INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.953

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(03/93)

DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1

STAGE 3 DESCRIPTION FOR SUPPLEMENTARY SERVICES USING DSS 1

STAGE 3 DESCRIPTION FOR CALL COMPLETION SUPPLEMENTARY SERVICES USING DSS 1 CLAUSE 2: CALL HOLD

ITU-T Recommendation Q.953

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation Q.953, clause 2, was prepared by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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STAGE 3 DESCRIPTION FOR CALL COMPLETION SUPPLEMENTARY SERVICES USING DSS 1

(Helsinki 1993)

2 Call Hold

2.1 Definition

This clause provides the Stage 3 description to be applied to the ISDN access for the Call Hold supplementary service.

The Stage 1 description, i.e. the service description as seen from the user, can be found in Recommendation I.253.2.

The Stage 2 description, i.e. the information flows for the service, can be found in 2/Q.83.

Only functional protocols (based upon procedures from 6.2/Q.932 and messages from 7/Q.932 are addressed.

A B-channel may or may not be reserved after a communication is interrupted by a call hold to allow the origination or possible completion of other calls. B-channel reservation is provided by the service provider as a user defined subscription option.

The Call Hold supplementary service includes the retrieve function that re-establishes communication on a B-channel between the served ISDN user and the held party.

2.2 Description

2.2.1 General description

When the Call Hold supplementary service is invoked, communication on a B-channel is interrupted, the B-channel is released and depending on a user subscription option, a B-channel is reserved for use by the given terminal used to invoke the Call Hold service.

When a user (as identified by a CEI) places a call on hold and reservation applies, the network shall attempt to have a B-channel available on that user's interface for the user to retrieve that call from hold; or set-up, retrieve, or connect to another call. One B-channel shall be kept available for the user as long as the user has

i) one or more calls on hold with reservation; and

ii) is not currently connected to any other call.

That is, the network shall not reserve more than one B-channel for a user, regardless of how a user is defined (e.g. as identified by a CEI).

When the served user wishes to re-establish communications with a held call, the retrieve function is requested. The success of the retrieve function depends upon whether or not a B-channel was reserved, and whether a B-channel is currently available to the served user.

2.2.2 Specific terminology

Figure 2-1 below shows a model of the Functional Entities (FEs) that may be involved in holding a call. The model presented is consistent with Stage 2 work that defines FEs and scenarios for information flows between FEs.

FIGURE 2-1/Q.953

Call hold model

The model in Figure 2-1 is used as follows:

1) *User A* – This is an ISDN TE that is connected to an ISDN service provider A. User A is a terminal where a party invokes the Call Hold service.

2) *Service provider A* – Service provider A is the ISDN connection between user A and either an NT2 or a public ISDN which is capable of supporting ISDN Call Hold supplementary service requests from user A.

3) *Network B* – The "network" connection for user B. Network B may or may not be an ISDN network.

4) *User B* – This is a terminal involved in a call with user A who is to be held. If user A initiated a call to user B, then the call must be in at least the Outgoing Call Proceeding state (U3) before user A can successfully invoke the Call Hold supplementary service.

   User B does not have to be in an ISDN network for user A to be able to invoke the ISDN Call Hold supplementary service. This Recommendation describes the optional notification information that may be delivered to user B when user B is also an ISDN TE.

Service provider A may be the same as network B if user A and user B are both served by service provider A. The "networks" shown in Figure 2-1 may be either public or private networks or combinations thereof.

The processing of operations of the Call Hold supplementary service is local between user A and service provider A. Network B and user B are relevant in the above model only for the optional notification to user B that the A-B call has either been placed on hold or been retrieved. It is thus not necessary for either network B or user B to support the Call Hold supplementary service: it is only necessary that service provider A support the Call Hold supplementary service and for user A to have subscribed to the service.

2.2.3 Qualifications on the applicability to telecommunication services

The Call Hold supplementary service may be supplied with the services as identified in 2.3.

2.2.4 State definitions

The call states, as defined in Recommendation Q.931, shall be utilized in the operation of Call Hold supplementary service, as appropriate.

Additionally, the six auxiliary states for this service shall be utilized as identified in 6/Q.932 as applicable.

Table 2-1 shows the states which shall be used on the user side and network side for the HOLD supplementary service. These states are specified for the purpose of the protocol definition; the states need not be provided in an implementation.

2.3 Operation requirements

2.3.1 Provision/withdrawal

2.3.1.1 Network option

As a network option, the Call Hold supplementary service shall be valid after transmitting the call proceeding message.

TABLE 2-1/Q.953

States for the HOLD supplementary service

	User A states
HOLD Idle	The HOLD supplementary service has not been activated.
HOLD Hold Requested	The call hold part of the HOLD supplementary service has been requested by the user.
HOLD Call Held	The HOLD supplementary service has been activated.
HOLD Retrieve Requested	The call retrieve part of the HOLD supplementary service has been requested by the user.
	Network states
HOLD Idle	The HOLD supplementary service has not been activated.
HOLD Call Held	The HOLD supplementary service has been activated.

For the operation of the Call Hold supplementary service, the network shall

1) reserve a B-channel when the user subscribes to the reservation option;
2) when a B-channel has been reserved, always keep a B-channel available for
   i) the retrieval of a held call;
   ii) use with an incoming call; or
   iii) use with an outgoing call, if the user has subscribed to the reservation option;
3) reserve one B-channel for a user when there are one or more calls on hold; and
4) optionally provide remote notification of call holds and retrievals by either of the notification options as described in 2.5.2.1.

2.3.1.2 Terminal subscription

A user, as identified by a terminal, has the choice of the following option for the Call Hold supplementary service:

1) Reservation option, meaning reservation of a B-channel when a call is placed on hold (yes/no).

2.3.2 Requirements on the originating network side

Not applicable.

2.3.3 Requirements at the terminating network side

Not applicable.

2.4 Coding requirements

The hold and retrieve family of messages that will be used for the invocation and control of the Call Hold supplementary service, as defined in 7.1/Q.932, follows:

1) HOLD
2) HOLD ACKNOWLEDGE
3) HOLD REJECT
4) RETRIEVE
5) RETRIEVE ACKNOWLEDGE
6) RETRIEVE REJECT

The codepoints of the notification information element, as defined in Recommendation Q.932, shall be utilized in the Call Hold supplementary service operation, as appropriate.

2.5 Signalling requirements

2.5.1 Activation/deactivation/registration

Activation of the Call Hold supplementary service shall be by subscription. Deactivation of the service shall be by withdrawal.

2.5.2 Invocation and operation

2.5.2.1 Procedures at the originating interface

The originating local exchange is the exchange where the service is controlled. The originating local exchange for this description is not necessarily the originating exchange for the basic call.

2.5.2.1.1 Call Hold normal operation

A call may be placed on hold by the calling user at any time after the call has been answered or additionally as a service provider option:

1) after alerting has commenced; or

2) after the calling user has provided all of the information necessary for processing the call.

The calling user may invoke the Call Hold supplementary service in states U3 (after receiving CALL PROCEEDING), U4 (after receiving ALERTING), or U10 (after receiving CONNECT).

User A initiates the Call Hold supplementary service by requesting the hold function according to 6.2.2/Q.932 utilizing the call reference indicating the call for which the Call Hold supplementary service applies.

Upon receipt of the HOLD message, service provider A shall check whether:

1) user A is in a valid call state; and

2) the call requested to be held is a circuit mode call; and

3) user A is a valid subscriber of the Call Hold supplementary service.

The order in which these checks are performed is not specified.

When the B-channel reservation user subscription option applies, the reservation function defined in 6.4/Q.932 shall be used.

When the call is held before alerting, the notification shall be delayed by network A, at least until the indication of alerting has been received from the remote user.

If service provider A determines that access to the requested hold service is authorized and available, service provider A shall acknowledge the hold function according to 6.2/Q.932.

When a call is held before answer, network A has the option of sending the notification towards network B immediately or delaying the sending of the notification towards network B until after answer. When a call is held before answer and network A sends the notification towards network B, network B has the option of delivering the notification to terminals that have responded with ALERTING or delivering the notification after answer. If user B is on an ISDN interface, the notification shall be delivered to user B's interface as specified by the notification procedures in 9.2/Q.932, containing a Notification indicator information element indicating "Remote HOLD".

2.5.2.1.1.1 Holding a call before the A-B call is active

2.5.2.1.1.1.1 Holding a call after receiving a CALL PROCEEDING message (by calling user A) (U3)

It is assumed that user A has initiated a call to a user B; has completed dialling (i.e. the provision of call information using either enblock or overlap sending methods); has received a CALL PROCEEDING message from service provider A and has entered the Outgoing Call Proceeding state (U3).

User A may send a HOLD message to service provider A indicating the call reference value of the call to user B. After sending this message, user A enters the Hold Request auxiliary state.

If all conditions for holding a call are met, service provider A shall return to user A a HOLD ACKNOWLEDGE message indicating the call reference value of the call to user B. After transmitting the message, service provider A shall ensure that the B-channel is deactivated (the B-channel may have been activated when service provider A has delivered the CALL PROCEEDING message and indicated interworking in a Progress indicator information element). Service provider A may provide hold notification as described in 2.5.2.1.1.

2.5.2.1.1.1.2 Holding a call after receiving an ALERTING message

It is assumed that user A has initiated a call to user B; has completed dialling; and has either received a CALL PROCEEDING message followed by an ALERTING message, or the first message returned to user A by service provider A was an ALERTING message. User A has entered the Call Delivered state (U4).

User A may send a HOLD message to service provider A indicating the call reference value of the call to user B. After sending this message, user A enters the Hold Request auxiliary state.

Service provider A shall accept this hold request if all conditions for holding a call are met. Service provider A shall return to user A a HOLD ACKNOWLEDGE message again indicating the call reference value of the call to user B. After transmitting the message, service provider A shall ensure that the B-channel is deactivated (the B-channel may have been activated when service provider A delivered a CALL PROCEEDING or the ALERTING message and indicated interworking in a Progress indicator information element), and shall enter the Call Held auxiliary state.

Service provider A may provide hold notification as described in 2.5.2.1.1.

Upon receiving the HOLD ACKNOWLEDGE message from service provider A, user A shall enter the Call Held auxiliary state and, if previously connected shall disconnect from the B-channel allocated to the A-B call.

2.5.2.1.1.2 Holding a call once the A-B call is active

User A may send a HOLD message to service provider A indicating the call reference value of the call to user B. After sending this message, user A enters the Hold Request auxiliary state.

Service provider A shall accept this hold request if all conditions for holding a call are met. Service provider A shall return to user A a HOLD ACKNOWLEDGE message indicating the call reference value of the call to user B. After transmitting the message, service provider A shall ensure that the B-channel is deactivated, and shall enter the Call Hold auxiliary state.

Service provider A may provide hold notification as described in 2.5.2.1.1.

2.5.2.1.1.3 Clearing a held call

A held call may be cleared by either user A, user B, or by service provider A (when the A-B call is not completed to a user B). The held A-B call may be in the Outgoing Call Proceeding (U3), Call Delivered (U4), or Active (U10) state when the call is cleared. When the A-B call is cleared, service provider A shall continue to reserve a channel for user A until there are no more held calls with reservation associated with user A.

2.5.2.1.1.3.1 Clearing a held call by user A

The held call may be cleared by user A by generally following the procedures of 5.3.3/Q.931. User A may send a DISCONNECT message to service provider A, start timer T305 and enter the Disconnect Request state (the call remains in the Call Held auxiliary state).

Upon receipt of the RELEASE message from service provider A, user A shall cancel timer T305, send a RELEASE COMPLETE message, release the call reference, return to the Null state and enter the HOLD Idle auxiliary state. The B-channel shall not be released because it was deactivated when the Call Held auxiliary state was entered.

2.5.2.1.1.3.2 Clearing a held call by service provider A

The held call may be cleared by service provider A as defined by procedures in 6.2/Q.932 and 5.3.4/Q.931.

Service provider A may initiate clearing of a held call by sending the RELEASE message as defined in 5.3/Q.931.

2.5.2.1.1.4 Operations available with call(s) on hold

Once user A places a call on hold, the operations that user A may perform are affected by whether or not channel reservation was in effect.

Call(s) held with channel reservation

Assume that user A subscribes to the Call Hold supplementary service with channel reservation, and places one or more calls on hold. A B-channel will be reserved for user A as long as there is at least one call on hold. When all reservations are cleared, all channels become available for use by either the service provider or any terminal at user A's interface.

The reserved B-channel may be used by user A to

- make an outgoing call;
- accept an incoming call; or
- retrieve a held call.

The notification of an incoming call (i.e. the delivery of a SETUP message) is affected by whether or not any calls are held, for when there is a held call, there are channels that may be "inactive, but not free". This affects the operation of the Call Waiting supplementary service (see 2.6.1).

Note that all of the above operations may be performed at any time after a call has been placed on hold. This includes holding a call before it has reached the Active state.

Calls held without channel reservation

When user A does not have channel reservation, user A may use an available B-channel to

- make an outgoing call;
- accept an incoming call; or
- retrieve a held call.

Since no B-channel has been reserved for user A, access to a B-channel to perform any of the above operations would be the same as when no calls are held.

The notification of an incoming call (i.e. the delivery of the SETUP message), is not affected by whether or not any calls are held since in this case there are no channels that are "inactive, but not free".

Assume that user A subscribes to the Call Hold supplementary service without channel reservation, and places more than one call on hold. User A may attempt to retrieve a held call on a selected B-channel. If this retrieval is successful (regardless of the actual B-channel selected by service provider A) and user A does not disconnect or place on hold this active call, the user A may also attempt to retrieve another held call on another B-channel associated with the D-channel of user A. The success of this second retrieval would be determined by user A's ability to manage more than one active call and the maximum number of calls allowed to user A in this basic call subscription. If user A is allowed to manage more than one active call, then multiple retrieve requests should be successful as long as there are available B-channels on which to attach the calls.

2.5.2.1.2 Call Hold exceptional procedures

Failure of the Call Hold function shall be indicated by the rejection of the hold function request. The following causes may be used:

1) User A has not subscribed to the Call Hold supplementary service

   Service provider A shall return a HOLD REJECT message containing a Cause information element with a cause value #50, "requested facility not subscribed" and a location of "public network serving the local user".

2) Service provider A does not support the Call Hold service

   Service provider A shall return a HOLD REJECT message containing a Cause information element with a cause value #69, "requested facility not implemented" and a location of "public network serving the local user" if service provider A recognizes the HOLD message. If the HOLD message is not recognized, then the procedures of 5.8.4/Q.931 shall be followed.

3) The call requested to be held by user A is in the process of being cleared by service provider A

The procedures of 6.2.2.4/Q.932 shall be followed.

4) The network receives a HOLD message for a particular call and determines that the resources are not available for holding the call

The network shall reject the hold request with a HOLD REJECT message containing a Cause information element with cause value #47, "Resources unavailable, unspecified", or as a service provider option, cause value #34 "No circuit/channel available".

5) 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 not a circuit-mode call

The network shall reject the hold request with a HOLD REJECT message containing a Cause information element with cause value #57, "Bearer capability not authorized".

6) The call identified by call reference value sent in the HOLD message by user A has not reached a valid call control state or is not in the process of being cleared for the hold service for service provider A

The network shall reject the hold request with a HOLD REJECT message containing a Cause information element with a cause value #101, "Message not compatible with call state".

2.5.2.1.3 Call retrieve normal procedures

A user initiates a call retrieve operation by transferring a RETRIEVE message across the user-network interface. Following the transmission of the RETRIEVE message, the call shall be considered by the user to be in the Retrieve Request auxiliary state. The user may only initiate the RETRIEVE message while in the Call Held auxiliary state. After transmitting the RETRIEVE ACKNOWLEDGE message, service provider A shall activate the B-channel connection and enter the HOLD Idle auxiliary state.

The user may invoke the Retrieve service in the states U3 (after receiving CALL PROCEEDING), U4 (after receiving ALERTING), U10 (after receiving CONNECT), or U12 (after receiving DISCONNECT).

Upon receipt of the RETRIEVE ACKNOWLEDGE message, the user enters the HOLD Idle auxiliary state.

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).

The channel identification within the RETRIEVE/RETRIEVE ACKNOWLEDGE follows the channel selection procedure as specified in 5.1.2/Q.931.

When a call is retrieved before answer, network A has the option of sending the notification towards network B or cancelling the delayed hold notification and not sending any notification to network B. When a call is retrieved before answer and network A sends the retrieval notification to network B, procedures need to be specified for delivering this notification to user B. If user B is on an ISDN interface, the notification shall be delivered to user B's interface as specified by the notification procedures in 9.2/Q.932 containing a Notification indicator information element indicating "Remote RETRIEVAL".

When the call is held before alerting, the notification shall be delayed by network A, at least until the indication of alerting has been received from the remote user.

2.5.2.1.4 Call retrieve exceptional procedures

Failure to retrieve a held call shall be indicated by the rejection of the retrieve request function according to 6.2/Q.932.

2.5.2.2 Procedures at the transit exchange

None applicable.

2.5.2.3 Procedures at the destination user-network interface

The destination local exchange for this description is not necessarily the destination exchange for the basic call.

None identified beyond the delivery of the NOTIFY message according to the basic call procedures of Recommendation Q.931.

2.6 Interactions with other supplementary services

This subclause defines the protocol interaction among various supplementary services Call Hold supplementary service.

2.6.1 Call Waiting

If all channels are "not free" (busy or reserved) and a user has also subscribed to the Call Waiting supplementary service, the network would 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.

2.6.2 Call Transfer

No impact.

2.6.3 Connected Line Identification Presentation

No impact.

2.6.4 Connected Line Identification Restriction

No impact.

2.6.5 Calling Line Identification Presentation

No impact.

2.6.6 Calling Line Identification Restriction

No impact.

2.6.7 Closed User Group

No impact.

2.6.8 Conference Calling

Protocol interactions with conference calling are specified in 1/Q.954.

2.6.9 Direct-Dialling-In

No impact.

2.6.10 Call forwarding services

No impact.

2.6.11 Line Hunting

No impact.

2.6.12 Three-Party-Service

Protocol interactions with Three-Party Service are specified in 2/Q.954.

2.6.13 User-to-User Signalling

2.6.13.1 Service 1

No impact.

2.6.13.2 Service 2

No impact.

2.6.13.3 Service 3

No impact.

2.6.14 Multiple Subscriber Number

No impact.

2.6.15 Call Hold service

No impact.

2.6.16 Advice of Charge

No impact.

2.6.17 Sub-addressing

No impact.

2.6.18 Terminal Portability

No impact.

2.6.19 Completion of Calls to Busy Subscriber

No impact.

2.6.20 Malicious Call Identification

No impact.

2.6.21 Reverse Charging

No impact.

2.6.22 Multilevel Precedence and Preemption

See 3.6.15/Q.955.

2.7 Interactions with other networks

2.7.1 Interworking with public ISDNs

Based on bilateral agreement, service provider B shall inform user B of a call held or retrieved by means of "remote hold" or "remote retrieval" notification.

2.7.2 Interworking with private ISDNs

Based on bilateral agreement, the private ISDN shall inform user B of a call held or retrieved by means of "remote hold" or "remote retrieval" notification.

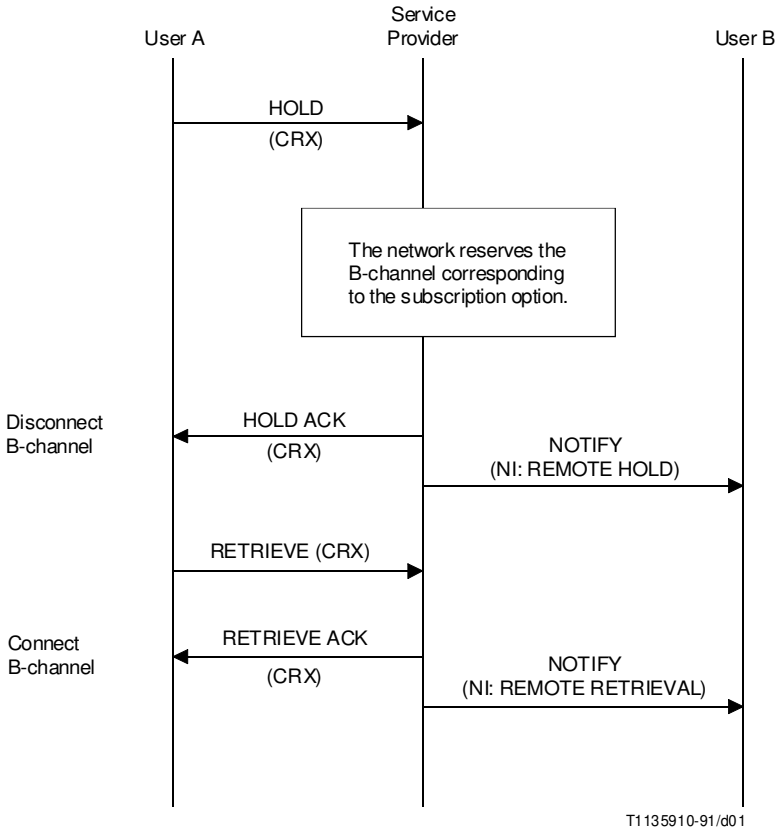
2.8 Signalling flows

This subclause contains examples of the signalling flow diagrams for the Call Hold supplementary service. The following diagrams depict one of two notification options specified in Recommendation Q.932. The following scenarios are depicted:

- Figure 2-2 – Hold and retrieve with reservation (successful procedure).
- Figure 2-3 – Hold and retrieve (unsuccessful procedure).

2.9 Parameter values (timers)

Parameter values to support the Call Hold supplementary service are as specified in Recommendation Q.932.



NOTE – The Channel Identification information element may be carried in the RETRIEVE or RETRIEVE ACKNOWLEDGE messages.

FIGURE 2-2/Q.953

Hold and retrieve with reservation (successful procedure)

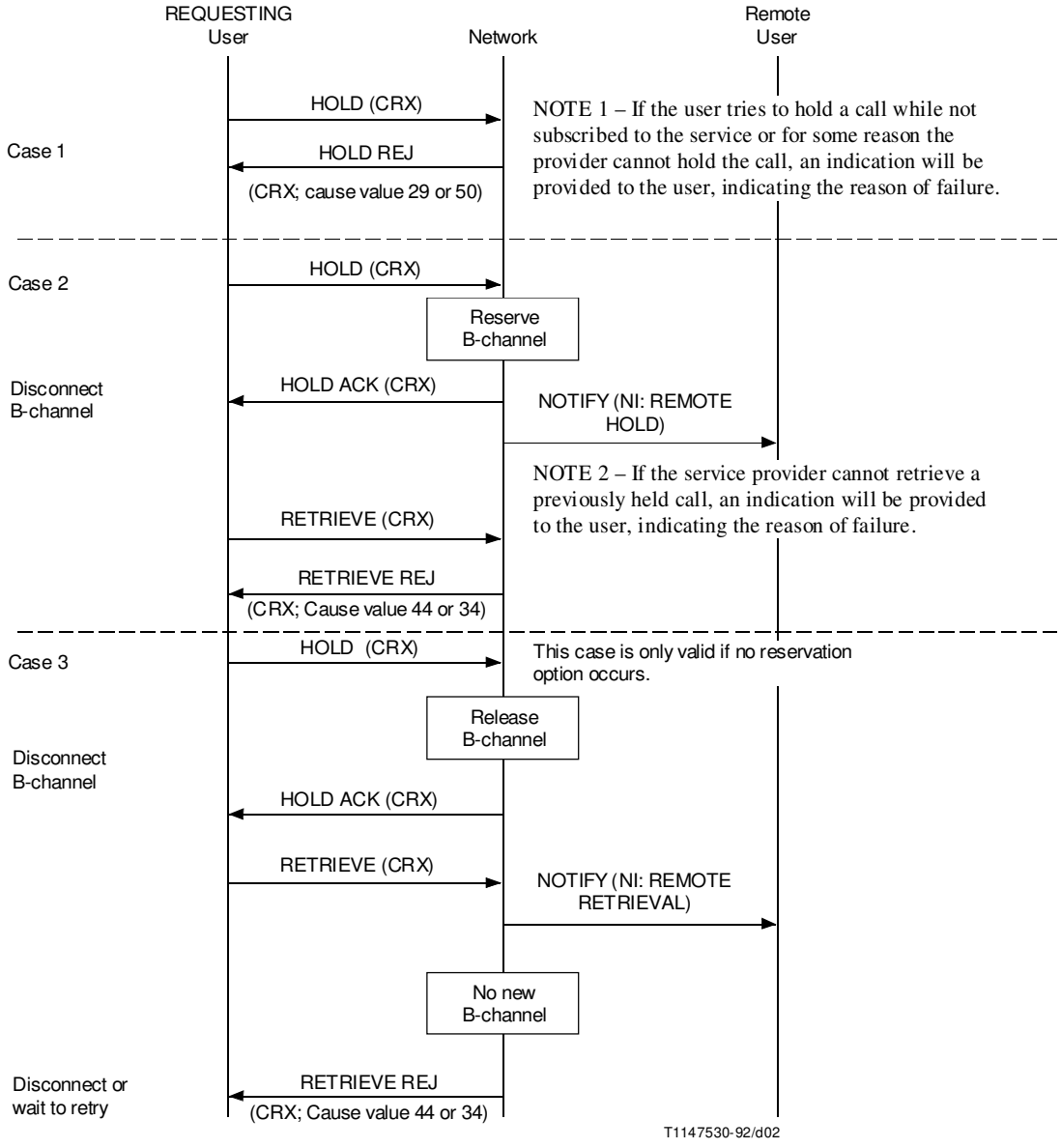


FIGURE 2-3/Q.953

Hold and retrieve with reservation (unsuccessful procedure)

2.10 Dynamic description

This subclause contains the SDL diagrams for the Call Hold supplementary service.

The following SDL diagrams are identified:

– Figure 2-4 – Hold user process SDL.

– Figure 2-5 – Hold network process SDL.

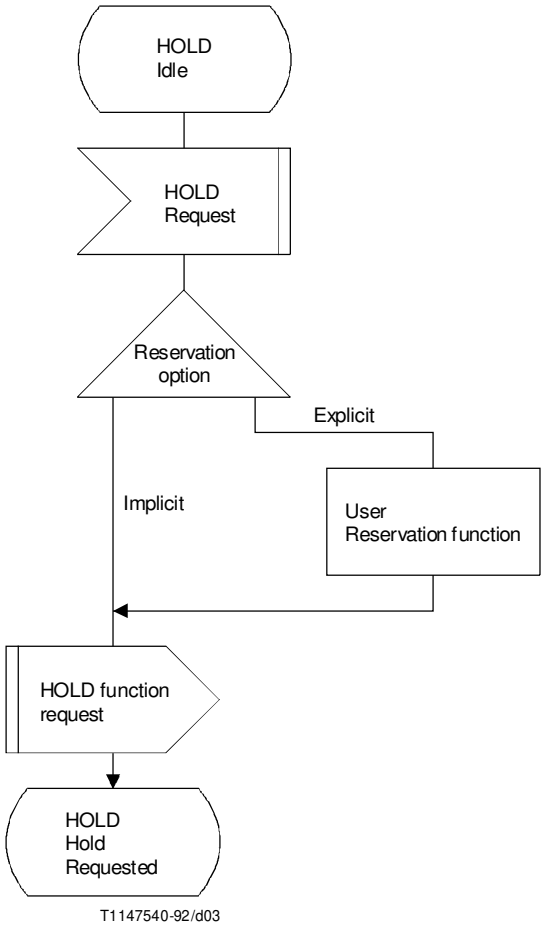


FIGURE 2-4/Q.953 (sheet 1 of 4)

Hold/Retrieve supplementary service user side

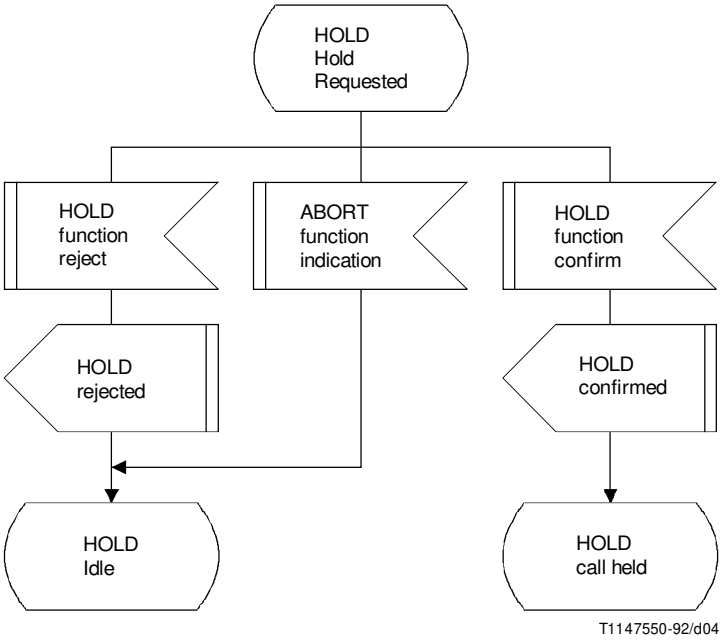


FIGURE 2-4/Q.953 (sheet 2 of 4)

Hold/Retrieve supplementary service user side

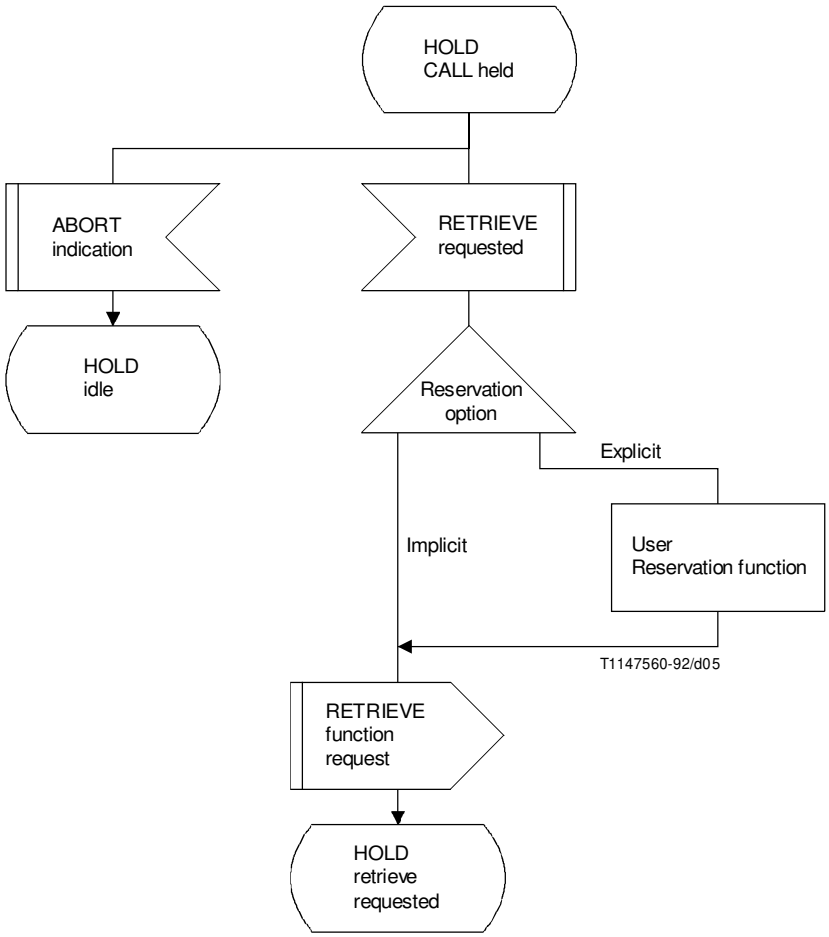


FIGURE 2-4/Q.953 (sheet 3 of 4)

Hold/Retrieve supplementary service user side

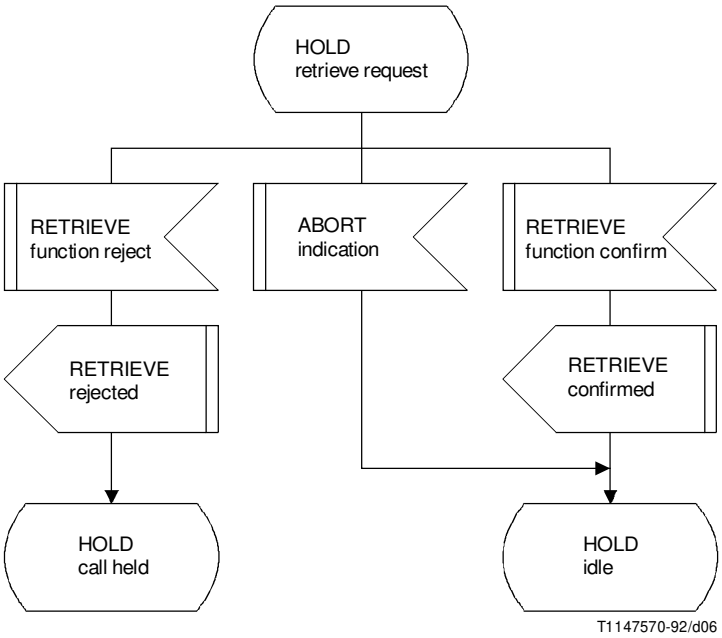
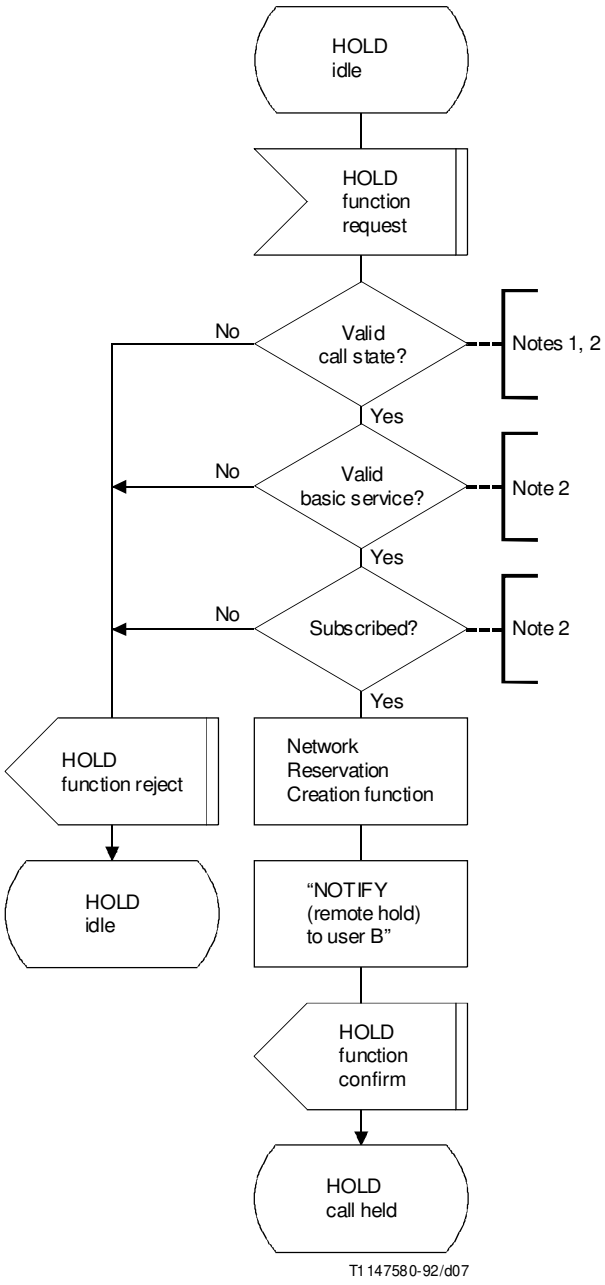


FIGURE 2-4/Q.953 (sheet 4 of 4)

Hold/Retrieve supplementary service user side



NOTES

1 The call shall be in one of the states as specified in 9.1.

2 The order of these tests is implementation dependent.

FIGURE 2-5/Q.953 (sheet 1 of 2)

Hold/Retrieve supplementary service network side

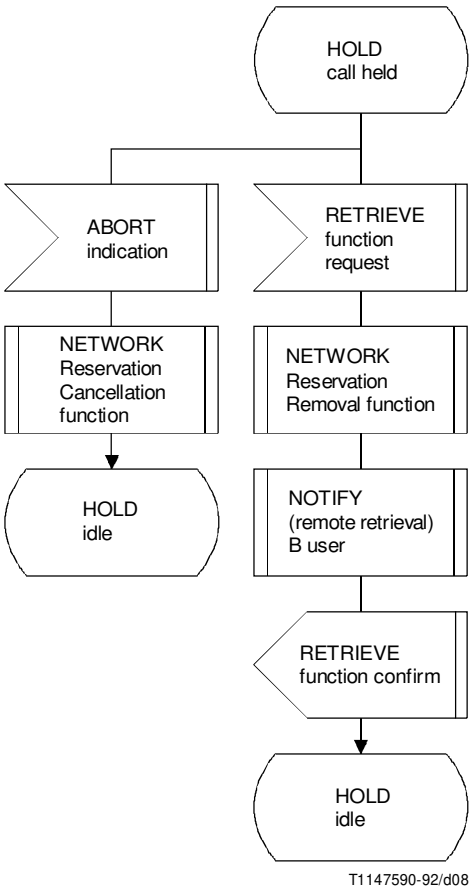


FIGURE 2-5/Q.953 (sheet 2 of 2)

Hold/Retrieve supplementary service network side