when the calling and called parties are in the same subgroup) if the service providers desire to do so.

13.1.3.3. Exception procedures

13.1.3.3.1. Activation, deactivation, and registration

None identified.

13.1.3.3.2. Invocation and operation

If the user and called party are not in the same MBG, neither DCW or CWO shall apply. If the called party is idle, call waiting treatment shall not be provided.

13.1.3.4. Alternate procedures

None identified.

13.1.4. Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

13.1.5. Interworking considerations

If the CWO or DCW indication is lost due to interworking during the call set-up, the call shall be treated like a normal call.

13.1.6. Interactions with other supplementary services

If the called party has activated a feature that takes precedence over the CWO or DCW feature, interswitch calls within the same MBG for which CWO or DCW has been activated shall not be given call waiting treatment. For example, Cancel Call Waiting may have precedence over CWO or DCW. (Cancel Call Waiting is a terminating option for Non-ISDN stations that allows a user to inhibit call waiting tone for the duration of a call.) If the call is not to be forwarded, the user (calling party) shall be given busy treatment. If the call is to be forwarded to a station in the same MBG at another switch, the CWO or DCW indication should be included in the new call set-up message. The priority of features that interact with the CWO or DCW feature is specified by the service providers.

13.1.6.1. MBG Basic Call

DCW or CWO feature can be invoked only on MBG calls. DCW or CWO indication should not be sent if a call is routed as POTS call.

13.1.6.2.   MBG Three-Way Calling and N-Way Conferencing

When the conference controller sets up a new call to the add-on party, the controller can invoke the DCW feature by dialing the DCW access code or the CWO feature if the controller has subscribed to CWO feature.

13.1.6.3.   MBG Call Transfer

When the transferring party sets up a new call to the transferred-to party, the controller can invoke the DCW feature by dialing the DCW access code or the CWO feature if the controller has subscribed to CWO feature.

13.1.6.4.   Call Forwarding

The DCW or CWO feature may have precedence over some call forwarding features. CWO and DCW have precedence over CFB, DCW has precedence over CFU, and CFU has precedence over CWO.

If the called party has activated a call forwarding feature that takes precedence over the CWO or DCW feature, an inter-switch call within the same MBG from which CWO or DCW has been activated shall not be given call waiting treatment and shall be forwarded. If the call is to be forwarded to a station in the same MBG at another switch, the CWO or DCW indication should be passed onto the new call.

If the called party has activated a call forwarding feature that does not take precedence over the CWO or DCW feature, an inter-switch call within the same MBG from which CWO or DCW has been activated shall not be forwarded and shall be given call waiting treatment.

13.1.6.5.   MBG AC and AR

AC and AR activation takes precedence over DCW or CWO activation when users activate both AC and AR and DCW and CWO simultaneously.

13.2.   MBG Call Waiting Originating and Dial Call Waiting, Stage-2 description (Information flows)

These two call waiting features allow members in a Multilocation Business Group (MBG) that are served by different switches to have the Call Waiting Originating (CWO) and Dial Call Waiting (DCW) services as though they are served by only one switch. The expansion of CWO and DCW features from intra-switch to inter-switch is transparent to the user.

13.2.1.   Functional model

The MBG CWO or MBG DCW feature may be performed by the two switches that serve the user and the called party. The call set-up may involve the originating, terminating, and intermediate switches.

13.2.1.1.   Specific terminology

13.2.1.1.1.   Exchange A Functional Entity

This is the network node that serves the user. Exchange A is an entity that recognizes that a CWO or DCW indication should be included in the call set-up message.

13.2.1.1.2.   Exchange B Functional Entity

This is the network node that serves the called party. Exchange B is an entity that applies a call waiting tone to the called party when applicable after receiving a call set-up message with the CWO or DCW indication.

13.2.1.1.3. Exchange C Functional Entity

This is an intermediate network node that may sometimes be involved in the call set-up between Exchange A and Exchange B. Exchange C is an entity that shall pass the CWO or DCW indication and the MBG related information unchanged.

13.2.1.2. Limiting assumptions

It is assumed that Exchange A, Exchange B, and Exchange C are equipped with SS7 and have SS7 connectivity between them. Exchange A, Exchange B, and Exchange C may not be in the same network if an MBG customer spans more than one network.

13.2.2. Normal procedures

The information flows for MBG CWO and DCW are shown in figures 43 and 44.

13.2.2.1. General description

The following discussion applies when a CWO user originates an inter-switch MBG call or a DCW user activates DCW for an inter-switch MBG call, and the called party is served by a different switch.

When Exchange A receives a request to set up an inter-switch MBG call, if the user has the CWO feature or has activated the DCW feature, Exchange A shall include a CWO or DCW indication in the call set-up message when the originating access restriction screening is successful. This shall be sent along with MBG Basic Call information (e.g., MBG Identifier, Subgroup Identifier, Line Privileges, and attendant status). If the user originates a POTS call or originates an MBG call that would be routed as a POTS call, the CWO or DCW indication shall not be included in the call set-up.

When Exchange C receives a call set-up message with the MBG information (including the CWO or DCW indicator), it should forward the MBG information in the new call set-up message if an outgoing SS7 trunk circuit is reserved for the call.

When Exchange B receives a call set-up message with a CWO or DCW indication and other MBG information from Exchange C, it may be required to perform gateway functions if Exchange C is in a different network. It then determines if the call is allowed to terminate (originating and terminating restriction screening) and whether it is an intragroup call. If the called party is busy and does not have any feature in activation that may precede the CWO or DCW feature, Exchange B shall apply a call waiting tone to the called party.

13.2.2.1.1. Activation, deactivation, and registration

Activation for CWO feature is handled automatically by the network. The CWO feature is always activated until the CWO user withdraws the feature.

The DCW feature is normally deactivated. The DCW user can activate the DCW feature on a per-call basis. The DCW feature is deactivated after the call is disconnected.

Exchange A

Exchange B

Setup

+ CWO or DCW Indication, other
MBG call related Information
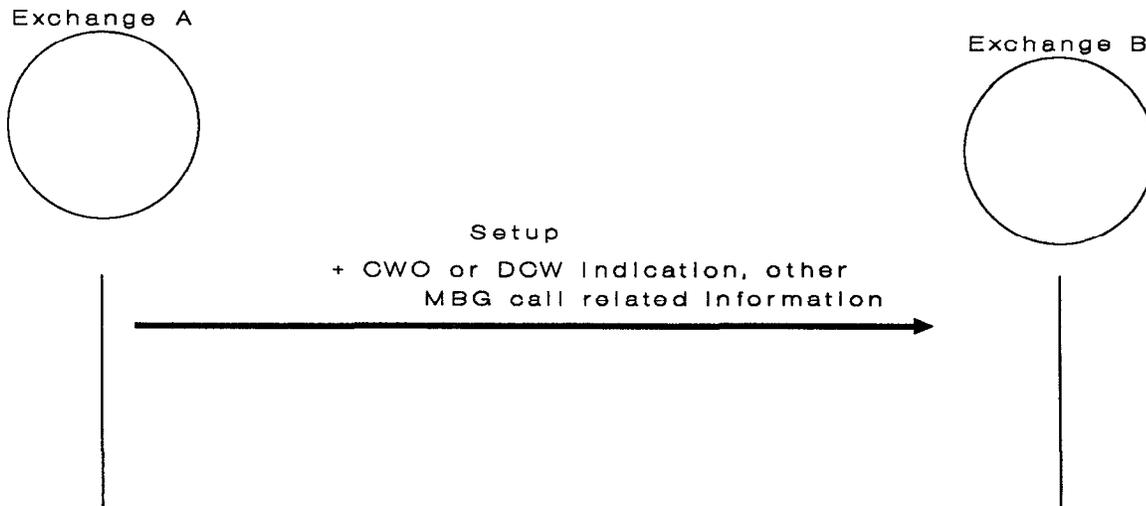
Figure 43

Information flow, Exchange C not involved

Exchange A

Exchange C

Exchange B

Setup

+ CWO or DCW Indication,
other MBG call related
Information

Setup

+ CWO or DCW Indication,
other MBG call related
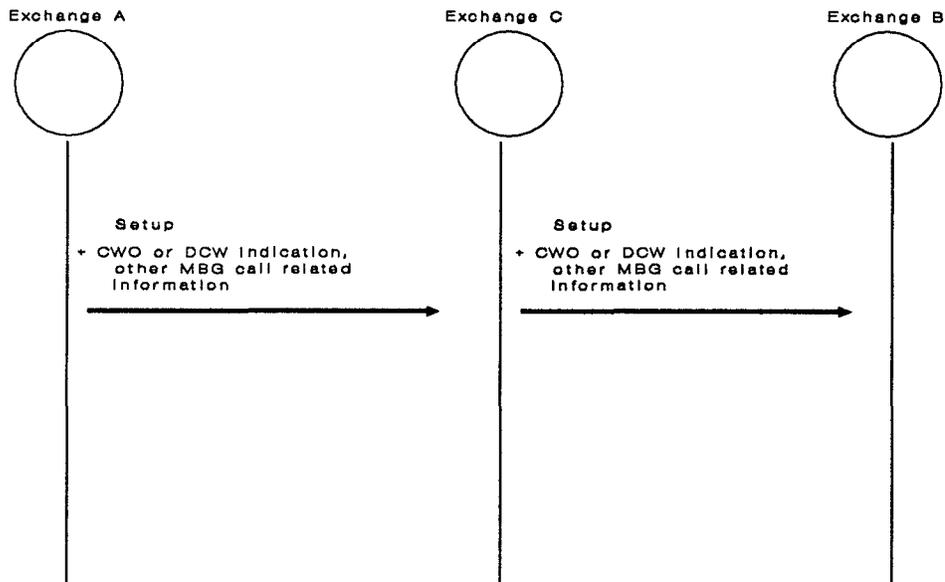Information

Figure 44

Information flow, Exchange C involved

13.2.3.   Exceptional procedures

If the user and called party are not in the same MBG, neither DCW or CWO shall apply. If the called party is idle, call waiting treatment shall not be provided.

If the called party is busy and has activated a non-call forwarding feature that takes precedence over the CWO or DCW feature, interswitch calls within the same MBG for which CWO or DCW has been invoked shall not be given call waiting treatment. The user (calling party) shall be given busy treatment. For example, Cancel Call Waiting may have precedence over CWO or DCW.

If the called party has activated a call forwarding feature that takes precedence over the CWO or DCW feature, interswitch calls within the same MBG for which CWO or DCW has been invoked shall not be given call waiting treatment and shall be forwarded. For example, Call Forwarding un-conditional may have precedence over CWO or DCW. The new call set-up message should in-clude the CWO or DCW indication if the call is to be forwarded to another switch.

If the CWO or DCW indication is lost due to interworking during the call set-up, the call shall be treated like a normal call.

13.3. MBG Call Waiting Originating and Dial Call Waiting Services, Stage-3 description (SS7 protocols)

13.3.1. General description

This subclause gives the stage-3 description for the Multilocation Business Group, Call Waiting Originating (CWO) and Dial Call Waiting (DCW) services. It describes the additions to the ISDN-UP protocol, the Service Activation Parameter (SAP) to support these two call-waiting services.

13.3.2. ISDN User Part formats and codes

13.3.2.1. Service Activation parameter

Service Activation is information sent in the forward or backward direction to invoke specific fea-ture operations at the terminating or originating switch. The Service Activation Parameter is a vari-able length parameter and is an optional parameter of the IAM. The name code of the parameter is 11100010. The format and encoding of the parameter is shown in table 24:

Table 24

Format of Service Activation Parameter

	8	7	6	5	4	3	2	1
1	Feature Code X1							
2	Feature Code X2							
:	:							
n	Feature Code Xn							

The following codes are used in the Service Activation parameter field.

01111100	call waiting originating invoked
01111101	dial call waiting invoked

This parameter is an optional parameter in the Initial Address Message.

13.3.3. Procedures

The SDLs for the functional entities are shown in figures 45-47 and the message flows are in figures 48 and 49. When an MBG station originates an MBG call (see clause 10) that fails the originating access restriction screening, the calling MBG station is given a call denial treatment. If the restriction screening is successful, the originating switch shall formulate an IAM following the procedures described for MBG Basic Call. If the calling MBG station has subscribed to the CWO feature or has invoked the DCW feature, the originating switch should include the SAP in the IAM.

If the MBG station has invoked the DCW feature, whether it has subscribed to the CWO feature or not, the originating switch should include a feature code "00000001" in the SAP indicating dial call waiting invoked. If the calling MBG station did not invoke the DCW feature but has subscribed to the CWO feature, the originating switch should include a feature code "00000000" in the SAP indicating call waiting originating invoked. The length indicator of the SAP shall be set based on the number of feature codes carried in the SAP. It is set to a value of 1 if there is only one feature code. The IAM is then sent out.

When an intermediate switch receives an IAM with the MBG information, it should follow the procedures described for MBG Basic Call. That is, it should carry the received MBG information including the SAP in the new IAM if an outgoing SS7 trunk circuit is reserved for the call.

When the terminating switch receives an IAM with MBG information and SAP, it should first follow the procedures described for MBG Basic Call. If the call is not allowed to be terminated due to originating or terminating restriction screening failure, the call is given a denial treatment. If the called station is idle, the call is given a normal termination treatment. If the called station is busy and it has another incoming call waiting to be answered, the call is given a busy treatment. If the called station is busy, its call waiting is not in effect and the calling and called stations are not in the same MBG, the call is given a busy treatment. The denial, normal termination, and busy treatments are described in stage 3 description for MBG Basic Call. If the called station is busy, its call waiting is not in effect and the calling and called stations are in the same MBG, the terminating switch should check whether the called station has activated any feature that precedes the CWO or DCW. If not, the called station is given a call waiting treatment. If so and the call is not to be forwarded, the call is given a busy treatment. If so and the call is to be forwarded, the call is given a call forwarding treatment.

13.3.4.   Interactions

If the user and called party are not in the same MBG, neither DCW or CWO applies. If the called party is idle, call waiting treatment shall not be provided.

If the called party is busy and has activated a non-call forwarding feature that takes precedence over the CWO or DCW feature, interswitch calls within the same MBG for which CWO or DCW has been invoked shall not be given call waiting treatment. The user (calling party) shall be given busy treatment. For example, Cancel Call Waiting may have precedence over CWO or DCW.

If the called party has activated a call forwarding feature that takes precedence over the CWO or DCW feature, interswitch calls within the same MBG for which CWO or DCW has been invoked shall not be given call waiting treatment and shall be forwarded. For example, Call Forwarding Unconditional may have precedence over CWO or DCW. The new call set-up message should include the CWO or DCW indication if the call is to be forwarded to a station in the same MBG at another switch.

If the user originates a non-MBG call or originates an MBG call but would be routed as a non-MBG call, the CWO or DCW indication shall not be included in the IAM.

13.3.5.   Interworking

If the CWO or DCW indication is lost due to interworking during the call set-up, the call shall be treated like a normal call.
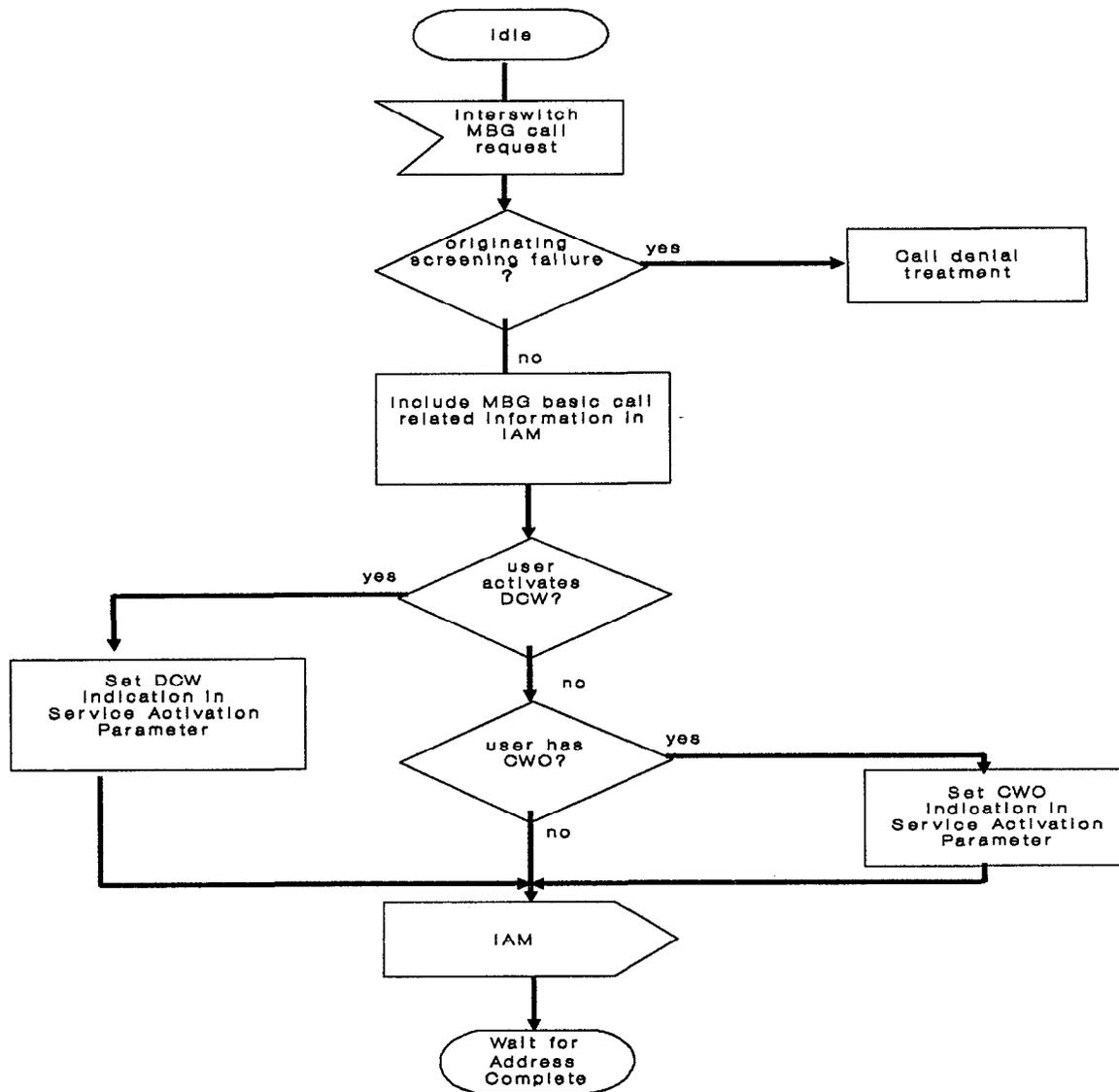
Figure 45
SDL Diagram at Exchange A
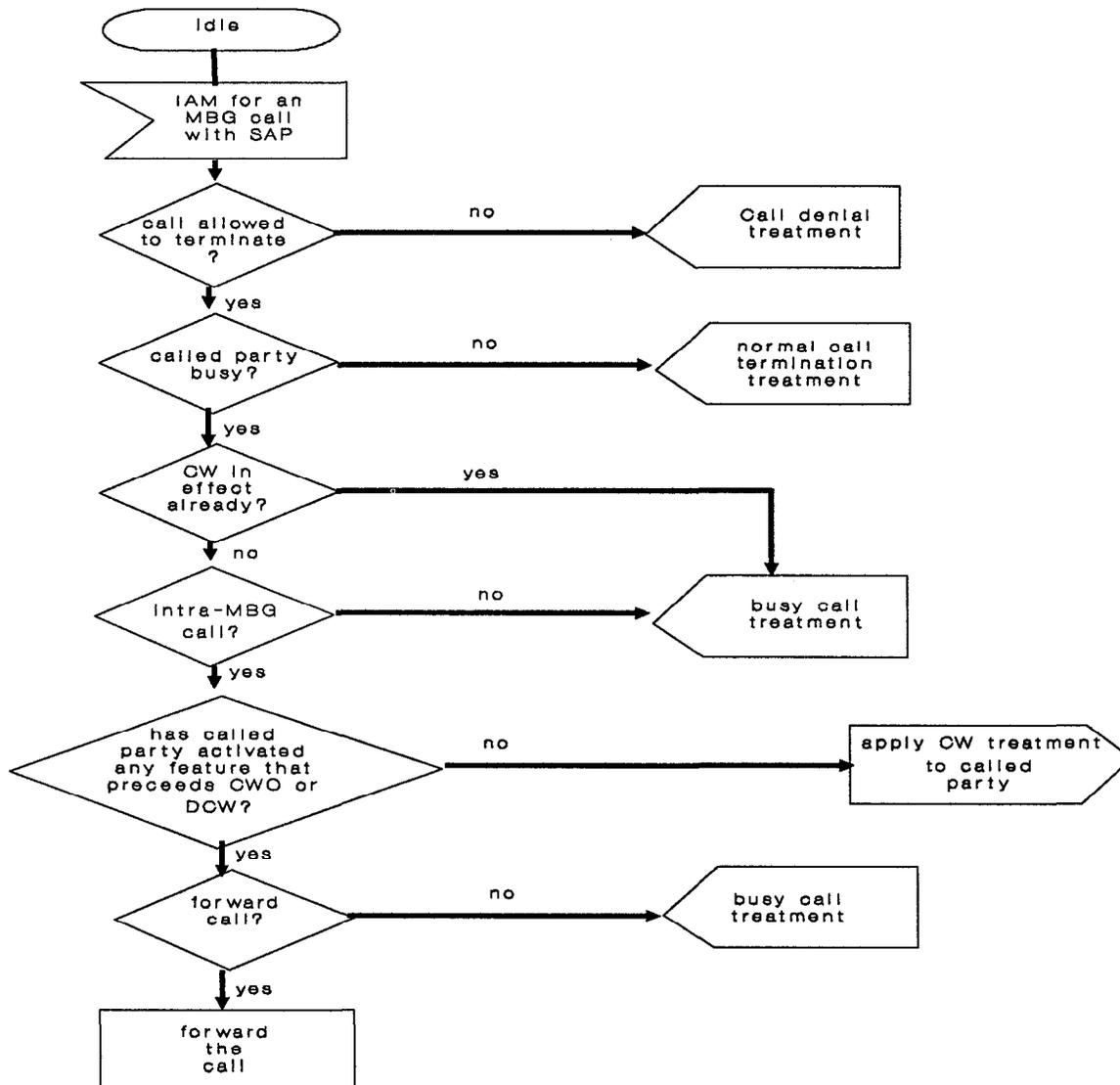
Figure 46
SDL Diagram at Exchange B
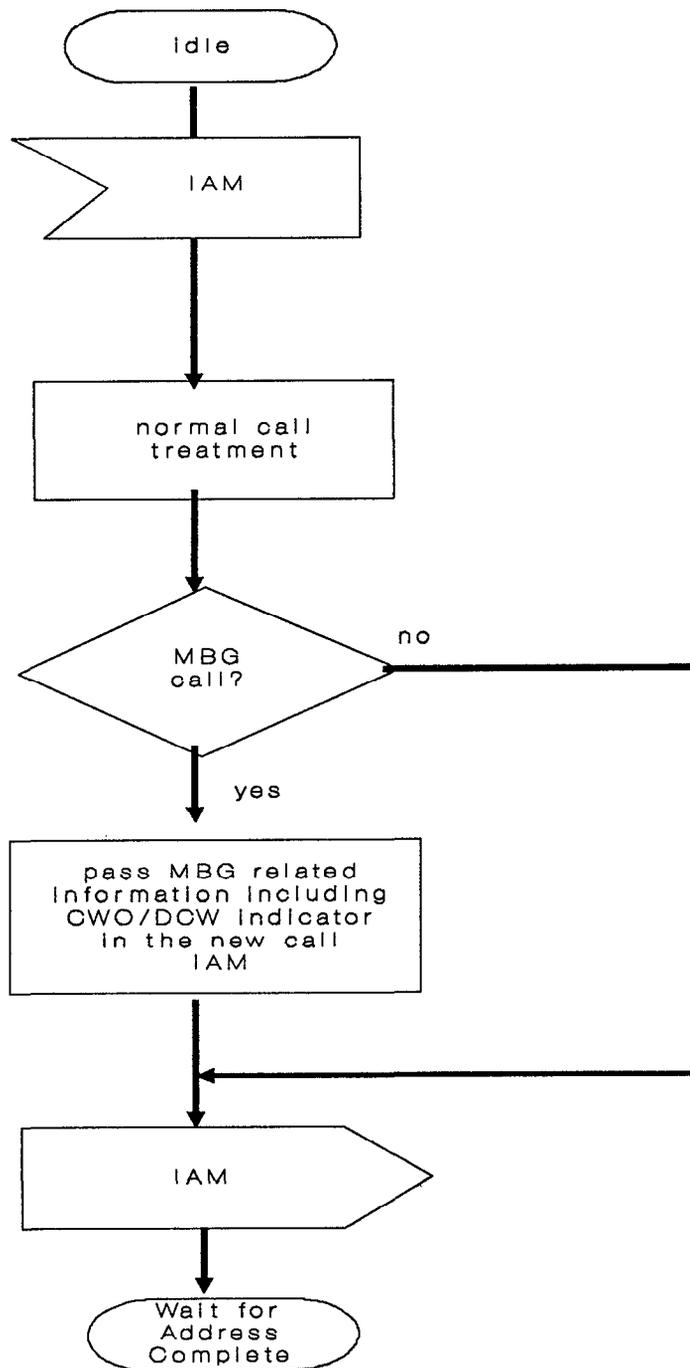
Figure 47
SDL Diagram at Exchange C

Exchange A

Exchange B

IAM

Service Activation Parameter
+ MBG Information
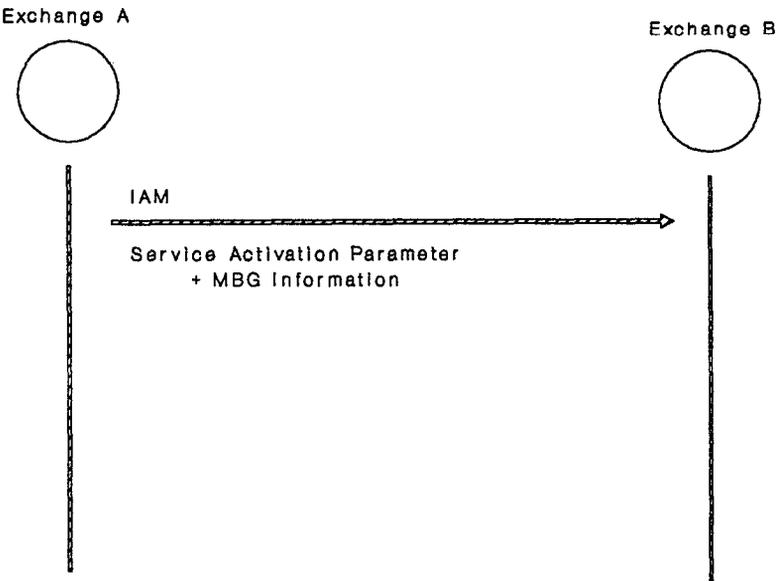
Figure 48
Information Flow, Exchange C not Involved

Exchange A

Exchange C

Exchange B

IAM

Service Activation Parameter
+ MBG Information

IAM

Service Activation Parameter
+ MBG Information

Figure 49
Information Flow, Exchange C Involved

14. Multilocation Business Group (MBG) N-Way Conferencing

The following description covers the Intra-LATA service.

14.1. MBG N-Way Conferencing, Stage-1 description (User perspective)

14.1.1. Definition

The MBG N-Way conferencing feature allows members in an MBG that are located in geographically distant locations to have a multiparty conferencing service as though they are at one locality

Note: Three-way conferencing works slightly differently from N-way conferencing, e.g., an access code is not required to activate the three way conferencing feature.

14.1.2. Description

14.1.2.1. General description

Multilocation Business Group N-Way Conferencing (MBG NWC) is an originating feature that allows the MBG non-ISDN stations to form an N way conference call where the line privileges are checked before adding on a party to an existing conference call.

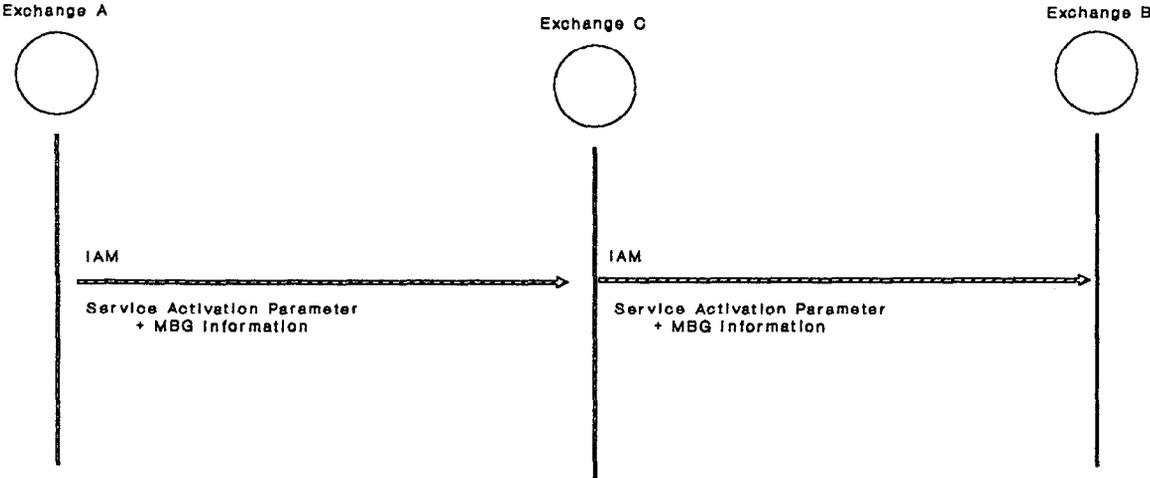An access code needs to be dialled to activate the N-Way Conferencing feature. The station that activates this feature is called the conference controller. During the conference call, the controller can flash the switch-hook to place the conference call on hold and initiate a new call. The controller then flashes the switch-hook again to add the new party to the conference call.

14.1.2.2. Specific terminology

14.1.2.2.1. User

This is the subscriber who has subscribed to MBG NWC service.

14.1.2.2.2. Station x(i)

This is the ith station that is to be added to the N-way conference call. Up to N-1 stations can be added onto the N-way conference call.

14.1.3. Procedures

14.1.3.1. Provision and withdrawal

The user shall subscribe to have or to drop the MBG NWC feature.

14.1.3.2. Normal procedures

14.1.3.2.1. Activation, deactivation, and registration

The user can activate the MBG NWC feature in two ways:

a) By dialing an access code upon receiving a dial tone when the user first originates a call;

b) By dialing an access code upon receiving a dial tone when the user flashes the switchhook during the conversation with station x(1).

Other procedures may also be possible. For example, the user can flash the switchhook during the conversation with station x(1) and dial a "Call Hold" access code upon receiving a dial tone. The user can then dial a "N-way conferencing" access code upon receiving a dial tone.3

14.1.3.2.2. Invocation and operation

When the user activates the MBG NWC feature and no call exists before activation, the user receives dial tone. The user dials the number of the first party to be added (e.g., station x(1)). Station x(1) is added when it answers. To add other parties to the conference call, the user flashes

the switchhook, receives dial tone, and dials the number of the next conferee. The user flashes to bring all parties together, and flashes again to get dial tone.

If a two-party call exists (e.g., between the user and station x(1)), the user flashes the switch-hook, the active call is placed on hold, and the user receives dial tone. The user dials the MBG NWC access code. The user again receives a dial tone and dials the number of the next conferee. If the call is answered, the user flashes to bring all parties together. The user flashes again to get dial tone.

14.1.3.3.   Exception procedures

14.1.3.3.1.   Activation, deactivation, and registration

None identified.

14.1.3.3.2.   Invocation and operation

If a conference call (at least three parties including the user) exists before the user activates the MBG NWC, the MBG NWC activation is denied and the user shall be given the denial treatment.

If the user cannot setup a connection to the add-on party owing to a situation such as busy, overflow, no answer, or restriction screening failure, the treatment given to the user is determined by the service provider. Some options are:

- The user can reestablish the connection to the existing conferee(s), if any.

- Note - For example, the user can abandon the call. The connection to the new conferee is disconnected and the user's line is rung back immediately. If the user answers, the connection to the existing conference is reestablished.

- The user can choose to be reconnected to the existing conferee(s) or originate a new call to add-on a new party while the existing party (conferees) remains (remain) on hold.

When the user initiates the add-on request, the request to connect the add-on party to the conference call is denied if the restrictions do not allow the add-on or there are already N-1 conferees. The treatment given to the user is determined by the service provider. Some options are:

- The connection to the add-on party is released and the user is reconnected to the existing conferee(s).

- The user can place the add-on party on hold and reestablish the connection to the existing conferee(s), if any. The user can then toggle between the add-on party and the existing conferee(s) by flashing the switchhook.

- The add-on party is placed on hold and the user can choose one of multiple options.

The network is given the option not to check the access restrictions between the add-on party and any existing conferee.

14.1.3.4.   Alternate procedures

None identified.

14.1.4.   Network Capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

14.1.5.   Interworking considerations

If the network does not have or cannot get the MBG information of an existing conferee, this conferee is treated as a station outside the user's MBG.

The same interworking considerations that apply to the MBG Basic Call apply to the setup of the call between the controller and the add-on party.

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14.1.6.   Interaction with other supplementary services

14.1.6.1.   MBG Basic Call

When a call is established between the N-way conference controller and the add-on party after the conference call is put on hold, all rules associated with the MBG Basic Call are upheld. For example, if the N-way conference controller and the add-on party are not allowed to communicate in a Basic Call, the call setup between them is denied.

14.1.6.2.   Three-Way Calling and N-Way Conferencing

If a conferee on an N-way conference call is also a conference controller, its conferees do not affect the restriction screening associated with the original N-way conference call. If this conferee disconnects, which does not result in a call transfer, the restrictions of the conference controller are still used for restriction screening purposes in the original N-way conference call. See 14.1.6.3 if the conferee disconnects, which results in a call transfer.

14.1.6.3.   MBG Call Transfer

If a conferee on an N-way conference call transfers the call to a station in the same MBG, the transferred party becomes the new conferee but the transferring conferee's access restriction is used for restriction screening purpose.

If a conferee on an N-way conference call transfers the call to a station outside the MBG, the transferred party becomes the new conferee and this new conferee's access restriction is used for restriction screening purpose.

14.1.6.4.   MBG Call Forwarding

If the add-on party in an N-way conference call has call forwarding service and the call is to be forwarded, the access restriction of the forwarded-to party shall be used for screening when the forwarded-to party is to be added to the conference call.

14.2.   MBG N-Way Conferencing, Stage-2 description (Information flows)

14.2.1.   Functional model

14.2.1.1.   Specific terminology

14.2.1.1.1.   Exchange A Functional Entity

Exchange A is an entity that serves the user. Exchange A recognizes the MBG N-Way Conferencing (NWC) activation, collects MBG information about the existing conferees when necessary, and checks whether the new conferee can be added to the conference call.

14.2.1.1.2.   Exchange B(i) Functional Entity

Exchange B(i) is an entity that serves an existing conferee or a new conferee x(i). It receives an MBG information request from, and would return the requested MBG information to, Exchange A.

14.2.2.   Normal procedures

The information flows for the MBG N-Way Calling service are shown in figures 50 and 51 and the SDLs for the functional entities are in figures 52 through 54.

14.2.2.1.   General description

When Exchange A detects an MBG NWC activation and a two-party call between the user and station x(1) exists before the MBG NWC activation, it shall immediately put station x(1) on hold, return a recall dial tone to the user and send a message to Exchange B(1) requesting station x(1)'s MBG information if the existing call is an MBG call. Exchange B(1) shall then return the requested MBG information about station x(1). Exchange A shall store station x(1)'s MBG information.

(If Exchange A does not have and cannot get the MBG information of an existing conferee, this particular conferee is assumed to be outside the user's MBG.)

If the network chooses not to check the line privileges between the add-on party and any existing conferee, Exchange A need not request station x(1)'s MBG information.

If no call exists before the MBG NWC activation, Exchange A only returns the recall dial tone.

If the user flashes the switch-hook during a conference call after MBG NWC activation, Exchange A puts the existing conferee(s) on hold and returns a recall dial tone to the user.

Exchange A then receives the dialled digits from the user and determines that it needs to set up an inter-switch MBG call between the user and station x(i). It includes a request for x(i)'s information together with the user's MBG information (e.g., MBG ID, SG ID, LP, and attendant status) in the call setup message. Exchange B(i) shall then check subgroups and line privileges for the controller and add-on parties and return the requested MBG information about station x(i) in the Report Alerting and optionally in the Connect Message (if the MBG information changes after report (Alerting)). Exchange A shall store the received MBG information. Normal call processing occurs between the user and station x(i).

When the user flashes the switch-hook indicating an add-on request, Exchange A should first check whether the new conferee is allowed to be added to the existing conference call. Exchange A is required to check the new conferee against those existing conferees that are added-on by the user. Exchange A needs not check the new conferee against those conferees that are not added-on by the user. However, the network has the option not to check the line privileges between the add-on party and any existing conferee.

The same procedures are repeated when the user adds-on a new conferee to the conference call. Up to N-1 parties other than the user are allowed in a N-way conference call.

When the user is still associated with the conference call, individual conferees can abandon without affecting the conference call.

14.2.2.1.1.   Activation, deactivation, and registration

The MBG NWC user shall first dial an access code to activate this feature. The user is allowed to activate this feature only if no call or a two-party call exists before the MBG NWC activation.
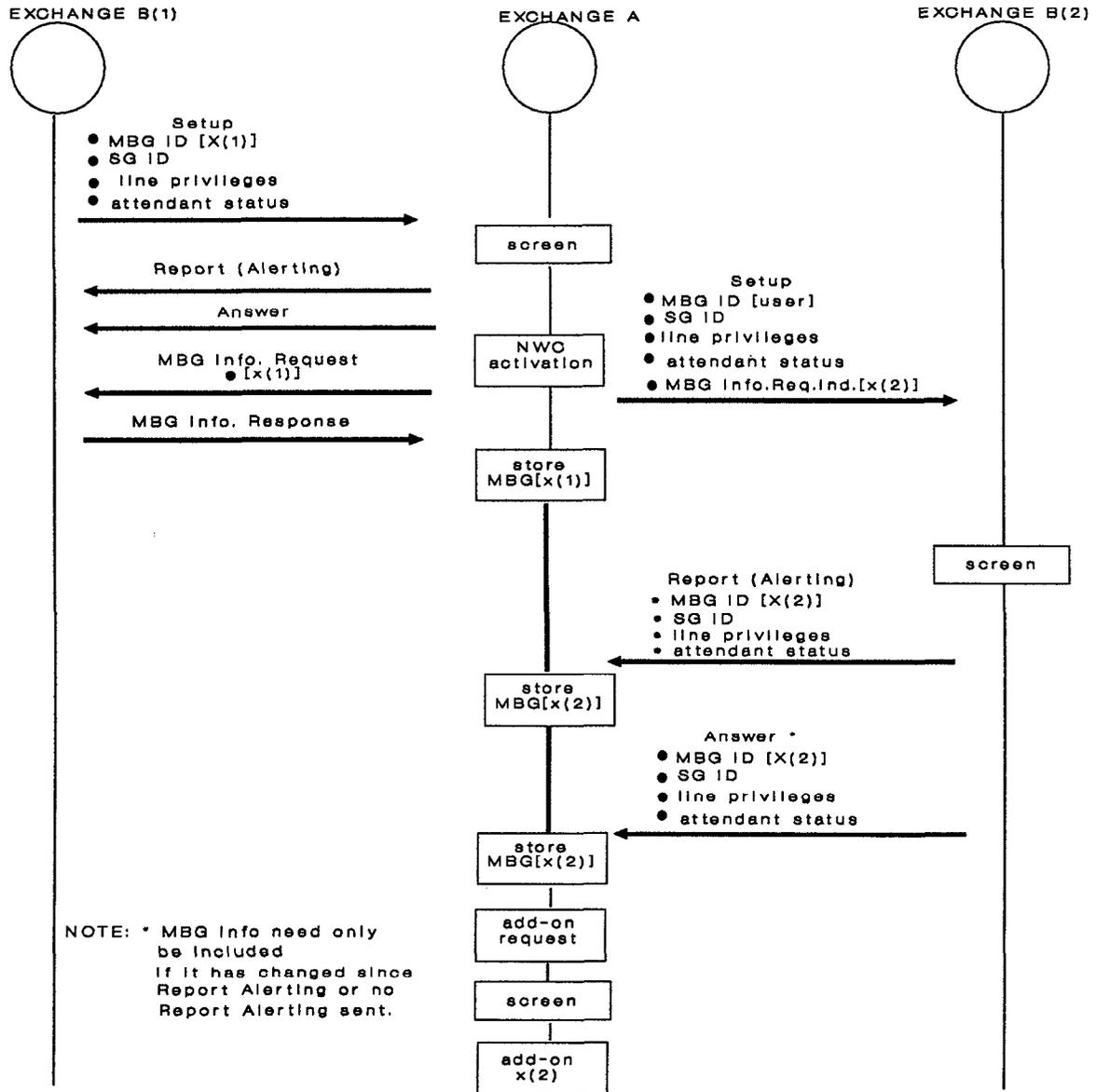
Figure 50
Information flow, Existing two-party call
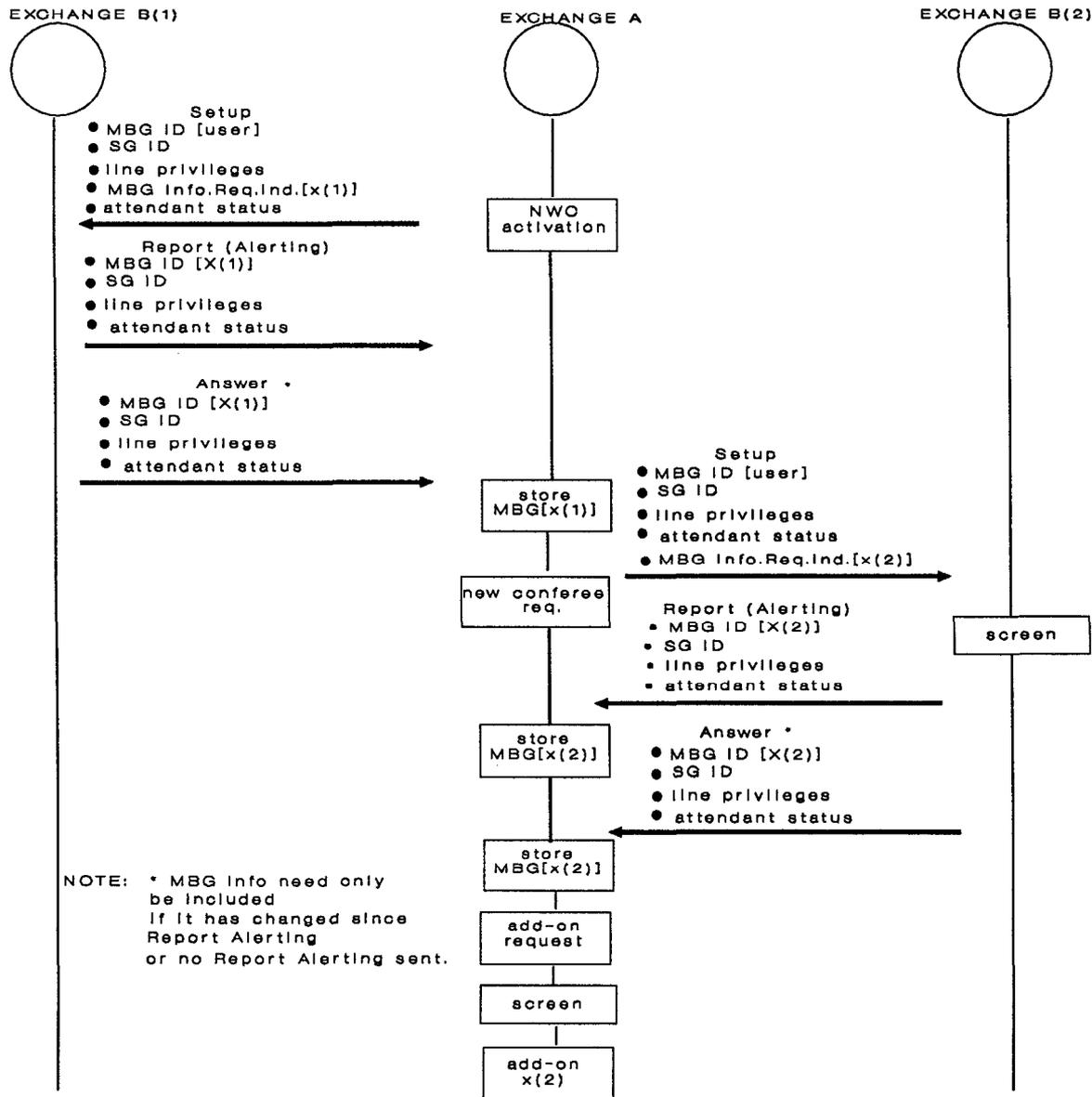
Figure 51
Information flow, No existing call

14.2.3. Exceptional procedures

If a conference call (at least three parties including the user) exists before the user activates the MBG NWC, the MBG NWC activation is denied and Exchange A shall give the user a denial treatment.

14.2.3.1. Error recovery procedure A

If the user cannot setup a connection to the add-on party due to a situation such as network congestion or restriction screening failure, the treatment given to the user is determined by the service provider. Some options are:

- The user can reestablish the connection to the existing conferee(s), if any;
- The user can choose to be reconnected to the existing conferee(s) or originate a new call to add-on a new party while the existing party (conferees) remains (remain) on hold.

14.2.3.2. Error recovery procedure B

When the user initiates the add-on request, the request to connect the add-on party to the conference call is denied if the restrictions do not allow the add-on or there are already N-1 conferees. The treatment given to the user is determined by the service provider. Some options are:

- The connection to the add-on party is released and the user is reconnected to the existing conferee(s);
- The user can place the add-on party on hold and reestablish the connection to the existing conferee(s), if any. The user then toggles between the add-on party and the existing conferee(s) by flashing the switch-hook;
- The add-on party is placed on hold and the user can choose one of multiple options.

The network is given the option not to check the line privileges between the add-on party and any existing conferee.

If the new conferee is not added-on to the conference call or an existing conferee disconnects, Exchange A should discard the MBG information of that party.

If the user abandons, the conference call shall be left intact unless:

- there is only one party left on the call;
- none of the remaining parties is a station or private facility in the user's MBG;
- none of the remaining connections is a line or incoming trunk with respect to Exchange A.

Additional conditions may apply, if so desired by the service provider.
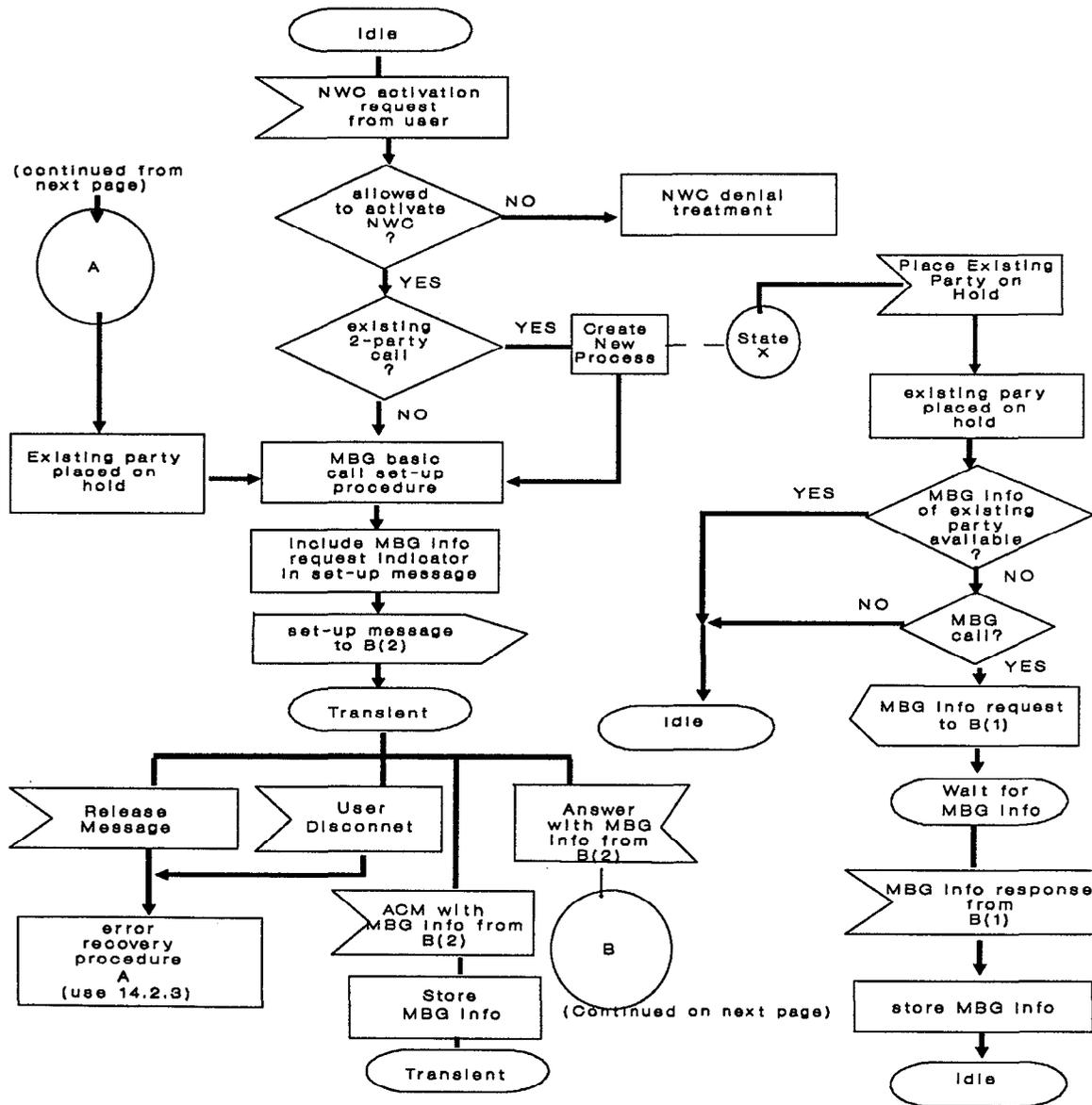
Figure 52
SDL Diagram at Exchange A

(Continued from preceding page)

B

store MBG Info

Wait for
add-on
request

user
disconnect

error
recovery
procedure A

add-on
request

allowed
to
add-on
?

NO

error
recovery
procedure
B
(see 14.2.3)

YES

conference
call

new conferee
request

A

(continued on preceding page)
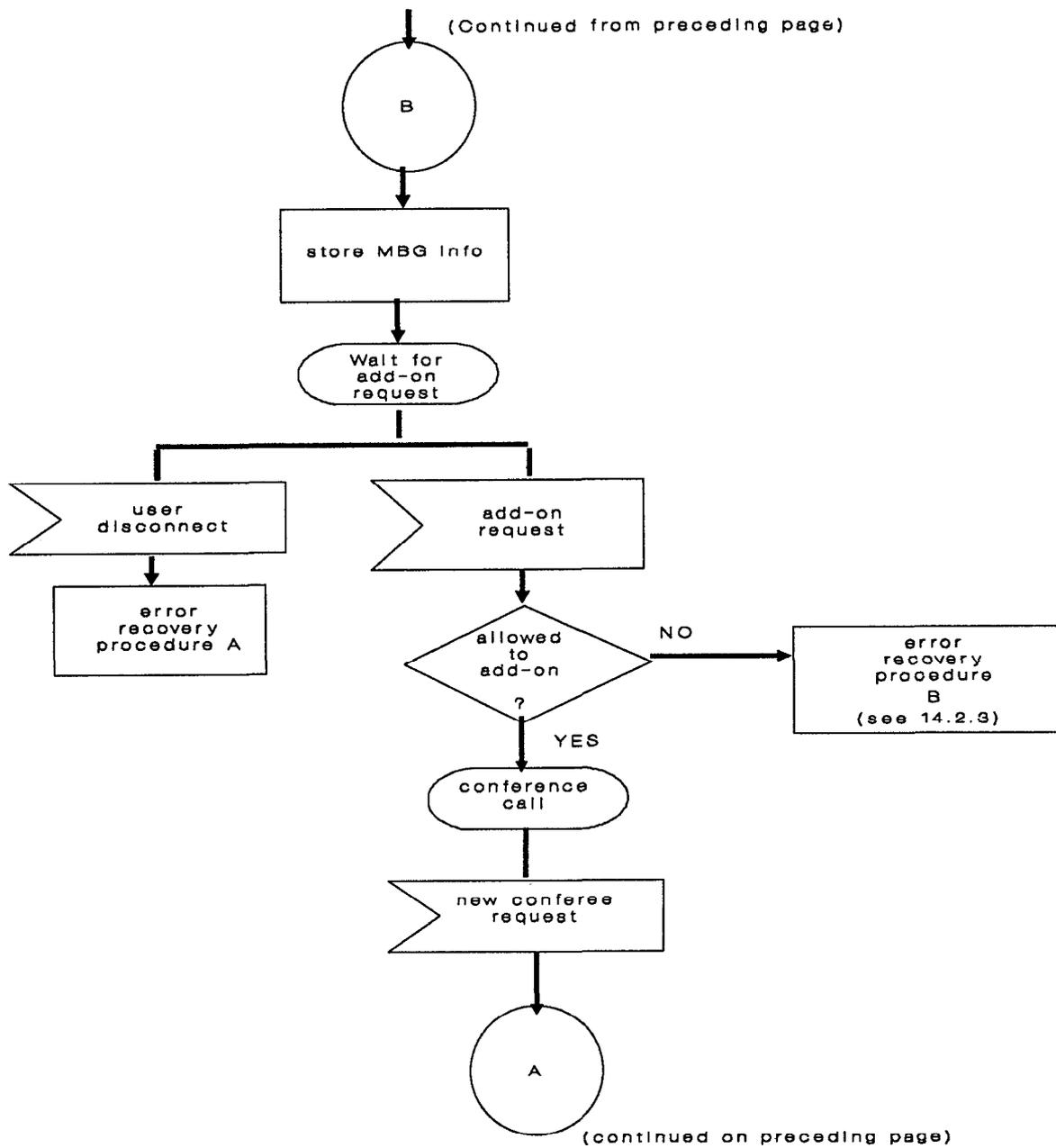
Figure 53
SDL Diagram at Exchange A
(Part 2)
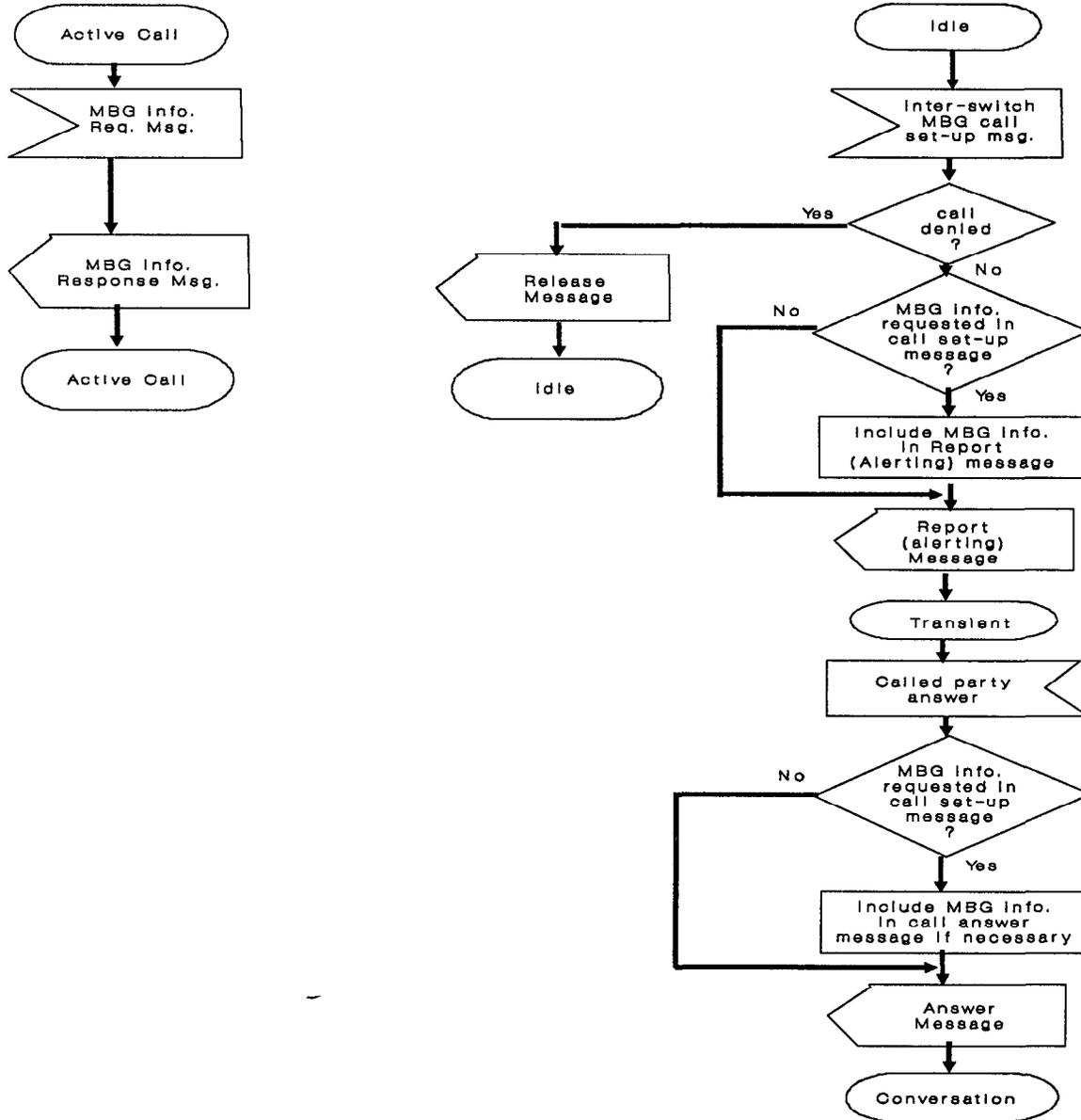
Figure 54
SDL Diagram at Exchange B(i)

14.3.   MBG   N-Way Conferencing Stage-3 description (SS7 protocols)

14.3.1.   General description

MBG N-Way Conferencing is a service in which an MBG party may establish a multiparty call. The major impact of this service on the ISDN User Part involves the service-controlling exchange requesting MBG information (Group Identifier, Subgroup Identifier, Attendant Status, and Line Privileges) for MBG parties served by remote exchanges for access restriction screening purposes. The functional description, basic formats and codes, and general procedures for the ISDN User Part are contained in ANSI T1.113.

14.3.2.   ISDN User Part formats and codes

The messages and parameters used to support MBG N-way conferencing are identical to those used to support MBG Three-Way Calling. The list below summarizes the ISDN User Part protocol additions to support the MBG N-Way Conferencing service:

- The list of IAM parameters includes the information request indicators parameter;

- The list of ACM, ANM, and CPG parameters includes the information indicators parameter;

The format of the information request indicators parameter and the information indicators parameter is illustrated in table 25:

Table 25

Format of Information Request Indicators parameter and Information Indicators parameter

	8	7	6	5	4	3	2	1
1	H	G	F	E	D	C	B	A
2	P	O	N	M	L	K	J	I

The following indication is included in the Information Request Indicators parameter:

Bit P:

- 0: MBG information not requested.

- 1: MBG information requested.

The following indication is included in the Information Indicators parameter:

Bit P:

- 0: MBG information not included.

- 1: MBG information included.

14.3.3.   ISDN User Part procedures

During the setup of the call between the controller and a new conferee, the controlling exchange shall follow the procedures that involve requesting MBG information for an add-on party in an IAM used for interexchange call establishment, as described in 11.3.3.2. These procedures apply to an MBG call between that controller and the new conferee. If the call is a non-MBG call, the controlling exchange does not include the request in the IAM.

The exchange receiving the request in the IAM shall follow the procedures that involve responding to a request for MBG information, as described in 11.3.3.2.

When the controlling exchange receives the MBG information for the new conferee, the controlling exchange associates this information with the interexchange circuit for the duration of the call to the conferee.

If the conference controller has flashed to request the addition of the new conferee to the conference call, and when MBG information for the new conferee is received in an ACM, CPG, or ANM, restriction screening is performed to determine if the add-on is allowed.

If the conference controller is involved in a two-party MBG call before the conferencing service is activated, the controlling exchange queries the remote exchange for the existing party's MBG information via the INR-INF sequence, as described in 11.3.3.3. When the controlling exchange receives the MBG information for the existing party call leg in an INF, the controlling exchange associates this information with the interexchange circuit for the duration of the call to the existing party.

14.3.4. Interactions

None identified.

14.3.5. Interworking

Because this service requires ISDN User Part, there are no interworking considerations (other than the release of MBG call legs if no SS7-supported facilities are available).

14.3.6. Message flow diagrams

Figure 55 illustrates the message flows for MBG N-Way Conferencing.
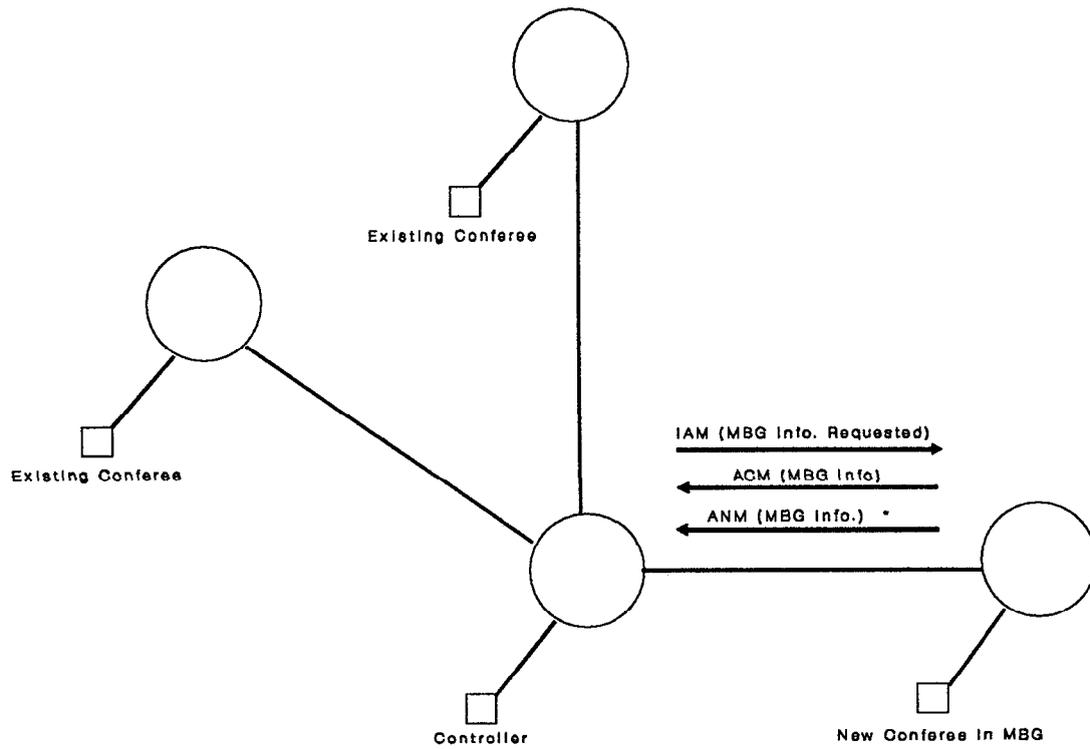
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Existing Conferee

Existing Conferee

IAM (MBG Info. Requested)

ACM (MBG Info)

ANM (MBG Info.) *

Controller

New Conferee In MBG

*NOTE: MBG Info need only be included if
It has changed since report alerting or
no report alerting sent.

Figure 55
MBG Conference Calling

15. Multilocation Business Group (MBG) Automatic Recall and Automatic Callback

The following description covers the Intra-LATA service.

15.1. MBG Automatic Recall and Automatic Callback, Stage-1 description (User perspective)

15.1.1. Definition

Automatic callback allows a user to return a call to the last station that they called. Automatic recall allows a user to return a call to the last person that called them. If the other party is busy when either service is invoked, the network monitors both parties until they are free and then offers the call to the served user. The multilocation business group automatic callback and recall (MBG AC and AR) features allow members in a multilocation business group that are located in geographically remote locations to have the ability to have AC and AR services as though they are at one locality.

The multilocation business group unrestricted AC and AR features allows the user to have automatic callback or recall to stations within or outside his MBG. The multilocation business group intragroup (restricted) AC and AR features allows the user to have automatic callback or recall to stations within the user's MBG only.

15.1.2. Description

15.1.2.1. General description

MBG AC or AR are originating features that enable a calling party to automatically place a call to the last outgoing called number (LOCN) or last incoming calling number (LICN) that is within or outside the MBG.

The MBG AC and AR features require the identity of the LOCN or LICN number. The LOCN and LICN can be the last directory number or extension dialled from the calling terminal or associated with the most recent incoming call respectively. The LOCN is updated every time an outgoing call is placed. The LICN is updated every time a call terminates and would not be updated for unsuccessful incoming calls (for example, if the incoming call went to busy or failed MBG access restrictions).

If the call cannot be completed immediately because the called party is busy, then the AC and AR features enable the calling party to camp-on to the LOCN or LICN. When both the calling party and the called party are found to be idle, the calling party is given ringback alerting. If the ringback is answered, a call is automatically placed to the called party.

15.1.2.1.1. Automatic Callback Versus Automatic Recall

AC and AR are very similar MBG features. The AC feature attempts to call the number associated with the most recent outgoing call made by the customer. The AR feature attempts to call the number associated with the most recent incoming call received by the customer.

15.1.2.2. Specific terminology

15.1.2.2.1. User

This is the subscriber who has subscribed to AC or AR or both. It is the calling party.

15.1.2.2.2. Called Party

This is the user whose busy/idle status is being monitored.

15.1.2.3. Qualifications on the applicability to telecommunication services

This MBG AC and AR features are part of the proposed Multilocation Business Group services.

15.1.3.   Procedures

15.1.3.1.   Provision and withdrawal

The user shall subscribe to have or drop the Intragroup AC, AR or unrestricted AC, or AR features.

15.1.3.2.   Normal procedures

15.1.3.2.1.   Activation, deactivation, and registration

Activation for AC and AR is handled by the end user. The end user activates AC and AR by going from an on hook status to an off hook status and then dialing the AC or AR feature access code.

If the end user places a call and receives a busy treatment, the user shall first hang up and obtain a dial tone and then dial the AC feature access code, in order to activate the AC feature.

The end user may cancel AC or AR activations at anytime before ringback is given. The user does this by dialing the AC or AR feature cancellation code.

If the user does not respond to ringback, the AC or AR feature shall be automatically deactivated by the network.

15.1.3.2.2.   Invocation and operation

When the user activates the AC or AR feature for a call to the called party, the network retrieves the LOCN or LICN number from memory and when necessary derives the routing number (i.e., called party's public directory number) from the LOCN or LICN (i.e., extension number).

If the called number is found to be idle, the user receives audible alerting and immediate call setup without camp-on occurs and the called number shall be alerted.

Short-term denial consists of the end user being given a reorder tone or announcement. Short-term denial results from some of the following conditions: The network resources utilized to process AC and AR requests are exhausted, or the called number has a feature active that causes the AC or AR request to be denied. An example of an active feature that would cause short term denial would be Call Forwarding Unconditional active at the called party.

Long-term denial consists of an announcement indicating that AC or AR camp-ons towards the called number are not allowed. Two examples that would cause long term denial are certain line service types (e.g., coin) and MBG access restrictions.

If either audible ringing, short term denial or long term denial is returned to the end user, then the AC or AR activation shall be considered complete.

If none of the conditions for short-term denial, long-term denial or immediate call setup hold, then AC or AR camp-on shall begin. AC or AR confirmation consists of a tone or an announcement returned to the end user indicating that the AC or AR feature has been successfully activated and that camp-on is required to complete the request.

If both the called number and the calling party are found to be idle before the feature duration timer expires, then the calling party is given AC or AR ringback alerting. Otherwise, the AC or AR activation is canceled. If the calling party answers the ringback before the ringback timer expires, the call is automatically placed to the called party and the AC or AR activation is complete.

If User A has accepted the AC or AR ringback alerting, a final busy/idle status query of User B can be made before call setup is attempted. This is desirable because User A has a certain period of time to respond to the AC or AR ringback and it is possible that, during this time period, User B became busy.

If an idle condition is returned, call setup should be attempted and the AC or AR request is considered complete. If a busy condition is returned, one of the following options should be provided:

a) The user should receive an announcement stating that the line has become busy and that MBG AC or AR activation must be repeated in order to resume scanning. If this additional information is not given, the user receives AC or AR ringback, accepts it, receives busy, and thinks that the network is malfunctioning.

b) The user should receive an announcement that the called party has become busy, monitoring of the called party shall be resumed, and the user shall receive ringback when the called party becomes idle. This not only explains to the user why the call setup could not be attempted but also saves network resources.

While the final optional check is made, the network should respond correctly to the request in conformance with the First In First Out (FIFO) queuing mechanism for AR and AC.

The user may have a number of AC and AR activations in effect concurrently. For the AC or AR feature, if the user has a terminal with display capability the called party directory number associated with the particular ringback may be displayed.

15.1.3.3.   Exception procedures

15.1.3.3.1.   Activation and deactivation

None identified.

15.1.3.3.2.   Invocation and operation

None identified.

15.1.3.4.   Alternate procedures

None identified.

15.1.4.   Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

15.1.5.   Interworking considerations

The service will not operate if SS7 to MF interworking occurs between the served and called users.

15.1.6.   Interaction with other supplementary services

15.1.6.1.   Call Waiting

MBG AC or AR is activated towards the called party with Call Waiting active. If the called party is idle, then the network proceeds with normal call setup. If the called party is busy but no calls are waiting, then the calling party receives audible ringing and the called party receives Call Waiting alerting. If the called party is busy, and no call waiting slots are available, then MBG AC or AR camp-on to the called party is allowed. The calling party is given MBG AC or AR ringback when the calling party is idle and the called party is idle.

If Call Waiting is active at the calling party, then the calling party must be idle before getting MBG AC or AR ringback. Call Waiting tone shall not be given for a ringback attempt.

15.1.6.2.   Call Transfer

A user with Call Transfer flash capability can flash and dial MBG AC or AR activation after dial tone is received.

15.1.6.3.   Conference Call

User A can invoke MBG AC or AR to a party that is currently on a conference call. Conference calling can be invoked by User A independently of any pending MBG AC or AR request. A conference controller can use MBG AC or AR to set up a leg of a conference call.

15.1.6.4. Call Forwarding Busy (CFB)

Calls to stations with Call Forwarding Busy (CFB) are forwarded to the remote station if the called line is busy. AC and AR attempts should be allowed to lines with CFB but call setup should only be attempted when the base station is idle.

If the MBG AC or AR user has CFB active, AC or AR ringback should occur at the user's base station, not the user's remote station.

15.1.6.5. Call Forwarding Unconditional (CFU)

Call Forwarding Unconditional (CFU) forwards all calls without regard for the busy/idle status of the called party. An AC or AR request should be denied (i.e., short-term denial announcement) if the called line has CFU active.

If the MBG AC or AR user has CFU active, AC or AR ringback should occur at the user's base station, not the user's remote station.

15.1.6.6. Call Forwarding No Reply (CFNR)

Calls to stations with Call Forwarding No Reply (CFNR) are forwarded to the remote station if the called station does not answer after a certain period of time. If AC or AR is applied to the called station, call setup should only be attempted when the called station is idle. If the called party does not answer, the call should be forwarded to the remote station.

If the MBG AC or AR user has CFNR active, AC or AR ringback should occur at the user's base station, not the user's remote station.

15.2. MBG Automatic Recall and Automatic Callback, Stage-2 description (Information flows)

15.2.1. Functional model

The MBG AC and AR features may be performed by two switches that serve the user and the called party.

15.2.1.1. Specific terminology

15.2.1.1.1. Exchange A Functional Entity

This entity is the network node that serves the user. Exchange A is the entity that retrieves the LOCN or LICN from memory and determines routing when the user activates the MBG AC or AR feature. Exchange A will query Exchange B in order to determine called party line status, line privileges, and features. Exchange A also requests resource reservation at Exchange B.

15.2.1.1.2. Exchange B Functional Entity

This entity is the network node that serves the called party. Exchange B is the entity that responds to the query from Exchange A. Exchange B also reserves resources upon request from Exchange A.

15.2.1.2. Limiting assumptions

If a MBG spans more than one LATA or network, this MBG AC or AR feature can work across the LATA or network boundary only if there are bilateral agreements between the concerned networks.

15.2.2. Normal procedures

The information flows for MBG automatic recall and callback are shown in figures 56-58.

15.2.2.1. General description

The following discussion applies when a user activates the MBG AC or AR for a call, and the called party is served by a different switch.

When the user activates the AC or AR feature to the called party, Exchange A shall retrieve the LOCN or LICN from memory and determine the routing number. There should be an indicator to distinguish whether the last incoming call was associated with a POTS, intra-MBG, or inter-MBG call. An indicator is needed to distinguish whether the LOCN was associated with a POTS, intra-MBG or inter-MBG call only if the dialled number is not stored as the LOCN. Exchange A then shall proceed with the first step of the activation process, a request for information. This information would include: the busy/idle status of called party, MBG Information if the LOCN or LICN was to an MBG station, feature interactions that temporarily interfere with the activation or operation of the service, and the line privileges of the called party. In addition, it shall ask for resource reservation at Exchange B.

15.2.2.1.1. Queuing

If Exchange B has the capability of queuing the call, it shall determine whether to queue the call or not. Exchange B shall send a response indicating whether it queued the call or not, and the reason for not queuing the call if applicable. In addition, it shall send the called party's line status information. Exchange A shall screen this information.

15.2.2.1.2. Tones and announcements

If the called number is found to be idle, the user shall receive alerting and immediate call set-up without camp-on occurs and the called number shall be alerted.

Short-term denial may consist of the end user being given reorder or an announcement by Exchange A. This tone indicates that either the network resources utilized to process AC and AR requests are exhausted or that the called number has a feature active that causes the AC or AR request to be denied.

Long-term denial consists of an announcement indicating that AC or AR camp-ons towards the called number are not allowed due to restrictions on the end user.

If either audible ringing, short-term denial or long-term denial is returned to the end user, then the AC or AR activation is considered complete.

If none of the conditions for short-term denial, long-term denial, or immediate call set-up hold, then AC or AR camp-on shall begin. AC and AR confirmation consists of an announcement returned to the end user indicating that the AC or AR feature has been successfully activated and that camp-on is required to complete the request.

15.2.2.1.3. Scanning

If the MBG AC or AR request is accepted and the called line is busy, the originating exchange should start the second step of the activation process, a request to begin scanning the busy/idle status of User B. Exchange A can request originating scanning or terminating scanning.

By terminating scanning Exchange A sends Exchange B a message requesting to be informed when the called party becomes idle. When the called party becomes idle, Exchange B sends a message to Exchange A that the called party is idle. If the user is busy, then Exchange A shall monitor the user's line. When the user becomes idle, then Exchange A again request's Exchange B to inform it when the called party is idle. A default to originating scanning shall be allowed if Exchange B cannot perform terminating scanning.

By originating scanning, Exchange A periodically sends out requests for the busy/idle status of the called party. Exchange B informs Exchange A of the called party busy/idle line status. If the called party is busy, Exchange A shall resume sending out queries requesting the called party busy/line status. If the called party is idle but the user is busy, Exchange A shall monitor the user's line. When the user becomes idle, then Exchange A shall resume sending out queries requesting the called party busy/idle status.

15.2.2.1.4. Call setup

If both the called party and the calling party are found to be idle before the feature duration timer expires, then the user is given AC or AR ringback alerting. Otherwise, the AC or AR activation is canceled. If the calling party answers the ringback before the ringback timer expires, the call is automatically placed to the called party and the AC or AR activation is complete.

An optional final busy/idle check can be sent when the user answers the ringback to determine if the called party is still idle. If the called party is still found to be idle at the time of this last query, then Exchange A shall proceed with standard call set-up. If the called party is found to be busy at the time of this last query, then a called party busy on ringback announcement shall be given to the calling party.

15.2.2.1.5. Activation and deactivation

Activation for AC and AR is handled by the end user. The end user activates AC and AR by going from an on-hook status to an off-hook status and then dialing the AC or AR feature access code.

The end user may cancel AC or AR activations at anytime before ringback is given. The user does this by dialing the AC or AR feature cancellation code. If the end user requests AC or AR cancellation, then all active AC or AR requests associated with the user shall be canceled.

If the user does not respond to ringback or the feature activation period has expired (i.e. called party is busy all the time), the AC or AR feature shall be automatically deactivated by the network.
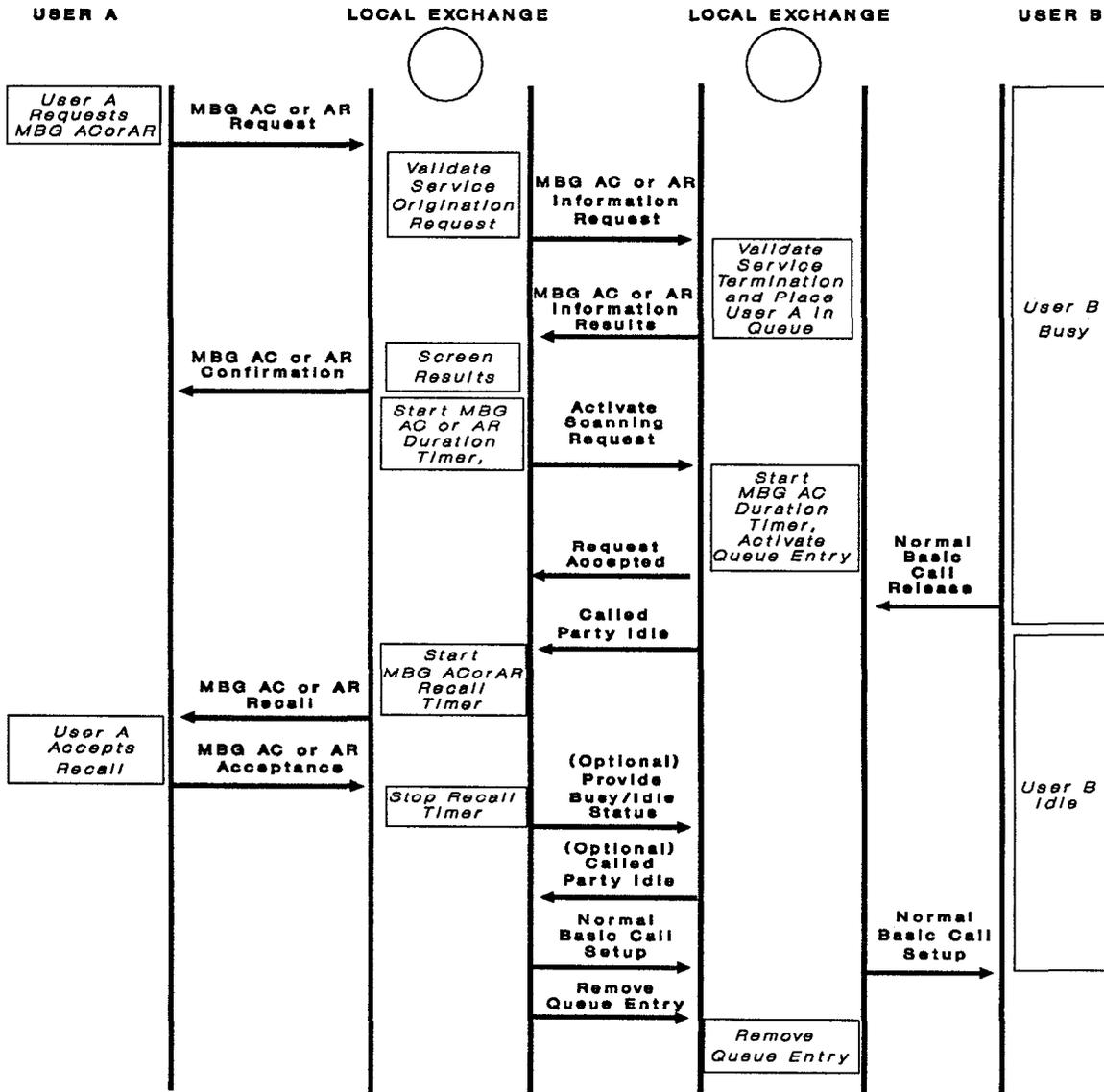
Figure 56
Successful MBG/AC/AR operation - Using terminating scanning

USER A		LOCAL EXCHANGE		LOCAL EXCHANGE		USER B

*User A
Requests
MBG ACorAR*

**MBG AC or AR
Request**

*Validate
Service
Origination
Request*

**MBG AC or AR
Information
Request**

*Validate
Service
Termination
and Place
User A In
Queue*

**MBG AC or AR
Information
Results**

**MBG AC or AR
Confirmation**

*Screen
Results*

*User B
Busy*

*Start MBG
AC or AR
Duration
Timer, and
Activate
Originating
Scanning*

**Provide
Busy/Idle
Status**

**Called Party
Busy**

*Start
MBG AC
Duration
Timer,
Activate
Queue Entry*

**Normal
Basic
Call
Release**

**Provide
Busy/Idle
Status**

**Called
Party Idle**

*Start
MBG ACorAR
Recall
Timer*

**MBG AC or AR
Recall**

*User A
Accepts
Recall*

**MBG AC or AR
Acceptance**

*Stop Recall
Timer*

**(Optional)
Provide
Busy/Idle
Status**

*User B
Idle*

**(Optional)
Called
Party Idle**

**Normal
Basic Call
Setup**

**Normal
Basic Call
Setup**

**Remove
Queue Entry**

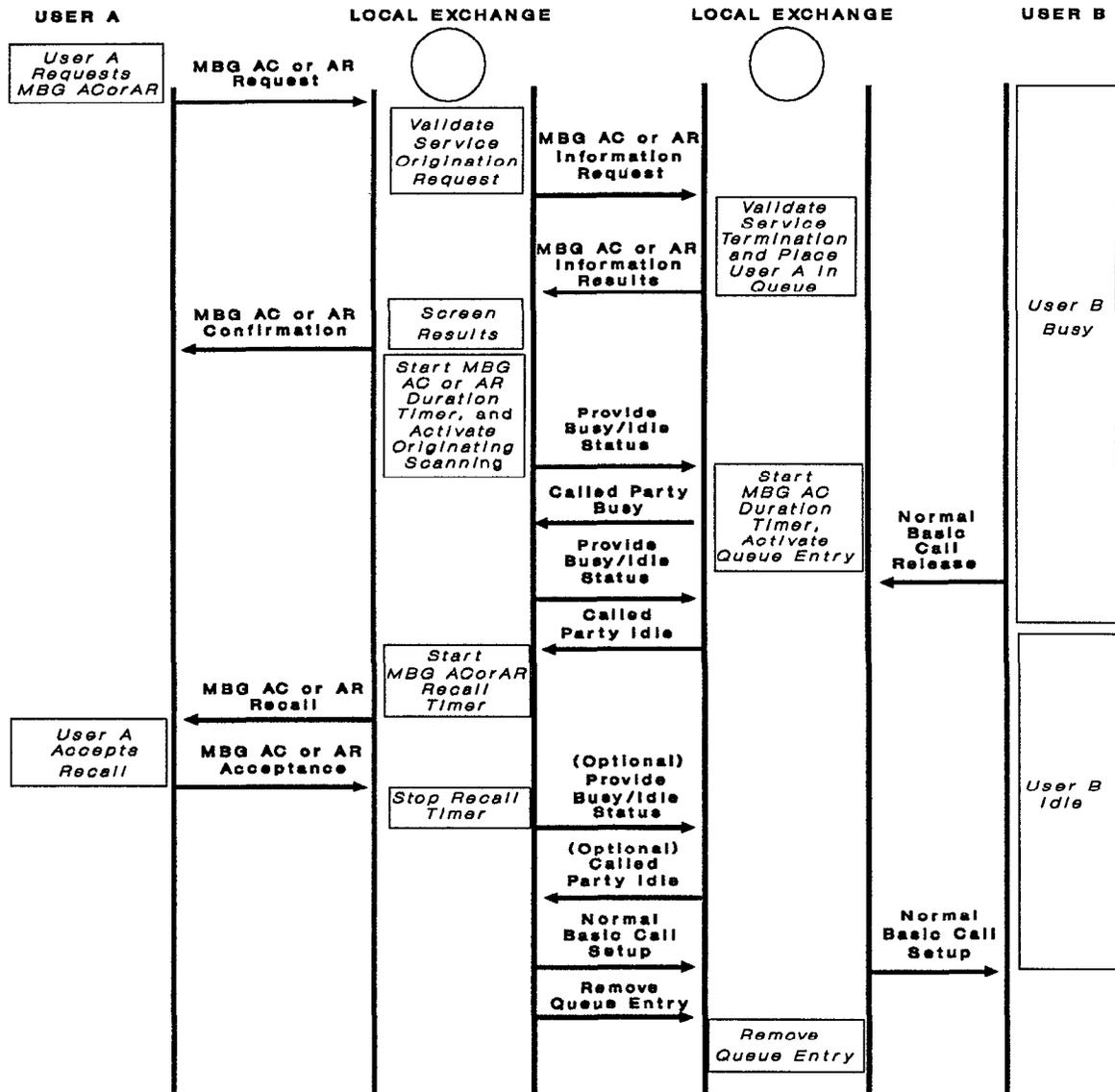*Remove
Queue Entry*

**Figure 57
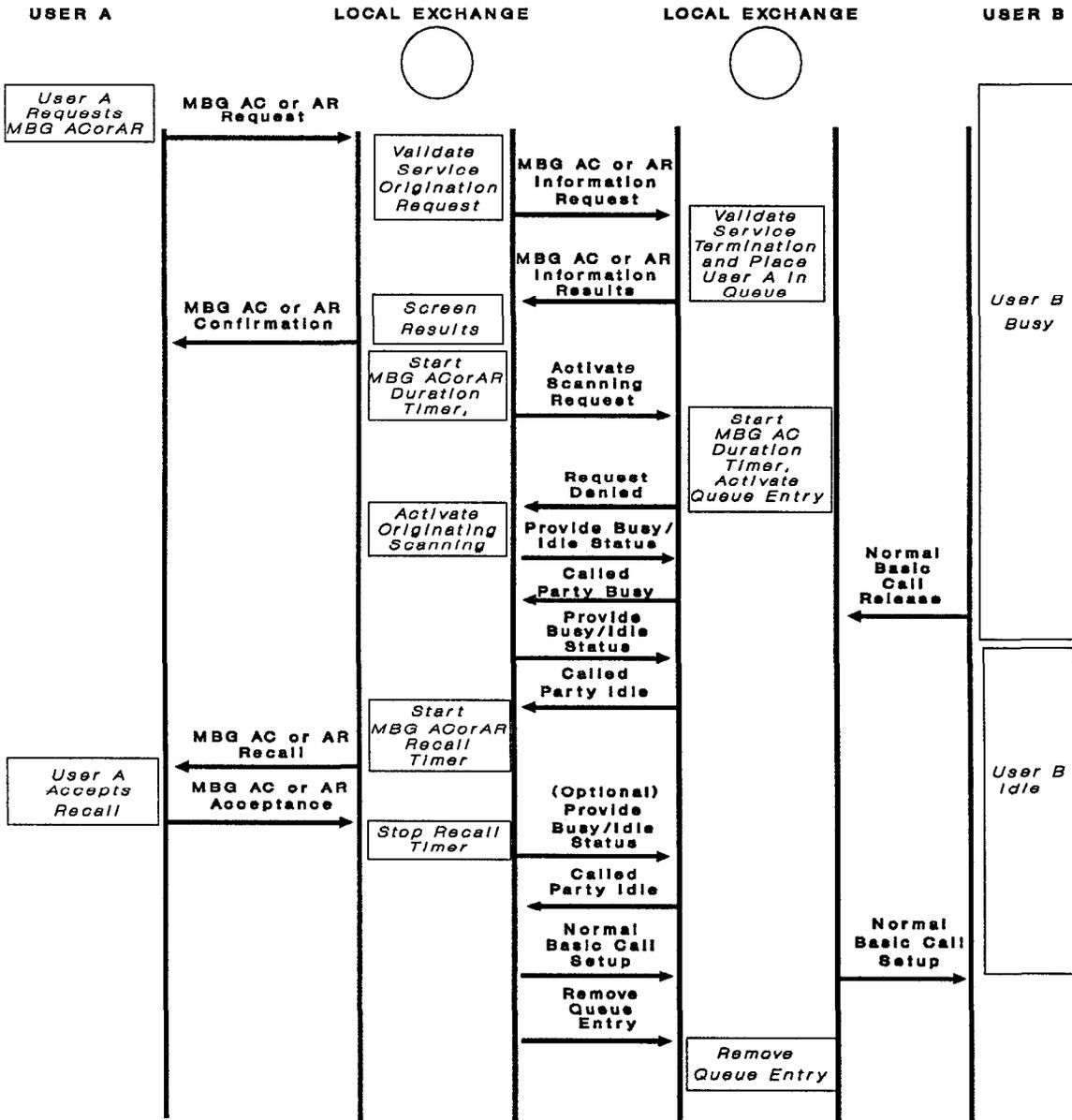Successful MBG/AC/AR operation - Using originating scanning**

Figure 58

Successful MBG/AC/AR operation - Using fallback to originating scanning

15.2.3. Exception procedures

When User A invokes MBG AC or AR, Exchange A will determine if the user's subscription information allows the service to be invoked to the LOCN or LICN. If invocation is not allowed, long-term or short-term denial will be returned.

In response to an MBG AC or AR activation request, Exchange B will send User B's line status information. If Exchange B can determine that camp-on will not be allowed to the User B, e.g., due to MBG access restrictions, the request will not be queued at Exchange B and a "not queued" indication will be sent to Exchange A. Otherwise, the request will be queued and the queued indication sent to Exchange A.

Exchange A will screen User B's line status information. If the camp-on is not allowed, due to call forwarding activation, line service type, or MBG access restrictions, Exchange A will return long-term or short-term denial to User A. If the request had been queued at Exchange B, a de-queue request will be sent to Exchange B.

15.3. Multilocation Business Group Automatic Recall and Automatic Callback Stage-3 Description (SS7 protocols)

This subclause gives the stage-3 description for the Multilocation Business Group - Automatic Callback and Recall (MBG AC and AR) services. It describes the TCAP protocol to support these two services (i.e., it provides the MBG AC and AR Application Service Element).

15.3.1. TCAP Usage

The procedures given in the following subclauses specify how the Transaction Capabilities Application Part (TCAP) is used to provide MBG AC and AR. These procedures are the activation of, monitoring of, processing for, deactivation of, and cancellation of the service.

The dynamic description in the form of SDLs is shown in figures 63 through 68.

15.3.1.1. Initial request for MBG AC and AR

When the user activates the MBG AC or AR feature to the called party, switch A shall retrieve the Last Outgoing Called Number (LOCN) or Last Incoming Called Number (LICN), respectively. There should be an indicator to distinguish whether the last incoming call was associated with a POTS, intra-MBG, or inter-MBG call. An indicator is needed to distinguish whether the LOCN was associated with a POTS, intra-MBG, or inter-MBG only, if the dialled number is not stored as the LOCN. Switch A shall check User A subscription options and determine whether the MBG AC or AR activation is allowed to the LOCN or LICN.

If the MBG AC or AR request is allowed to the LOCN or LICN, Switch A sends a Query with Permission message to Switch B to determine if the service can be offered to Calling User A. The Query contains two Invoke components: the first Invoke component requests the terminating switch to queue the calling number, and the second component requests information about destination B. The first component contains an Invoke (Last) Component and a Miscellaneous - Queue Call operation code. This component contains a Service Key parameter including the Digits-Destination Number parameter and Digits-Calling Directory Number parameter. The service key is included so that:

    a)   Switch B shall queue User A's Calling Number, and

    b)   the destination number against which to queue is identified.

When the Digits parameter with Destination Number or Calling Directory Number digits is used for MRC to carry private numbering plan numbers, the type of digits subfield is coded "Destination number" or "Calling Directory Number" (as appropriate), the nature of number is coded to indicate "national" and "no presentation restriction," the numbering plan indicator is coded "private numbering plan," the encoding scheme and number of digits subfields are coded as appropriate, and the

digits subfield contains the digits of the concatenated location code and intercom-dialing code. If the MBG does not use location codes, only the intercom-dialing code is sent in the digits subfield.

The second component contains an Invoke (Last) component, Parameter - Provide Value operation code, and a parameter set indicating the following parameter values: Busy/Idle Status, Call Forwarding Status, DN to Line Service Type Mapping, and the Business Group parameter requesting the Business Group Id, Subgroup ID, Attendant Status, and the Line Privileges of the called party. The length indicator of the Business Group parameter should be set to zero when requesting the business group information of the called party. A Service Key parameter is also contained in this component. It includes the Digits-Destination Number, Digits-Calling Directory Number, and the Business Group parameter containing information about User A. The Business Group parameter should only be sent in the Parameter - Provide Value operation code and the service key of the second Invoke Last component if the LOCN or LICN was to a MBG station. If the LOCN or LICN was to a non-MBG station, then the Business Group parameter is not sent. Instead, the Terminating Restrictions parameter is sent in the Parameter - Provide Value component. Since the parameter values being sought refer to a particular line, the Digits-Destination Number field is included in the Service Key. Digits-Calling Directory Number is also included in the Service Key because some of the feature interactions depend on the identity of the calling party (e.g, "Selective Call Forwarding active for Calling User A?").

Switch B shall respond to both components of the Query with Permission message with a Response package type. The response to the first component indicates whether the call was queued or not.

In a successful activation, the terminating switch puts the calling number in its queue, so that the response to the first component contains a Return Result (Last) component with an empty parameter set.

Other possible responses to the first component in the initial query are the Reject component or the Return Error component. The Reject component should be returned if there is a protocol error. The Return Error component should be returned if Switch B does not have the necessary processing resources, if there is erroneous data, if the queue is full, if the calling number cannot be queued based on the values of the parameters in the second component or if there is no queue at the terminating exchange.

The response to the second component either contains the requested information or reports an error condition. The former case is reported by a Return Result (Last) component. The parameters are: the busy/idle status is either busy or idle. The Call Forwarding Status value is either marked "active," "not active," or "service not supported." A DN match occurs if the location and intercom-dialing codes in the Digits (Destination Number) parameter that cause a call to terminate a particular line are identical to the location and intercom-dialing codes associated with that line when a call originates from the line. Acceptable values for the DN match field are "match" and "no match" and the line type is either individual, coin, series completion, multiline hunt, PBX, multiparty, choke, unassigned DN, nonspecific, or temporarily out of service. The only DN to line service type mapping for "no match" that would accept the service is the multiline hunt line service type. The Business Group ID, Subgroup ID, Attendant Status, Party Selector, and the Line Privileges of the called party are returned in the the Business Group parameter. The Party Selector is set to "Connected Party Number." The Line Privilege information indicator should be set to either Fixed Line Privileges or Customer-Defined Line Privileges. If the LP II is coded as "Fixed Line Privileges," bits 1 to 8 of the Line Privileges field are coded as specified in the MBG Basic Call service. If the LP is coded as "Customer-Defined Line Privileges," then bits 1 to 8 of the Line Privilege field should be coded with customer defined line privilege codes. If the parameter values are acceptable, confirmation is returned to Calling User A and the service is activated. If the parameter values received by Exchange A are not acceptable, lonterm or short-term denial is returned to User A and the service activation is terminated. If the request had not been queued by Exchange B, no further action is needed. If the request had been queued by Exchange B, a Unidirectional message with an operation code of "Miscellaneous - Dequeue Call" should be sent to Switch B. The Service Key Parameter should include the Digits - Destination Number and Digits - Calling Number parameters.

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Other possible responses to the second component are Return Error or Reject. The Return Error component would be sent if one or more of the requested values were not available or if Switch B does not have the necessary processing resources. The Reject component would be returned if a protocol error is detected.

15.3.1.2. Scanning

If the MBG AC or AR request is accepted at Switch A and the called party is busy, Switch A should start the second step of the activation process, a request to begin scanning the busy/idle status of user B. Exchange A can request originating or terminating scanning. A default to originating scanning shall be allowed if Exchange B cannot perform terminating scanning.

15.3.1.2.1. Terminating Scanning Accepted

If the MBG AC or AR request has been activated, Switch A sets a duration timer and launches a second TCAP message to Switch B. The purpose of this second message is to determine if Switch B can provide terminating scanning on Destination B. The TCAP message has a Query with Permission package type and an Invoke (Last) component with Send Notification - When Party Free operation code. This message is used to request that switch B perform terminating scanning and inform Switch A when Destination B goes idle. The parameter set should consist of the Service Key containing the Digits-Destination Number, Digits-Calling Number, and Duration. The Duration parameter is sent to limit the amount of time that terminating scanning occurs against Destination B.

Assuming that Switch B is capable of controlling Destination B's busy/idle scanning status and the called party is busy, Switch B should respond immediately with a message that has a Conversation with Permission package type, and a Return Result (Not Last) Component with an empty parameter set to confirm that the requested operation was understood and has been initiated.

If Destination B becomes idle before the time specified in the Duration Timer expires, the following message flow shall occur. Switch B sends a Response message to switch A containing a Return Result (Last) component with the Busy/Idle Status parameter set to "idle."

When Switch A receives a message indicating that the called line is idle, Switch A should attempt to ringback the calling user. Upon calling user's answer, Switch A should proceed with MBG AC or AR call setup.

Switch A may optionally send out a final busy/idle query to Switch B. This message should have a Query with Permission package type, an Invoke (Last), component of Parameter-Provide Value operation code and a parameter set that contains Busy/Idle Status and a Service Key with the Digits-Destination Number and Digits Calling Number. Switch B should send a "Response" message to Switch A containing a Return Result (Last) Component with the Busy/Idle Status parameter set to busy or idle.

If the called party is still found to be idle at the time of this last query, then Switch A shall proceed with standard call setup. If the called party is found to be busy at the time of this last query, then a called party busy on ringback announcement shall be given to calling user A. In either case the MBG AC or AR activation is complete.

If the call was successfully queued, switch A should send a Unidirectional message with a Miscellaneous - Dequeue Call operation code to Switch B. The Service Key parameter should include the Digits-Destination Number and Digits-Calling Number parameter.

It is also possible that calling user A became busy during the MBG AC or AR activation. If calling user A is busy at ringback, Switch A waits for Calling User A to become idle. When calling user A becomes idle, Switch A sends another "Send Notification - When Party Free".

15.3.1.2.2. Terminating Scanning Refused

If the MBG AC or AR request is accepted and the line status of destination B is busy, switch A launches a second message with the Query with Permission package type and an Invoke (Last)

component with a Send Notification - When Party Free operation code . This message is used to inform Switch B to perform terminating scanning and inform Switch A when destination B goes idle. The parameter set should consist of the Service Key parameter containing the Digits-Destination Number, Digits-Calling Directory Number, and the Duration parameter to limit the amount of time that terminating scanning shall occur against destination B.

If Switch B is capable of determining the busy/idle status of the called line, but is incapable of controlling the scanning process, Switch B should respond to the original scanning request with a Response message that contains a Return Error component. The Error Code in the message should have the value Unavailable Resource.

If the terminating switch chooses not to support terminating scanning at this time due to resource shortages, then it shall respond with an Error Message with the cause Task Refused. The originating switch shall then invoke the originating scanning operation.

15.3.1.2.3. Originating Scanning

When Switch A decides to use originating scanning or receives a response indicating that Switch B is incapable of controlling the scanning of the called line, it shall assume control of the scanning process by periodically sending out messages to determine the busy/idle status of the called line. These messages should have a Query With Permission package type , an Invoke (Last) component, Parameter - Provide Value operation code, and a parameter set that contains the Busy/Idle Status parameter, and a Service Key with the Digits-Destination Number and Digits-Calling Directory Number parameters.

Switch B should respond to these queries with a Response Message that contains a Return Result component with the Busy/Idle Status parameter equal to "Busy" or "Idle."

When the Switch A receives a message indicating that the called line is idle, Switch A should attempt to ringback the Calling User A. Upon Calling User A's answer, Switch A should proceed with a MBG AC or AR call setup.

Switch A may optionally send out a final busy/idle query to Switch B. This message should have a Query with Permission package type an Invoke (Last) component, a Parameter - Provide Value operation code, a parameter set that contains the Busy/Idle Status parameter, and a Service Key with the Digits-Destination Number and the Digits-Calling Directory Number parametrs. If the called party is found to be idle at the time of this last query, then Switch A shall proceed with standard call setup. If the called party is found to be busy at the time of this last query, then a called party busy on ringback announcement shall be given to the calling user A. In either case, the MBG AC or AR activation is complete.

If calling user's line is busy when Switch A receives the response indicating that the called line is idle, Switch A waits for the calling user's line to become idle. If the Calling User A becomes idle, Switch A resumes monitoring of the called line's busy/idle status.

If the call was successfully queued, Switch A should send a Unidirectional Message with an Invoke component containing a Miscellaneous - Dequeue Call operation code to Switch B. The Service Key parameter should include the Digits-Calling Directory Number and the Digits-Destination Number parameters.

If Switch B does not currently have the necessary processing resources to respond to the Query, the response should be contained in a Response package type containing a Return Error component with an Task Refused error code. If there is an error(s) in the data in the query, an Unexpected Data Value error code is returned. If the data requested in the query is currently unavailable, the error code should be "Data Unavailable."

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15.3.1.3. Cancellation of MBG AC or AR

There are two possible methods for canceling a MBG AC or AR request. The first scenario occurs when Switch A does not receive a idle notification from Switch B before the duration timer expires. The second scenario occurs when calling user A deactivates the MBG AC or AR request for destination B.

15.3.1.3.1. If Terminating Office Controls Scanning

For either case, the originating office cancels the request by sending a Response message with an Invoke component containing an of Operation Control - Cancel operation code. A Service Key is also included containing the Digits-Calling Number and Digits-Destination Number parameters. The Cancel message may optionally include a second component. The second component of Invoke, with a Miscellaneous- Dequeue DN operation code and a parameter set containing digits of the type "Destination Number" and "Calling DN" within a Service Key. When this message is received with one or both components in it, the terminating switch should cancel terminating scanning and remove the entry from the queue.

15.3.1.3.2. If Originating Office Controls Scanning

For either case, if the terminating exchange supports queues, the request is canceled by the originating office sending a Unidirectional message with an Invoke Component containing a Miscellaneous-Dequeue Call operation code. A service key is included containing the Digits-Calling Number and the Digits-Destination Number parameters. If the terminating switch does not support queues, the message is ignored.

15.3.2. TCAP operations

The following description utilizes the ASN.1 method of protocol description, which is described in CCITT Recommendations X.208 and X.209.

15.3.2.1. Miscellaneous - Queue Call

```
miscellaneous-queueCall              OPERATION
PARAMETER SET                        {serviceKey   ServiceKey}

RESULT  SET                          {}
--to indicate successful queueing of calling DN


ERRORS                               {unexpectedDataValue,  taskRefused,
                                     queueFull,  noQueue,  notQueued}


ServiceKey  ::=  [10]  IMPLICIT  SET
{destinationNumber   Digits,
callingDN    Digits}


Digits  ::=  [4]  IMPLICIT  OCTET  STRING

unexpectedDataValue                  ERROR
PARAMETER                            SET{}
::=  2


taskRefused                          ERROR
PARAMETER                            SET{}
::=  7
```

```
queueFull                                ERROR
PARAMETER                                SET{}
::= 8


noQueue                                  ERROR
PARAMETER                                SET{}
::=9


notQueued                                ERROR
PARAMETER                                SET{}
::=13


::=   (65025)
-- family = 11111110, specifier = 00000001 .
```

15.3.2.2.   Parameter - Provide Value (for Initial Query)

```
parameter-ProvideValue                   OPERATION
PARAMETER SET                            {Busy-IdleStatus,
                                         CallForwardingStatus,
                                         DnToLineServiceTypeMapping,
                                         BusinessGroupParameter,
                                         serviceKey     ServiceKey}


RESULT SET                               {Busy-IdleStatus,
                                         CallForwardingStatus,
                                         DnToLineServiceTypeMapping,
                                         BusinessGroupParameter} --connected  party's  MBG


ERRORS {unexpectedDataValue, dataUnavailable, taskRefused}


Busy-IdleStatus                          ::= [11]  IMPLICIT  OCTET  STRING
CallForwardingStatus                     ::= [12]  IMPLICIT  OCTET  STRING
DNtoLineServiceTypeMapping               ::= [15]  IMPLICIT  OCTET  STRING
BusinessGroupParameter                   ::= [21]  IMPLICIT  OCTET  STRING
ServiceKey                               ::= [10]  IMPLICIT  SET
{destinationNumber  Digits,
callingDN  Digits,
BusinessGroupParameter} --  calling  party's  MBG
Digits                                   ::= [4]  IMPLICIT  OCTET  STRING


unexpectedDataValue                      ERROR
PARAMETER                                SET{}
::= 2


dataUnavailable                          ERROR
PARAMETER                                SET{DNtoLine  ServiceTypeMapping}
::=6
```

taskRefused   ERROR
PARAMETER   SET{}
::=   7

::=   (33025)
-- family = 10000001, specifier = 00000001

The errors that may be reported for the unsuccessful completion of this operation are given below. The "Data Unavailable" error is used if Exchange B unable to determine either some or all of the parameters. "Task Refused" is used to indicate that the requested operation is refused. "Unexpected Data Value" is used to indicate that an incorrect number of digits were found by the application. (See table 26.)

Table 26

Parameter - Provide Value Error Code Table

Error Name	Error Code
unexpected Data Value	00000010
data Unavailable	00000110
task Refused	00000111

15.3.2.3. Send Notification - When Party Free (See table 27)

sendNotificationWhenPartyFree   OPERATION
PARAMETER SET   {serviceKey   ServiceKey}

--INTERMEDIATE RESULT

--This operation contains an intermediate result. Because ASN does

--not allow for intermediate results, it is being put here to show

--that this intermediate step must be done. The intermediate

--result, in TCAP, is as follows: a CONVERSATION WITH PERMISSION

--Package Type. The component contains an empty set to indicate

--that the request for terminating scanning has been accepted.

--This ends the intermediate result.

RESULT SET   {Busy-IdleStatus}

--to indicate Destination B is idle

ERRORS   {unexpectedDataValue, unavailableResource, taskRefused}

ServiceKey :: = [10] IMPLICIT SET {destinationNumber Digits, callingDN Digits, Duration}
Digits   :: = [4] IMPLICIT OCTET STRING

```
Busy-IdleStatus                          ::= [11] IMPLICIT OCTET STRING
Duration                                 ::= [16] IMPLICIT OCTET STRING


unexpectedDataValue                      ERROR
PARAMETER                                SET{}
::= 2


unavailableResource                      ERROR
PARAMETER                                SET{}
::=3


taskRefused                              ERROR
PARAMETER                                SET{}
::= 7


::= (42305)
-- family = 10000110, specifier = 00000001
```

Table 27

Send Notification - When Party Free Error Code Table

Error Name	Error Code
unexpected Data Value	00000010
unavailable Resource	00000011
task Refused	00000111

15.3.2.4.   Miscellaneous - Dequeue Call

```
miscellaneous-DequeueCall                OPERATION
PARAMETER SET                            {serviceKey   ServiceKey}


ServiceKey ::= [10] IMPLICIT SET
{destinationNumber  Digits,
callingDN  Digits}
Digits ::= [4] IMPLICIT OCTET STRING

::=(39258)
--family01111110,specifier000000010
```

15.3.2.5.   Parameter - Provide Value (for Originating Scanning).

```
parameter-ProvideValue                   OPERATION
PARAMETER SET                            {Busy-IdleStatus,
                                         serviceKey    ServiceKey}


RESULT SET                               {Busy-IdleStatus}


ERRORS                                   {unexpectedDataValue, dataUnavailable, taskRefused}
```

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```
Busy/Idle  Status                              ::=  [11]  IMPLICIT  OCTET  STRING
ServiceKey                                     ::=  [10]  IMPLICIT  SET
                                                          {destinationNumber   Digits,
                                                                 callingDN   Digits}
Digits                                         ::=  [4]  IMPLICIT  OCTET  STRING


unexpectedDataValue                            ERROR
PARAMETER                                      SET{}
::=   2


dataUnavailable                                ERROR
PARAMETER                                      SET{DNtoLine   ServiceTypeMapping}
::=6



taskRefused                                    ERROR
PARAMETER                                      SET{}
::=   7



::=  (33025)

-- family = 10000001, specifier = 00000001
```

Table 28

Parameter-Provide Value (Originating Scanning) Error Code Table

Error Name	Error Code
unexpected Data Value	00000010
unavailable Resource	00000011
task Refused	00000111

15.3.2.6. Control-Cancel

```
operationControl-Cancel                        OPERATION
PARAMETER SET                                  {serviceKey   ServiceKey}


ServiceKey                                     ::=  [10]  IMPLICIT  SET
                                                          {destinationNumber   Digits,
                                                                 callingDN   Digits}
Digits                                         ::=  [4]  IMPLICIT  OCTET  STRING

::=   (2305)
-- family  =  00001001,  specifier  =  00000001
```

15.3.3. TCAP parameters

The Destination Number parameter (a type of Digits), the Calling Number parameter (a type of Digits), and the Service Key parameter are defined in ANSI T1.114. The Digits parameter shall be

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as defined in ANSI T1.114 with one new coding in the numbering plan field - the 'private number-ing plan' indication, which has a code of 0111.

15.3.3.1. Busy/Idle Status

The Busy/Idle Status parameter is used to indicate whether the status of a line is busy or idle. It is 1 octet long and of type OCTET STRING. (See table 29.)

Table 29

Format of Busy/Idle Status

Parameter Name	Identifier Code
Busy/Idle Status	10001011
Contents	
Busy/Idle Status	hgfedcba
Not Used	00000000
Busy	00000001
Idle	00000010

The ASN.1 definition of Busy/Idle Status is:

Busy-IdleStatus ::= [11] IMPLICIT OCTET STRING

15.3.3.2. Call Forwarding Status

Call Forwarding Status is used to indicate which types of Call Forwarding are active on a line. It is 1 octet long and of type OCTET STRING. (see table 30)

Table 30

Format of Call Forwarding Status

Parameter Name	Identifier Code
Call Forwarding Status	10001100
Contents	

Status bits are allocated to call forwarding services as shown in table 31:

Table 31

Status Bit Allocation of Call Forwarding Status

Bits	Service
hg	Call Forwarding Variable
fe	Call Forwarding on Busy
dc	Call Forwarding Don't Answer
ba	Selective Forwrading

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Bit values indicate status as shown in table 32:

Table 32

Bit Value Indication of Call Forwarding Status

Bit Value	Status
00	Service not Supported
01	Active
10	Not Active
11	Spare

The ASN.1 definition of Call Forwarding Status is:

CallForwardingStatus::= [12] IMPLICIT OCTET STRING

15.3.3.3. DN to Line Service Type Mapping

The DN to Line Service Type Mapping is used to indicate the type of line that corresponds to a given Directory Number. It is 1 octet long and of type OCTET STRING. (See table 33)

Table 33

Format of DN to Line Srvice Type Mapping

Parameter Name	Identifier Code
DN to LIne Service Type Mapping	10001111
Contents	

Bits hg indicate the DN match. This indicates whether or not a DN that causes a call to terminate on a line is equal to the DN that is associated with that line when calls originate from the line. Bits hg are defined as shown in table 34:

Table 34

Bit Values for DN Match

Match Status	hg
Spare	00
No match	01
Match	10
Spare	11

Bits fedcba indicate the line service type and are defined as shown in table 35:

Table 35

Bit Values for Service Type

Line Service Type	fedcba
Individual	000000
Coin	000001
Multiline Hunt	000010
PBX	000011
Choke	000100
Series Completion	000101
Unassigned DN	000110
Multi-Party	000111
Non-Specific	001000
Temporarily out of Service	001001

The ASN.1 definition of DN to Line Service Type Mapping is:

DnToLineServiceTypeMapping::=[15] IMPLICIT OCTET STRING

15.3.3.4.   Business Group parameter

The Business Group parameter is used as required to identify MBG information associated with each type of number in the message.

The numbers that the Business Group parameter can apply to are:

- Calling Party Number;

- Called Party Number;

- Connected Party Number;

- Redirecting Number;

- Original Called Party Number.

The optional appearance of Business Group ID and Sub group ID is supported by the use of a No Indication code (all 0's) for these items. Instead of a "No indication" code for Line Privileges the all 0's value, which indicates Unrestricted access (no MBG access restrictions), should be used.

The Business Group parameter length is variable. It is normally 7 octets long when only one party's MBG information is carried. These 7 octets can be repeated within the parameter when other parties' MBG information is also included. "0" is used when this parameter is included in the Provide - Value component. It is of type OCTET STRING.

Table 36

Format of Business Group parameter

Parameter Name	Identifier Code
Business Group Parameter	10010101
Contents	

The contents of the parameter are shown in table 37:

Table 37

Contents of Business Group Parameter

	Bits				
	h	g	f	e	dcba
1	Spare	AttSt	BGIDtp	LP II	Party Selector
2-4	Business Group ID (3 octets)				
5-6	Sub-Group ID (2 octets)				
7	Line Privileges (1 octet)				

15.3.3.4.1.   Attendant Status (AttSt)

A 1-bit field that indicates whether the party identified by the Party Selector is an attendant.

0   No Indication

1   Attendant Line

15.3.3.4.2.   Business Group Identifier Type (BGID)

The Business Group Identifier subfield indicates the service associated with the business group identifier. The following coding is used for this subfield:

0   MBG Identifier

1   IWPN Identifier

15.3.3.4.3. LP Information Indicator (LP II)

An MBG customer can select either conventional Centrex restrictions or customer-defined MBG restrictions. This is a 1-bit field that indicates whether the restrictions are fixed line privileges or customer-defined line privileges.

0	Fixed Line Privileges
1	Customer-Defined Line Privileges

15.3.3.4.4. Party Selector

The Party Selector is a 4-bit field that determines the number to which the Business Group information applies.

0000	No indication
0001	Calling Party Number
0010	Called Party Number
0011	Connected Party Number
0100	Redirecting Number
0101	Original Called Party Number

15.3.3.4.5. Business Group ID

The Business Group ID is a 3-octet field used to indicate the business group to which the party identified by the Party Selector belongs to. Business Group IDs are uniquely assigned to customers across all networks in which the MBG customer subscribes to MBG service.

0000..0000	No Indication
0000..0001	Public Network
0000..0010	
to	Assigned Business Group Codes
1111..1111	

15.3.3.4.6. Subgroup ID

The subgroup ID is a 2-octet field, defined by the customer to indicate the subgroup membership of the party, identified by the Party Selector, within the customer's organization. If the customer does not subscribe to a subgroup, this field is coded as '0000..0000' (No Indication).

15.3.3.4.7. Line Privileges

Line Privileges ia a 1-octet field defined by the customer to indicate the line privilege of the party identified by the Party Selector. If the LP II field is coded 0 (fixed line privileges), the LP field is divided into two 4-bit subfields. Bits 1 to 4 represent the terminating restriction and Bits 5 to 8 represent the originating restriction. The originating and terminating restrictions may be coded independently. Both 4-bit subfields are coded as follows:

0000	Unrestricted
0001	Semi-Restricted
0010	Fully-Restricted
0011	Fully-Restricted Intraswitch
0100	Denied

If the "LP II" field is coded '1' (customer-defined LPs), the LP field is coded as follows;

00000000

to   Customer-Defined Line Privileges codes

11111111

15.3.3.5. Duration

The Duration parameter is used to indicate how long scanning should occur. It is three octets long and of type OCTET STRING. (See table 38.)

Table 38

Format of Duration Parameter

Parameter Name	Identifier Code
Duration	10010000
Contents	
Bits hgfe	**Bits dcba**
Hours	Hours
Minutes	Minutes
Seconds	Seconds

The hours, minutes, and seconds are recorded in BCD format.

15.3.4. Interworking considerations

The service will not operate if SS7 MF interworking occurs between the calling and called users.

15.3.5. Message flow diagrams

15.3.5.1. Initial check

See figure 59.

15.3.5.2. Terminating Scanning followed by Deactivation

See figure 60.

15.3.5.3. Terminating Scanning Refused

See figure 61.

15.3.5.4. Originating Scanning followed by Deactivation

See figure 62.

User A   Switch A   Switch B   User B

Query with Permission

Invoke (Last), Miscellaneous - Queue Call
Service Key
Digits Destination Number
Digits Calling Directory Number

Invoke (Last), Parameter - Provide Value
Busy/Idle Status
Call Forwarding Status
DN to Line Service Type Mapping
Business Group Parameter (Called Party)
Service Key
Digits Destination Number
Digits Calling Directory Number
Business Group Parameter (Calling Party)

Response

Returen Result (Last)
<empty>

Return Result (Last)
Busy/Idle Status
Call Forwarding Status
DN to Line Service Type Mapping
Business Group Parameter

Figure 59
Initial check

User A   Switch A   Switch B   User B

Query with Permission
   Invoke (Last), Send Notification - When Party Free
   Service Key
      Digits - Destination Number
      Digits - Calling Directory Number
      Duration

Coversation with Permission
   Return Result (Not Last)
   <empty>

                                    •
                                    •
                                    •

Response
   Return Result (Last)
   Busy/Idle Status (=Idle)

Query with Permission
   Invoke (Last), Parameter - Provide Value
   Busy/Idle Status
   Service Key
      Digits Destination Number
      Digits Calling Directory Number

Response
   Return Result
   Busy/Idle Status

Undirectional
   Invoke (Last), Miscellaneous - Dequeue Call
   Service Key
      Digits - Destination Number
      Digits - Calling Directory Number

• This is an optional final busy/idle status query-response

Figure 60

Terminating scaning followed by deactivation

User A   Switch A   Switch B   User B

Query with Permission
    Invoke (Last), Send Notification - When Party Free
    Service Key
        Digits - Destination Number
        Digits - Calling Directory Number
        Duration

Response
    Return Error
    Unavailable Resource
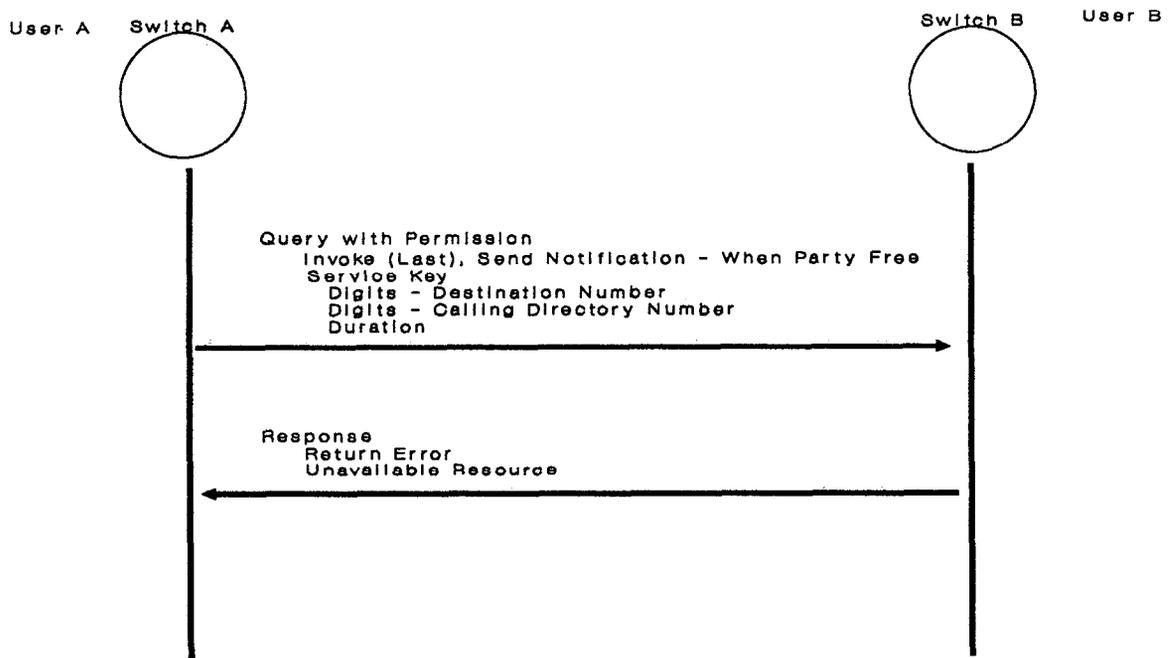
Figure 61
Terminating scanning refused
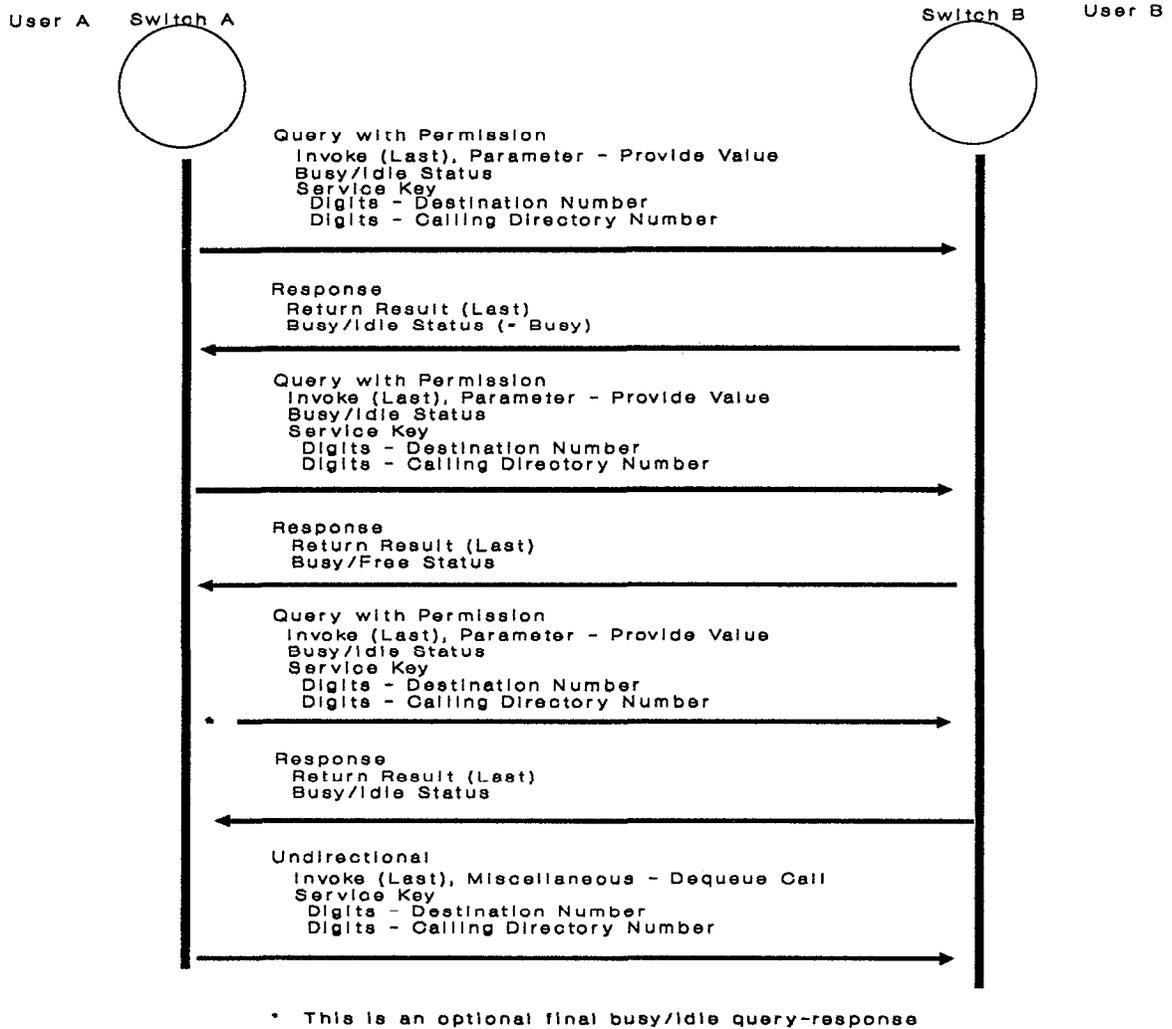
Figure 62
Originating scanning followed by deactivation

```
            ┌─────────────────┐
            │      Idle       │
            └─────────────────┘
                     │
            ┌────────────────────┐
         ┌──┤  MBG AC or AR      │
         │  │    Activation      │
         └──┴────────────────────┘
                     │
            ┌────────────────────┐
            │     retrieves      │
            │        the         │
            │   LOCN or LICN     │
            └────────────────────┘
                     │
                    ╱ ╲
                   ╱   ╲        NO
                  ╱ Number╲───────────────┐
                  ╲Conversion╱            │
                   ╲required?╱            │
                    ╲   ╱                 │
                     ╲ ╱                  │
                      │ YES               │
            ┌────────────────────┐        │
            │     Convert        │        │
            │     Number         │        │
            └────────────────────┘        │
                     │                    │
                     │←───────────────────┘
                     │
            ┌──────────────────────────┐
            │  Query                    ╲
            │                            ╲
            │ + sending user's MBG ID, SG ID
            │    LP ID, ATT Status       ╱
            │                           ╱
            │ + requesting called party's
            │    MBG ID, SG ID
            │    LP ID, ATT Status
            └──────────────────────────┘
                     │
            ┌─────────────────┐
            │    Waiting      │
            │      for        │
            │    Response     │
            └─────────────────┘
```
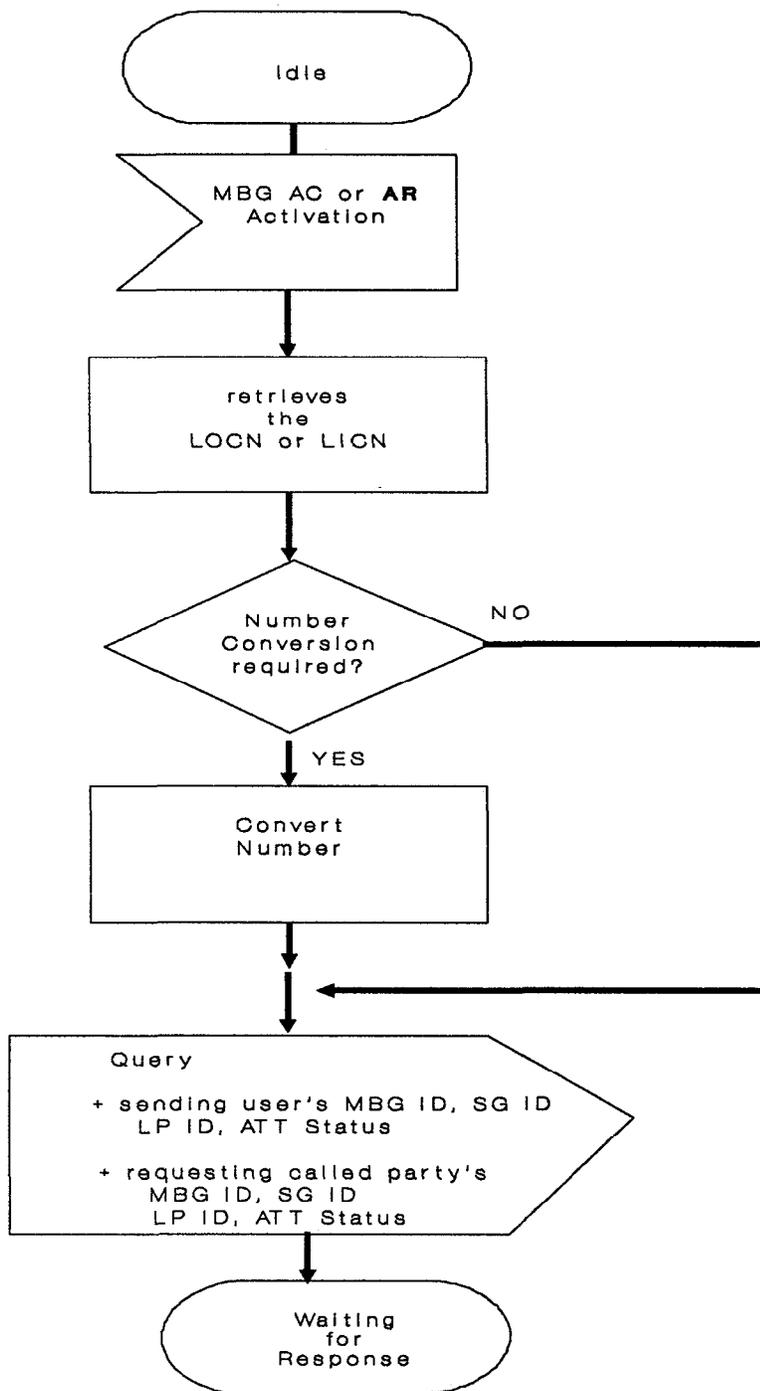
Figure 63

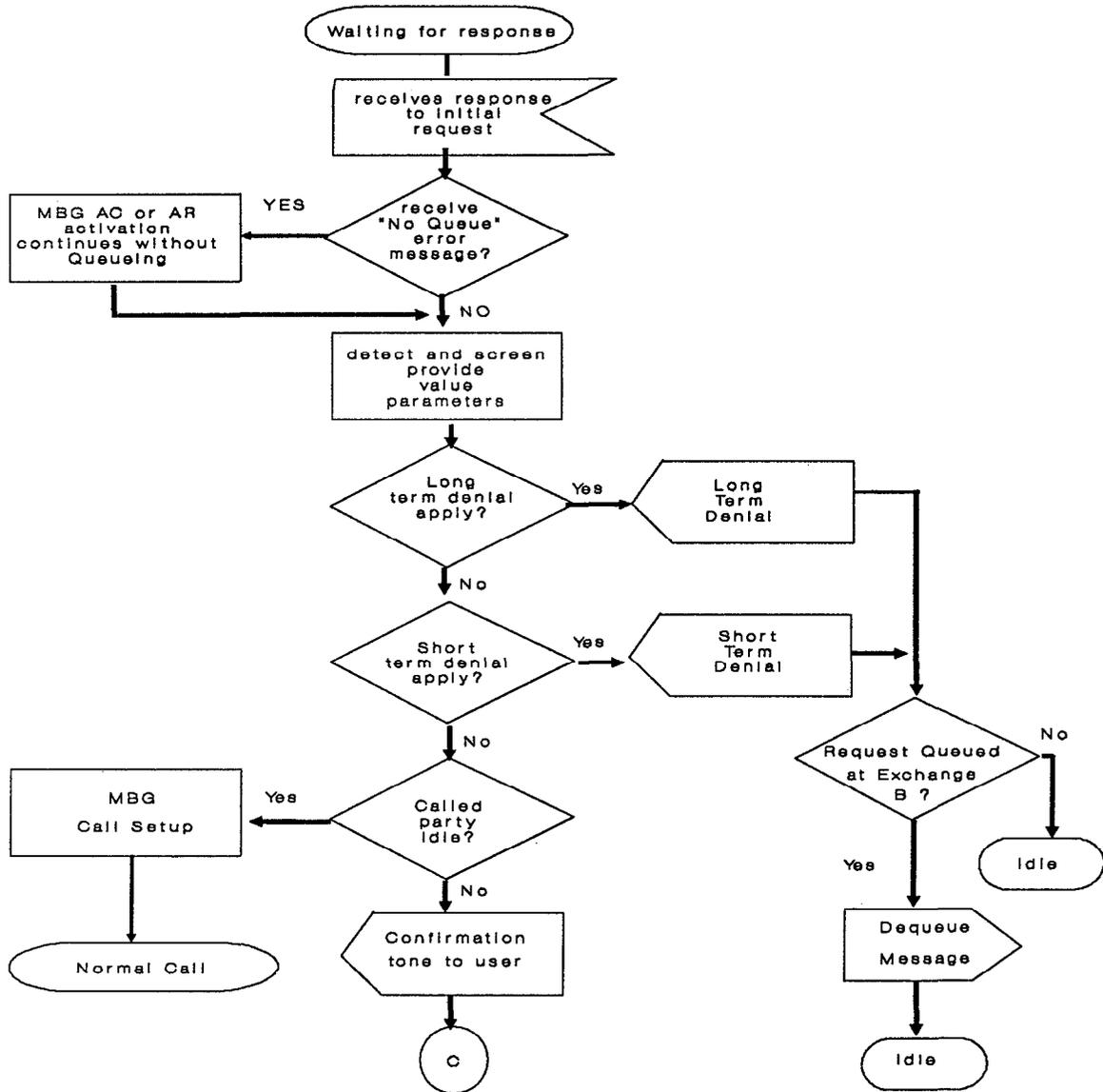**SDL diagram at Exchange A when the MBG AR or AC feature activated**

Figure 64
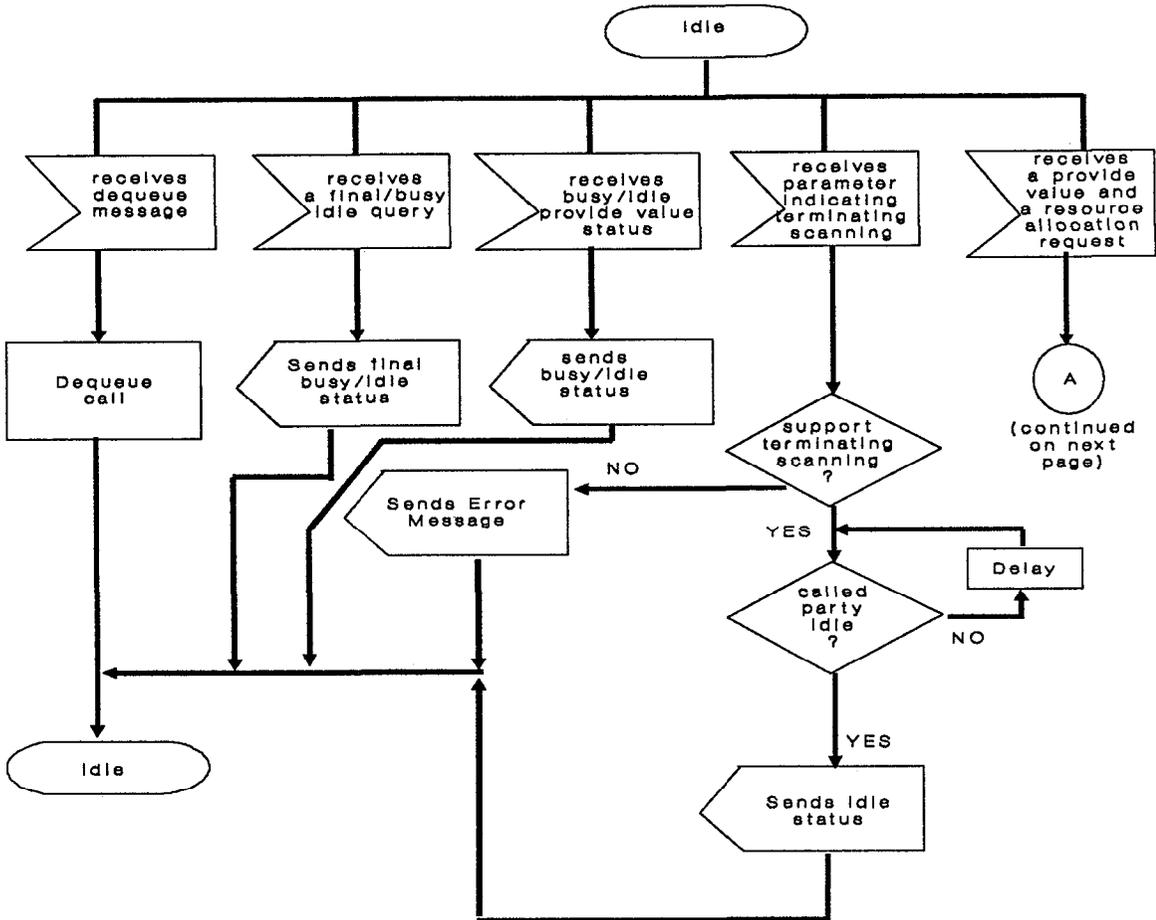**SDL Diagram at exchange A in response to the initial request**
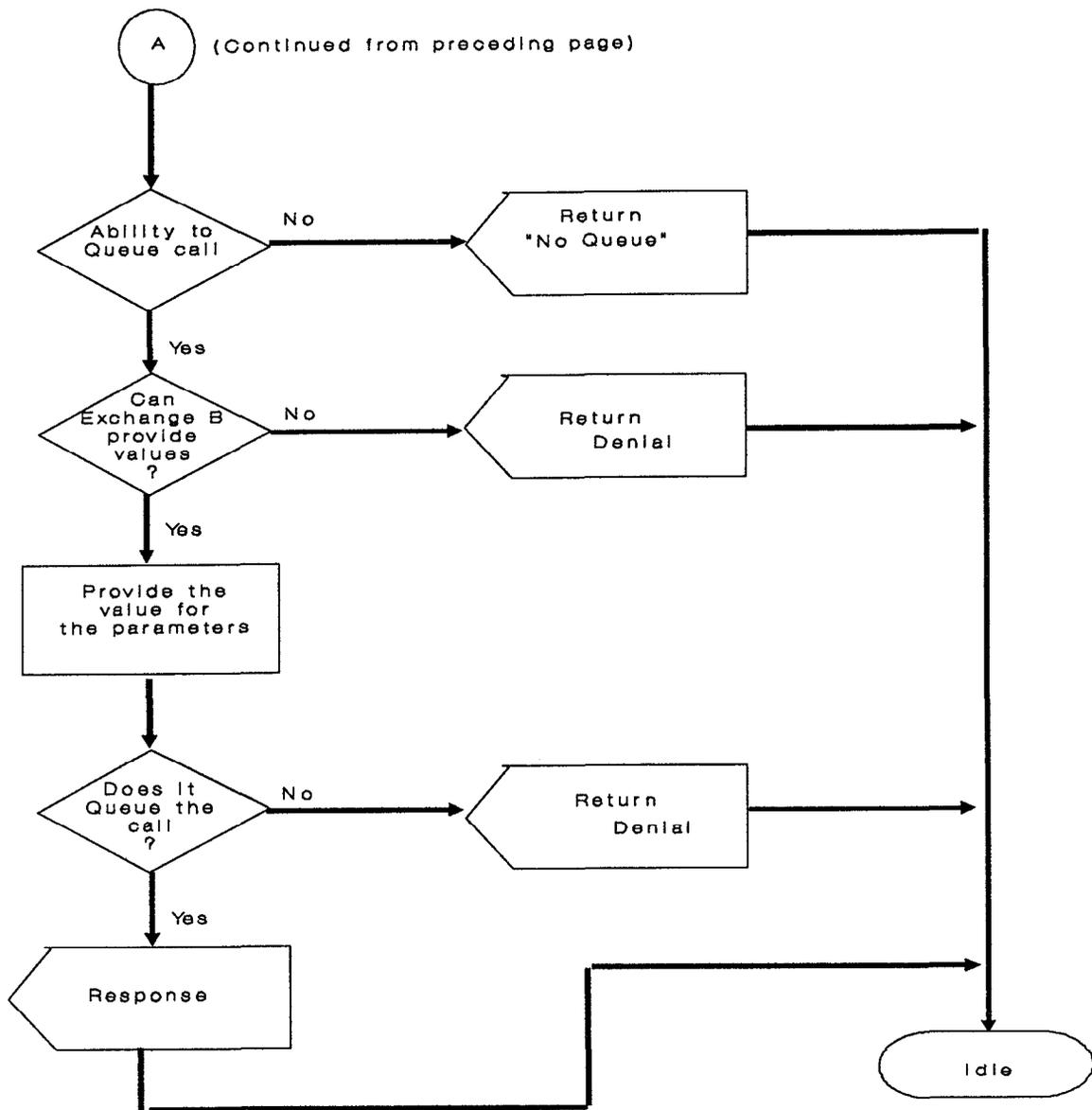
Figure 65
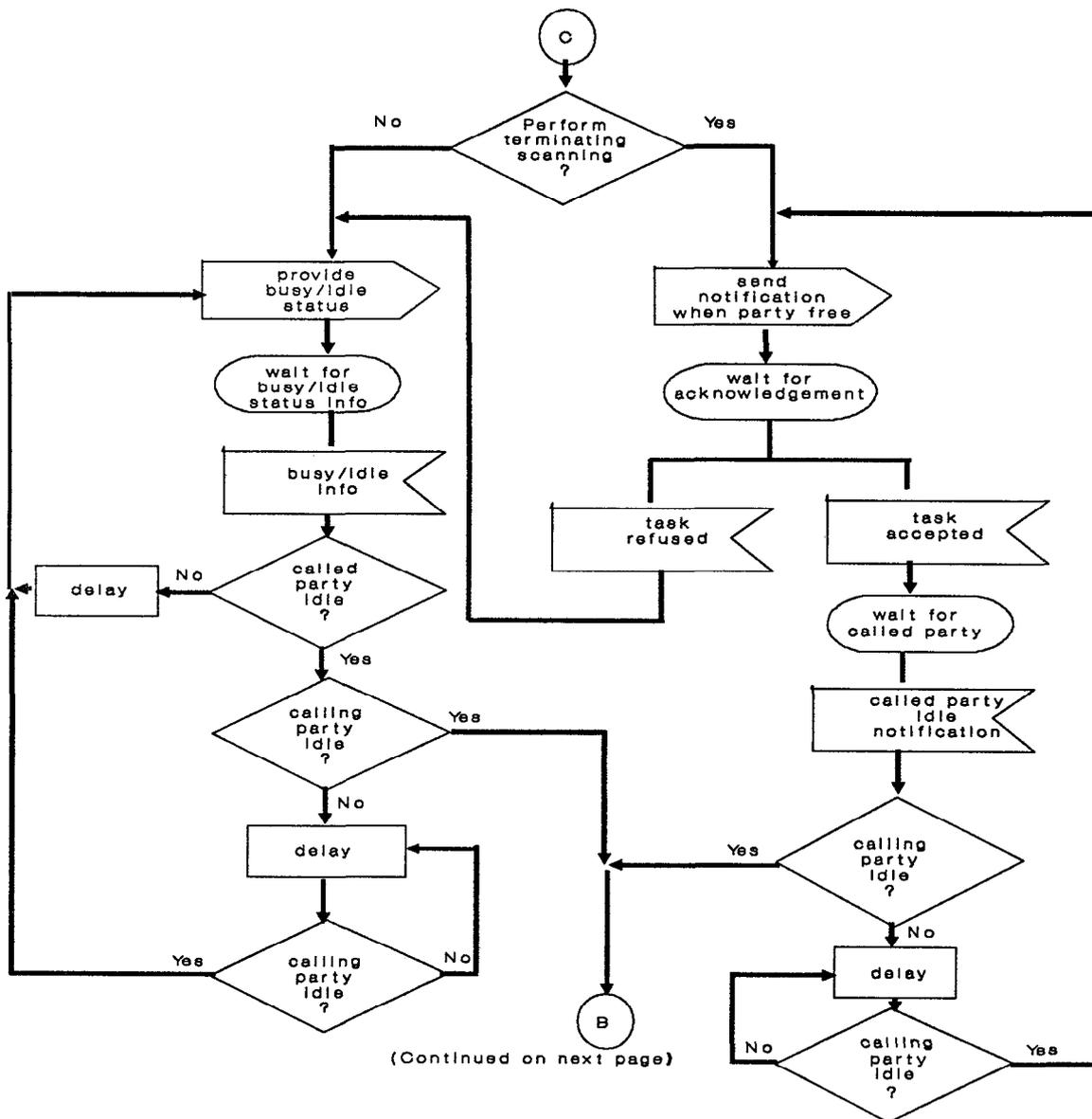**SDL diagram at Exchange B**

Figure 66
SDL Diagram at Exchange B
(Part 2)

Figure 67
SDL at Exchange A in response to scanning method

(Continued from preceding page) B

Ringback
the user

wait for
user response

user
answer
ringback

no response
time
out

send final
busy/idle
query
?

No

MBG AC or AR
feature
cancelled

Yes

provide busy/
idle status

Idle

wait for
busy/idle
status

busy/idle
info

does
Exchange B
support
queues
?

No

called
party
idle
?

Yes

Yes

Dequeue
message

No

called party busy
on ringback
announcement

call
set-up
message
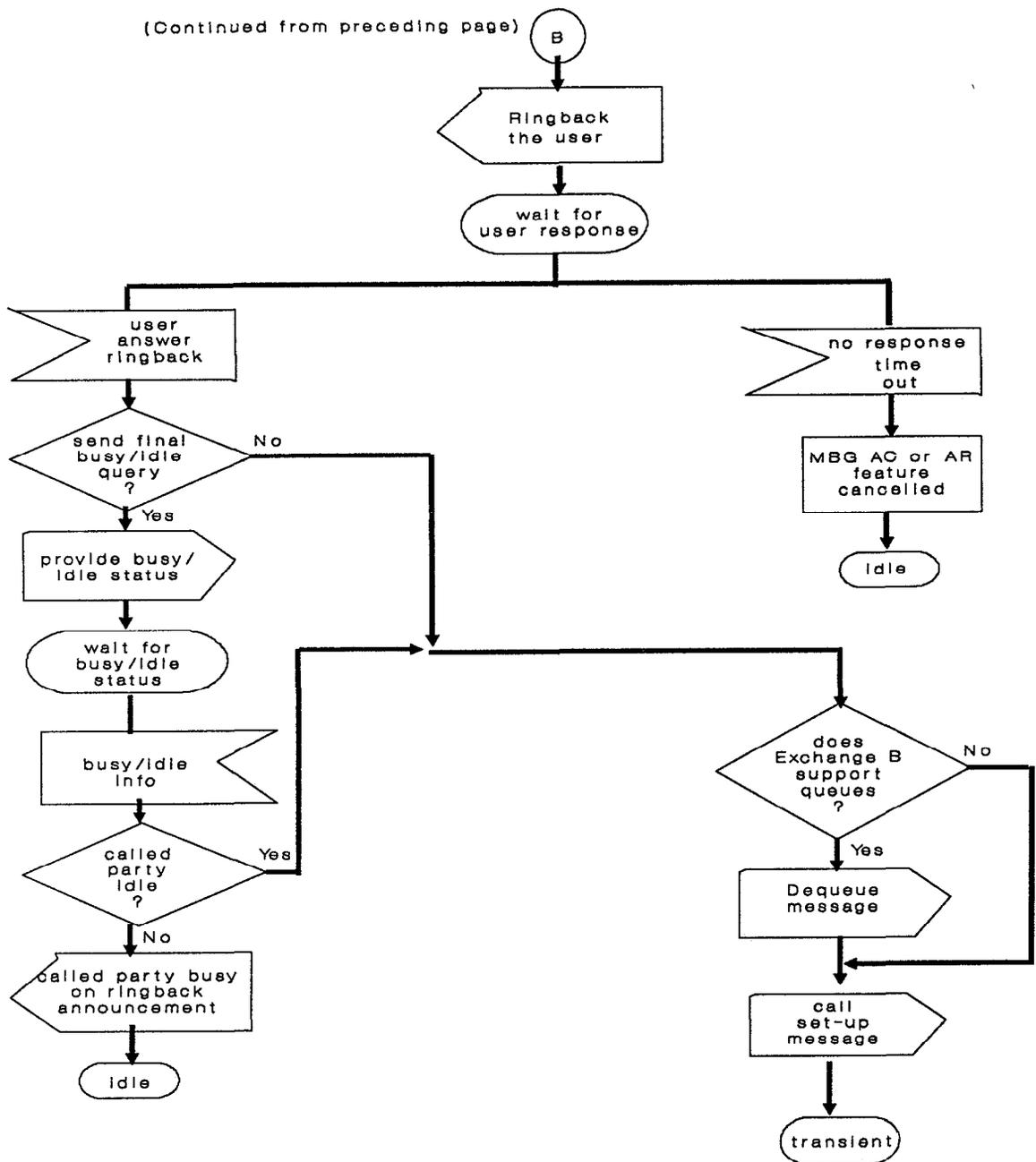
Idle

transient

Figure 68
SDL at Exchange A in response to scanning method
(Part 2)

16.   User-Network Interaction

16.1.   User Network Interaction, Stage-1 description (User perspective)

16.1.1.   Definition

This network capability allows a network to temporarily halt call set-up and play tones or announcements, or both, and collect additional in-band information from the calling user before routing the call further.

16.1.2.   Description

16.1.2.1.   General description

This network capability requires a user to interact with the network before a call can proceed any further. When a network determines that additional user information is required to complete the call setup (e.g., authorization codes, selection codes), an indication should be sent from the network to alert the user and request further user information. Judging from the information gathered from the user, the network proceeds with the call setup.

16.1.2.2.   Specific terminology

16.1.2.2.1.   User

This is the subscriber who interacts with the network capability.

16.1.2.3.   Qualifications on the applicability to telecommunication services

This network capability is considered applicable to a number of services in which additional user information is required during call setup for further call processing.

16.1.3.   Procedures

16.1.3.1.   Provision and Withdrawal

This network capability is implemented by the network. Users do not have to subscribe.

16.1.3.2.   Normal procedures

The information flow for the User-Network Interaction service is shown in figure 69 and the dynamic description of the functional entities in the form of SDL is shown in figures 70 and 71.

16.1.3.2.1.   Activation, deactivation, and registration

Activation, deactivation, and registration shall be handled automatically by the network.

16.1.3.2.2.   Invocation and operation

Invocation of this network capability shall be handled by the network, as shall the operation. The user perceives an interuption in call setup and is prompted to input information so that the call may proceed.

16.1.3.3.   Exception procedures

16.1.3.3.1.   Activation, deactivation, and registration

None identified

16.1.3.3.2.   Invocation and operation

None identified.

16.1.3.4. Alternate procedures

16.1.3.4.1. Activation, deactivation, and registration

None identified.

16.1.3.4.2. Invocation and operation

None identified.

16.1.3.5. Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

16.1.3.6. Testing procedures

None

16.1.4. Interworking considerations

None, this network capability is not affected in an interworking environment.

16.1.5. Interaction with other supplementary services

Since this is a network capability, it can be used by other supplementary services.

16.2. User-Network Interaction, Stage-2 description (Information flows)

16.2.1. Functional model

The User-Network Interaction capability requires the coordination of the following network entities namely: originating exchange, serving exchange, and possibly a database. The originating and serving exchanges, together enable the network to provide a two-way path between the calling party and the serving exchange to collect more in-band information from the calling user before the call setup can be completed. The originating exchange entity and the serving exchange entity may be a single entity incorporating the functions of both.

16.2.1.1. Specific terminology

16.2.1.1.1. Originating Exchange Entity

An originating exchange is a network entity, that, if it receives an indication from the serving exchange that a user-network interaction will occur, shall cut through the transmission path in both directions and inform the calling party that in-band information is available.

16.2.1.1.2. Serving Exchange Entity

A serving exchange is a network entity that, when it receives a call set up message from a preceding exchange, and determines, possibly through conversations with a database, that additional information is needed from the calling party, shall halt temporarily the call set-up procedure and inform the originating exchange that a user-network interaction may occur.

16.2.1.2. Relationship to Basic Service

After the serving exchange has collected necessary information through the interaction with the calling party, the call set-up shall proceed as for the Basic Call setup.

Modification is needed in the call set-up procedure at the serving exchange to request more information from the calling party before a call set-up can be completed.

16.2.2. Normal procedures

The information flow for the User-Network interaction service is shown in figure 69 and the dynamic description of the functional entities in the form of SDL is shown in figures 70 and 71.

16.2.2.1. General description

A serving exchange, upon receiving a call setup request from a preceding exchange and recognizing that additional information is needed from the calling party, shall halt the call set-up procedure temporarily. An indication is then sent backward from the serving exchange that a user-network interaction may occur and a cut-through of the voice path in both directions is needed. On receiving the indication, the originating exchange shall cut through in both directions and inform the calling party that in-band information is available. After the serving exchange has collected necessary information through interaction with the calling party, the basic call set-up procedure is resumed at the serving exchange.
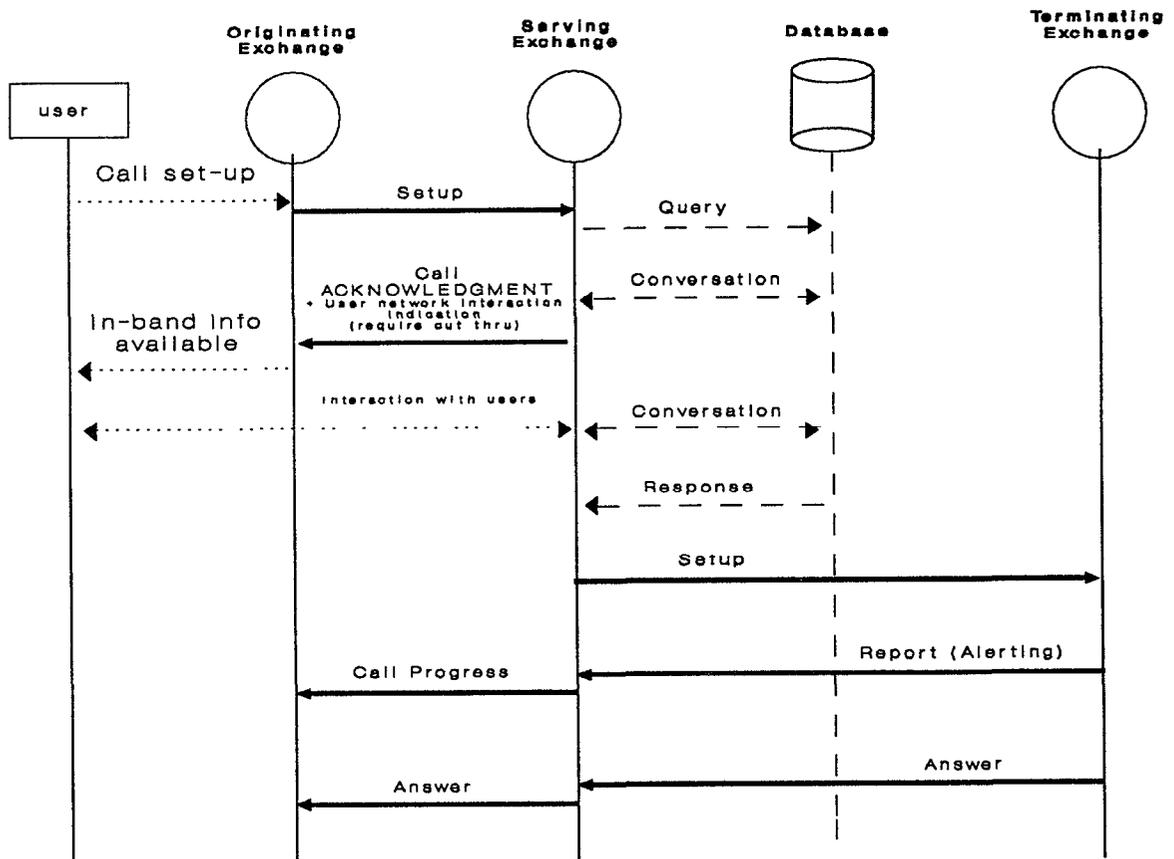
Figure 69

Information flow for User-Network Interaction

16.2.2.2.   Activation and Deactivation

The capability is activated automatically by the network if the network determines that more information should be collected from the calling party.
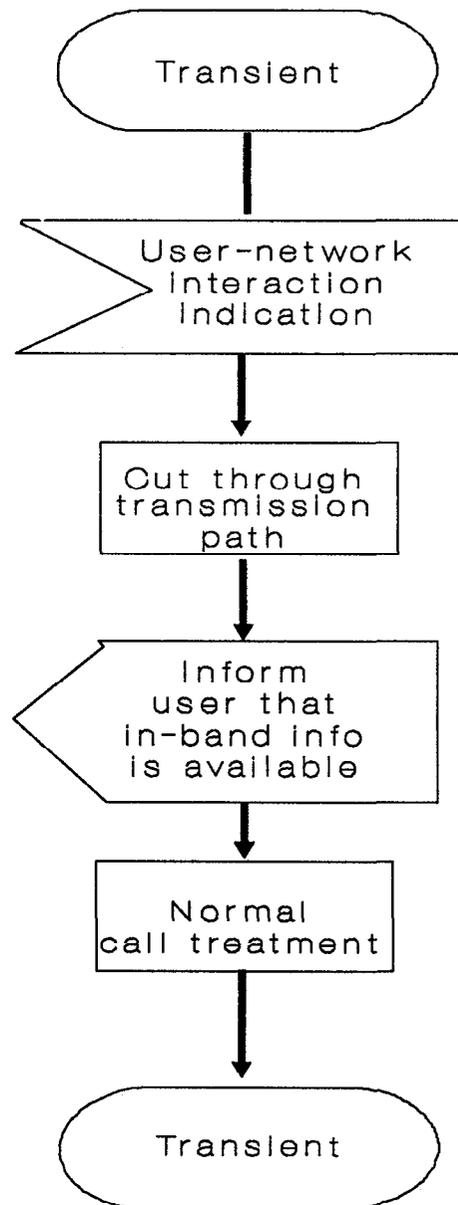
16.2.3.   Exceptional Procedures

None Identified

Figure 70

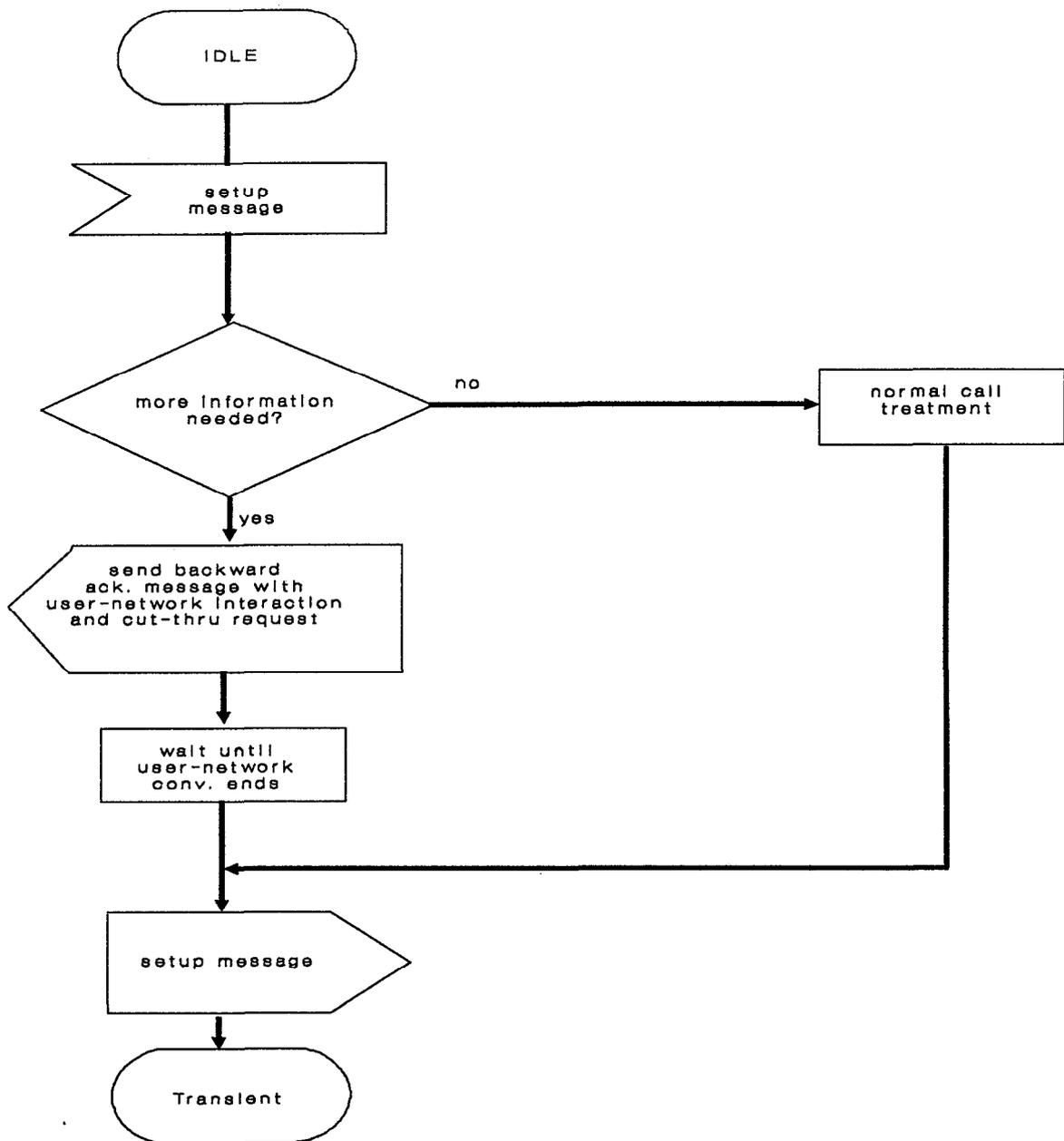**SDL for User-Network Interaction at the Originating Exchange**

Figure 71

SDL for User-Network Interaction at the Serving Exchange

16.3.   User Network Interaction, Stage-3 description (SS7 protocols)

16.3.1.   General description

This stage-3 description provides the ISDN User Part protocol to support the User-Network Interaction service.

16.3.2.   ISDN User Part formats and codes

16.3.2.1.   Optional Backward Call Indicators.

The name code of the parameter is 00101001. For the User-Network Interaction service, the parameter is carried in the Address Complete Message. The format and coding of the parameter for User-Network Interaction is shown in table 39:

Table 39

Format of Optional Backward Call Indicators

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Bit H: User-Network Interaction Indicator

0 No Indication

1 User-Network Interaction occurs, cut through in both directions

16.3.3.   ISDN User Part Procedures (during call setup)

The message flow is shown in figure 85.

16.3.3.1.   Actions required at the serving exchange

16.3.3.1.1.   Return of Address Complete Message from the serving exchange

When a serving exchange has received an Initial Address Message (IAM) from a preceding exchange and has determined that additional information is necessary from the calling party before the call can be routed further, the serving exchange shall send an Address Complete Message (ACM) containing the Optional Backward Call Indicator to the preceding exchange with the User-Network Interaction Indicator. This means that user-network interaction occurs, cut through in both directions,

The Backward Call Indicator parameter should be coded as follows:

- Charge indicator: "no indication"

- Called party's status indicator: "no indication"

- Called party's category indicator: "no indication"

- End-to-end method indicator: "no end-to-end method available"

- Interworking indicator: "no interworking encountered"

- End-to-end information indicator: "no end-to-end information available"

- ISDN-UP indicator: "ISDN-UP used all the way"

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16.3.3.1.2. Tones and announcements

After sending the ACM, the backward transmission path at the serving exchange is connected to the appropriate tones or announcements, or both. The forward path is cut through so that information can be received from the customer.

16.3.3.1.3. Sending the Initial Address Message from the serving exchange

After the necessary information has been collected through interaction with the calling party, the call set-up proceeds exactly as the case for Basic Call setup described in 2.1 of Chapter T1.113.4 of ANSI T1.113.

16.3.3.1.4. Receipt of an Address Complete Message at the serving exchange

The receipt of an ACM at the serving exchange that has previously sent an ACM causes the exchange to

    a)   cancel the awaiting address complete timer;

    b)   perform the procedures specified in 7.5.3.3.3.

16.3.3.1.5. Receipt of a Release Message at the serving exchange

If a release message is received for the outgoing circuit before an ACM is received for the outgoing circuit and the release contains a cause value which can be mapped into the playing of a tone/announcement, the release message should not be returned to the preceeding exchange (unless prior arrangement has assured that the appropriate announcement can be played). The appropriate tone or announcement should be played from the serving exchange.

16.3.3.2. Actions required at an originating exchange for the case where user-network interacts during call setup

16.3.3.2.1. Receipt of an Address Complete Message at the originating exchange.

On receiving an ACM with an Optional Backward Call Indicators parameter containing an "user-network interaction may occur, cut through in both directions" indication, the originating exchange should stop the awaiting address complete timer and:

    a)   send a progress indication to the calling party with the information that in-band information is available;

    b)   through connect the transmission paths in both directions.

16.3.3.2.2. Receipt of Call Progress Message at the originating exchange.

Receiving a Call Progress Message (CPM) causes no state change at the exchange. Based on the information contained in the Event Information parameter, an alerting, progress or in-band information available indication should be sent to the calling party together with any user-to-user information, if received.

The Backward Call Indicators received in the CPM corrects the settings of the same indicators from those received previously in the ACM.
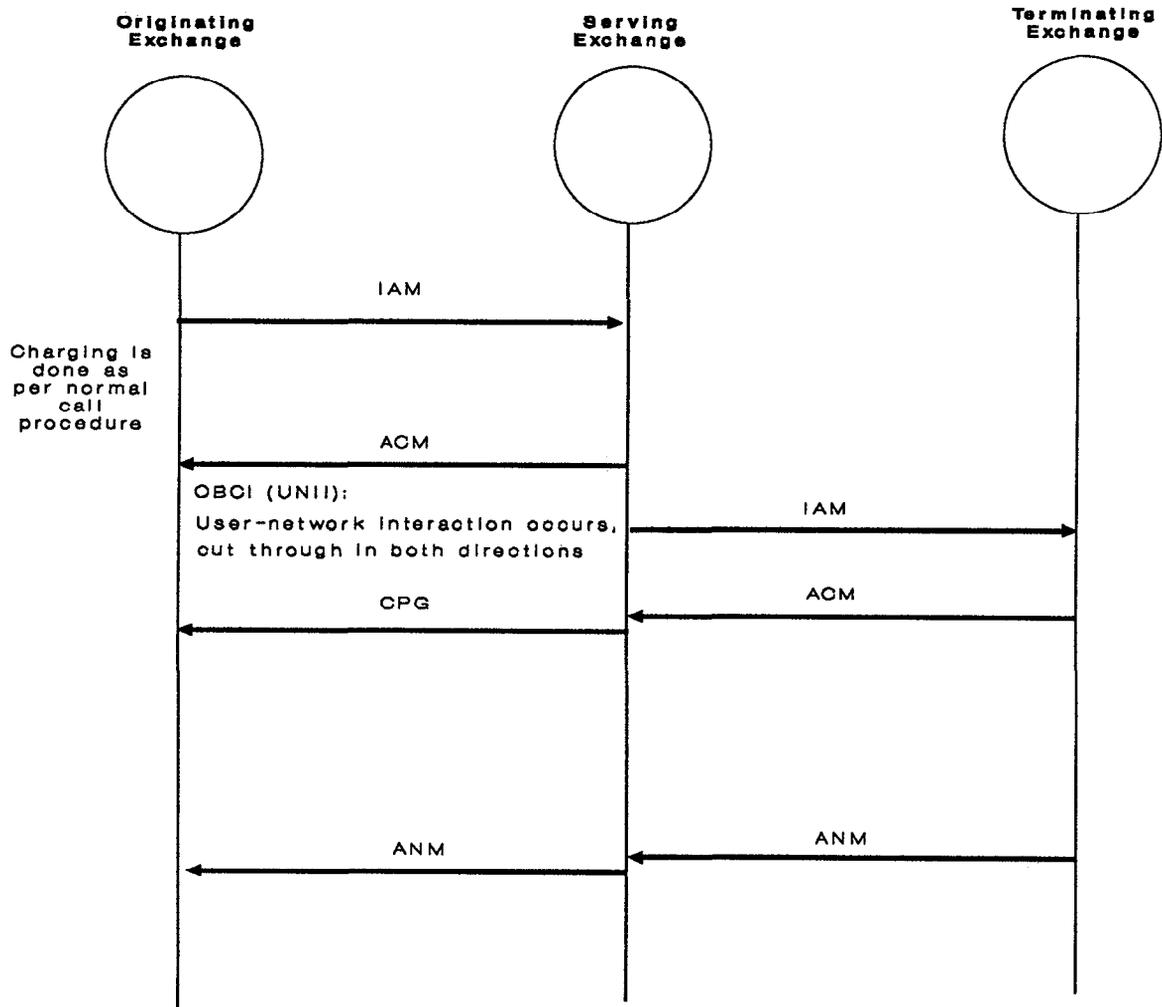
Figure 72
Message Flow for User-Network Interaction

17. Voice Message Waiting Indication Control

17.1. Voice Message Waiting Indication Control, Stage-1 description (User perspective)

17.1.1. Definition

Voice Message Waiting Indication Control allows a user to be notified by a voice message system that they have a message waiting and to be notified when no further messages are waiting.

17.1.1.1. Background

Voice Message Waiting Indication Control is part of the Voice Message Storage and Retrieval (VMSR) service. VMSR allows a calling user to record a voice message for a called user who is currently away from the phone, busy on the phone or not accepting calls. It then supplies a notification to the called user that there is a message and allows the called user to subsequently retrieve this voice message and any other messages that have arrived in the interim. When the user has retrieved all outstanding messages, the message waiting notification is removed.

It is assumed that VMSR calls are diverted to a VMSR system utilizing the SS7 supported Non-ISDN Access Call Forwarding services (SS7-supported call forwarding is required in order for the VMSR system to obtain the calling number, the forwarding number, and the cause of forwarding). The SS7-supported non-ISDN Call Forwarding Procedures, Charging Considerations, Interworking Considerations, and Interactions therefore also apply to a VMSR user.

17.1.2. Description

17.1.2.1. General description

Network-supported VMSR has three differences in capabilities compared to traditional answering machine methods:

a) The service does not require any sophisticated customer premise equipment that the customer must maintain;

b) The message can be recorded for customers who are busy on their phone;

c) There is the opportunity for the calling user to be identified via their calling number.

17.1.2.2. Specific terminology

17.1.2.2.1. Served User or Called User

This is the user who is requesting that calls to his/her number that meet unconditional diversion (i.e., user not accepting calls), busy or no answer, or both, are forwarded to a VMSR system.

17.1.2.2.2. Calling User

This is a user who gets diverted to a VMSR system.

17.1.3. Procedures

17.1.3.1. Provision and withdrawal

VMSR shall be provided after prearrangement with the service provider. Voice Messaging provider(s) are selected at subscription time. A customer may add Voice Messaging provider(s) or modify Voice Messaging provider(s) by written or verbal customer request. There are three conditions under which the served user can choose to have their calls receive VMSR, Unconditional, Busy, and No Reply. Each of these cases is supported by the corresponding Call Forwarding service.

The notification aspect of VMSR is offered with two subscription options:

Table 40

Subscription options for Voice Message Waiting Indication Control

Subscription option	Value
Form of Notification	Message Waiting Light Stutter Dial Tone
Authorized VMSR Identifier(s)	No Value (Default) ("No Value" indicates that any received VMSR ID will be accepted) VMSR ID(s)

The notification may be directed to the served user's phone or a remote phone (e.g., a secretary's phone).

17.1.3.2. Normal procedures

The normal procedures, from the user's viewpoint, are shown in figure 86.

17.1.3.2.1. Activation, deactivation, and registration

The form of notification is chosen at subscription time and cannot be activated, deactivated or changed using the served user's phone. As an option of the serving switch, the served user may indicate which VMSR providers can activate a message waiting light or stutter dial tone.

17.1.3.2.2. Invocation and operation

17.1.3.2.2.1. General

This description does not attempt to describe the interactions between the calling users or VMSR subscribers and the VMSR system. This interaction is beyond the scope of this standard.

17.1.3.2.2.2. Served Users View

Assume that there are initially no messages for the served user. When the first voice message for the served user arrives at the VMSR system, the served user is notified of the message's arrival by the means of a message waiting light or stutter dial tone. The number of the party who left the message (i.e., the calling number if it is known) may be included in this and subsequent notifications (if the VMSR system sends a message waiting indication for the arrival of subsequent messages). If the served user has an access interface that is capable of receiving a calling number, then the number of the individual that left the message should be delivered (if it is available). The served user picks up their voice messages by making a regular telephone call to the VMSR system and interacting with the system (this interaction is beyond the scope of this standard). When a user has picked up all their messages, the stutter dial tone or message waiting light notification is removed.

17.1.3.3. Exceptional procedures

17.1.3.3.1. Activation, deactivation, and registration

None identified.

17.1.3.3.2. Invocation and operation

None identified.

17.1.3.4. Alternate procedures

None Identified.

17.1.4. Network capabilities for charging

It shall be possible for the service provider to charge accurately for the service.

17.1.5. Interworking considerations

If SS7 connectivity does not exist between the switch serving the VMSR system and the served user, it will not be possible to support the service.

17.1.6. Interactions with other supplementary services

Only the diversion aspects of VMSR have interaction implications. Please refer to the appropriate sections of the SS7-supported Non-ISDN access Call Forwarding service descriptions for these interactions.
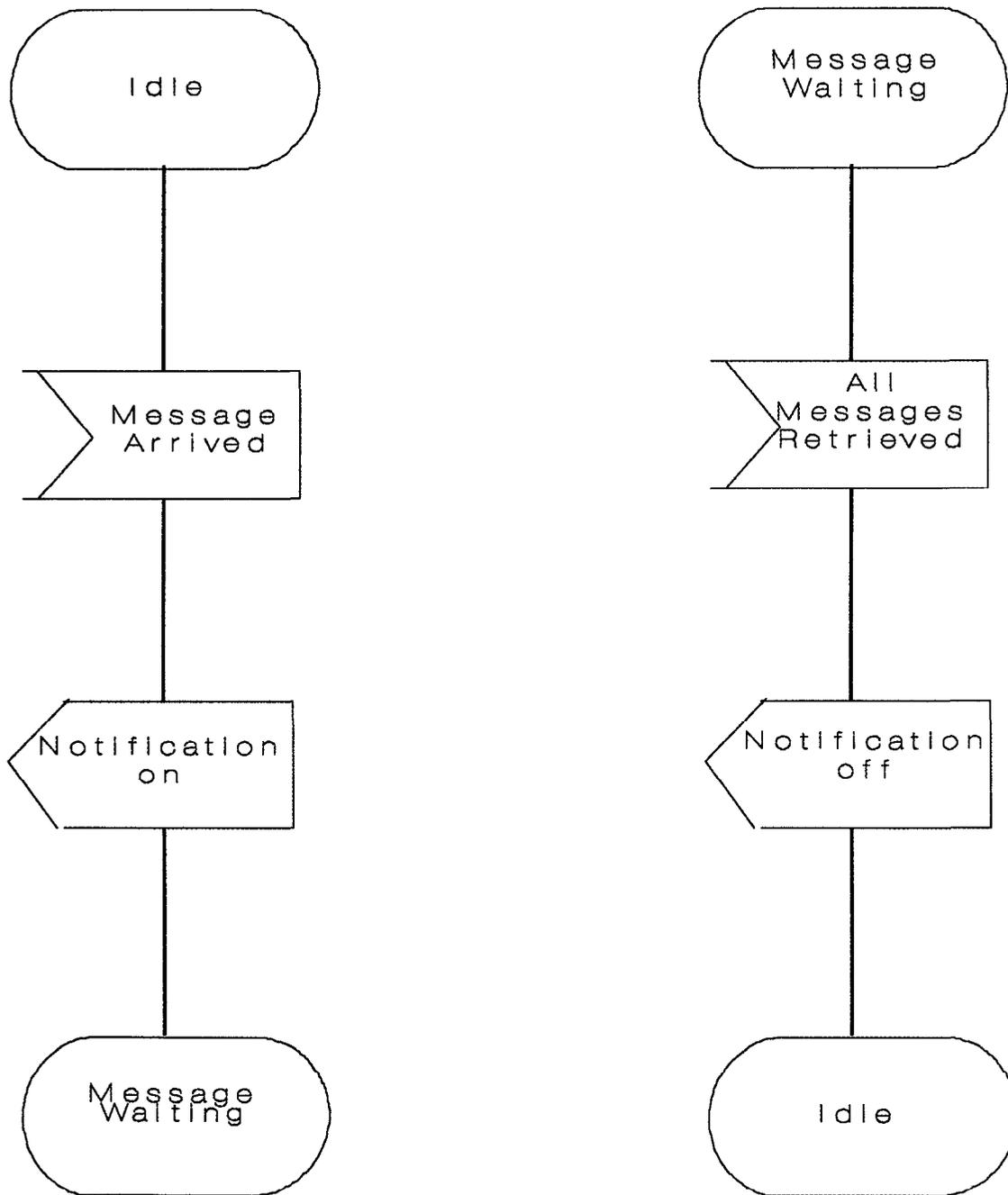
Figure 73
VMSR Notifiction Aspect

17.2. Voice Message Waiting Indication Control, Stage-2 description (Information flows)

This description gives the stage-2 information for the notification aspects of the VMSR service. The stage 2 information for the diversion aspects of the VMSR service is identical to the stage 2 information given in the SS7 supported call forwarding services for non-ISDN accesses.

17.2.1. Functional model

17.2.1.1. Specific terminology

17.2.1.1.1. Serving Switch

This is the switch that serves the VMSR subscriber. The serving switch is responsible for maintaining the served user profile (i.e., the form of served user notification, the Directory Number of the remote station for remote notification if applicable, and, optionally, the VMSR system identification(s) associated with the served user) and may perform security screening (see 17.2.2.3).

17.2.1.1.2. VMSR Switch

This is the switch that serves the VMSR system. The VMSR switch simply validates and responds to VMSR system requests and delivers them to the serving switch over SS7. The VMSR switch is also responsible for ensuring valid VMSR system identification in all requests (see 17.2.2.3).

17.2.1.2. Network configurations in the realization of the service

There are two configurations. The serving switch may be different from the VMSR switch or the serving switch may also be the VMSR switch. It is a trivial case when the serving switch is also the VMSR switch. The remainder of the description assumes that they are different switches.

17.2.1.3. Limiting assumptions

It is assumed that both switches are equipped with SS7 and that SS7 connectivity exists between them. It is assumed that a single VMSR system only provides service within a single Local Access Transport Area (LATA).

17.2.2. Normal procedures

17.2.2.1. General description

When a VMSR system receives a voice message for a VMSR subscriber that it serves, it sends a message, via the VMSR switch, requesting that the serving switch inform the VMSR subscriber that they have a voice message waiting. In the message that the VMSR switch sends to the serving switch, the VMSR subscriber is identified via a destination number, the VMSR system is identified by a VMSR system identification, the directory number of the calling user is identified (optional), and an optional timestamp indicating the time of arrival of the voice message may be present. Upon receipt of the message, the serving switch determines the correct form of notification for the served user and applies it. The information flow is shown in figure 74.

When the VMSR subscriber picks up all of their voice messages, a VMSR system sends a message, via the VMSR switch, to the serving switch, requesting that the switch remove the voice message waiting indication for the VMSR subscriber. The information flow is shown in figure 75.

Serving   VMSR
Switch   Switch

Message Waiting
    Destination Number
    Calling Number (Optional)   *VMSR System Requests*
    VMSR System Identification   *that Message*
    Timestamp (optional)   *Waiting be Activated*

Serving Switch
Successfully
Activates
Message waiting
Notification

Notification Successful
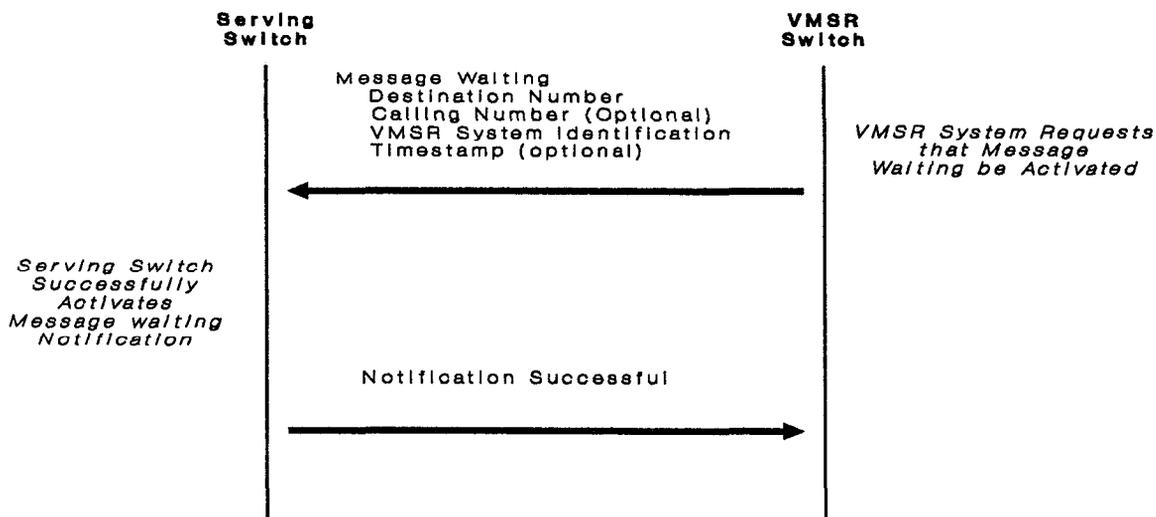
Figure 74
Message Waiting Information

Serving   VMSR
Switch   Switch

Cancel Message Waiting
    Destination Number   *VMSR System Requests*
    VMSR System Identification   *that Message*
                                                 Waiting be Deactivated

Serving Switch
Successfully
Deactivates
Message waiting
Notification

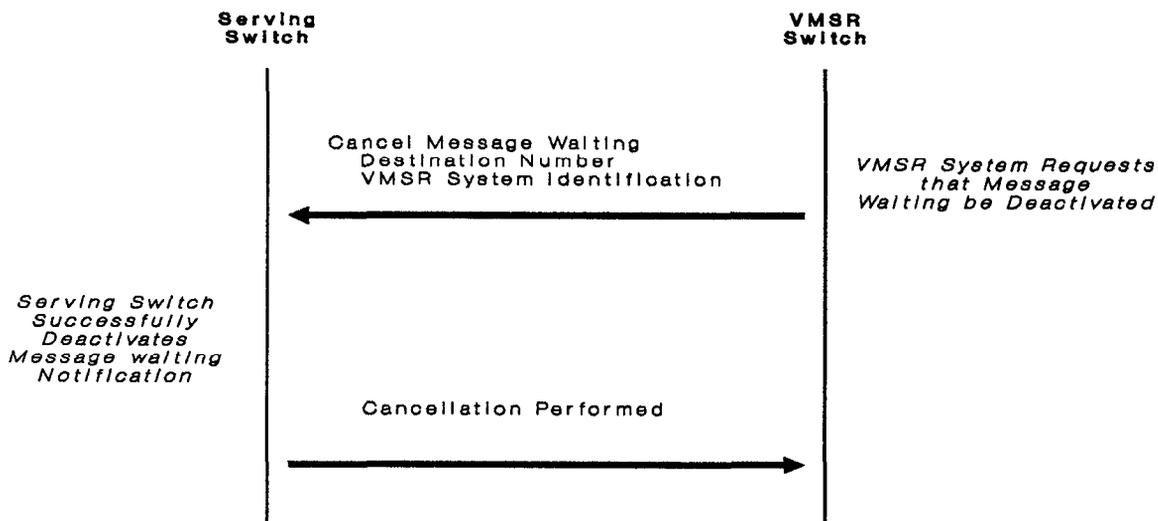Cancellation Performed

Figure 75
All Messages Retrieved Information Flow

17.2.2.2.   VMSR security

The network may take precautions to ensure that a served user's message waiting notification status is not modified by unauthorized systems. This is accomplished by using a VMSR System Identification to identify the VMSR system that is making the request.

17.2.2.2.1. Actions at Serving Switch

The VMSR System Identification may optionally be used by the serving switch. If it is, when a serving switch receives a message waiting control request (i.e., activate or deactivate), it should validate the received VMSR system identification against the VMSR system identification(s) in the user profile. The message waiting status should only be modified if the identifiers match.

17.2.2.2.2. Actions at VMSR Switch

The VMSR switch is responsible for ensuring that a valid VMSR system identification is placed in message waiting control messages. This may be done by:

a) maintaining a single VMSR system identification value per VMSR access (data link) and inserting it when a message waiting control request is received from a VMSR system on that particular access; or

b) screening a received identification against an allowable list for a particular VMSR access and only using values that pass screening as indexes to produce VMSR system identifications.

17.2.2.3. Data loss

In the event that a serving switch loses the status of a message waiting indicator, the indicator should be reset to true (i.e., message waiting).

17.3. Voice Message Waiting Indication Control, Stage-3 description (SS7 protocols)

This document gives the stage-3 SS7 protocols for the notification aspects of the Voice Message Storage and Retrieval (VMSR) service (i.e., it provides the VMSR message waiting indication control application service element). The stage-3 SS7 protocols for the diversion aspects of the VMSR service are given in the SS7 protocols of the call forwarding services for non-ISDN accesses.

17.3.1. TCAP usage

17.3.1.1. Voice message waiting notification

When a VMSR system informs its VMSR switch that it has a message for a VMSR subscriber, the switch shall determine if the subscriber is supported from a remote switch. If it is, a TCAP message shall be launched to notify the served user that they have a voice message available. The message should be Query with Permission Package and should contain a single Invoke component with Report Event - Voice Message Available operation code. The component should contain an Invoke Identifier parameter. There may be up to four additional parameters contained within the component, a Destination Number (that identifies the served user), a VMSR System Identifier (a ten digit number that identifies the VMSR system making the message waiting control request), an optional Calling Number (the number of the person who left the message, if it is available), and an optional Timestamp (showing when the message was left, optional).

In normal situations, the serving switch serves the destination number and is able to notify the served user that they have a voice message waiting. To confirm success, the serving switch should respond with a TCAP message of the Response Package type containing a single empty Return Result (last) component. If the notification could not be performed, the response should contain a Return Error component. The possible errors are Unassigned DN, Task Refused, Notification Unavailable to Destination DN, and VMSR System Identification Did Not Match User Profile.

17.3.1.2. Voice messages retrieved notification

When a VMSR system informs its VMSR switch that a user has retrieved all their messages, the switch shall determine if the subscriber is supported from a remote switch. If it is, a TCAP message shall be launched to cancel the voice message waiting indication. The message should be Query with Permission Package and should contain a single Invoke component with of Report

Event - Voice Message(s) Retrieved operation code. The component should contain an Invoke Identifier parameter. There should be two additional parameters contained within the component, a Destination Number and a VMSR System Identifier.

In normal situations, the serving switch serves the destination number and removes the message waiting indication. To confirm success, the serving switch should respond with a TCAP message of the Response Package type containing a single empty Return Result (last) component. If the notification removal could not be performed, the response should contain a Return Error component. The possible errors are Unassigned DN, Task Refused, Notification Unavailable to Destination DN, and VMSR System Identification did not Match User Profile.

17.3.2.   TCAP operations

The following description utilizes the ASN.1 method of protocol description that is described in CCITT Recommendations X.208 and X.209.

17.3.2.1.   Report Event - Voice Message Available operation

The Report Event family of operations is used to indicate that there has been an event occurrence at a remote location. The Report Event Voice Message Available operation is used when a voice mail message arrives for a VMSR subscriber at a remote VMSR system. The operation is used to notify the VMSR subscriber that they have a voice message available.

```
reportEvent-VoiceMessageAvailable        OPERATION
PARAMETERSEQUENCE                        {destinationNumber Digits,
                                         vMSRIdentifierDigits,
                                         callingNumber Digits OPTIONAL,
                                         timestamp UTCTime OPTIONAL}
--The Destination Number is provided by the VMSR system


RESULTSET                                {}
--To indicate successful completion


ERRORS                                   {taskRefused, unassignedDN,
                                         notificationUnavailableToDestinationDN,
                                         vMSRIDdidNotMatchUserProfile}


Digits ::= [4] IMPLICIT OCTET STRING --as coded in 5.4 of chapter T1.114.3 of ANSI T1.114.


UTCTime ::= [UNI 23] IMPLICIT VisibleString

--The visible string is coded YYMMDDhhmm   + or -         hhmm

--                         local time               Time difference from

--                                                  Greenwich Mean Time


taskRefusedERROR
PARAMETER SET {}
::= 7


unassignedDN ERROR
PARAMETER SET {}
::= 14
```

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notificationUnavailableToDestinationDN ERROR
PARAMETER SET { }
::= 16

vMSRIDdidNotMatchUserProfile ERROR
PARAMETER SET { }
::= 17

::= 35,329

--FAMILY :=138, SPECIFIER :=1

The errors that may be reported for the unsuccessful completion of this operation are given in table 41. "Task Refused" is used when the remote switch is overloaded and cannot currently handle the request. "Unassigned DN" is used when the Destination DN is not currently assigned to an active interface. "Notification Unavailable to Destination DN" is used when the notification cannot be provided to the destination for some short term reason (e.g., the line is temporarily out of service). "VMSR System Identification Did Not Match User Profile" is used when the Destination DN is not a customer of the identified VMSR system (i.e., the VMSR System Identification is not authorized for the Destination DN).

Table 41

Report Event - Voice Message Available Error Code Table

Error Name	Error Code
TaskRefused	00000111
Unassigned DN	00001110
Notification Unavailable to Destination DN	00010000
VMSR ID did not match user profile	00010001

17.3.2.2. Report Event - Voice Message(s) Retrieved operation

The Report Event family of operations is used to indicate that there has been an event occurrence at a remote location. The Report Event - Voice Message(s) Retrieved operation is used when a VMSR subscriber has picked up all their messages at a remote VMSR system. The operation is used to remove the voice message waiting indication.

reportEvent-VoiceMessage(s)Retrieved   OPERATION
PARAMETER SEQUENCE   {destinationNumber Digits,
                                             vMSRIdentifier Digits}

--The Destination Number is provided by the VMSR system

--The VMSR Identifier identifies the VMSR system

RESULT SET   {}
--To indicate successful completion

ERRORS   {taskRefused, unassignedDN,
                                             notificationUnavailableToDestinationDN,
                                             vMSRIDdidNotMatchUserProfile}

Digits ::= [4] IMPLICIT OCTET STRING --as coded in 5.4 of chapter T1.114 of ANSI T1.114-1988.

taskRefusedERROR
PARAMETER SET {}
::= 7

unassignedDN ERROR
PARAMETER SET {}
::= 14

notificationUnavailableToDestinationDN ERROR
PARAMETER SET{}
::= 16

vMSRIDdidNotMatchUserProfile ERROR
PARAMETER SET{}
::= 17

::= 35,330
--FAMILY :=138, SPECIFIER := 2

The errors that may be reported for the unsuccessful completion of this operation are given in table 42. "Task Refused" is used when the remote switch is overloaded and cannot currently handle the request. "Unassigned DN" is used when the Destination DN is not currently assigned to an active interface. "Notification Unavailable to Destination DN" is used when the notification cannot be provided to the destination for some short term reason (e.g., the line is temporarily out of service). "VMSR System Identification did not Match User Profile" is used when the Destination DN is not a customer of the identified VMSR system.

Table 42

Report Event - Voice Message(s) Retrieval Error Code Table

Error Name	Error Code
TaskRefused	00000111
Unassigned DN	00001110
Notification Unavailable to Destination DN	00010000
VMSR ID Did Not match user profile	00010001

17.3.3.   TCAP Parameters

17.3.3.1.   Destination, VMSR System Identifier, and Calling Party Numbers

The Destination Number parameter and the Calling Number parameter are defined in ANSI T1.114. The VMSR System Identifier Parameter requires a new type of digits: VMSR Identifier. This new type of digits is coded as 12 (= 00001100)

The subfields of the destination number parameter are coded as follows:

type of digits: destination number

nature of number: national, no presentation restriction (=00000000)

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numbering plan: ISDN numbering

encoding BCD

number of digits: 10

The subfields of the VMSR System Identifier parameter are coded as follows:

type of digits: VMSR ID = 12 (=00001100)

nature of number: national, presentation restricted (=00000010)

numbering plan: either ISDN numbering or unknown/not applicable

encoding BCD

number of digits: 10

Initially, a default value of zero for the VMSR ID can be used when a VMSR access is first activated. The identifier should be assignable VMSR system basis. The VMSR ID may be changed to another valid value at any time at the discretion of the service provider.

Table 43

Format and Coding of Timestamp Parameter

Parameter	Identifier Code
Timestamp	00010111
Contents	
YY MM DD hh mm + or -hh mm	

17.3.3.2. Timestamp

This parameter identifies what time a voice message was received. It uses local time and gives the difference between the local time and universal coordinated time (Greenwich Mean Time - GMT). It is 15 octets long and of type Visible String. The parameter is coded as shown in table 43.

The contents of the parameter give the year, month, date, and time of the message arrival as shown in table 44:

Table 44

Year, Month, Date and Time Encoding

	H G F E D C B A
Octets 1-2	YY
Octets 3-4	MM
Octets 5-6	DD
Octets 7-8	hh
Octets 9-10	mm
Octet 11	- or +
Octets 12-13	hh
Octets 14-15	mm

Where YY = Year (e.g., 88), MM = Month (e.g., July = 07), DD = Date, first hh and mm = hours and minutes in local time, (e.g., 5:30 PM = 17 30) and second hh and mm gives the difference between local time and GMT (e.g., Atlanta GA is five hours behind = - 05 00). Each character is coded in one octet.

For CCITT Recommentation T.61 encoding, the digits are coded as shown in table 45:

Table 45

Codes for CCITT Recommendations T.61

Digits	H	G	F	E	D	C	B	A
Digit 0	0	0	1	1	0	0	0	0
Digit 1	0	0	1	1	0	0	0	1
Digit 2	0	0	1	1	0	0	1	0
Digit 3	0	0	1	1	0	0	1	1
Digit 4	0	0	1	1	0	1	0	0
Digit 5	0	0	1	1	0	1	0	1
Digit 6	0	0	1	1	0	1	1	0
Digit 7	0	0	1	1	0	1	1	1
Digit 8	0	0	1	1	1	0	0	0
Digit 9	0	0	1	1	1	0	0	1
+	0	0	1	0	1	0	1	1
-	0	0	1	0	1	1	0	1

Annex A
(informative)

CFU Interactions with Other Supplementary Services

This annex contains descriptions of interactions with services that have not been standardized and that are still undergoing change. These tentative interactions are for information only and may be completely revised as the other services are standardized.

A.1   Call Waiting

- *Calling User:* No impact, i.e., neither supplementary service affects the operation of the other supplementary service;

- *Served User:* If a served user has activated CFU, then the execution of that forwarding condition takes precedence over Call Waiting;

- *Forwarded-to User:* A forwarded call can invoke Call Waiting.

A.2   Call Transfer

A.2.1   Transfer of a forwarded call

- *Calling User:* A call that has been forwarded can be transferred by the calling user, if that calling user can transfer a nonforwarded call;

- *Served User:* No impact, i.e., neither supplementary service affects the operations of the other supplementary service;

- *Forwarded-to User:* A call that has been transferred will be forwarded if the transferred-to user has Call Forwarding Unconditional active and the appropriate forwarding conditions are set. A call that has been forwarded can be transferred by the forwarded-to user.

A.2.2   Forwarding of a call during transfer

A call that is being transferred can be forwarded by the party to whom the call is being transferred.

A.3   Calling Line Identification Presentation (CLIP)

- *Served User:* The Non-ISDN Served user may not receive the Calling Number as the alerting state may not be attained;

- *Forwarded-to User:* Forwarded-to users, which have subscribed to CLIP, may receive the calling user's number if the calling user has not subscribed or invoked Calling Line Identification Restriction (CLIR).

A.4   Calling Line Identification Restriction (CLIR)

- *Calling User:* When the calling line identification restriction is applicable and activated, the calling line identification will not be presented to the forwarded-to user unless the forwarded-to user has an override category. In addition, if the forwarding user has an override category, the calling party's number will be provided in the call offering information. The latter is a network option.

A.5   Conference Calling

- *Calling User:* If a conference controller attempts to establish a conference call and calls a user with call forwarding active, the forwarded-to user will be alerted and can be added to the conference;

- *Served User:* No impacts, i.e., neither supplementary service affects the operation of the other supplementary service;

- *Forwarded-to User:* A forwarded-to user can establish a conference using an existing forwarded call as one of the conference connections.

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A call that has been forwarded can be added to an existing conference by the forwarded-to user.

A.6 Diversion Services

A.6.1 Call Forwarding Busy

The invocation of CFU takes precedence over CFB.

A6.2 Call Forwarding No Reply

The invocation of CFU takes precedence over CFNR.

A.6.3 Call Forwarding Unconditional

Not applicable.

A.7 Line Hunting

When Call Forwarding Unconditional applies to a group number or member number and a call is directed to one of these numbers, CFU occurs.

A.8 User-to-User Signalling

User-to-user signalling directed to a non-ISDN access will never be delivered to that access or forwarded from that access.

A.9 Call hold service

No impact, i.e., neither supplementary service affects the operation of the other supplementary service.

A.10 Call Completion to Busy Subscriber (CCBS)

It is assumed, in this case, that User A calls Destination B and that Destination B is a CFU subscriber who may activate CFU to User C.

- *CFU activated by B before A requests CCBS:* If the call to Destination B is forwarded to C by Call forwarding Unconditional and C is busy, then a CCBS request if made by User A will be rejected. User A will be informed that the CCBS request has been rejected (Short Term Denial). The CCBS request is rejected because user A cannot encounter a busy destination B.

- *CFU activated by B after A requests CCBS:* If Destination B invokes CFU after A requests CCBS then the CCBS call will be forwarded when it is set up.

- *User A invokes CFU before or after invoking CCBS:* CCBS recall will not be forwarded and will be given to User A at his original location.

A.11 Multilevel Precedence and Preemption (MLPP)

The CFU service has precedence over the MLPP service. The precedence level of calls is preserved during the forwarding process, and the forwarded-to user may be pre-empted.

Annex B
(Informative)

CFB Interactions with other supplementary services

This annex contains descriptions of interactions with services that have not been standardized and that are still undergoing change. These tentative interactions are for information only and may be completely revised as the other services are standardized.

The ways in which Call Forwarding Busy interacts with other supplementary services are in general identical to the ways in which Call Forwarding Unconditional interacts with other supplementary services. Thus, if the interactions are described to be "Same as CFU", the CFU text should be taken verbatim, except that the word "Call Forwarding Unconditional" should be replaced by "Call Forwarding Busy".

B.1   Call Waiting

– *Calling User:* Same as CFU.

– *Served User:* If the user has a call waiting slot available, Call Waiting will take place. If the user is "Busy" (i.e., all Call Waiting slots also occupied), Call Forwarding Busy will take place.

– *Forwarded-to User:* A forwarded call can invoke Call Waiting.

B.2   Call Transfer

Same as CFU.

B.3   Calling Line Identification Presentation

– *Served User:* The non-ISDN served user cannot receive the calling number as the alerting state is not attained.

– *Forwarded-to User:* Same as CFU .

B.4   Calling Line Identification Restriction

Same as CFU.

B.5   Conference Calling

Same as CFU.

B.6   Diversion Services

B.6.1   Call Forwarding Busy

Not applicable.

B.6.2   Call Forwarding No Reply

No impact, i.e., neither supplementary service affects the operation of the other service. CFB occurs only when the called party is busy while CFNR occurs only when they are not busy.

B.6.3   Call Forwarding Unconditional

The invocation of CFU takes precedence over CFB.

B.7   Line Hunting

When CFB applies to a group number or member number, CFB occurs when all members are busy.

B.8 User-to-User Signalling

User-to-user signalling directed to a non-ISDN access will never be delivered to that access or forwarded from that access.

B.9 Call Hold Service

No impact, i.e., neither supplementary service affects the operation of the other supplementary service.

B.10 Call Completion to Busy Subscriber

It is assumed, in this case, that User A calls Destination B and that Destination B is busy and has CFB activated to User C.

- *CFB activated by B before A requests CCBS:* If B has activated CFB and is busy and the forwarded-to User C is also busy, then any subsequent CCBS request by A will be applied to the originally called Destination B.

- *CFB activated by B after A requests CCBS:* If User A accepts the CCBS recall, the resulting call will be applied to the originally called Destination B. Destination B will be alerted if B is idle. The call will be forwarded to User C if B is busy.

- *User A invokes CFB before or after invoking CCBS:* CCBS Recall will be given to User A at his original location.

B.11 Multilevel Precedence and Preemption

If the incoming call is of higher precedence than one or more calls at User B, a call of the lowest precedence will be preempted and the incoming call will be established, i.e., CFB will not be invoked. If the incoming call is of equal or lower precedence than the established calls, CFB will be invoked. If the served subscriber is nonpreemptable, CFB will be invoked regardless of the precedence levels of the incoming call and established calls. The precedence level of calls is preserved during the forwarding process, and the forwarded-to user may be preempted.

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Annex C
(informative)

CFNR Interactions with Other Supplementary Services

This annex contains descriptions of interactions with services that have not been standardized and that are still undergoing change. These tentative interactions are for information only and may be completely revised as the other services are standardized.

The ways in which Call Forwarding No Reply interacts with other supplementary services are in general identical to the ways in which Call Forwarding Unconditional interacts with other supplementary services. Thus, if the interaction is described to be "Same as CFU", the CFU text should be taken verbatim, except that the words "Call Forwarding Unconditional" should be replaced wHh "Call Forwarding No Reply".

C.1   Call Waiting

If Subscriber B has CFNR activated, then a waiting call will still be offered as described in the Call Waiting definition. If no answer is received to this call during the duration of the CFNR Reply timer, then CFNR becomes invoked and the waiting call is forwarded.

C.2   Call Transfer

Same as CFU.

C.3   Calling Line Identification Presentation

- *Served User:* If subscribed to, the served user can receive the Calling Line Identification of all calls that have been forwarded.

- *Forwarded-to User:* Same as CFU.

C.4   Calling Line Identification Restriction

Same as CFU.

C.5   Conference Calling

Same as CFU.

C.6   Diversion Services

C.6.1   Call Forwarding Busy

No impact, i.e., neither supplementary service affects the operation of the other service. CFB occurs only when the called party is busy while CFNR occurs only when they are not busy. When a call is offered and all call waiting slots are full, that call will receive CFB.

C.6.2   Call Forwarding No Reply

Not applicable.

C.6.3   Call Forwarding Unconditional

The invocation of CFU takes precedence over CFNR.

C.7   Line Hunting

When CFNR applies to a group number or member number, CFNR occurs when a call is offered, alerting occurs and the call meets no-reply conditions.

C.8   User-to-User Signalling

User-to-user signalling directed to a non-ISDN access will never be delivered to that access or forwarded from that access.

C.9   Call Hold Service

No impact, i.e., neither supplementary service affects the operation of the other supplementary service.

C.10   Call Completion to Busy Subscriber

It is assumed, in this case, that User A calls Destination B and that Destination B is busy and has CFNR activated to User C.

–   *CFNR activated by B before A requests CCBS:* If B has activated CFNR and the call is forwarded on no-reply to C and C is busy, any request by A for CCBS will be rejected with User A being given a short-term denial. The CCBS request is rejected because User A has not encountered a busy destination B.

–   *CFNR activated by B after A requests CCBS:* If User A accepts the CCBS recall, the call set up will be applied to the originally called destination B. The call will be connected to the forwarded-to user C if it meets No Reply conditions at Destination B.

–   *User A invokes CNR before or after invoking CCBS:* CCBS recall will not be forwarded and will be given to User A at his original location.

C.11   Multilevel Precedence and Preemption

Same as CFU.

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Annex D
(informative)

Customer-Defined Line Privileges and MBG Screening Examples

This annex contains two examples to illustrate the concept of customer-defined line privileges and MBG screening. These examples are for illustrative purposes only, and should not be construed as implementation details.

D.1   Example

Suppose MBG 1 is composed of two subgroups (SGs). SG A represents the Accounting Department, and SG B represents the Engineering Department. Further, suppose there are two sets of line privileges LP1 and LP2 associated with each subgroup. In SG A, LP1 represents the managers, and LP2 represents the non managers. In SG B, LP1 represents the non managers, and LP2 represents the managers.

The MBG customer configured the MBG in this manner to meet the following goals;

-   each line in the MBG is barred from originating calls to outside the MBG;

-   each line in the MBG is barred from receiving calls from outside the MBG;

-   members in a subgroup may communicate with members of the same subgroup only, with the exception in subclause D.2 below;

-   managers in SG A may communicate with managers in SG B.

D.1.1   Originating restrictions and screening

In the most general sense, each MBG line is associated with a list of MBG IDs to which the user may originate calls, including an indication of whether or not calls may originate to non-MBG lines directly or indirectly (i.e., via another MBG line in the same MBG).

In this example, every line in MBG 1 has MBG 1 as the single entry in the list.

D.1.2   Terminating restrictions and screening:

In the most general sense, each MBG line may be associated with a list of

-   MBG IDs

-   (MBG ID, SG ID) combinations, and

-   (MBG ID, SG ID, LP) combinations

from which calls may be received or rejected, including an indication of whether or not non-MBG calls may terminate directly or indirectly.

For the example above, the terminating restrictions could be assigned as follows:

Lines in (MBG 1, SG A, LP1) may accept calls from lines in (MBG 1, SG A) and (MBG 1, SG B, LP2).

Lines in (MBG 1, SG B, LP2) may accept calls from lines in (MBG 1, SG B) and (MBG 1, SG A, LP1).

Lines in (MBG 1, SG A, LP2) may accept calls from lines in (MBG 1, SG A).

Lines in (MBG 1, SG B, LP1) may accept calls from lines in (MBG 1, SG B).

D.2   Example 2

Suppose a business customer wanted to use the classical Centrex restriction scheme available today in many business group environments. This scheme involves the designation of fully

restricted, semi-restricted, or unrestricted to lines in a business group to identify whether or not the line could originate or terminate or originate and terminate calls to outside the group (directly or indirectly), and whether or not the line could originate or terminate or originate and terminate calls to an attendant.

While the MBG model described here allows much greater flexibility than the current Centrex restriction scheme, the model can be used to support any MBG using the Centrex restriction scheme (i.e., the flexible MBG model is backward compatible with the current Centrex restriction scheme).

Suppose an MBG 1 is composed of lines that are fully restricted originating, i.e., none of the lines can originate call to outside MBG 1 or to the MBG attendant. Further, suppose MBG 1 is composed of lines with three different types of terminating restrictions:

a) unrestricted terminating (the lines can receive calls from inside or outside MBG 1).

b) semi-restricted terminating (the lines can receive calls from inside MBG 1, and the lines can receive calls from outside MBG 1 if the calls were redirected by a line inside MBG 1).

c) fully restricted terminating (the lines can receive calls from inside MBG 1, but the lines may not receive any calls from outside MBG 1 or from the MBG attendant).

One method for formulating the MBG model for this customer is as follows:

− assign MBG 1 to each line in the MBG;

− assign SG A to each line in the MBG;

− assign LP1 to each unrestricted terminating line;

− assign LP2 to each semi-restricted terminating line;

− assign LP3 to each fully restricted terminating line.

In this example, the line access restrictions provide the only distinction between MBG lines; therefore, the LPs differ depending upon the terminating restriction, but the MBG ID and the SG ID are identical for each line in the MBG.

D.2.1 Originating restriction and screening

In this example, all lines are fully restricted originating. Therefore, the list associated with each line for originating screening purpose includes MBG 1 as the single entry.

D.2.2 Terminating restrictions and screening

In this example, there are three variations for terminating screening.

Lines in (MBG 1, SG A, LP1) may accept calls from lines in MBG 1 and lines outside MBG 1.

Lines in (MBG 1, SG A, LP2) may accept calls from lines in MBG 1.

Lines in (MBG 1, SG A, LP3) may accept calls from lines in MBG 1, except if the line is an MBG attendant line.

Note that no provision is made for lines in (MBG 1, SG A, LP2) to accept indirect calls from outside the MBG. The indirect calls involve redirections (forwarding, transfer) that are beyond the scope of the MBG basic call service description, and these are covered in the appropriate MBG supplementary service description.

Annex E
(informative)

Acronyms

AC	Automatic Callback
ACM	Address Complete Message
ANM	Answer Message
AR	Automatic Recall
ASE	Application Service Entity
ASN	Abstract Syntax Notation
AttSt	Attendant Status
CCS	Common Channel Signalling
CCBS	Call Completion to Busy Subscriber
CCITT	International Telegraph and Telephone Consultative Committee
CFB	Call Forwarding Busy
CFNR	Call Forwarding No Reply
CFU	Call Forwarding Unconditional
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
CPG	Call Progress Message
CWO	Call Waiting Originating
DB	Database
DCW	Dial Call Waiting
DN	Directory Number
DO	Denied Originating
DT	Denied Terminating
DTMF	Dual Tone Multi-frequency
FE	Functional Entities
FIFO	First In First Out
FRO	Fully-Restricted Originating
FROI	Fully-restricted Originating Intra-switch
FRT	Fully-Restricted Terminating
GMT	Greenwich Mean Time
IAM	Initial Address Message
IMO	Intermediate MBG Office

INF	Information Message
INR	Information Request Message
ISDN	Integrated Services Digital Network
ISDN-UP	ISDN User-Part
ISUP	ISDN User-Part
IWPN	Inter Working with Private Networks
LATA	Local Access Transport Area
LICN	Last Incoming Calling Number
LOCN	Last Outgoing Called Number
LP	Line Privileges
MBG	Multilocation Business Group
MCW	MBG Call Waiting
MF	Multi-Frequency
MLPP	Multilevel Precedence & Preemption
Non-EAEO	Non-Equal Access End Office
Non-ISDN	Non-Integrated Services Digital Network
NWC	N-Way Conferencing
OEO	Originating End Office
PCM	Pulse Code Modulation
POTS	Plain Old Telephone Service
RLC	Release Complete
SAP	Service Activation Parameter
SCCP	Signalling Connection Control Part
SDL	Symbolic Description Language
SG	Subgroup
SRO	Semi-Restricted Originating
SGID	Subgroup ID
SS7	Signalling System Number 7
TC	Transaction Capabilities
TCAP	Transaction Capability Application Part
TCM	Travelling Class Mark
TEO	Terminating End Office
URO	Unrestricted Originating

URT	Unrestricted Terminating
VMSR	Voice Message Storage and Retrieval
VMW	Voice Message Waiting