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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Supplementary services for multimedia

Call hold supplementary service for ITU-T H.323 systems

Recommendation ITU-T H.450.4

ITU International Telecommunication Union

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Recommendation ITU-T H.450.4

Call hold supplementary service for ITU-T H.323 systems

Summary

This Supplementary Service describes the procedures and the signalling protocol for the Call Hold supplementary service in ITU-T H.323 ("Packet based multimedia communications systems") networks.

This revision introduces a number of corrections and clarifications by incorporating technical and editorial corrections from the ITU-T H.323-series Implementers Guide (03/2011).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.450.4	1999-05-27	16
2.0	ITU-T H.450.4	2013-03-16	16

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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 Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Recommendation ITU-T H.450.4

Call hold supplementary service for ITU-T H.323 systems

1 Scope

This Recommendation specifies the Call Hold supplementary service (SS-HOLD), which is applicable to various basic services supported by ITU-T H.323 Multimedia Endpoints.

SS-HOLD enables the Served (Holding) User A to put User B (with whom User A has an active call) into a hold condition (Held User) and subsequently to retrieve that User again.

During this hold condition, User B may be provided with music and/or video on hold. The Served (Holding) User A may perform other actions while User B is being held, e.g., consulting with another User C.

The call between User A and User B has to be in the active state before SS-HOLD may be invoked.

This Recommendation makes use of the "Generic functional protocol for the support of supplementary services in ITU-T H.323 systems" as defined in Recommendation ITU-T H.450.1.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.225.0] Recommendation ITU-T H.225.0 (2009), *Call signalling protocols and media stream packetization for packet-based multimedia communication systems*.

[ITU-T H.245] Recommendation ITU-T H.245 (2011), *Control protocol for multimedia communication*.

[ITU-T H.323] Recommendation ITU-T H.323 (2009), *Packet based multimedia communications systems*.

[ITU-T H.450.1] Recommendation ITU-T H.450.1 (2011), *Generic functional protocol for the support of supplementary services in ITU-T H.323 systems*.

[ITU-T H.450.3] Recommendation ITU-T 450.3 (2011), *Call diversion supplementary service for ITU-T H.323 systems*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 call [ITU-T H.323]: Point-to-point multimedia communication between two H.323 endpoints. The call begins with the call set-up procedure and ends with the call termination procedure. The call consists of the collection of reliable and unreliable channels between the endpoints. A call may be directly between two endpoints or may include other H.323 entities such as a Gatekeeper or MC. In case of interworking with some SCN endpoints via a Gateway, all the channels terminate at the Gateway where they are converted to the appropriate representation for

the SCN end system. Typically, a call is between two users for the purpose of communication, but may include signalling-only calls. An endpoint may be capable of supporting multiple simultaneous calls.

3.1.2 endpoint [ITU-T H.323]: An H.323 terminal, Gateway, or MCU. An endpoint can call and be called. It generates and/or terminates information streams.

3.1.3 terminal [ITU-T H.323]: An H.323 Terminal is an endpoint on the network which provides for real-time, two-way communications with another H.323 terminal, Gateway, or Multipoint Control Unit. This communication consists of control, indications, audio, moving colour video pictures, and/or data between the two terminals. A terminal may provide speech only, speech and data, speech and video, or speech, data and video.

3.1.4 user [ITU-T H.450.3]: An application which uses one or more of the services defined in this Recommendation (activation, deactivation, interrogation, invocation) via an application programming interface.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 active state: The ITU-T H.225.0 call state U10 "Active" (after CONNECT message).

3.2.2 consultation; consultation call: An ITU-T H.323 call established while having another call(s) on hold.

3.2.3 far-end call hold (Remote-end call hold): An SS-HOLD scenario in which the served user asks the held endpoint to provide MOH to the held User.

3.2.4 held user, User B: The user who has been put on hold by the remote User A.

3.2.5 media on hold (MOH): The media pattern which may be provided to the held user during hold condition. This may include music, announcements, video, freeze (blank) frame, and other indications.

3.2.6 near-end call hold: An SS-HOLD scenario in which MOH is provided from the holding endpoint to the held user.

3.2.7 proxy: A proxy in conjunction with SS-HOLD is an entity on the call signalling path that intercepts messages for the remote-end call hold. This is in order to act on behalf of User B for SS-HOLD. The proxy entity may be co-located with the gatekeeper or may be located in a separate transit entity.

3.2.8 served user, holding user, User A: The User who has put the remote User B on hold.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

APDU	Application Protocol Data Unit
ASN.1	Abstract Syntax Notation One
GK	Gatekeeper
HDSE (User)	Held Signalling Entity (User)
HGSE (User)	Holding Signalling Entity (User)
MOH	Media on Hold
NFE	Network Facility Extension
SCN	Switched Circuit Network

SDL Specification and Description Language

SS-HOLD Supplementary Service Hold

5 Description

Call Hold (SS-HOLD) allows the served user, which may be the originally calling or the called user, to interrupt communications on an existing call and then subsequently, if desired, re-establish (i.e., retrieve) communications with the held user.

SS-HOLD applies to the complete ITU-T H.323 call (audio and video media streams) for which the supplementary service is being invoked. Putting on hold only a subset of the media streams as well as putting on hold an ITU-T T.120 call is for further study.

While having put the held user into a hold condition, the served user may perform other actions. Examples are: to communicate (consult) with another user, to have some private side talk, etc.

Hold may only be invoked by the served user for a call in the active state. Communication on the media channels is interrupted and the call is placed in the held state. The distant party is informed, and if appropriate, a specific MOH pattern (e.g., video and/or music on hold) may be provided to the held user. The served user may then originate or accept other calls, or use other services without impacting the call in the held state.

NOTE 1 – Contrary to muting, to just closing the audio logical channel or to just closing the video logical channel (which corresponds to a "video-off" command in ITU-T H.221), SS-HOLD enables functional supplementary service control. An implementation may, for example, depend/tie the invocation of other features to whether SS-HOLD is invoked or not. While a call is being held, the served user and/or the held user may be restricted from invoking other features depending on the implementation of those features. For example, a held user may be restricted from putting its call on hold (simultaneous hold).

The served user invokes the Retrieve procedure to terminate the held state of a call. The held party is informed of the retrieval and communication on the media channels is re-established.

Implementations may limit the time that a call can remain in the held state. A reminder may be provided to the served user to inform the served user that the distant user is still on hold (i.e., providing a hold time-out notification).

Two scenarios are specified for SS-HOLD, "Near-end Call Hold" and "Remote-end Call Hold". The decision whether to invoke one or the other of the methods is an implementation and application matter.

NOTE 2 – A reason for deciding to use Near-end Call Hold may, for example, be to provide a company's local announcement and thus use the opportunity to provide an advertisement to the held party. A reason for invoking Remote-end Call Hold may be to decrease network traffic.

5.1 Near-end call hold

Hold is invoked at the holding endpoint as a local procedure. The holding endpoint informs the held endpoint of the hold condition by sending a hold notification and stops receiving user packets from the held endpoint as well as sending user packets to the held endpoint. The held endpoint upon receiving the hold notification may stop sending user packets but shall continue listening to the receive channel.

Depending on the opened channels and depending on the resources of the holding endpoint, the following MOH information may be provided from the holding endpoint to the held endpoint:

– Music/Announcement in the audio logical channel.

– Video in the video logical channel.

– Video plus audio in the video and audio channel.

– Freeze frame (still image) in the video channel plus music/announcement in the audio channel.
– Other indications.

Retrieval is also a local procedure at the holding endpoint. The holding user informs the held user about the ending of the hold condition by sending a retrieve indication.

5.2 Remote-end call hold

The holding endpoint sends a hold request to the remote endpoint requiring the held endpoint to provide MOH to the held user.

The held endpoint will either accept the request and return an acknowledgement, or reject the request with an appropriate reason. If the request is rejected, then the holding endpoint will know that the hold is not in effect and Users A and B can continue communication based on the media types used prior to SS-HOLD invocation.

If the remote-hold request is accepted, depending on the media types used between holding and held endpoints prior to SS-HOLD invocation and depending on the resources of the held endpoint, the following MOH information may be provided from the held endpoint to the held user locally:

– Music/Announcement.
– Video.
– Video plus audio.
– Freeze frame (still image) plus music/announcement.
– Other indications.

The logical channels opened between the holding endpoint and the held endpoint prior to the invocation of SS-HOLD are maintained. The holding endpoint sends silence and a blank freeze frame (when a video logical channel is in use) to the remote endpoint.

If the remote-hold request is rejected by the remote endpoint, the served user is informed.

The holding user may retrieve a held call by sending a retrieve request to the held endpoint. The held endpoint will either terminate the hold state and send an acknowledgement, or reject the retrieve request. If the retrieve request is rejected, then the holding endpoint will clear the call.

After successful remote retrieve request, Users A and B continue communication based on the media types used prior to SS-HOLD invocation.

6 Messages and information elements

The operations specified for SS-HOLD in clause 12 shall be sent within h4501SupplementaryService APDUs contained within an ITU-T H.225.0 FACILITY message.

When conveying the Invoke APDU of operations defined in clause 12, the destinationEntity data element of the NFE shall contain the value "endpoint".

When conveying the Invoke APDU of operations holdNotific and retrieveNotific, the Interpretation APDU shall contain the value discardAnyUnrecognizedInvokePdu.

When conveying the Invoke APDU of operations remoteHold and remoteRetrieve, the Interpretation APDU shall be omitted or shall contain the value rejectAnyUnrecognizedInvokePdu.

NOTE – The ITU-T H.450.1 supplementary service APDU structure is defined in Table 3 of [ITU-T H.450.1].

7 Actions at the holding endpoint

7.1 Normal procedures

7.1.1 Near-end call hold

On receiving a near-end call hold request from the local User when SS-HOLD is allowed, the holding endpoint shall send a FACILITY message with a **holdNotific** Invoke APDU to the remote endpoint and shall enter the Hold_NE_Holding state. MOH shall be provided to the held user.

On receiving a near-end retrieve request from the local User, the holding endpoint shall check whether the call to which the retrieve request applies is in state Hold_NE_Holding. If so, the holding endpoint shall send a FACILITY message with a **retrieveNotific** Invoke APDU to the held endpoint and shall stop sending MOH to the remote endpoint. User A and User B may then continue communicating with each other.

The states of the logical channels are not affected by the near-end call hold supplementary service. Refer to clause 5 for more information regarding media handling.

7.1.2 Remote-end call hold

Upon receiving a remote-hold request from the local User, the served endpoint shall check whether SS-HOLD is allowed. If allowed, the served endpoint shall send a FACILITY message with a **remoteHold** Invoke APDU to the remote endpoint, start timer T1 and shall enter the Hold_RE_Requested state.

On receipt of a FACILITY message with a **remoteHold** Return Result APDU, timer T1 shall be stopped and the Hold_RE_Holding state shall be entered.

The bandwidth occupied by the media connections of the held call may be reused for other calls. Refer to clause 5 for more information regarding media handling.

Upon receiving a remote retrieve request from the local User, the served endpoint shall check whether the call to which the retrieve request applies is in state Hold_RE_Holding. If so, the served endpoint shall send a FACILITY message with a **remoteRetrieve** Invoke APDU to the held endpoint, start timer T2 and enter state Hold_RE_Retrieve_Req.

On receipt of a FACILITY message with **remoteRetrieve** Return Result APDU, the holding endpoint shall stop timer T2, restore the bandwidth, if necessary, and enter state Hold_Idle.

7.2 Exceptional procedures

7.2.1 Near-end call hold

A Reject APDU received as a response to a **holdNotific** Invoke APDU or as a response to **retrieveNotific** Invoke APDU while in state Hold_NE_Holding shall be ignored (meaning that the remote endpoint does not understand the SS-HOLD supplementary service). In such cases, the held user B knows about the hold condition only by the reception of MOH and about the retrieval condition by the cessation of MOH and the resumption of normal communications.

7.2.2 Remote-end call hold

The holding endpoint shall not allow the local User to invoke multiple, simultaneous remote-hold requests for the same call. That is, the holding endpoint shall not send a **remoteHold** Invoke APDU for a call:

1) while timer T1 is running for that call; or
2) when that call is already in the Hold_RE_Holding state.

If in response to a **remoteHold** Invoke APDU a FACILITY message with a **remoteHold** Return Error APDU is received, the holding endpoint shall stop timer T1, terminate the hold procedure and enter the Hold_Idle state. The served endpoint in this case may either retry the remote-end call hold supplementary service or may perform the near-end call hold procedure.

If in response to a **remoteHold** Invoke APDU a FACILITY message with a Reject APDU is received, the holding endpoint shall stop timer T1, terminate the hold procedure and enter the Hold_Idle state. The served endpoint in this case may perform the near-end call hold procedure.

If timer T1 expires the holding endpoint shall terminate the hold procedure and enter the Hold_Idle state. As an option, the holding endpoint may invoke the near-end call hold procedure.

The holding endpoint shall not allow the local User to invoke multiple, simultaneous remote retrieve requests for the same call. That is, the holding endpoint shall not send a **remoteRetrieve** Invoke APDU for a call:

1) while timer T2 is running for that call; or

2) when that call is already in the Hold_Idle state.

If in response to a **remoteRetrieve** Invoke APDU a FACILITY message with a **remoteRetrieve** Return Error APDU or a Reject APDU is received, the holding endpoint shall stop timer T2 and release the held call.

If timer T2 expires the holding endpoint shall release the held call.

8 Actions at the held endpoint

8.1 Normal procedures

8.1.1 Near-end call hold

On receipt of a FACILITY message with **holdNotific** Invoke APDU or **retrieveNotific** Invoke APDU, the User B may be informed of the hold or retrieval. Logical channels associated with the held call are not affected. The held User shall continue listening to the opened logical channels.

Refer to clause 5 for more information regarding media handling.

8.1.2 Remote-end call hold

On receipt of a FACILITY message with a **remoteHold** Invoke APDU, if hold is acceptable, the held endpoint shall return a FACILITY message with a **remoteHold** Return Result APDU, enter the Hold_RE_Held state; and the bandwidth occupied by media connections of the call shall be regarded as temporarily free. The held endpoint shall provide MOH to the held User.

On receipt of a FACILITY message with a **remoteRetrieve** Invoke APDU while in state Hold_RE_Held, the held endpoint shall stop providing MOH to the local User and shall re-establish the opened logical channels to the served user. A FACILITY message with a **remoteRetrieve** Return Result APDU shall be returned and state Hold_Idle shall be entered.

Refer to clause 5 for more information regarding media handling.

8.2 Exceptional procedures

8.2.1 Near-end call hold

Not applicable.

8.2.2 Remote-end call hold

If the remote-end call hold request is not acceptable, the held endpoint shall return a FACILITY message with a **remoteHold** Return Error APDU indicating an appropriate error reason.

If a received **remoteRetrieve** Invoke APDU does not relate to a call in state Hold_RE_Held, a FACILITY message with **remoteRetrieve** Return Error APDU shall be returned containing error value invalidCallState.

8.3 Additional procedures

A hold request received from the local user while being on hold may be rejected locally, i.e., simultaneous hold shall be an option.

A call on hold (either near-end or remote-end call hold) may be cleared by either side of the held call using regular ITU-T H.323 call clearing procedures. This applies also for call clearing during hold invocation.

9 Interworking

9.1 Interworking with SCN

SS-HOLD may interwork with corresponding supplementary services as defined by other standards making use of gateway interworking functions. The specification of detailed gateway interworking procedures is out of the scope of this Recommendation and will be specified by other Recommendations.

9.2 Interworking with other supplementary services

9.2.1 Call transfer (ITU-T H.450.2)

If prior to Consultation, the first call has been put on hold, the served User endpoint shall decide whether or not to automatically retrieve the held User before Call Transfer is invoked.

– If the served User endpoint decides for the automatic retrieve option, a **retrieveNotific** Invoke APDU (in case of near-end call hold) or a **remoteRetrieve** Invoke APDU (in case of remote-end call hold) may either be sent by the served user prior to the message containing the **callTransferInitiate** Invoke APDU or may be sent within the same message containing the **callTransferInitiate** Invoke APDU.

  If the call transfer fails after retrieval from hold was successful (i.e., if **callTransferInitiate** Return Error or Reject APDU is received or if timer CT-T3 expires), the served user endpoint may automatically re-invoke SS-Hold.

  If remote-end call hold retrieval is unsuccessful, in order to proceed with the call transfer the **remoteRetrieve** Return Error or **remoteRetrieve** Reject APDU should be disregarded.

– If the served User endpoint decides to not choose the automatic retrieve option, call hold applies to the primary call until call transfer has been completed successfully (i.e., until the primary call is cleared). If transfer fails, the primary call remains being held by User A.

9.2.2 ITU-T H.323 conference

A member of a decentralized conference or of a centralized MCU based conference, may invoke near-end call hold with the restriction that the holding endpoint shall not provide MOH but shall provide silence and freeze blank frame. The **holdNotific** Invoke APDU shall be sent to the active MC (MCU). The entity containing the active MC may optionally pass on the **holdNotific** Invoke APDU to the other members of the conference.

A member of a decentralized conference or of a centralized MCU based conference shall not invoke remote-end call hold.

An MCU having point-to-point connections to the conference members (centralized conference) may put the connection(s) to a conference member on hold. This applies to both, Near-end Call Hold and Remote-end Call Hold.

9.2.3 Call waiting (ITU-T H.450.6)

A user may invoke SS-HOLD in order to be able to accept a waiting call.

9.2.4 Call park and call pickup (ITU-T H.450.5)

If a held user requests SS-PARK on a held call, the SS-PARK request shall be rejected locally.

9.3 Interaction with ITU-T H.225.0 parameters

The ITU-T H.225.0 elements ConferenceIdentifier and CallIdentifier within a consultation call shall be set to values which are different from the corresponding values of the held call.

10 Gatekeeper/proxy actions

In a gatekeeper routed model, the gatekeeper should pass on SS-HOLD operations transparently (applies to both near-end call hold and remote-end call hold).

The following alternative gatekeeper/proxy procedures may apply:

10.1 Remote-end call hold

A proxy on the call path between the served endpoint and the held endpoint may act upon a received FACILITY message containing a **remoteHold** Invoke APDU. The proxy in this case shall act as a held endpoint for remote-end call hold and may act as a served endpoint for near-end hold. As part of SS-HOLD, the proxy in this case shall provide MOH to the held endpoint B. Logical channels between endpoints A and B shall be closed and new channels have to be established between the proxy and the held endpoint, if not already available. Therefore, the procedures for "Third party initiated pause and re-routing" as described in clause 8.4.6 of [ITU-T H.323] shall apply. For an example signalling flow illustrating the procedure, refer also to Figure 9.

The proxy intercepting a FACILITY message with a **remoteHold** Invoke APDU shall also intercept a subsequently received FACILITY message with a **remoteRetrieve** Invoke APDU. Upon receiving a **remoteRetrieve** Invoke APDU, logical channels between the proxy and endpoint B shall be closed and new channels between endpoint A and endpoint B shall be established (if not already available) using the procedures for "Third party initiated pause and re-routing" as described in clause 8.4.6 of [ITU-T H.323]. If the proxy has chosen the option to act as a served endpoint for near-end call hold (i.e., **holdNotific** Invoke APDU sent to the held endpoint), the proxy shall send a **retrieveNotific** Invoke APDU to the held endpoint during retrieve from hold. For an example signalling flow illustrating the procedure, refer also to Figure 12.

10.2 Near-end call hold

A gatekeeper/proxy that has registered the holding endpoint may act on received Near-end Call Hold messages by means of providing MOH on behalf of the holding endpoint to the held endpoint. However, the Near-end Call Hold messages shall be passed on to the held endpoint.

As part of call hold and retrieve from call hold, the gatekeeper/proxy may use the procedures for "Third party initiated pause and re-routing" as described in clause 8.4.6 of [ITU-T H.323] for closing and opening logical channels as desired.

A gatekeeper/proxy that has not registered the holding endpoint shall not act on received messages for Near-end Call Hold, but shall transparently pass them on to the held endpoint.

11 Dynamic description for call hold

11.1 Operational models and signalling flows

11.1.1 Near-end call hold

See Figures 1 to 5.

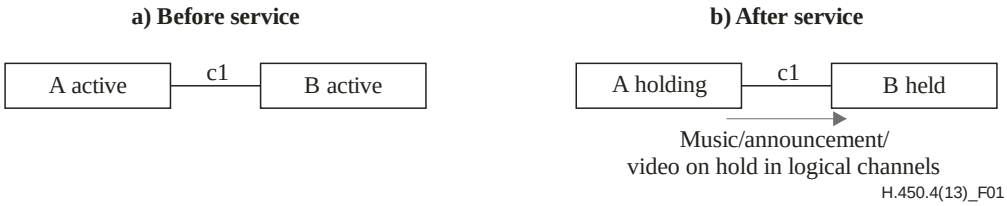


Figure 1 – Operational model for near-end call hold

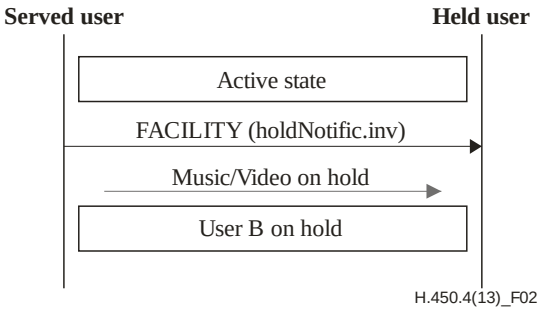


Figure 2 – Signalling flow for near-end call hold

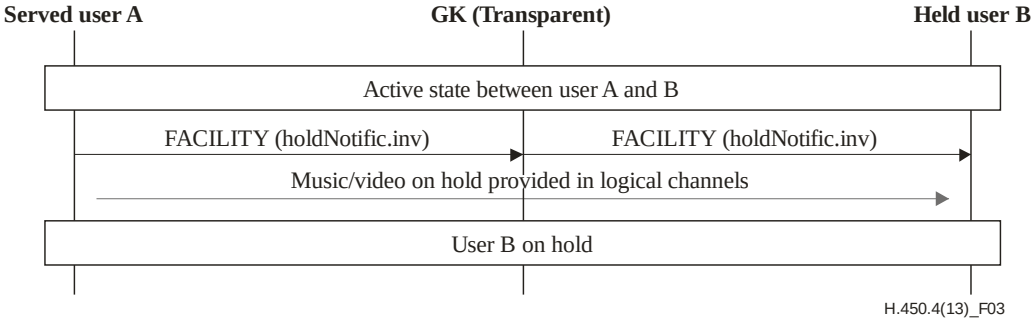


Figure 3 – Signalling flow for near-end call hold for a GK routed model

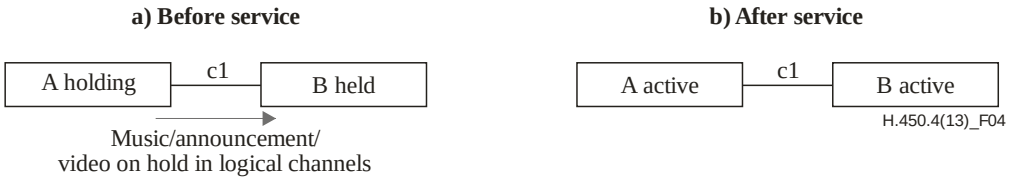


Figure 4 – Operational model for retrieve from near-end call hold

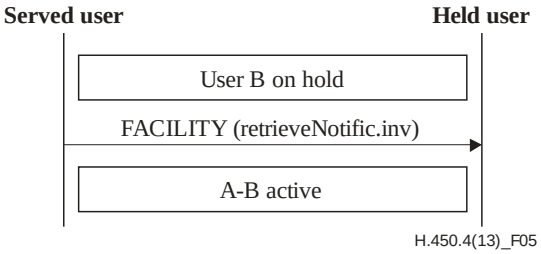


Figure 5 – Signalling flow for retrieve from near-end call hold

11.1.2 Remote-end call hold

See Figures 6 to 12.

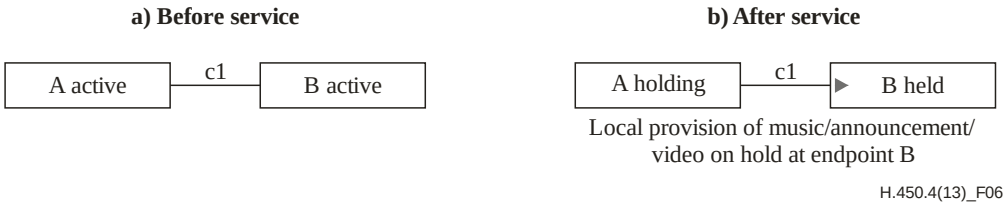


Figure 6 – Operational model for remote-end call hold

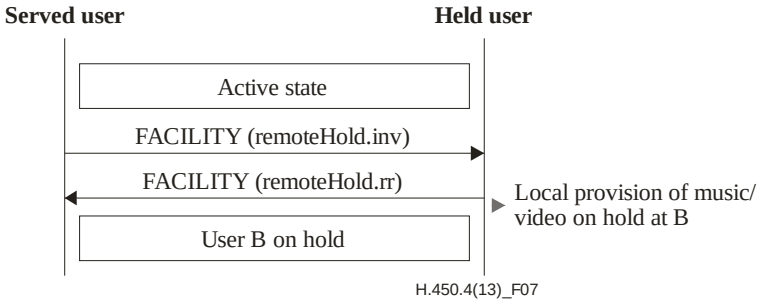


Figure 7 – Signalling flow for remote-end call hold

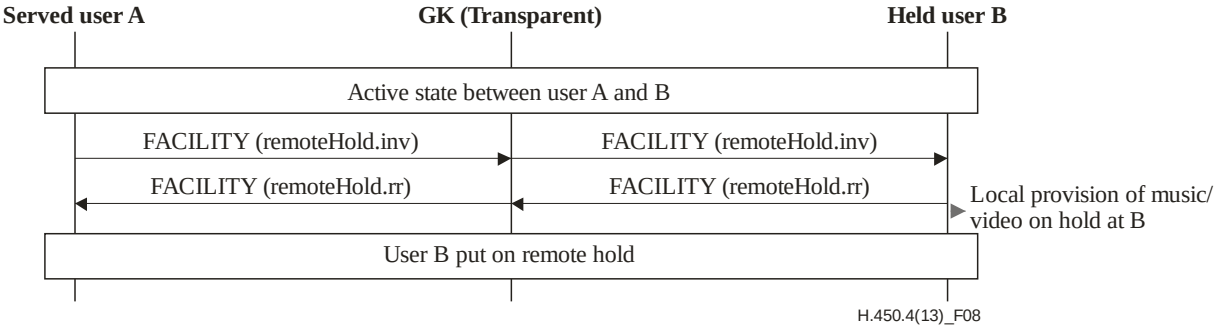
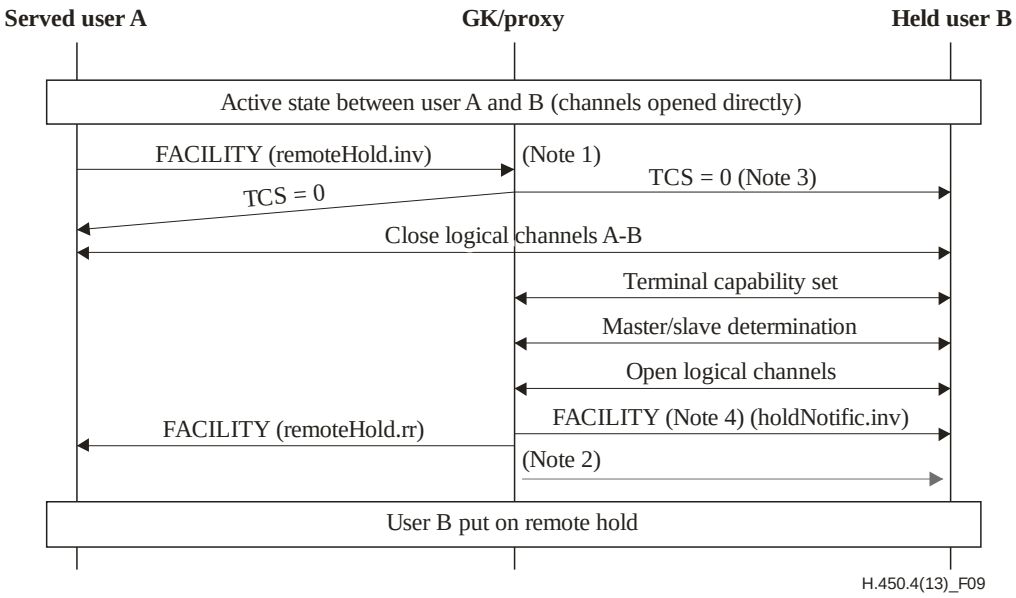


Figure 8 – Signalling flow for remote-end call hold – GK routed model – GK transparent



NOTE 1 – The GK/proxy acts upon the received remote-end call hold invocation. "Third party initiated pause and re-routing" procedures according to clause 8.4.6 of [ITU-T H.323] may be used for closing the channels between endpoints A and B as well as for establishing new channels for MOH provision between the GK/proxy and endpoint B.

NOTE 2 – Provision of MOH by GK/proxy.

NOTE 3 – TCS = 0 means empty terminal capability set.

NOTE 4 – Optional.

Figure 9 – Signalling flow example for remote-end call hold – GK routed model – GK acts on remote-hold request on behalf of Te B

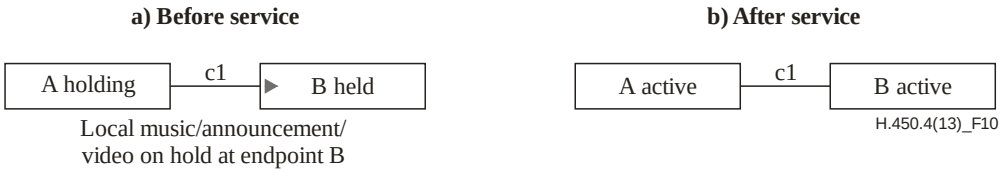


Figure 10 – Operational model for retrieve from remote-end call hold

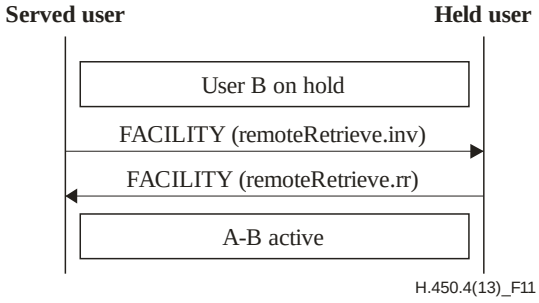
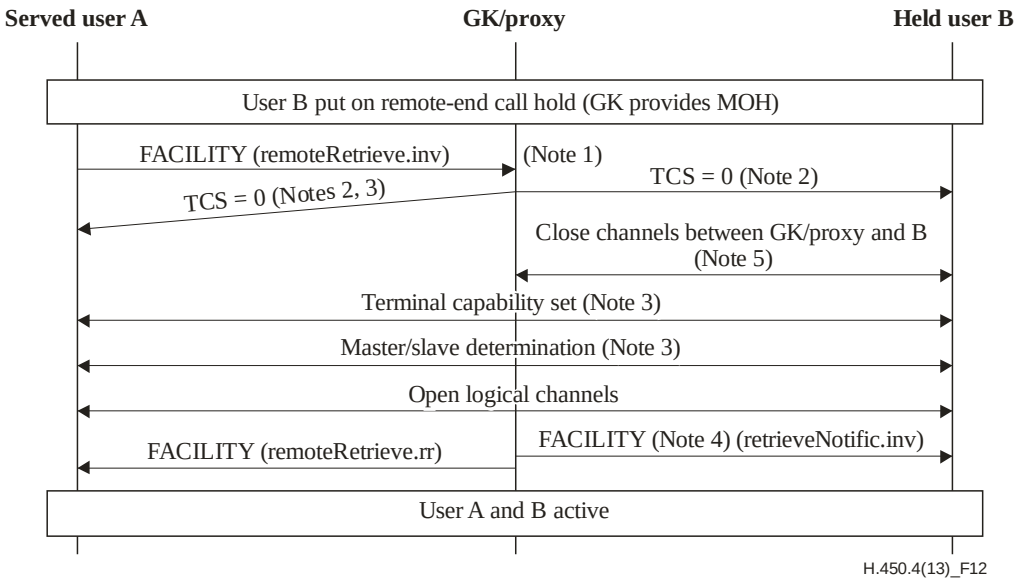


Figure 11 – Signalling flow for retrieve from remote-end call hold



NOTE 1 – The GK/proxy acts on the received retrieve request for remote-end call hold. "Third party initiated pause and re-routing" procedures according to clause 8.4.6 of [ITU-T H.323] may be used for closing the channels between the GK/proxy and endpoint B as well as for establishing new channels between endpoint A and endpoint B.
NOTE 2 – TCS = 0 means empty terminal capability set.
NOTE 3 – If applicable.
NOTE 4 – Optional.
NOTE 5 – Endpoint B may only have receive channels open at this time.

Figure 12 – Signalling flow example for retrieve from remote-end call hold – GK routed model – GK acts on remote-hold retrieve request

11.2 Communication between holding signalling entity (HGSE) and holding signalling entity user (HGSE user)

11.2.1 Table of primitives

See Table 1.

Table 1 – Primitives at the served endpoint

Generic name	Type			
	Request (req)	Indication (ind)	Response (resp)	Confirm (conf)
holdNotific	–	(Note 2)	(Note 2)	(Note 3)
retrieveNotific	–	(Note 2)	(Note 2)	(Note 2)
remoteHold	–	(Note 2)	(Note 2)	PARAMETERS
remoteRetrieve	–	(Note 2)	(Note 2)	PARAMETERS
NOTE 1 – "–" means no parameters (manufacturer specific parameters may be present). NOTE 2 – This primitive is not defined. NOTE 3 – Local confirmation.				

11.2.2 Primitive definition

The holdNotific.Request primitive is used to put the HDSE user into a near-end call hold condition.

The retrieveNotific.Request primitive is used to request retrieval of the HDSE user from the hold condition.

The remoteHold.Request primitive is used to request putting the HDSE on remote-end call hold.

The remoteHold.Confirm primitive is used to indicate the successful or unsuccessful outcome of the remote-end call hold request.

The remoteRetrieve.Request primitive is used to retrieve the HDSE user from remote-end call hold.

The remoteRetrieve.Confirm primitive is used to indicate the outcome of the remote-end call hold retrieve request.

11.2.3 Parameter definition

remoteHold.Confirm parameters:

– Refer to clause 11.3.3 (parameters for remoteHold.Response primitive).

remoteRetrieve.Confirm parameters:

– Refer to clause 11.3.3 (parameters for remoteRetrieve.Response primitive).

11.2.4 States

Hold_Idle	No call hold procedure has been initiated.
Hold_NE_Holding	Near-end call hold has been invoked by holding endpoint.
Hold_RE_Requested	Remote-end call hold has been requested, waiting for response.
Hold_RE_Holding	Remote-end call hold has been invoked successfully
Hold_RE_Retrieve_Req	Remote-end call hold retrieval has been requested.

11.3 Communication between held signalling entity (HDSE) and held signalling entity User (HDSE user)

11.3.1 Table of primitives

See Table 2.

Table 2 – Primitives at the held endpoint

Generic name	Type			
	Request (req)	Indication (ind)	Response (resp)	Confirm (conf)
holdNotific	(Note 2)	–	(Note 2)	(Note 2)
retrieveNotific	(Note 2)	–	(Note 2)	(Note 2)
remoteHold	(Note 2)	–	PARAMETERS	(Note 2)
remoteRetrieve	(Note 2)	–	PARAMETERS	(Note 2)
NOTE 1 – "–" means no parameters (manufacturer specific parameters may be present). NOTE 2 – This primitive is not defined.				

11.3.2 Primitive definition

The holdNotific.Indication primitive is used to indicate to the HDSE user that the HGSE has put the HDSE user on near-end call hold.

The retrieveNotific.Indication primitive is used to indicate to the HDSE user that the HGSE has retrieved the HDSE user from the near-end call hold condition.

The remoteHold.Indication primitive is used to indicate a remote-end call hold request from the HGSE.

The remoteHold.Response primitive is used to acknowledge or to reject the remote-end call hold request from HGSE.

The remoteRetrieve.Indication primitive is used to request retrieval of the remote-hold condition.

The remoteRetrieve.Response primitive is used to acknowledge or reject the remote retrieve request from HGSE.

11.3.3 Parameter definition

remoteHold.Response parameters:

– notAvailable: feature not available in combination with the basic service.

– invalidCallState: hold not possible in current call state.

– resourceUnavailable: maximum number of calls on hold reached.

– supplementaryServiceInteractionNotAllowed: other supplementary service prohibits hold.

– undefined: undefined reason (may be accompanied by manufacturer specific extension).

remoteRetrieve.Response parameters:

– invalidCallState: Retrieve not possible in current call state.

– undefined: undefined reason (may be accompanied by manufacturer specific extension).

11.3.4 States

Hold_Idle No call hold procedure has been initiated.

Hold_NE_Held Near-end call hold has been invoked.

Hold_RE_Held Remote-end call hold has been requested successfully.

11.4 Timers

T1: Remote-hold Request Timer (timer value administrable).

T2: Remote-hold Retrieve Request Timer (timer value administrable).

11.5 Counters

None.

12 Operations in support of SS-call hold

```
Call-Hold-Operations
     {itu-t recommendation h 450 4 version1(0) call-hold-operations(0)}

DEFINITIONS AUTOMATIC TAGS ::=
BEGIN
IMPORTS    OPERATION, ERROR FROM Remote-Operations-Information-Objects
          { joint-iso-itu-t remote-operations (4) informationObjects (5)
version1(0) }
EXTENSION, Extension { } FROM Manufacturer-specific-service-extension-definition
          { itu-t recommendation h 450 1 version1(0) msi-definition(18)}
notAvailable, invalidCallState, resourceUnavailable,
supplementaryServiceInteractionNotAllowed
          FROM H4501-General-Error-List
          { itu-t recommendation h 450 1 version1(0) general-error-list (1) }
NonStandardParameter FROM H323-MESSAGES; -- see H.225.0

CallHoldOperations  OPERATION ::=
{holdNotific | retrieveNotific | remoteHold | remoteRetrieve }

holdNotific   OPERATION ::=
{ -- sent from holding to held H.323 endpoint to invoke near-end call hold
feature
```

```
     ARGUMENT  HoldNotificArgOPTIONAL TRUE
     RETURN RESULT      FALSE
     ALWAYS RESPONDS    FALSE
     CODE local: 101
}

HoldNotificArg ::= SEQUENCE
     {extensionArg      SEQUENCE SIZE (0..255) OF MixedExtension OPTIONAL,
     ...
     }

retrieveNotific         OPERATION ::=
     { -- sent from holding to held H.323 endpoint to invoke retrieval of near-
end call hold feature
     ARGUMENT      RetrieveNotificArg OPTIONAL TRUE
     RETURN RESULT      FALSE
     ALWAYS RESPONDS    FALSE
     CODE local: 102
     }

RetrieveNotificArg ::= SEQUENCE
     {extensionArg      SEQUENCE SIZE (0..255) OF MixedExtension OPTIONAL,
     ...
     }

remoteHold         OPERATION  ::=
     { -- sent from holding to held H.323 endpoint to invoke remote-end call
hold feature
     ARGUMENT  RemoteHoldArg OPTIONAL TRUE
     RESULT         RemoteHoldRes OPTIONAL TRUE
     ERRORS {
          notAvailable | -- feature not available in combination with the basic
service
          invalidCallState | -- hold not possible in current call state
          resourceUnavailable | -- maximum number of calls on hold reached
          supplementaryServiceInteractionNotAllowed |
               -- other supplementary service prohibits hold
          undefined      -- undefined reason
               }
CODE local: 103
     }

RemoteHoldArg ::= SEQUENCE
     {extensionArg      SEQUENCE SIZE (0..255) OF MixedExtension OPTIONAL,
     ...
     }

RemoteHoldRes ::= SEQUENCE
     {extensionRes      SEQUENCE SIZE (0..255) OF MixedExtension OPTIONAL,
     ...
     }

remoteRetrieve     OPERATION  ::=
     { -- sent from holding to held H.323 endpoint to invoke retrieval of
remote-end call hold feature
     ARGUMENT  RemoteRetrieveArg  OPTIONAL TRUE
     RESULT         RemoteRetrieveRes  OPTIONAL TRUE
     ERRORS {invalidCallState |
                    -- Call to which retrieve request applies is not in state
Hold_RE_Holding
               undefined -- undefined reason
               }
```

```
     CODE local: 104
     }

RemoteRetrieveArg  ::= SEQUENCE
     {extensionArg      SEQUENCE SIZE (0..255) OF MixedExtension OPTIONAL,
     ...
     }

RemoteRetrieveRes  ::= SEQUENCE
     {extensionRes      SEQUENCE SIZE (0..255) OF MixedExtension OPTIONAL,
     ...
     }

MixedExtension ::= CHOICE
          {    extension     Extension{{ExtensionSet}},
               nonStandardData    NonStandardParameter}

ExtensionSet EXTENSION  ::= {...}
     -- Actual values defined by individual manufacturers

undefined ERROR     ::=
{
     PARAMETER     SEQUENCE SIZE (0..255) OF MixedExtension OPTIONAL TRUE
     CODE local:2002
}

END  -- of Call-Hold-Operations
```

13 SDLs

The procedures for Call Hold signalling entities are described in SDL form in Figures 14 to 20.

The SDLs only show SS-Call Hold messages transported on an ITU-T H.225.0 reliable connection. ITU-T H.245 procedures (terminal capability exchange, master/slave determination, opening and closing of logical channels, etc.) are not shown.

ROSE APDUs sent via the network are indicated using bold letters with the following abbreviations:

(.inv) Invoke APDU

(.rr) Return Result APDU

(.re) Return Error APDU

(.rej) Reject APDU

For primitives and their meanings, refer to clauses 11.2 and 11.3.

In case of a conflict between these SDLs and the text within the previous clauses, the text shall take precedence.

Specific gatekeeper SDLs are not provided.

The symbols used in the following SDLs are defined in Figure 13.

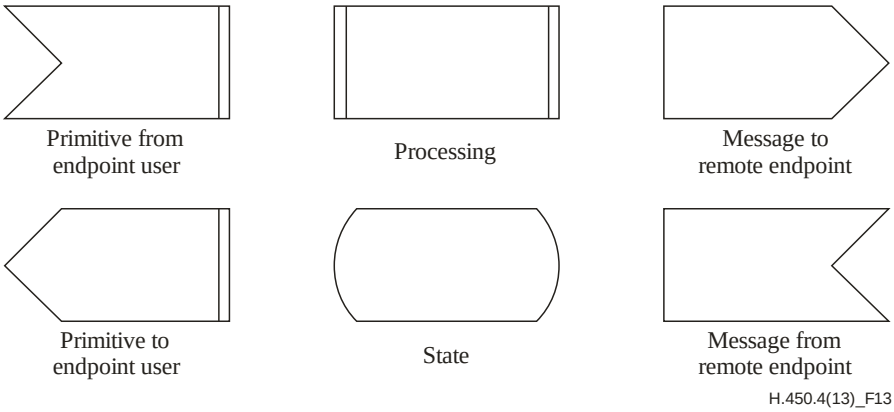


Figure 13 – SDL symbols

13.1 Near-end call hold SDLs

See Figures 14 and 15.

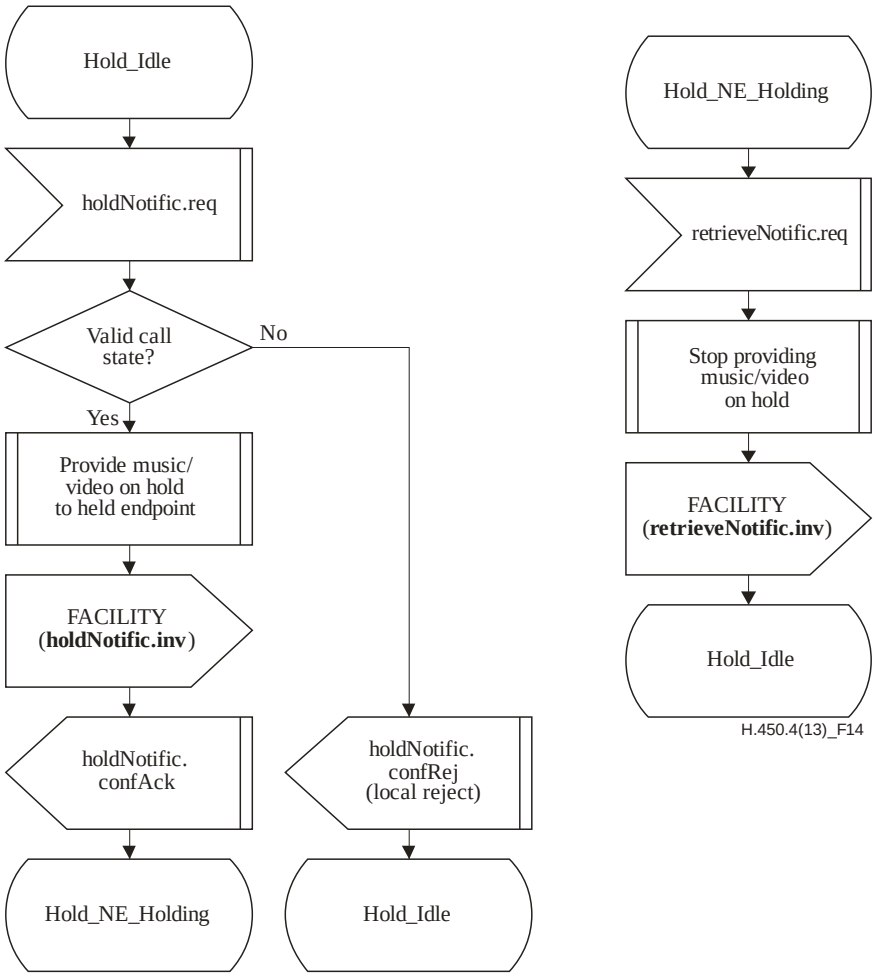


Figure 14 – Near-end call hold – Holding SDL

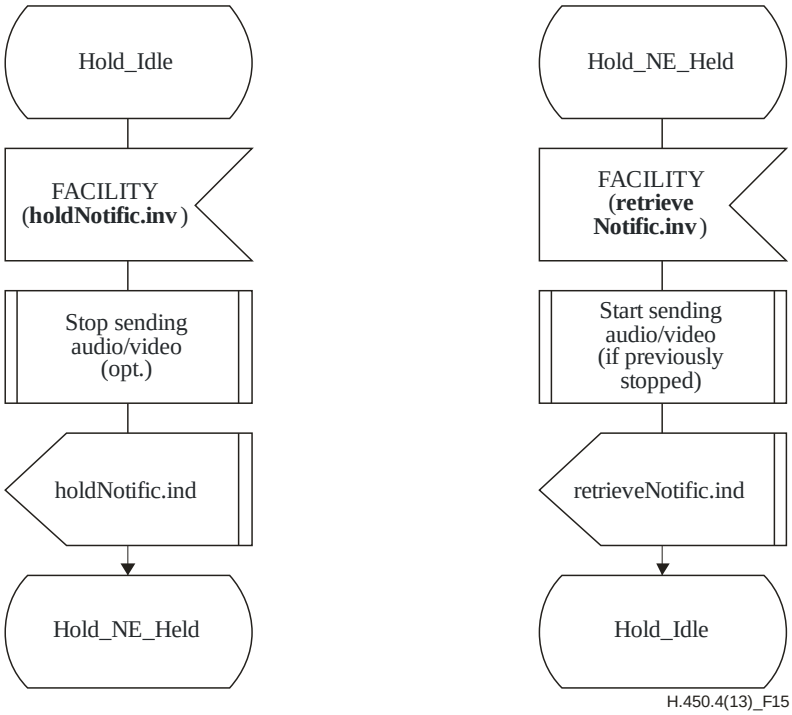


Figure 15 – Near-end call hold – Held SDL

13.2 Remote-end call hold SDLs

See Figures 16 to 20.

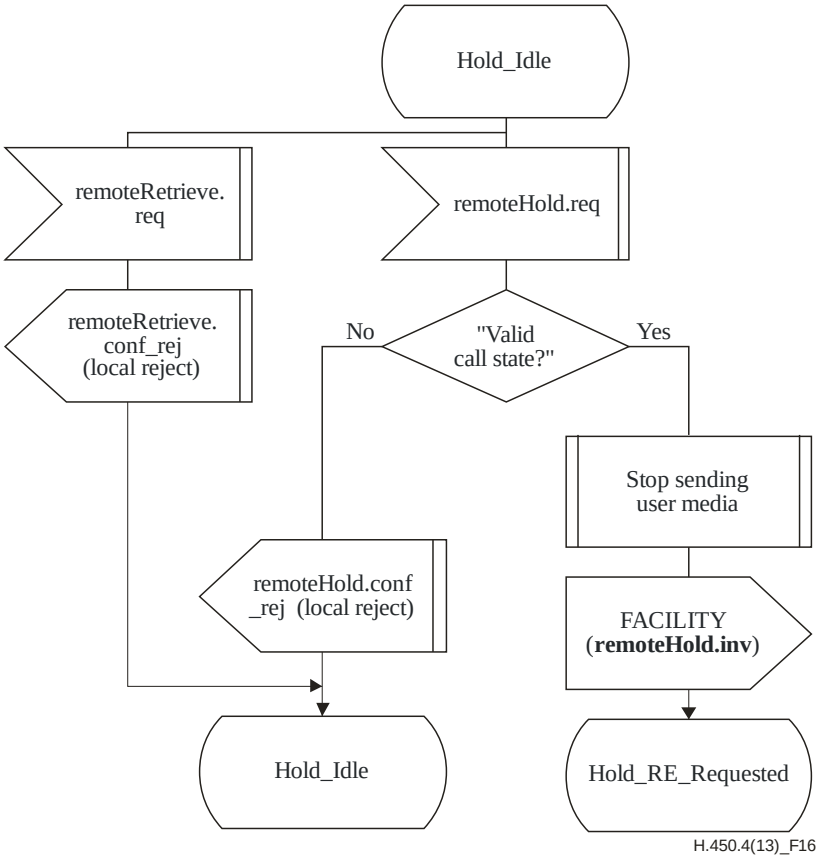


Figure 16 – Remote-end call hold – Holding SDL *(sheet 1 of 3)*

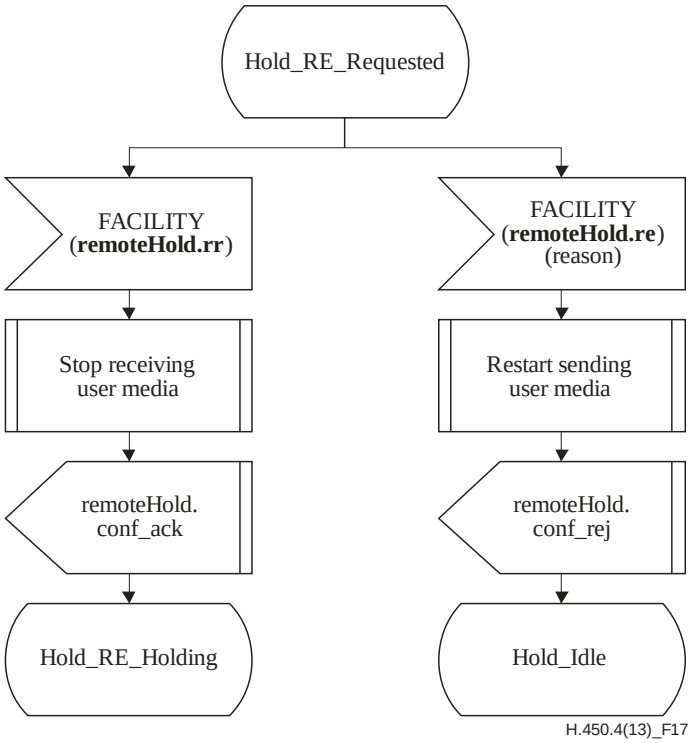


Figure 17 – Remote-end call hold – Holding SDL *(sheet 2 of 3)*

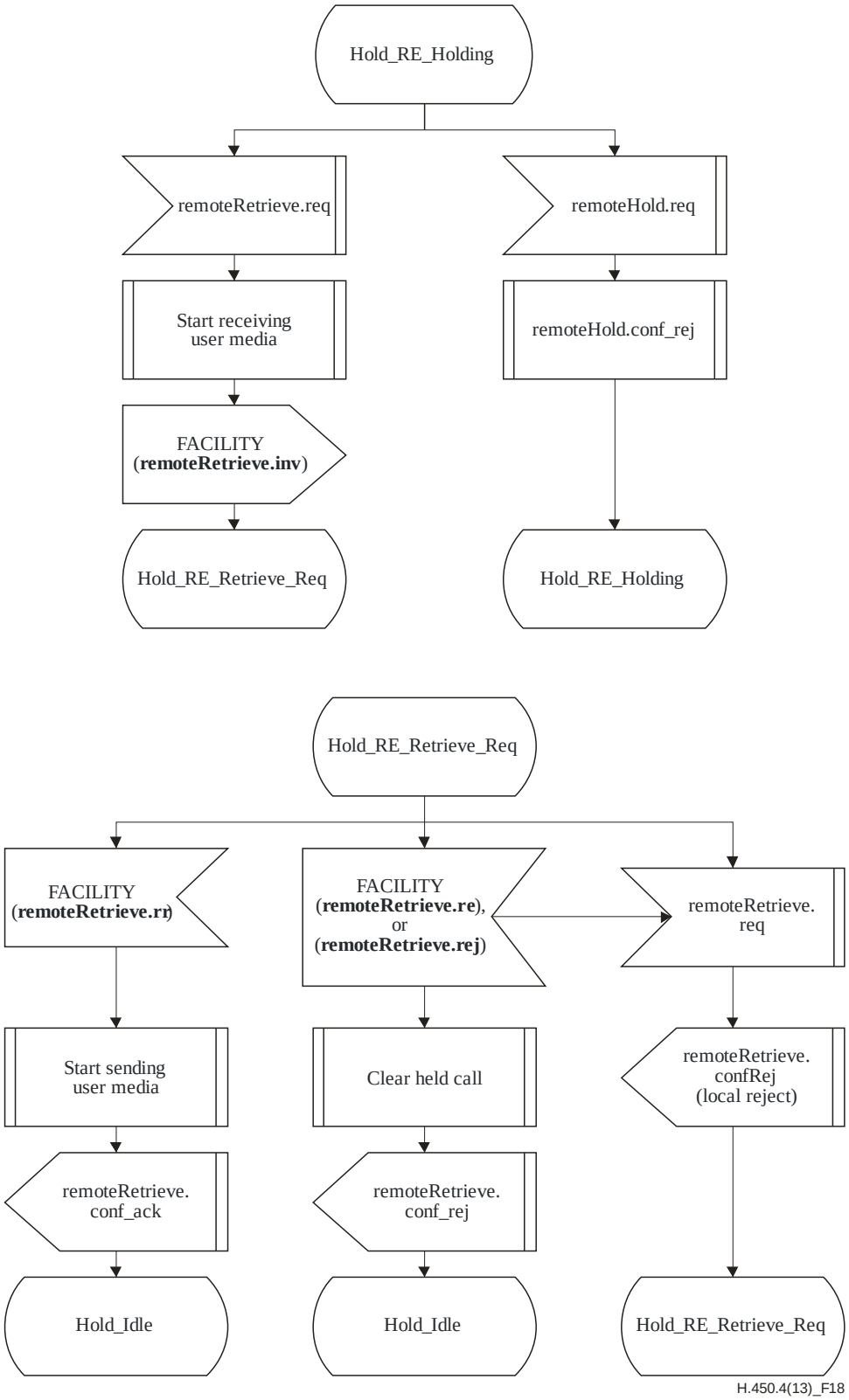


Figure 18 – Remote-end call hold – Holding SDL *(sheet 3 of 3)*

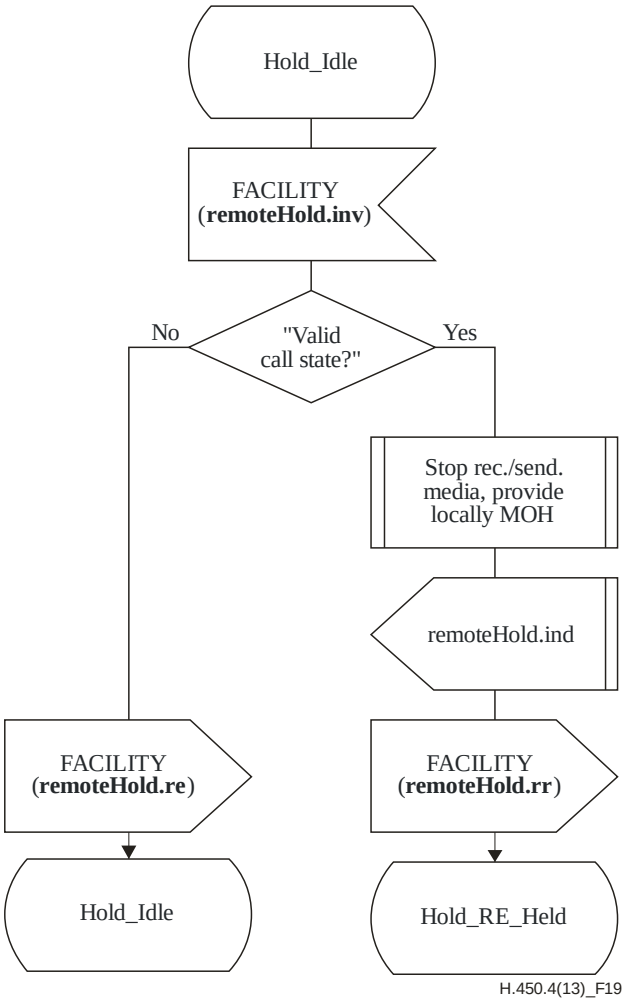


Figure 19 – Remote-end call hold – Held SDL ***(sheet 1 of 2)***

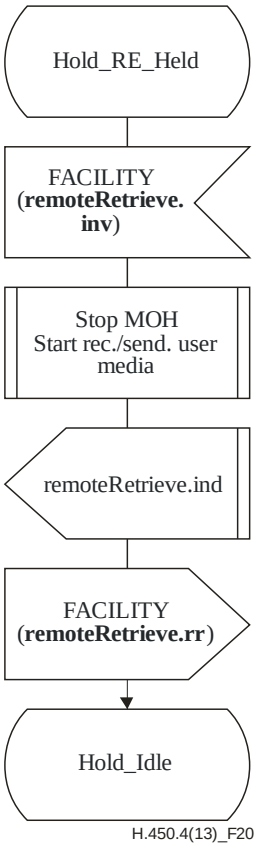


Figure 20 – Remote-end call hold – Held SDL ***(sheet 2 of 2)***

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