ATIS-1000616.2014(R2019)

Integrated Services Digital Network (ISDN) – Call Hold Supplementary Service

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ATIS-1000616.2014(R2019), *Integrated Services Digital Network (ISDN) – Call Hold Supplementary Service*

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American National Standard for Telecommunications

Integrated Services Digital Network (ISDN) – Call Hold Supplementary Service

Alliance for Telecommunications Industry Solutions

Approved June 2014

American National Standards Institute, Inc.

Abstract

This standard specifies the service capabilities of the Call Hold service within the context of an Integrated Services Digital Network (ISDN).

Foreword

The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

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Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, PTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of consensus on this document, PTSC, which was responsible for its development, had the following leadership:

M. Dolly, PTSC Chair (AT&T)
V. Shaikh, PTSC Vice-Chair (ACS)
M. Dolly, PTSC SAC Chair (AT&T)

The **SAC** Subcommittee was responsible for the development of this document.

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Integrated Services Digital Network (ISDN) – Call Hold Supplementary Service

1 Scope, Purpose, & Application

1.1 Scope & Purpose

This standard specifies the service capabilities of the Call Hold service within the context of an Integrated Services Digital Network (ISDN). The Call Hold service allows a served user to interrupt B-channel communications on an existing call and then subsequently, if desired, re-establish communications. The associated switching and signaling specifications are also provided. This service may be made available on demand or in a subscription arrangement. The interaction of this service with other service capabilities defined in American National Standards is also included. The purpose of this standard is to allow maximum compatibility among public-, and user-owned telecommunications equipment in order to increase the attractiveness and usefulness of ISDN-based capabilities.

1.2 Application

This standard applies to ISDN Basic Accesses and Primary Rate Interfaces and is intended to supplement the Basic Circuit Mode call procedures described in *American National Standard for Telecommunications – Integrated Services Digital Network (ISDN) – Layer 3 signaling specification for circuit-switched bearer service for digital subscriber signaling system number 1 (DSS1)*, ATIS-1000607 and *American National Standard for Telecommunications – Signaling system number 7 (SS7) – Integrated services digital network (ISDN) user part*, ATIS-1000113. It should be used in conjunction with the other American National Standards for ISDN supplementary services for a complete understanding of the interactions between this and other services. This supplementary service is applicable to the Speech, Voice-Band Data (3.1 kHz audio), and Data (64 kbit/s unrestricted) Circuit-Mode bearer services identified in *American National Standard for Telecommunications – Integrated services digital network (ISDN) – Minimal set of bearer services for the basic rate interface*, ATIS-1000604, and *American National Standard for Telecommunications – Integrated services digital network (ISDN) – Minimal set of bearer services for the primary rate interface*, ATIS-1000603.

2 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.

- ATIS-1000113.2005(R2010), *Signaling System No. 7 (SS7) – Integrated Service Digital Network (ISDN) User Part*.[1]

[1] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < https://www.atis.org/docstore/product.aspx?id=24941>

- ATIS-1000603.1993(R2009), *Integrated services digital network (ISDN) – Minimal set of bearer services for the primary rate interface*.[2]
- ATIS-1000604.1990(R2009), *Integrated services digital network (ISDN) – Minimal set of bearer services for the basic rate interface*.[3]
- ATIS-1000607.2000(R2009),*Integrated Services Digital Network (ISDN) – Layer 3 signaling specification for circuit- switched bearer service for digital subscriber signaling system number 1 (DSS1)*.[4]
- ATIS-1000610.1998(R2013),*Generic Procedures for the Control of ISDN Supplementary Services*.[5]
- ATIS-1000620.1991(R2012), *Integrated Services Digital Network (ISDN) - Circuit-Mode Bearer Service Category Description*.[6]

3 Definitions

Served user (user A): This is an ISDN TE or NT2 (as described in the ITU-T Recommendations of the I-series) that is connected to an ISDN network and invokes the Call Hold service.

Network: In this description, network refers to all telecommunications equipment that has any part in processing a call or a supplementary service for the user referred to. It may include local exchanges, transit exchanges, and NT2s but does not include the ISDN terminal and is not limited to the "Public" network or any other particular set of equipment.

Service provider: This is a company, organization, administration, business, etc. that sells, administers, maintains, charges for, etc., the service. The service provider may or may not be the provider of the network.

User B: This is a user involved in a call with the served user that may be held or retrieved. User B does not have to be an ISDN terminal or be connected to an ISDN exchange in order for the served user to place a call on hold.

Terminal Service Profile (TSP): Information the service provider maintains for a given user to characterize the services offered by the network to that user. A terminal service profile may be allocated to an interface or to a particular user equipment or a group of user equipment.

4 Description of the Call Hold Service from the User's Perspective

The Call Hold service allows a user to interrupt communications on an existing call and then subsequently, if desired, re-establish communications. A B-channel may be reserved after the communication is interrupted to allow the origination or possible termination of other calls. Reservation

[2] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < https://www.atis.org/docstore/product.aspx?id=24727>

[3] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < https://www.atis.org/docstore/product.aspx?id=24728>

[4] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < https://www.atis.org/docstore/product.aspx?id=24729>

[5] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < https://www.atis.org/docstore/product.aspx?id=27979>

[6] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < https://www.atis.org/docstore/product.aspx?id=26092>

shall be provided by the service provider as a subscription option. The Call Hold service includes the Retrieve operation, which re-establishes communication on a B-channel between the served user and the held party.

This clause further defines the Call Hold service in terms of procedures and other aspects visible to the user or users without regards to the means of implementation. It describes interworking with non-ISDNs and interactions between Call Hold and other ISDN service capabilities. This clause does not suggest how the required functions should be divided between public- and customer-owned equipment. It does not address the protocol needed for implementing this service in a standard way. It provides a prose description and a diagrammatic description of the Call Hold service in the form of a Specification and Description Language (SDL) Diagram. In case of conflict between the following text and the SDL, the text takes precedence.

4.1 Description

When the Call Hold service is invoked, communication on a B-channel is interrupted and the B-channel is released from use by the existing call. If reservation is subscribed to, a B-channel is reserved for use by the given terminal used to invoke the Call Hold service. The subscription option to allow the served user the ability to release all reserved B-channels is a service-provider option.

When a served user places a call on hold and reservation applies, a B-channel shall always be available on that user's interface for the user to retrieve that call from hold; or setup, retrieve, or connect to another call. The subscribed-to number of B-channels shall be kept available for the user as long as the user has at least that number of calls on hold with reservation. That is, the network should not reserve more than the subscribed-to number of B-channels for each ISDN Number/Bearer Service/TSP or TSP. If the network receives a Hold request from a user who is subscribed to B-channel reservation, and the network has already reserved all M B-channels for that user, then the network shall proceed with the Hold request in the normal manner, but no additional B-channel will be reserved for the user.

Table 1: Subscription options for the Call Hold service (per TSP, or number/bearer service/TSP)

Subscription options	Values
Call Hold service assigned	-No -Yes
Notification of hold/retrieve sent to the held/retrieved party	-No -Yes
Limit of number of reserved channels	-M (where 0 ≤ M ≤ maximum number of channels available on the interface, M = 0 indicates no reservation)
B-channel reservation release allowed	-No -Yes
NOTE – The number of calls that can be held is limited only by the limits on the number of calls on the interface as provided by the basic call description.	

When the served user wishes to re-establish communications, the Retrieve operation is requested. The success of the Retrieve operation depends on whether or not a B-channel was reserved and whether a B-channel is currently available to the served user.

The served user has the option at subscription to have the notification of hold/retrieve sent to the held party. Either no notifications will be sent or both hold and retrieve notifications will be sent.

In order to terminate calls that have been on hold for unreasonable amounts of time, a network optional guard timer may be set. The same length of the guard timer applies to all calls placed on hold by the service provider. The value of the optional guard timer ranges from 30 minutes to 48 hours, with 48 hours being the expected value.

4.2 Procedures

4.2.1 Provision/Withdrawal

The Call Hold service can be provided on a subscription basis, or can be provided to all users without subscription, as a service-provider option. The Call Hold service can be withdrawn for administrative reasons. As a network option, the Call Hold service can be offered with several subscription options. If the Call Hold service is provided to all users without subscription, the service provider shall assign subscription option values. The service provider may provide the capability of combining 3.1-kHz Audio and Speech bearer services for the purpose of assigning subscription options. Options that apply separately to each terminal service profile, or to each number/bearer service per TSP are listed in table 1.

Withdrawal of the service is made by the service provider upon request by the subscriber or for service provider reasons.

4.2.2 Normal Procedures

4.2.2.1 Activation/deactivation

The Call Hold service is active whenever pro- vided on a subscription basis, or as a service provider option, whenever provided to a user without subscription.

4.2.2.2 Invocation & Operation

4.2.2.2.1 **Hold Request** (see figure 1)

The served user indicates to the network that the communication on the interface is to be interrupted. A call may be placed on hold:

- on a calling served user's interface, by a calling served user at any time after the net- work acknowledges the completion of dialing;
- on the called served user's interface, by the called served user at any time after the call has been answered; and
- before call clearing has begun.

The communication on the interface is then interrupted. The network acknowledges this action, and the associated channel is made available for other uses. Based on the subscription options, the network may send a notification to the held party indicating that the call has been placed on hold. This optional notification, for a call that has not yet become active end-to-end, shall be delayed by the net- work until the called party answers.

If held call(s) are cleared for any reason, the network shall continue to reserve a B-channel for the specified terminal until there are no more held calls with reservation associated with the specified terminal. If at any time a call is in the held state, either party may clear the call.

4.2.2.2.2 **Retrieve Request** (see figure 2)

When the served user that invoked the Call Hold service indicates that a call is to be retrieved, the network shall re-establish communications, provided that a B-channel is available, and notify the served user and optionally the held party.

A call that is placed on hold and then retrieved before it is answered shall not have any notifications sent forward to the called party. The notifications of hold and retrieve shall cancel each other.

The served user may optionally indicate a B- channel selection parameter in the retrieve request. The parameter may indicate:

a) Any channel acceptable;
b) Specified channel is preferred; or
c) Specified channel is exclusively required. If the network can satisfy the request, communications for the call on the interface shall be re-established; if it cannot, the request will be rejected with the appropriate cause returned to the served user.

4.2.2.2.3 Reservation Processing

The following conditions concerning reservation against a B-channel apply:

a) When a call is retrieved, any reservation against a B-channel associated with that call shall be cleared, independent of which B- channel is used to retrieve the call;
b) When a call is cleared, any reservation against a channel associated with the call shall be cleared;
c) When all reservations are cleared, all B- channels become available for use by either the network or a user;
d) When any reservation is outstanding for a given served user and that served user is associated with a held call, but is not using a channel for an active call, then the network shall consider a B-channel as “not free” for that user for subsequent incoming calls. (Interaction with the Call Waiting service when all channels are “not free” is described in 4.5.1.);
e) When the Call Hold served user requests that reservation be released, the network shall release the reservation associated with this served user and immediately consider all reserved channels associated with this served user as “free” regardless of the number of outstanding calls on hold with reservation.

4.2.3 Exceptional Procedures

4.2.3.1 Activation/deactivation

(None identified)

4.2.3.2 Invocation & Operation

4.2.4.2.1 Hold Request

If a served user tries to hold a call while not subscribed to the service or for some other reason the network cannot hold the call, an indication shall be provided to the user giving the reason of failure.

4.2.4.2.2 Retrieve Request

If the network cannot retrieve a previously held call, the served user shall be informed of the reason for failure. (For example, there may not be any channel available).

If the network cannot process the retrieve request because no prior hold request was made, the user shall be informed of the reason for failure.

4.2.4 Alternative Procedures

(None Identified)

4.3 Interworking Considerations

The operation of this feature is not affected by the nature (i.e., ISDN or non-ISDN) of the far end of the connection except for the optional notifications of hold and retrieve. These optional notifications shall not be sent outside of the ISDN.

4.4 Network Capabilities for Charging

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

4.5 Interactions with other Supplementary Services

4.5.1 Call Waiting

When an ISDN user receives a call waiting indication, the ISDN user may use the Call Hold service to hold a call as given in 4.2.2.2.1 and then answer the incoming waiting call. Use of the Call Hold service cannot change a call into a waiting call. Use of the Call Hold service while a waiting call is pre-sent does not automatically cause the waiting call to be accepted.

If all channels for a given served user are “not free” (busy or reserved) and a user has also subscribed to the Call Waiting service, the network may be able to offer an incoming call with an indication that “no interface information channels are available.” The served user may accept that incoming call using a reserved channel.

4.5.2 Calling Line Identification Presentation

This supplementary service has no impact on the operation of the Call Hold service.

4.5.3 Calling Line Identification Restriction

This supplementary service has no impact on the operation of the Call Hold service.

4.5.4 Call Hold Service

Assume that parties A and B have both subscribed to the Call Hold service. The Hold service is unidirectional, so it is possible for:

a) Only party A to have party B on hold;
b) Only party B to have party A on hold; and
c) Each party to have the other on hold.

5 Functional Capabilities & Information Flows Needed for Call Hold

This clause identifies a way of dividing the overall functionality for Call Hold into functional units, each of which could be placed in one location. The overall functionality results from communication between the

functional units (called entities) using information flows, which are also identified in this clause. An information flow is an abstraction that is subsequently realized in clauses 6 through 8 by means of additions to existing signaling system messages or by new messages. Finally, this clause identifies one or more specific ways in which the functional entities of Call Hold can be located in specific user or network equipment.

5.1 Functional Entity Model for Call Hold

This subclause identifies a way of partitioning the Call Hold functionality into functional entities and identifies actions that occur in each functional entity. Each functional entity is an abstract representation that could be implemented in more than one kind of telecommunication equipment (e.g., in terminal equipment, in a local switching machine, or in a database). Functional entities may be combined in a single piece of telecommunication equipment. Figure 3 shows the Call Hold functional model.

5.1.1 Description of Functional Entity 1

Functional Entity 1 provides the following functionality in support of the served user and Functional Entity 2:

a) Interprets hold and retrieve requests from the served user and accesses the service providing capabilities of FE2 by way of service requests;

b) Receives functional indications relating to requests from FE2 (i.e., hold confirmation/rejection, retrieve confirmation/rejection), then processes and relays them to the served user.

5.1.2 Description of Functional Entity 2

Functional Entity 2 provides the following functionality in support of Functional Entities 1 and 3:

a) Receives service requests from FE1, verifies the invocations, and relays appropriate information through the network towards User B (e.g., receives a hold request from FE1 and relays an optional notification of the held call toward User B). In processing service requests, FE2 verifies that Call Hold services are invoked only by a subscribed user if subscription is required by the service provider;

b) Performs the hold and retrieve functions;

c) Provides the optional sending of hold/ retrieve notifications towards User B;

d) Sends functional indications relating to a held call to FE1 (e.g., hold confirmation, retrieve confirmation);

e) Reserves a B-channel, if B-channel reservation is subscribed to;

f) Supports B-channel release processing, if subscribed to.

5.1.3 Description of Functional Entity 3, 4, 5, 6

Functional Entity 3, and Functional Entities 4, 5, 6 if they exist, provide the following functionality in support of Functional Entities 2 and 7: receives optional notifications originating from FE2 (which may transit intermediate FEs, if they exist) that the served user User B call is being held or retrieved and relays them toward FE7.

5.1.4 Description of Functional Entity 7

Functional Entity 7 provides the following functionality in support of User B and Functional Entity 3, 4, 5, 6: receives optional notifications that the served user User B call is being held or retrieved and informs (relays them to) User B.

5.2 Information Flow Model for Call Hold

This subclause identifies the information that needs to be passed between functional entities, and identifies when this information needs to be passed in order to permit overall operation of the Call Hold service. Each information flow is an abstract representation that could be implemented as a new message or as an addition to an existing message in a call-control signaling system. See figures 4 and 5.

Figures 6 and 7 show the explicit relation of the Call Hold information flows to the DSS1 and SS7 messages that implement them.

5.2.1 Definition of Individual Information flows

5.2.1.1 Hold Request

Hold request is the information sent from FE1 to FE2 to request that a call be placed on hold by the network. It contains an identifier of the call to which the hold request applies.

5.2.1.2 Hold Confirmation

Hold confirmation is the information sent from FE2 to FE1 that confirms that a call has been put on hold for the user by the network. It contains an identifier of the call to which the hold confirmation applies.

5.2.1.3 (Optional) Notification of Hold

(Optional) notification of hold is the information sent from FE2 towards FE7 indicating that the call between FE1 and FE2 has been placed on hold. It contains an identifier of the call to which the (optional) notification of hold applies.

5.2.1.4 Retrieve Request

Retrieve request is the information sent from FE1 to FE2 to request the reconnection of a held call. It contains an identifier of the call to which the retrieve request applies. It also contains an optional indication that:

a) Any channel is acceptable for retrieval; or

b) A specified channel is preferred for retrieval; or

c) A specified channel is exclusively required for retrieval.

5.2.1.5 Retrieve Confirmation

Retrieve confirmation is the information sent from FE2 to FE1 that confirms that communication was able to be re-established and that the held call is now reconnected. If an option- al indication concerning the B-channel over which communication was to have been re-established was included in the retrieve request, then the retrieve confirmation serves as an acknowledgment that retrieval was carried out as requested. The retrieve confirmation contains an identifier of the call to which the retrieve confirmation applies and an identifier of the channel over which the held call is reconnected.

5.2.1.6 (Optional) Notification of Retrieval

(Optional) notification of retrieval is the information sent from FE2 towards FE7 indicating that the B-channel between FE1 and FE2 has been reconnected. It contains an identifier of the call to which the (optional) notification of retrieval applies.

5.3 Allocation of functions to equipment

This subclause identifies a number of different plans, called scenarios, for allocating the functional subdivisions of Call Hold to specific network of user equipments (figure 8). Each scenario implicitly identifies what protocol is impacted by the Call Hold information flows. Functional Entities 3, 4, 5, and 6 may not exist for the listed scenarios.

6 Switching & Signalling Specifications for Call Hold at the User-Network Interface

6.1 Formats & Coding for Call Hold

This subclause describes the messages, information elements within these messages, and coding required for the invocation and control of the Call Hold service.

6.1.1 Messages

The following messages, which are defined in subclause 7.1 of ATIS-1000610, are used for the Call Hold service:

a) HOLD – Message sent by the user to request hold for an existing call;
b) HOLD ACKNOWLEDGE – Message sent by the network to indicate that the Hold function has been successfully performed;
c) HOLD REJECT – Message sent by the network to indicate denial of request to hold a call;
d) RETRIEVE – Message sent by the user to request retrieval of held call;
e) RETRIEVE ACKNOWLEDGE – Message sent by the network to indicate that the Retrieve function has been successfully per- formed;
f) RETRIEVE REJECT – Message sent by the network to indicate denial of request to retrieve the call.

The NOTIFY message, as described in 3.1.7 of ATIS-1000607, is used for the notification of hold and retrieve.

The INFORMATION message, as described in 3.1.6 of ATIS-1000607, is used for the B-channel reservation release procedures.

6.1.2 Information Elements

The following information elements, which are defined in ATIS-1000607, are used for the Call Hold service: Protocol Discriminator, Call Reference, Message Type, Notification Indicator, Cause, Channel Identification, and Signal.

The following information elements, which are defined in ATIS-1000610, are used for the B- channel Reservation Release Procedures: Feature Activation and Feature Indication.

6.1.3 Codepoints

Additional codepoints used for the Call Hold service in the Notification Indicator Information Element (IE) are shown in figure 9.

Figure 10 shows the national-specific code- point used for the Call Hold service in the Cause information element (cause value 51). No diagnostic is used.

6.2 Procedures for Call Hold

6.2.1 Service States & Timers

6.2.1.1 States

The call states, as defined in ATIS-1000607, shall be utilized in the Call Hold service operation. No new basic call states are required for the Call Hold service.

Four auxiliary states, which are described in 6.2.4 of ATIS-1000610, are used in conjunction with the Hold and Retrieve functions: Idle, Hold Request, Call Held, and Retrieve Request.

A two-dimensional state space, (X,Y), is used for the Call Hold service:

a) X – ATIS-1000607call states
b) Y – Auxiliary state as listed above.

6.2.1.2 Timers

An optional guard timer, CH-T1, shall be utilized for the maximum time a call can be placed on hold.

Timers T-hld and T-ret are optional user-side timers and shall be started by the served user to monitor for a valid response to a HOLD and RETRIEVE message, respectively.

Timers T-hld and T-ret have a range of 1 to 10 seconds with a default value of 4 seconds.

6.2.2 Invocation

The served user can request that a call be placed on hold by sending a HOLD message and can request that a call be retrieved from hold by sending a RETRIEVE message. The call reference value in the HOLD and RETRIEVE messages specifies the call to be held or retrieved.

6.2.3 Notification

If the service provider supports the remote hold and remote retrieve notification option and the subscription option “Notification of hold/retrieve sent to the held/retrieved party” is set to “Yes”, then an indication shall be sent toward User B in the NOTIFY message.

If a call is placed on hold before the call has reached the active state, the NOTIFY message shall only be sent after the call has been answered. If a held call is retrieved before answer, no notification is sent towards User B.

6.2.4 Normal Operation

6.2.4.1 Hold Function Operation for Call Hold Service

The served user may send a HOLD message in states U3, U4, or U10 to request that a call be placed on hold (see ATIS-1000607, sub-clause 4.5.6). After sending the HOLD message, the calling user enters into the state (X = U3, U4, or U10, Y = Hold Request). If the hold request is successful, the network places the call on hold and sends a HOLD ACKNOWLEDGE message to the served user. If the network has previously sent a call control message that contains the signal information coded to turn a tone on, the HOLD ACKNOWLEDGE message shall contain the Signal information element coded to “tones off.”

The served user starts the optional timer T-hld when the HOLD message is sent. If timer T- hld expires, the served user shall enter the Idle auxiliary state.

Upon receipt of a HOLD ACKNOWLEDGE message at any time, the served user shall stop any monitor timers (T-hld or T-ret), if running, and enter the Call Held auxiliary state.

Notification may be sent as defined in 6.2.3. The NOTIFY message shall contain the Notification Indicator information element coded to indicate “remote-hold.”

If a call is successfully placed on hold, the network shall send all call control messages to the served user as defined in ATIS-1000607, with the exception that the Signal information element shall not be coded to turn a tone on.

6.2.4.2 Retrieve Function Operation for Call Hold service

The served user may send a RETRIEVE message to request that a held call be retrieved. The served user may send the RETRIEVE message when the served user is in the state (X = U3, U4, or U10, Y = Call Held). After sending the RETRIEVE message, the served user enters the Retrieve Request auxiliary state. When retrieving a held call, the served user shall send a RETRIEVE message with one of the following channel designations:

- *Case a*: Channel is indicated, no acceptable alternative;
- *Case b*: Channel is indicated, any alternative is acceptable;
- *Case c*: Any channel is acceptable; or
- *Case d*: No channel designation present in the RETRIEVE message (the Channel Identification information element is not mandatory in the RETRIEVE message).

When the network receives a RETRIEVE message, the channel designation shall be checked:

1) For case a: If the designated channel is available, the network shall return a RETRIEVE ACKNOWLEDGE message. The RETRIEVE ACKNOWLEDGE message shall not contain the channel identification information element;
2) For case a: If the designated channel is not available, the network shall return a RETRIEVE REJECT message containing a Cause information element with cause value 44, “requested circuit/channel not available”; For case b: If the designated channel is available, the network shall return a RETRIEVE ACKNOWLEDGE message containing an exclusive channel designation in the Channel Identification information element to the served user;
3) For case b: If the designated channel is not available and another channel is avail- able, the network shall return a RETRIEVE ACKNOWLEDGE message containing an exclusive channel designation in the Channel Identification information element to the served user;
4) For case c or d: If a channel is available, the network shall return a RETRIEVE ACKNOWLEDGE message containing an exclusive channel designation in the Channel Identification information element to the served user;
5) For case b, c, or d: If no channel is avail- able, the network shall return a RETRIEVE REJECT message containing a Cause information element with cause value 34 “no circuit/channel available.”

If a call is successfully retrieved from hold and tones are appropriate, the RETRIEVE ACKNOWLEDGE message shall contain the Signal information element coded to the appropriate signal value (for example, “ring back tone on”, “busy tone on”).

The served user starts the optional timer T-ret when the RETRIEVE message is sent. If timer T-ret expires, the served user shall enter the Call Held auxiliary state.

Upon receipt of a RETRIEVE ACKNOWL- EDGE message at any time, the served user shall stop any monitor timer (T-hld or T-ret), if running, and enter the Idle auxiliary state.

Notification may be sent as defined in 6.2.3. The NOTIFY message shall contain the Notification Indicator information element coded to indicate “remote-retrieval.”

6.2.4.3 Clearing of Held Calls

A held call may be cleared by the network or either user. The clearing of a held call at the served user’s interface shall be initiated by the sending of a RELEASE message. The clearing at User B’s interface shall follow the call clearing procedures as described in 5.3 of ATIS-1000607.

6.2.4.4 Reservation Processing & Procedures

4.2.2.2.3 specifies the procedures for reservation processing.

6.2.4.5 Procedures for Release of a Reserved B-channel

The served user may request release of a reserved B-channel by sending an INFORMA- TION message to the switch that contains the Feature Activation information element indicating “B-channel reservation release”.

If a B-channel is currently reserved for the user (identified by a particular terminal end-point), the switch shall release the B-channel reservation regardless of the number of calls on hold. The switch shall send an INFORMATION message with the Feature Indication information element coded to “feature identifier = B-channel reservation release; status = activated” to the user.

If a B-channel is not currently reserved and a call(s) is on hold, the switch shall send an INFORMATION message with the Feature indication information element coded to “feature identifier = B-channel reservation release; status = activated” to the user.

If no calls are on hold, the switch shall send an INFORMATION message with the Feature Indication information element coded to “feature identifier = B-channel reservation release; status = deactivated” to the user.

After B-channel reservation has been released, if the user (identified by a particular terminal endpoint) places another call on hold or the switch determines that there are no longer any calls on hold associated with the user, the switch shall send the Feature Indication information element coded to “feature identifier = B-channel reservation release; status = deactivated” to the user in the appropriate message:

a) a HOLD ACKNOWLEDGE if the user places another call on hold;
b) a RELEASE or RELEASE COMPLETE if the last held call is cleared;
c) a RETRIEVE ACKNOWLEDGE if the last held call was retrieved;
d) an INFORMATION message, otherwise.

Procedures for using the common element for releasing B-channel reservations are not specified in this standard.

6.2.5 Error Handling

6.2.5.1 Hold Function Operation for Call Hold service

If the network receives a HOLD message for a particular call and determines that the user who sent the HOLD message is not sub- scribed to the Call Hold service, the network shall reject the hold request by

sending the HOLD REJECT message containing the Cause information element with cause 50, “requested facility not subscribed.”

When a call is in the process of being cleared, the network may respond to a hold request with an appropriate clearing message which is an implicit rejection of this request. The user equipment shall transition to the Idle auxiliary state and update any feature status, lamps, etc., accordingly.

When a call is not in the process of being cleared and the network receives a HOLD message for a call and determines that the call is not in states N3, N4, or N10, the network shall reject the hold request by sending the HOLD REJECT message containing the Cause information element with cause 101, “message not compatible with call state”.

If the network receives a HOLD message for a particular call and determines that resources are not available for holding the call, the net- work shall reject the hold request by sending the HOLD REJECT message containing the Cause information element with cause 34, “no circuit/channel available.”

If the network receives a HOLD message for a particular call and determines that the call identified by the call reference of the HOLD message is a packet-mode call, the network shall reject the hold request by sending a HOLD REJECT message containing the Cause information element with national-specific cause 51, “call type incompatible with service request.”

If the network receives a HOLD message for a call that is already on hold, the network will respond with a HOLD REJECT message, containing the Cause information element with cause 101, “message not compatible with call state.”

Upon receipt of a HOLD REJECT message at any time, the served user shall stop any monitor timer (T-hld or T-ret), if running, and enter the Idle or Call Held auxiliary state based on the cause value contained in the Cause information element. The served user shall enter the Idle auxiliary state if the HOLD REJECT message contains cause values 50, 34, or 51. The served user shall enter the Call Held auxiliary state if the HOLD REJECT message contains cause value 101 and the user is in call states U3, U4, or U10: (see ATIS-1000607, subclause 4.5.6). The served user shall enter the Idle auxiliary state if the HOLD REJECT message contains cause value 101 and the user is in any other call state.

6.2.5.2 Retrieve Function Operation for Call Hold Service

If the network receives a RETRIEVE message for a call that is not on hold and not in the process of being cleared, the network shall respond with a RETRIEVE REJECT message containing the Cause information element with cause 101, “message not compatible with call state”.

When a call is in the process of being cleared, the network may respond to a retrieve request with an appropriate clearing message, which is an implicit rejection to this request. The user equipment shall transition to the Idle auxiliary state and update any feature status, lamps, etc., accordingly.

Upon receipt of a RETRIEVE REJECT message at any time, the served user shall stop any monitor timer (T-hld or T-ret), if running, and enter the Idle or Call Held auxiliary state based on the cause value contained in the Cause information element. The served user shall enter the Idle auxiliary state if the RETRIEVE REJECT message contains cause value 101. The served user shall enter the Call Held auxiliary state if the RETRIEVE REJECT message contains cause values 34 or 44.

6.2.5.3 Procedures for use with Timer, CH-T1

At the expiry of timer CH-T1, the network shall initiate clearing to both the served user and User B. A RELEASE message containing cause 102, “recovery on timer expiry,” shall be sent to the served user. The network will apply appropriate call clearing procedures to User B using cause 41, “temporary failure.”

6.3 Interactions

6.3.1 Basic Call

The basic call interactions with the Call Hold service shall be as described in clause 4 of this standard.

6.3.2 Other Services

6.3.2.1 Call Waiting

When an ISDN user receives a call waiting indication, the user may use the Call Hold service to hold an active call and answer the waiting call. Use of the Call Hold service cannot place a call into the waiting state.

6.3.2.2 Calling Line Identification Presentation

This supplementary service has no impact on the operation of the Call Hold service.

6.3.2.3 Calling Line Identification Restriction

This supplementary service has no impact on the operation of the Call Hold service.

6.3.2.4 Call Hold

Not applicable.

7 Switching & Signaling Specifications for Call Hold at Interexchange Interfaces

7.1 Format & Coding for Call Hold

Only ISDN-User part protocol has been identified in association with SS7 procedures sup- porting ISDN Call Hold. No Transactions Capabilities Application Part (TCAP) procedures have been identified for this service.

7.1.1 ISDN-User Part Formats & Parameter Codings

7.1.1.1 Messages

The format of the Call Progress (CPG) message is shown below:

Message type codes:

Message Type	Reference Table	Code
Call Progress	(7.1.1.1)	00101100

Call progress message:

Parameter	Reference section	Type	Length (octets)
Message type	2.1[1]	F	1
Event information	(7.1.1.2)	F	1
Notification indicator	(7.1.1.2)	O	3 – ?

[1] ATIS-1000113 chapter 3.
F = Mandatory fixed length parameter
O = Optional parameter of fixed or variable length

7.1.1.2 Parameters

The format and coding of the Notification Indicator parameter and the Event information indicators parameter are shown below:

Parameter name codes:

Parameter name	Reference table	Code
Event information indicators	(7.1.1.2)	0 0 1 0 0 1 0 0
Notification indicators	(7.1.1.2)	1 1 1 0 0 0 0 1

Event information indicators parameter:

8	7	6	5	4	3	2	1
Res.	Event indication						

(1) Event indication

0 0 0 1 0 0 0 notification for supplementary service

(2) Res. = Event presentation restricted indicator

0 no indication

1 presentation restricted

Notification indicator parameter:

8	7	6	5	4	3	2	1
Ext.	Notification indicator						

(1) Notification indicator

1 1 1 1 0 0 1 remote hold

1 1 1 1 0 1 0 remote hold released

(2) Ext. = Extension indicator

0 octet continues through next octet

1 last octet

7.2 Procedure

There are no identified Transactions Capabilities Application Part (TCAP) procedures associated with Call Hold service. The first clause details the ISDN-User Part (ISDN- UP) procedures to provide (optional) notification of Call Hold operations to the remote party. The second clause provides error treatment.

7.2.1 ISDN-UP Procedures

There are two ISDN-UP procedures for the (optional) notification to the remote party depending on the call state at which the Hold/Retrieve operations were invoked.

7.2.1.1 Invocation of Hold/Retrieve while Call Active (After Receipt/Sending of ANM) (see figure 11)

If the Hold operation is invoked by either party while the call is in the active state (after the receipt of ANM at the originating exchange, or the sending of ANM at the terminating exchange), the notification information shall be transmitted interswitch immediately using a Call Progress (CPG) message.

If the Retrieve operation is invoked by either party while the call is in the active state, the notification information shall be transmitted interswitch immediately using a Call Progress (CPG) message.

If interworking is encountered, notification of hold and retrieve shall not be sent from the network where the hold or retrieve is invoked to the network where the held party resides. The network where the controller of Hold or Retrieve operation resides shall determine that interworking has occurred by inspecting, as appropriate, the backward or forward call indicators parameter.

The CPG message should contain the notification indicator parameter. The event indicator field of the mandatory event information parameter should be coded “notification for supplementary service.” The event presentation restricted indicator field should be coded “no indication. “There are no procedures to code the event presentation restricted indicator field to “presentation restricted” as a part of this service. For the notification of invocation of the Hold function, the notification indicator parameter is coded “remote-hold. “For the notification of invocation of the Retrieve function, the parameter is coded “remote-hold-released.”

7.2.1.2 Invocation of hold Before call active (before receipt of ANM) (see figure 12)

If both the Hold and Retrieve operations are invoked by the calling party before the call is in the active state (before the receipt of ANM at the originating exchange), no notification will be sent to the remote party.

If only the Hold operation is invoked by the calling party before the call is in the active state (before the receipt of ANM at the originating exchange), the originating exchange delays the transmission of the notification information over the SS7 network until the call enters the active state, that is, until an ANM is

received. A Call Progress (CPG) message containing notification information should be sent on receipt of ANM.

If interworking is encountered, notification of hold shall not be sent from the network where the hold is invoked to the network where the held party resides. The network where the controller of the hold operation resides shall deter- mine that interworking has occurred by inspecting the backward call indicators parameter.

The Call Progress (CPG) message should contain the Notification Indicator parameter. The event indicator field of the mandatory event information parameter should be coded “notification for supplementary service.” The event presentation restricted indicator field should be coded “no indication.” There are no procedures to code the event presentation restricted indicator field to “presentation restricted” as a part of this service. For the notification of invocation of the Hold function, the Notification Indicator parameter is coded “remote-hold.”

7.2.1.3 Procedures at the Remote Exchange

If the CPG message containing the Notification Indicator parameter coded as in 7.2.1.1 or 7.2.1.2 is received at the exchange serving the held/retrieved party, the exchange shall inform the held/retrieved party in accordance with the user–network interface protocol.

7.2.2 Error Treatment

The (optional) notification to the remote party should be sent to the remote party via SS7 only if the operation that the served user requests is successfully invoked. No notification should be sent if the requested operation is unsuccessful.

8 Specifications for Protocol Interworking

8.1 SS7/DSS1

8.1.1 Message Mapping

SS7	DSS1
CPG	NOTIFY

8.1.2 Parameter/Information Element Mapping

SS7 (Parameter)	DSS1 (Information element)
Notification indicator	Notification indicator

8.2 ISDN/NON-ISDN

If an exchange encounters interworking with MF signaling, the CPG message containing the notification information will be discarded. No further action will be taken to convey the notification of Hold or Retrieve to the adjacent exchange.

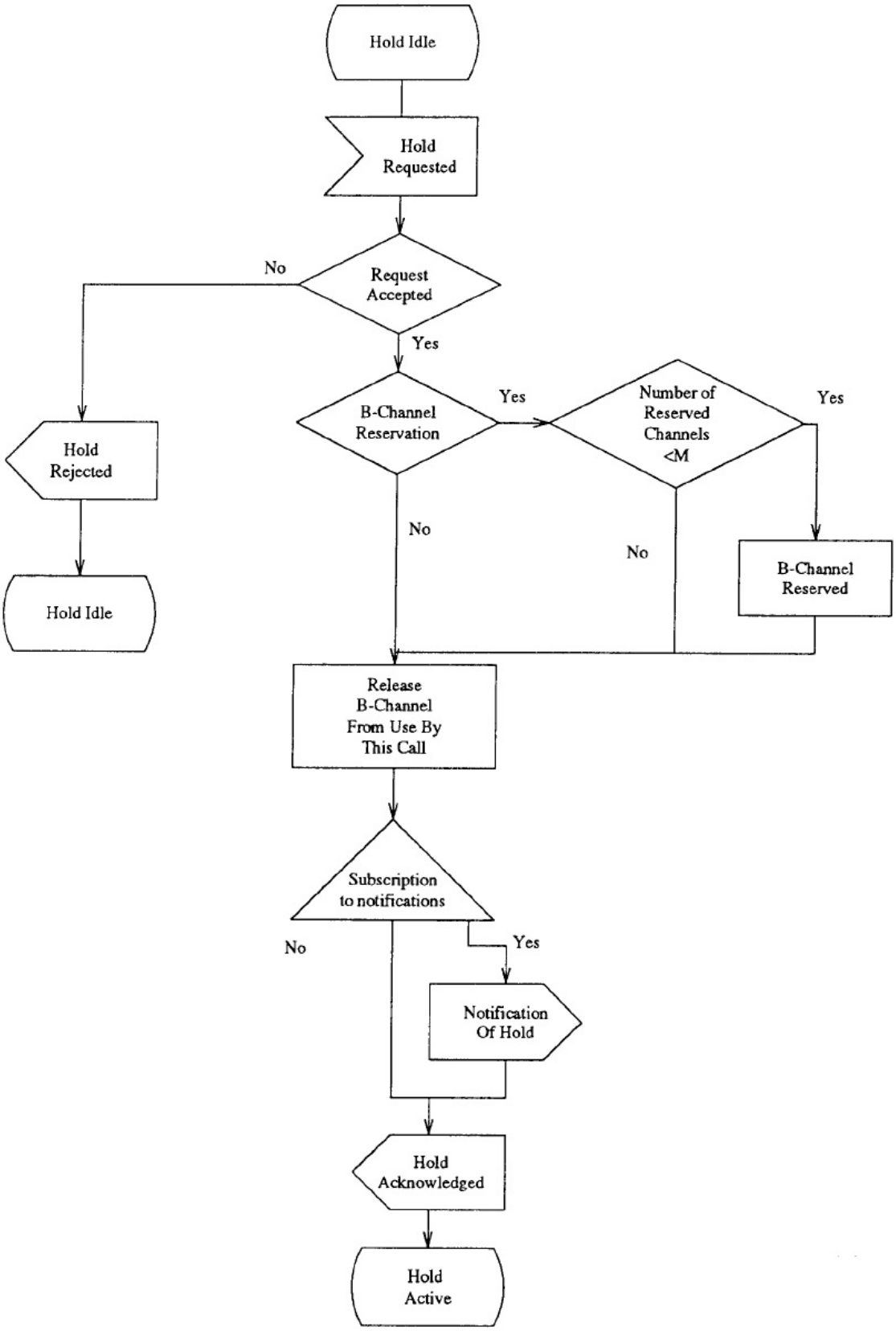


Figure 1: Hold Operation

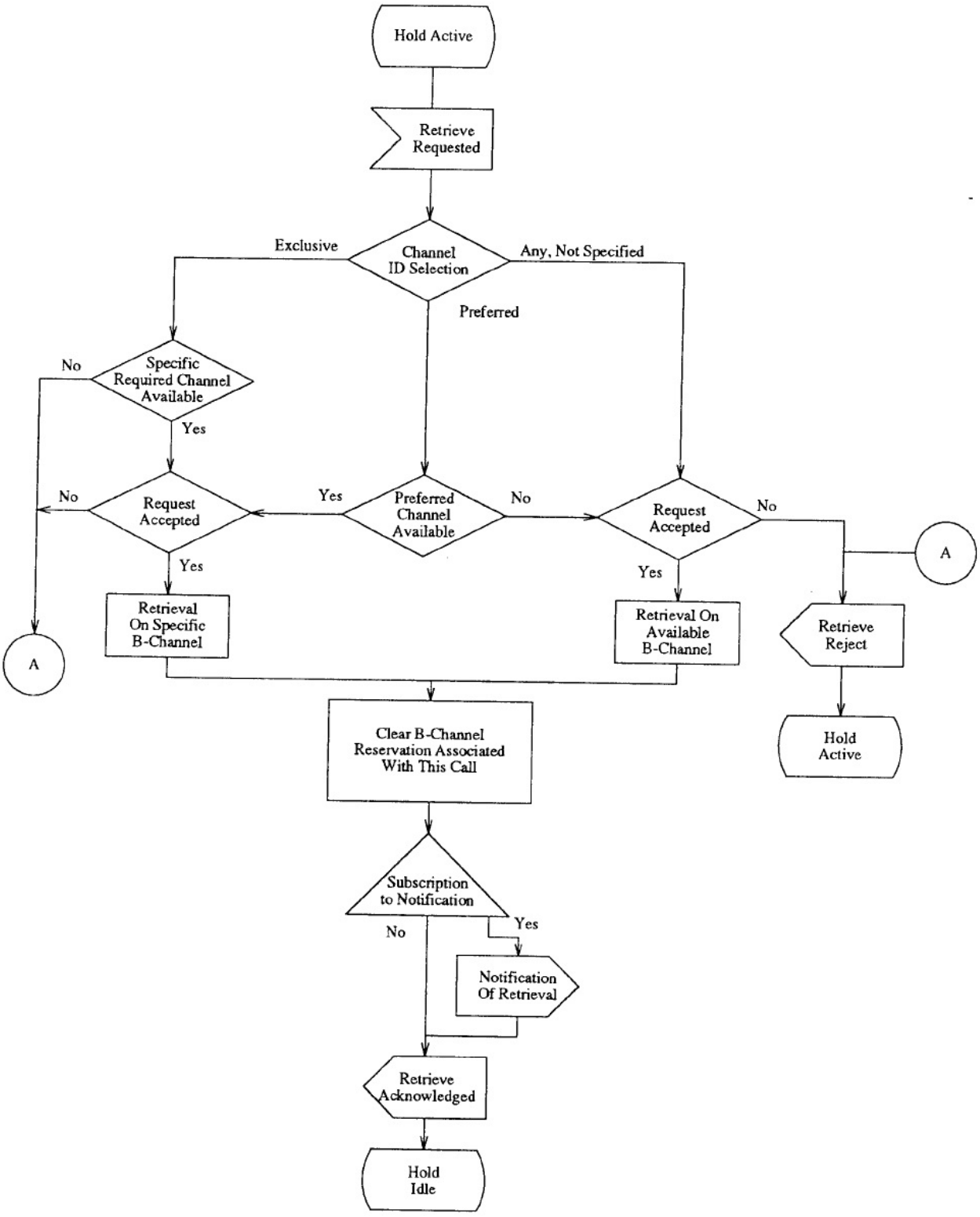
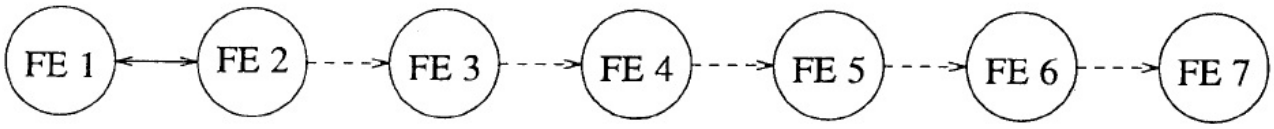


Figure 2: Retrieve Operation



NOTE – The arrows between FE2 and FE3 and between FE3 and FE4…FE6 and FE7 are depicted with dashes to emphasize their optional nature in the functional model.

Figure 3: Functional Entity Model for Call Hold

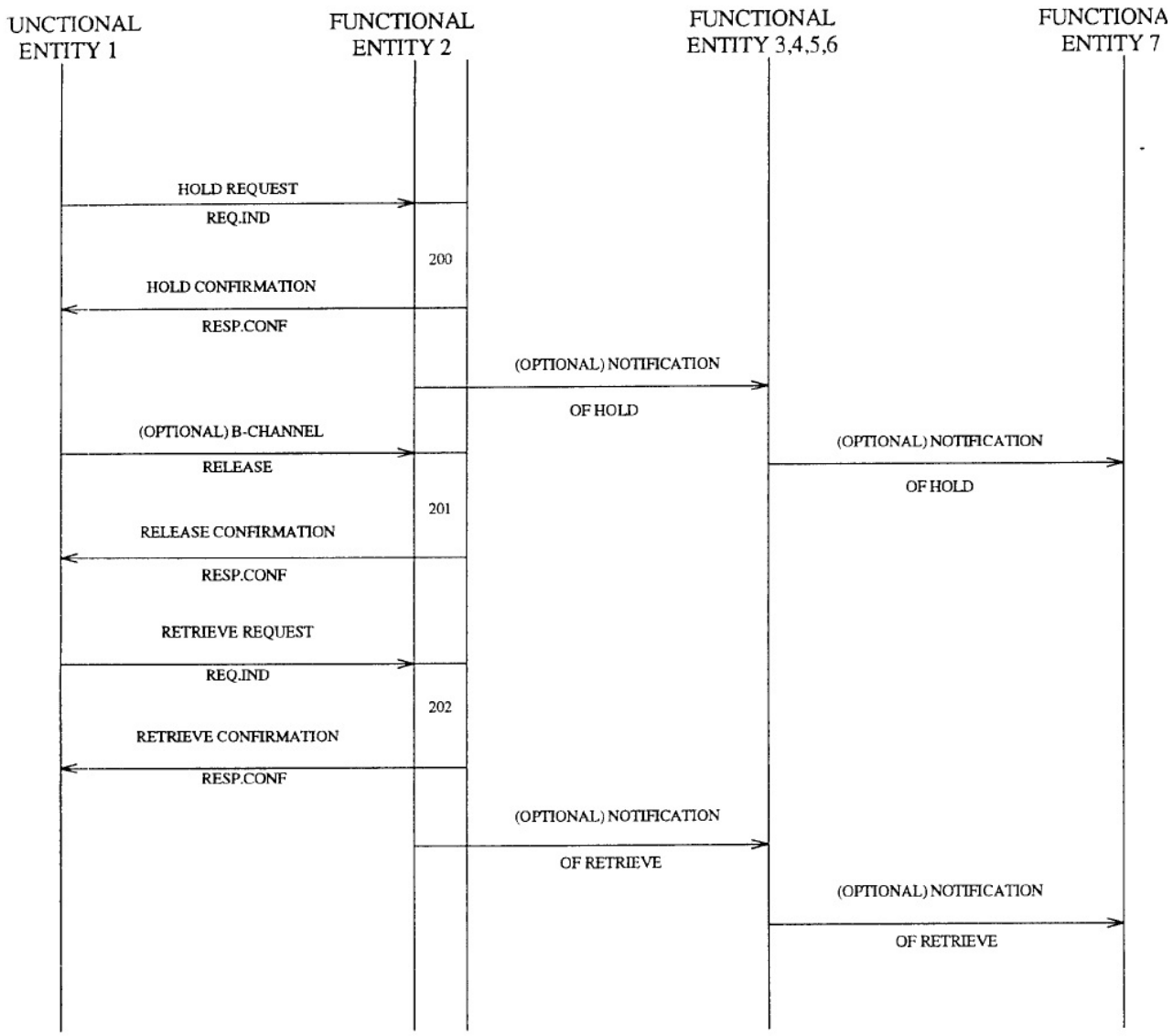
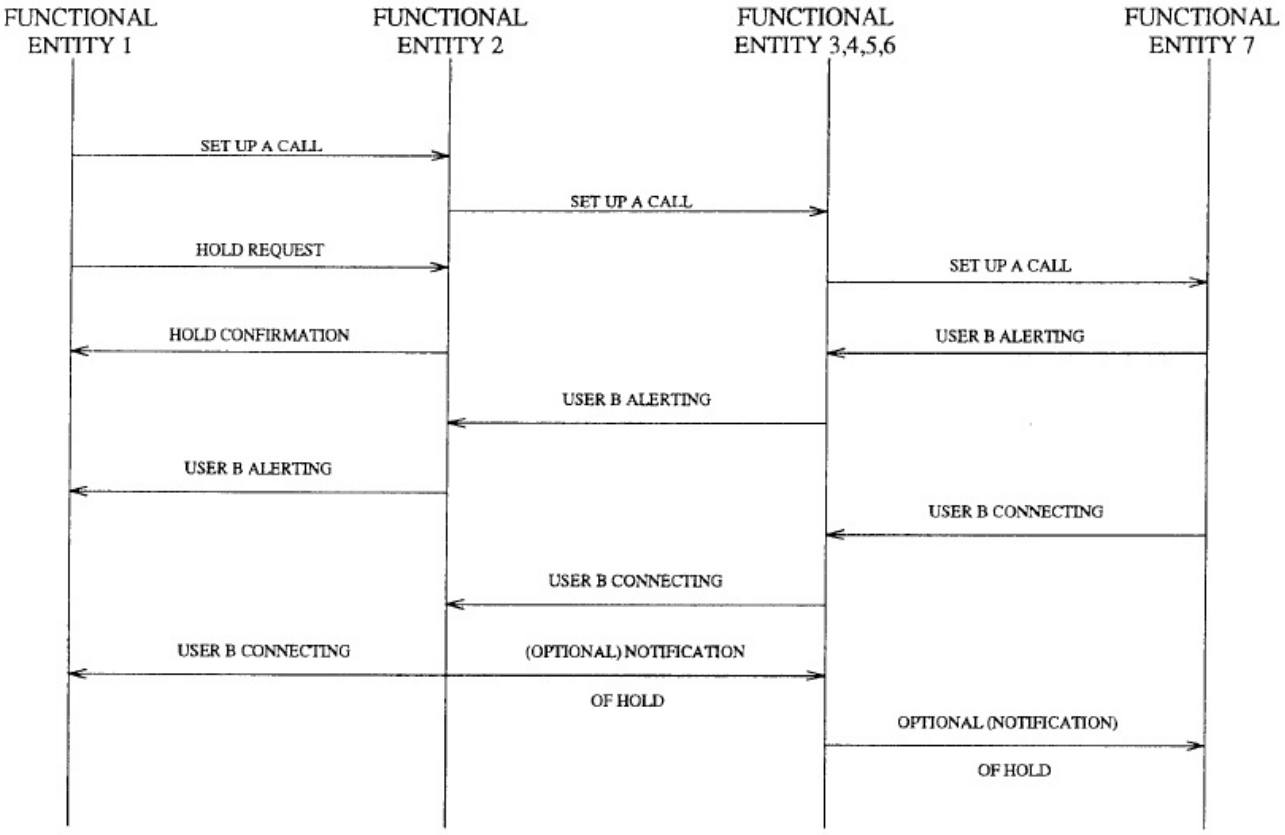


Figure 4: Call Hold Information Flow Diagram

200- Functional entity action - Verify user subscription to Call Hold if required by the service provider. Interrupt the 8-channel communication between FE1 and FE2 for the indicated call. Reserve a 8- channel for the served user, if applicable.

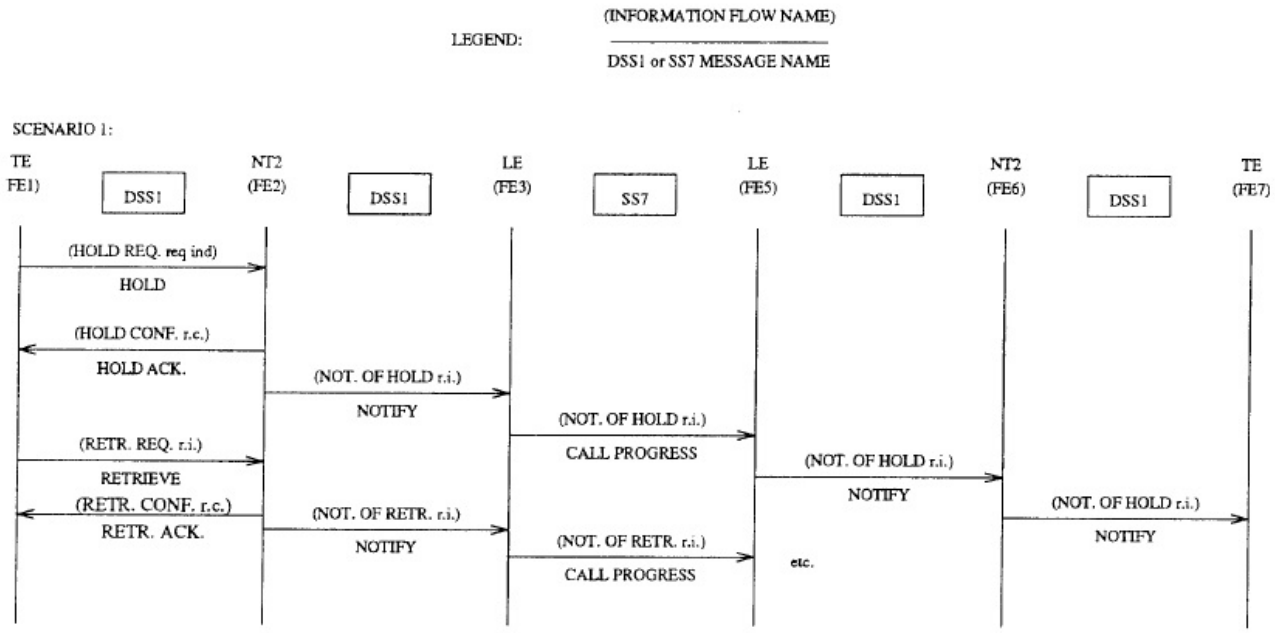
201- Functional entity action - Release all 8-channels reserved for FE1.

202- Functional entity action - Verify call on hold for FE1. Reconnect 8-channel for this call, if available.



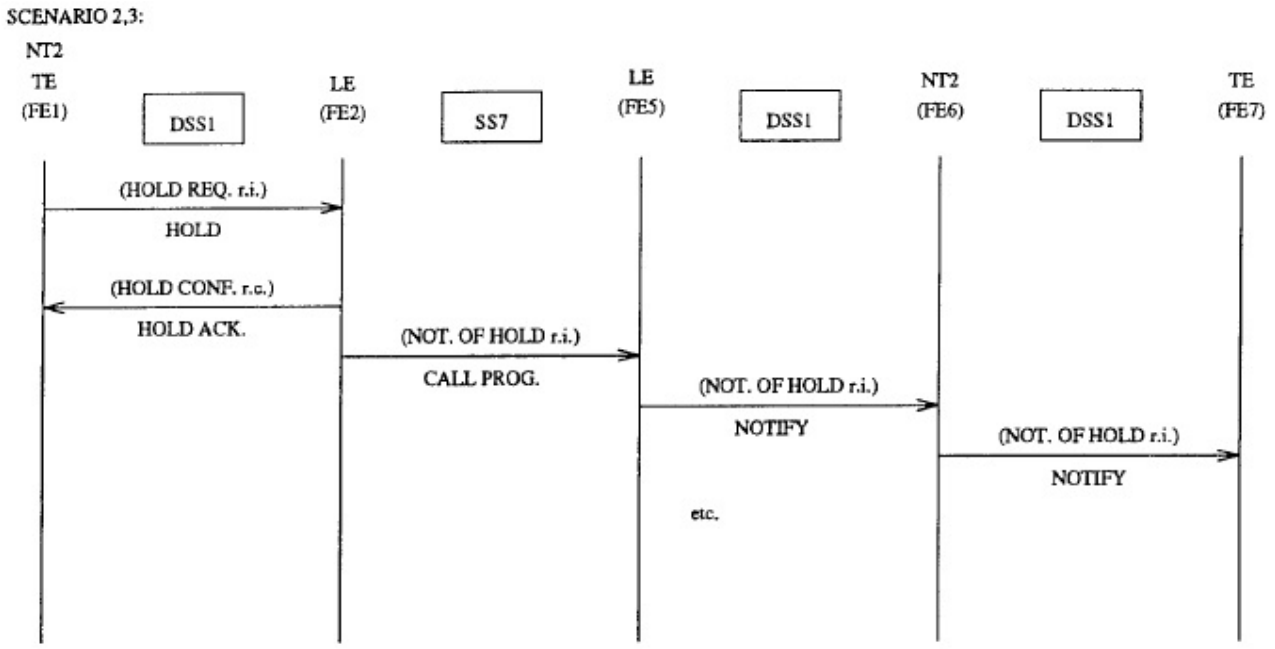
NOTE – The optional release of a B Channel is also possible in this special case.

Figure 5: Call Hold Information Flow Diagram (when the call is placed on hold prior to achieving an answer)



NOTE – Tandem (transit) exchanges (FE4) are not shown. If present, they pass the SS7 messages shown.

Figure 6: Information Flow Mapping to DSS1 and SS7 (scenario 1)



NOTE – Tandem (transit) exchanges (FE4) are not shown. If present, they pass the SS7 messages shown.

Figure 7: Information Flow Mapping to DSS1 and SS7 (scenario 2, 3)

	FE1	FE2	FE3	FE4	FE5	FE6	FE7
Scenario 1 (Figure 6)	TE	NT2	LE	TR	LE	NT2	TE
Scenario 2 (Figure 7)	TE	LE	—	TR	LE	NT2	TE
Scenario 3 (Figure 7)	NT2	LE	—	TR	LE	NT2	TE

Figure 8: Allocations of Functions to Equipment

TE = Terminal Equipment
NT2 = Network Termination – Type 2
LE = Local Exchange
TR = Transit Exchange
— = This FE does not exist for this scenario

Bits 7 6 5 4 3 2 1	Meaning
1 1 1 1 0 0 1	Remote-hold
1 1 1 1 0 1 0	Remote-retrieval (or hold-released).

Figure 9: Notification Description

Bits 7 6 5 4 3 2 1	Meaning
0 1 1 0 0 1 1	Call Type incompatible with service request

Figure 10: Cause Value

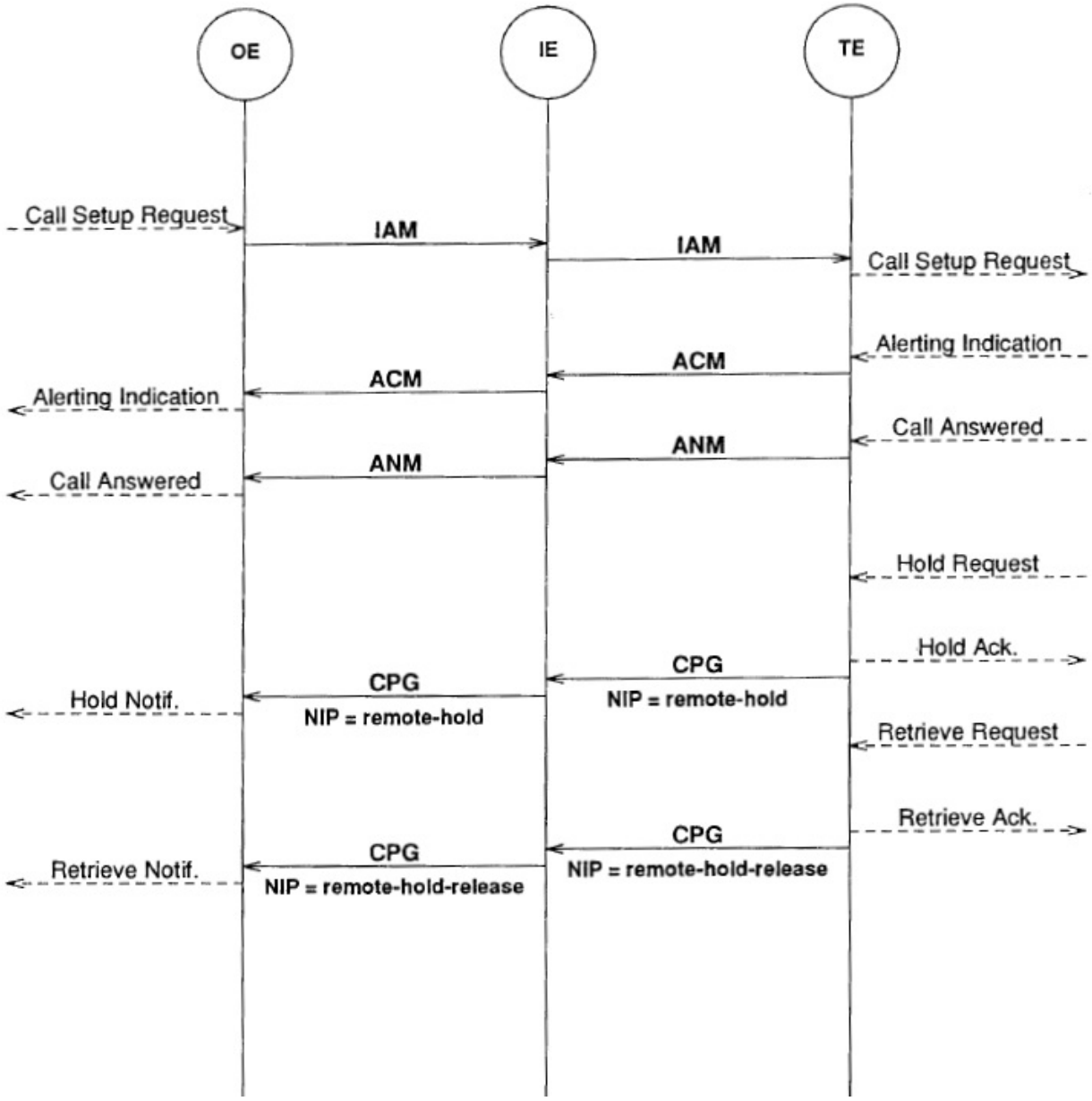


Figure 11: Hold and Retrieve Invoked by the Called Party

LEGEND

IAM = Initial Address Message
ACM = Address Complete Message
CPG = Call Progress Message
NIP = Notification Indicator Parameter
ANM = Answer Message
OE = Originating Exchange
IE = Intermediate Exchange
TE = Terminating Exchange

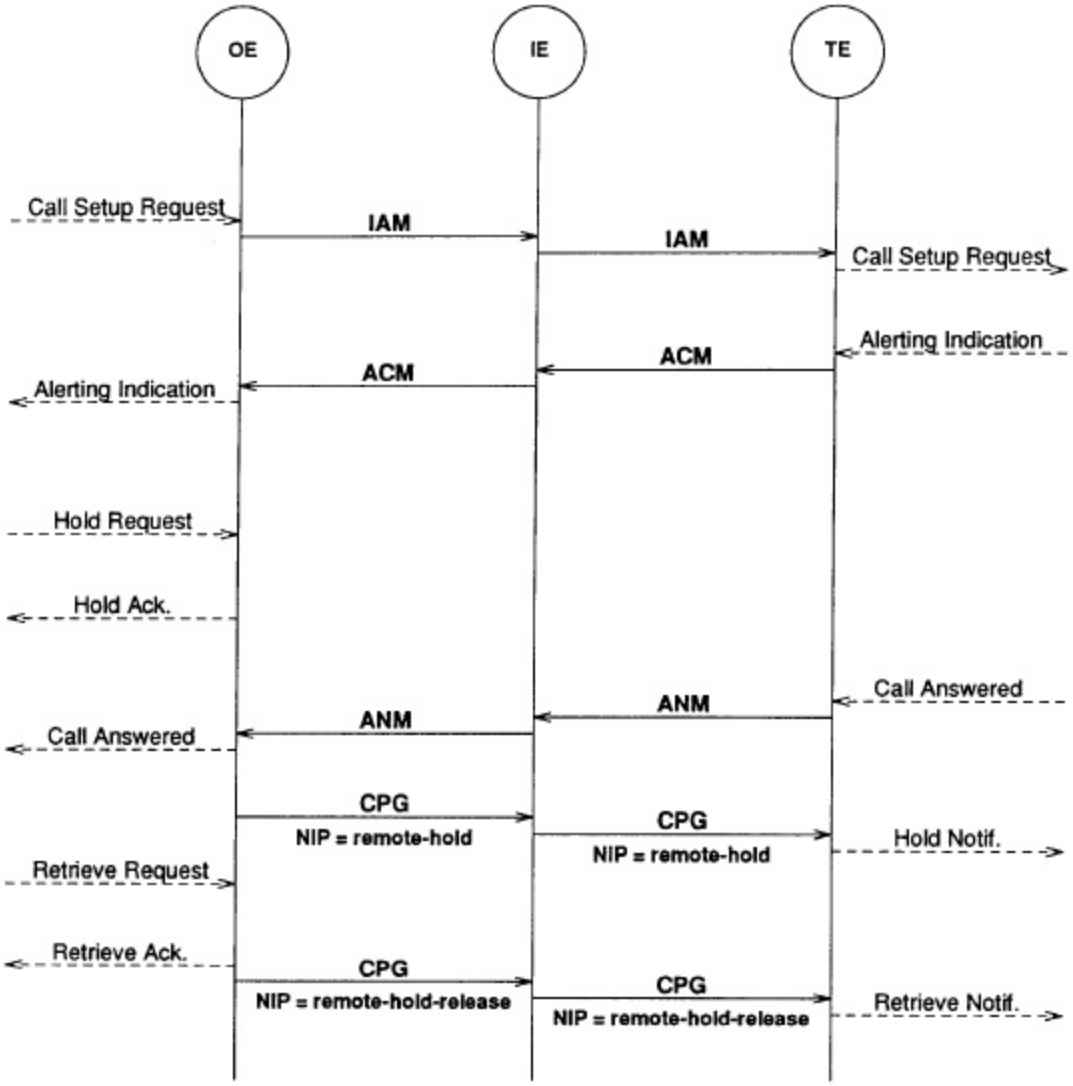


Figure 12: Hold Invoked by the Calling Party before ANM

LEGEND

IAM =	Initial Address Message	ANM =	Answer Message
ACM =	Address Complete Message	OE =	Originating Exchange
CPG =	Call Progress Message	IE =	Intermediate Exchange
NIP =	Notification Indicator Parameter	TE =	Terminating Exchange