INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.460.14

(03/2004)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Supplementary services for multimedia

Support for Multi-Level Precedence and Preemption (MLPP) within H.323 systems

ITU-T Recommendation H.460.14

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ITU-T Recommendation H.460.14

Support for Multi-Level Precedence and Preemption (MLPP) within H.323 systems

Summary

This Recommendation describes the procedures and the signalling protocol for Multi-Level Precedence and Preemption (MLPP), which allow the originator of a call in an H.323 environment to specify a precedence level of the call and for an existing lower precedence call to be preempted to release resources needed to complete that higher precedence call. For the networks and domains that allow this functionality, the H.460.14 mechanism ensures that important calls can be established and can remain connected during periods of congestion.

These procedures use the H.323 Generic Extensibility Framework (GEF) and therefore do not require any changes to the base standards.

Source

ITU-T Recommendation H.460.14 was approved on 15 March 2004 by ITU-T Study Group 16 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. 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.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Support for Multi-Level Precedence and Preemption (MLPP) within H.323 systems

1 Scope

Multi-Level Precedence and Preemption provides a framework for the treatment of calls based on precedence. It supports the preemption of active calls by higher-precedence calls when resources are limited. The system presented here is designed to be adaptable to different models of endpoints within H.323. It may be used to support direct endpoint call signalling or gatekeeper-routed endpoints of varying capabilities. For example, intelligent endpoints may support the MLPP procedures internally, while simple (e.g., stimulus-based) endpoints may require their Gatekeeper to implement the procedures in their stead. In the latter case, MLPP-specific signalling would be used only between Gatekeepers and other Gatekeepers or intelligent Gateways.

The elements of MLPP signalling are rather simple, hence they are defined using the tabular method described in ITU-T Rec. H.460.1.

2 Introduction

This Recommendation applies to H.323 endpoints (including Gateways) and Gatekeepers, and the interactions between them. It may be used with the direct endpoint call signalling model or the gatekeeper-routed model. This Recommendation provides signalling elements that may be used from one end of a call to the other, that is, from a calling endpoint, possibly through one or more Gatekeepers, to a destination endpoint.

In addition, two types of endpoints may be supported. Functional endpoints (e.g., those supporting H.450-series operations) are expected to support MLPP signalling to the endpoint, and should implement feature negotiation, user interaction, signalling, and timing in the endpoint. Stimulus-driven endpoints (e.g., those supporting Annex L/H.323) may remain ignorant of MLPP since the feature operation and interactions with the user are implemented within the controlling Gatekeeper or feature server. In either case, the elements of MLPP signalling defined herein should be used between Gatekeepers.

The following configurations are supported by the protocol defined in this Recommendation. It is possible for the various parties involved in an MLPP service to be using different configurations, that is, the following shall interwork.

2.1 Direct Endpoint Signalling

The configuration for the Direct Endpoint Signalling is as shown in Figure 1.

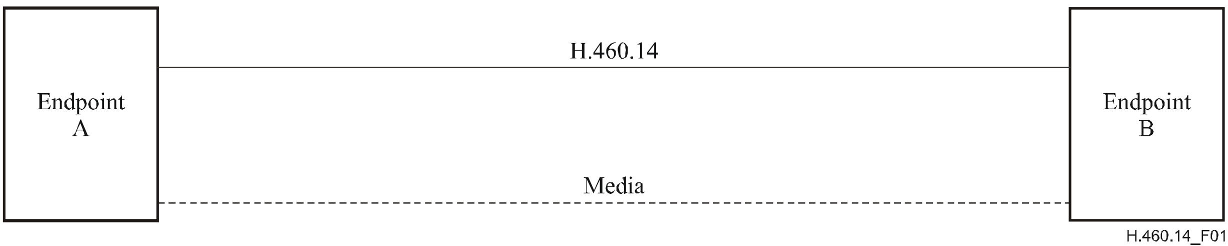


Figure 1/H.460.14 – Direct Endpoint Signalling configuration

This Recommendation describes the signalling required to support this configuration.

2.2 Gatekeeper Routed Signalling

Gatekeeper Routed Signalling has three cases as shown in Figure 2.

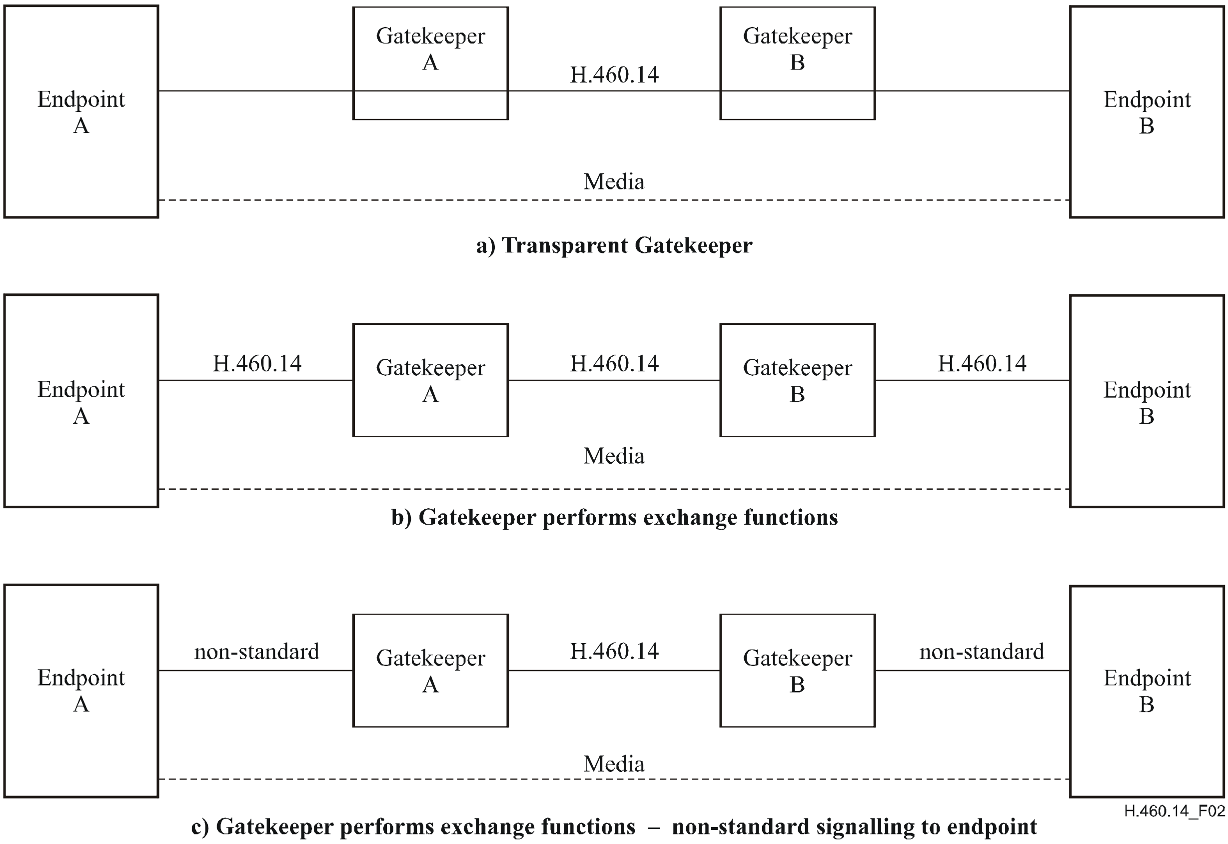


Figure 2/H.460.14 – Gatekeeper Routed Signalling configurations

For Configuration a, the Gatekeepers are completely transparent and only route the messages. The signalling between the endpoints is the same as for the Direct Endpoint Signalling case.

For Configuration b, the Gatekeepers terminate the call signalling messages and perform the exchange functions such as routing and feature interactions. The signalling between each Gatekeeper and its connected Endpoint and between the Gatekeepers is the same as for the Direct Endpoint Signalling case; however, the messages on each portion will be different.

For Configuration c, the Gatekeepers terminate the call signalling messages and perform the exchange functions such as routing and feature interactions. The signalling between the Gatekeepers is the same as for the Direct Endpoint Signalling case. This Recommendation does not address any non-standard protocol which might be used in Configuration c for communications with the endpoints.

2.3 Decomposed Gateway

As shown in Figure 19/H.323, an endpoint may be a gateway to the PSTN. It may be decomposed and utilize H.248 signalling as shown in Figure 3.

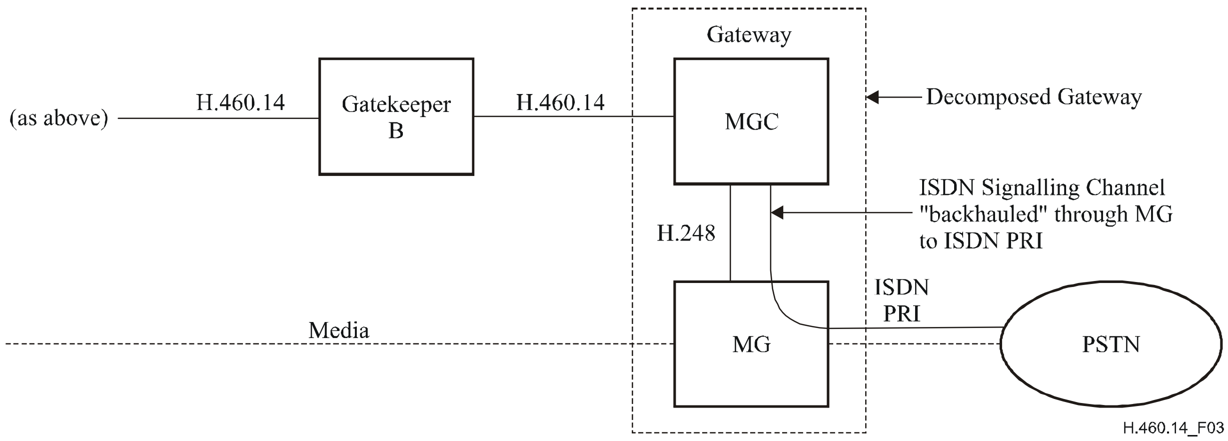


Figure 3/H.460.14 – Decomposed Gateway configuration

This Recommendation does not address the H.248 capabilities which may be required for this configuration.

2.4 H.248 managed devices

As shown in Figure 20/H.323, H.248 may be used to manage (control) the service operation in an endpoint. In this case, the end device functions as the Media Gateway portion of a decomposed Gateway as shown in Figure 4, but without capabilities related to interworking to other signalling systems.

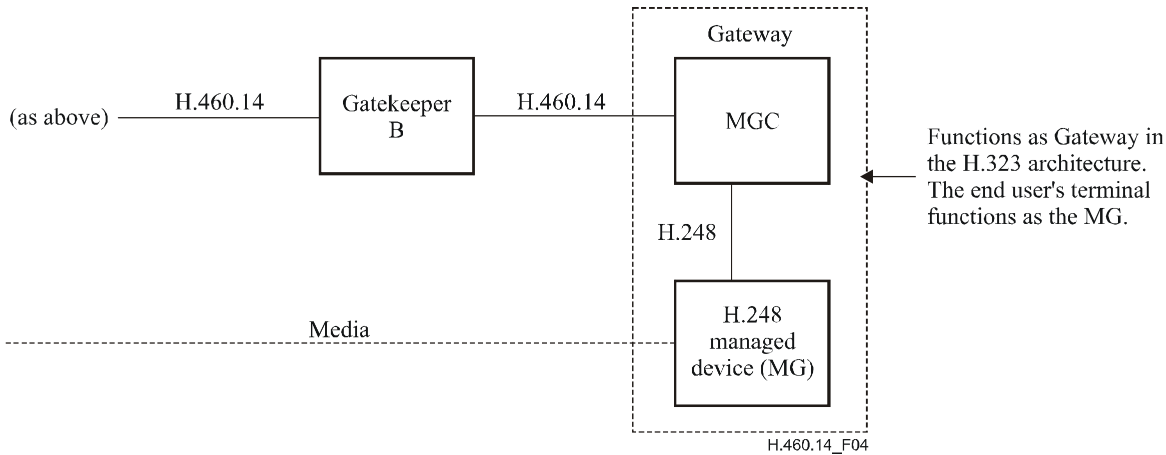


Figure 4/H.460.14 – H.248 managed device

This Recommendation does not address the H.248 capabilities which may be required for this configuration.

2.5 Stimulus device

An endpoint may operate using a stimulus protocol in accordance with Annex L/H.323 as shown in Figure 5 and Figure 21/H.323. The Feature Server functional entity may be associated with, or collocated with, a Gatekeeper.

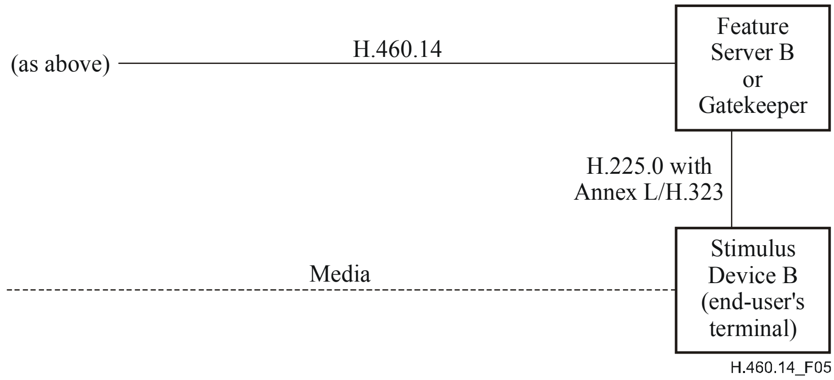


Figure 5/H.460.14 – Stimulus signalling using Annex L/H.323

This Recommendation does not address the signalling between the Feature Server/Gatekeeper and the Stimulus Device which may be required for this configuration. As described in ITU-T Rec. H.323 for interactions with H.450-services, the Feature Server must terminate the H.460 signalling and handle the MLPP operations described in this Recommendation, while using a stimulus protocol to signal via the terminal to the user as described in Annex L/H.323.

3 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 published regularly. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

– ITU-T Recommendation H.225.0 (2003), *Call signalling protocols and media stream packetization for packet-based multimedia communication systems*.

– ITU-T Recommendation H.245 (2003), *Control protocol for multimedia communication*.

– ITU-T Recommendation H.323 (2003), *Packet-based multimedia communications systems*.

– ITU-T Recommendations of the H.450.x series, *Supplementary services for multimedia*.

– ITU-T Recommendation H.460.1 (2002), *Guidelines for the Use of the Generic Extensible Framework*.

4 Definitions

This Recommendation defines the following terms:

4.1 alternate party: A third party to whom an MLPP call may be diverted if it is not accepted or acknowledged by the called user.

4.2 diversion: The operation in which a precedence call is redirected to a pre-assigned alternate party due to (in)action by the called party.

4.3 preemption: The act of forcibly removing a connection in order to free up facilities for another higher-precedence call.

4.4 preemption in progress: The period of time after a party is notified that their existing call is going to be preempted until the preemption actually occurs and is completed by the intended party acknowledging the action.

4.5 **served user, user A**: The user who requests to originate a call using MLPP (calling user).

4.6 **user B**: The wanted user that is subject to the call preemption (called user).

4.7 **user C**: The other user in the established call, also referred to as the unwanted user.

5 Abbreviations

This Recommendation uses the following abbreviations:

ACF Admission confirmation

ARJ Admission rejectation

ARQ Admission request

DCF Disengage confirmation

DRQ Disengage request

GCF Gatekeeper confirmation

GK Gatekeeper

GRQ Gatekeeper request

LCF Location confirmation

LRJ Location rejectation

LRQ Location request

MLPP Multi-level precedence and preemption

RAS Registration, admission and status

RCF Registration confirmation

RRJ Registration rejectation

RRQ Registration request

6 Multi-level Precedence and Preemption Service description

The basic requirements for MLPP are the ability of call processing equipment to signal the precedence of each call, and for each entity (Gatekeeper, Gateway, or endpoint) which handles a call to properly manage resources for that call according to its precedence. This may well include the termination (preemption) of one or more active calls of lower precedence.

6.1 Provision of precedence levels

A maximum precedence level shall be allocated to each user, which shall have a value in the range from 4 (lowest level) to 0 (highest level). Each user shall be provided with a means to select a precedence for each call originated, not greater than the maximum allocated. If a precedence level is not explicitly selected for a call, the lowest value (4) shall be used. All five of the precedence level values shall be supported.

The Precedence levels are referred to as:

- 0 Flash Override
- 1 Flash
- 2 Immediate
- 3 Priority
- 4 Routine

The procedures by which the maximum precedence level is allocated to a user and the criteria by which a user chooses a value of precedence level for a particular call are outside the scope of this Recommendation.

6.2 Preemption of facilities

This Recommendation provides a means to identify the priority (precedence) of individual calls as they move through the network. It also defines signalling procedures for handling such calls when resource conflicts arise in the network or at an endpoint. When a facility (network bandwidth or endpoint hardware) is busy, and a call of higher precedence requires that facility, the facility may be preempted by termination of the existing call and establishment of the preempting call. If the facility is an endpoint under the control of a user, the user shall be notified of the presence of a preempting call, and must take action to accept the new call. When a call is preempted, special indication shall be given to all parties of that call to indicate that fact.

The decision to preempt a call is taken automatically by the call processing equipment and does not require any specific action of the called user. The details of how the existence of a precedence call or impending preemption is presented to the end user, or how the user indicates which actions to take, are beyond the scope of this Recommendation.

6.3 Diversion

A precedence call may be redirected (diverted) if an endpoint does not accept it within a specified time interval. The redirecting entity may indicate the new destination for the call.

6.4 Interactions with other services

Interactions with specific Supplementary Services defined in the H.450-series of Recommendations shall be as follows.

6.4.1 Call Transfer (CT)

User A shall not be able to invoke CT during the preemption in progress state on that call. (This is similar to the CT requirement that the call being transferred shall be answered before transfer can be initiated.) While performing CT, a user shall be allowed to invoke MLPP on the transfer request.

User B shall not be able to invoke CT during the preemption in progress state on the preempting call, that is, the call cannot be transferred until after the preemption is acknowledged and the new connection is established.

User C may be able to transfer an established call during preemption. In all cases, the transferred-to user that becomes connected to user B shall become the new user C, and shall receive all future notifications accordingly.

6.4.2 Call Forwarding Unconditional (CFU)

At User A: No service interaction.

At User B: If CFU is active when a call using MLPP arrives, CFU shall take precedence, i.e., the call shall be forwarded regardless of the precedence level of the call. If a call with a precedence level higher than the lowest is forwarded and is not responded to by any forwarded party, then the alternate party option of MLPP (using the alternate party of the original called party) shall apply.

However, if the network element controlling the call forwarding is aware that it is being used to forward to a voice mail system, it should apply the MLPP alternate party diversion instead of the Call Forwarding Unconditional.

At User C: No service interaction.

The precedence level of a call shall be preserved during the forwarding process. At the final diverted-to user (using CFB, CFU, or MLPP diversion), MLPP shall operate if that user is busy. However, if either CFNR or Call Deflection has taken place, the optional alternate party diversion shall not occur.

6.4.3 Call Forwarding Busy (CFB)

At User A: No interaction.

At User B: When a call using MLPP (with a precedence level greater than the lowest) arrives when User B is busy and has CFB active, the following order of preference shall apply:

- If the new call is of equal or lower precedence, or preemption is not possible for some other reason, CFB shall apply.
- If the new call is of higher precedence than an existing call, MLPP shall apply, i.e., preemption shall be used.
- If no answer is received for the CFB attempt, the alternate party option, if subscribed, shall apply. That is, the alternate party timer shall be used. If not subscribed, the normal failure procedures of CFB shall apply.

However, if the network element controlling the call forwarding is aware that it is being used to forward to a voice mail system, it should apply the MLPP alternate party diversion instead of the Call Forwarding Busy.

The precedence level of a call shall be preserved during the forwarding process. At the final diverted-to user (using CFB, CFU, or MLPP diversion), MLPP shall operate if that user is busy. However, if either CFNR or Call Deflection has taken place, the optional alternate party diversion shall not occur.

6.4.4 Call Forwarding on No Reply (CFNR)/Call Deflection (CD)

At User A: No interaction

At User B: When a call using MLPP (with a precedence level greater than the lowest) arrives and User B does not answer, the following shall apply:

- CFNR takes precedence over the Alternate Party.
- If the forwarded call is not responded to by any forwarded-to party within a specified period of time, the call shall then be diverted using the Alternate Party capability.

However, if the network element controlling the forwarding is aware that it is being used to forward to a voice mail system, it should apply the MLPP alternate party diversion instead of the Call Forwarding No Reply.

The precedence level of a call shall be preserved during the forwarding process. If either CFNR or Call Deflection has already taken place on the call, the optional alternate party diversion shall not occur.

6.4.5 Call Hold

At User A: There are no additional restrictions on Call Hold other than those defined for the CH service.

At User B: The preempting call shall not be put on hold. After it has been acknowledged and connected, it may be placed on hold. User B may put the established call to User C on hold as a means of becoming not busy.

6.4.6 Call Park

At User A: No service interaction.

At User B: It shall not be possible to park the preempting call until after it has been acknowledged and connected. User B may park the established call to User C as a means of becoming not busy.

6.4.7 Call Pickup

At User A: No service interaction.

At User B: MLPP shall take precedence over Call Pickup, i.e., if User B is busy, preemption shall occur rather than allowing others in the pickup group to retrieve the call. If User B is not busy, the call shall be placed in the pickup group and any member of that pickup group may answer it. If there is more that one call in the unanswered condition, a pickup attempt shall retrieve the one with the highest precedence level and, within a single level, the one which has been alerting the longest.

6.4.8 Call Waiting

At User A: No service interaction.

At User B: If a new call arrives for which MLPP is invoked and CW is subscribed, the interaction shall be as follows:

- If the new call is a higher precedence level than an existing call and preemption is possible, MLPP shall be used.
- If the new call is not a higher precedence level or User B is non-preemptable, CW shall be used.

6.4.9 Message Waiting Indication

No service interaction.

6.4.10 Name Identification

No service interaction.

6.4.11 Completion of Calls on Busy (CCBS)

At User A: It shall be possible to invoke MLPP with CCBS, that is, to specify a precedence level on a CCBS invocation.

At User B: If both MLPP invocation and CCBS are requested in the same call setup request, MLPP shall take precedence at User B, that is, an existing call will be preempted if possible. If not, the alternate party procedures shall be applied. If there is no alternate party specified, then CCBS shall apply. If the limit of number of calls waiting for CCBS has been reached, the new MLPP call may preempt an existing waiting call that is, take its place in the CCBS queue.

6.4.12 Completion of Calls on No Reply (CCNR)

At User A: It shall be possible to invoke MLPP with CCNR, that is, to specify a precedence level on a CCNR invocation.

At User B: If both MLPP and CCNR are requested in the same call setup request, MLPP shall take precedence at User B, that is, the alternate party procedures shall be applied. If there is no alternate party specified, then CCNR shall apply.

6.4.13 Call Offer (CO)

At User A: It shall be possible to request both CO and MLPP in the same call setup request.

At User B: If both MLPP invocation and CO invocation are requested at call set up, precedence shall be given to the MLPP service.

6.4.14 Call Intrusion

At User A: Call Intrusion and MLPP should not be requested in the same call setup request.

At User B: If a request for both Call Intrusion and MLPP is received in the same call setup request, the MLPP request shall take precedence.

6.4.15 Common information

At User A: By exchange of Common Information data, User A may have a priori knowledge of the MLPP capabilities at the called endpoint, e.g., the precedence level of existing calls at User B.

7 Signalling elements for MLPP

The following tables define the required signalling elements and parameters for MLPP utilizing the Generic Extensible Framework of H.323. The elements are defined in such a way that the MLPP capabilities may be easily extended by the definition of new parameters and no new ASN.1 definitions in ITU-T Rec. H.225.0 are required.

These parameters may be used in:

- H.501 Access Request and Service Request messages to perform inter-administrative domain address resolution and service negotiation.
- H.225.0 RAS messages to perform intra-domain address resolution and service negotiation.
- H.225.0 Call Signalling messages to control call setup.

7.1 Feature identifier

The feature identifier value in Table 1 is used to identify the feature in both the **featureSet** elements of H.225.0 and the **genericData** elements of H.225.0.

Table 1/H.460.14 – MLPP feature identifier

Feature name:	Multi-Level Precedence and Preemption (MLPP)
Feature description:	This feature provides the ability to associate a precedence level with each call, and to signal the preemption of facilities, based on relative call precedences.
Feature identifier type:	Standard
Feature identifier value:	14

The **featureSet** element provides the ability for an endpoint or Gatekeeper to indicate whether a feature is required (i.e., service cannot be provided without support for the feature), desired (i.e., the feature will be used if available), or supported (i.e., the feature will be used if the other party so desires) by that endpoint or Gatekeeper. An indication that a feature is required or desired implicitly indicates support. When used in the discovery/registration request/confirm messages (GRQ, GCF, RRQ, and RCF), the MLPP feature shall be specified as "required" or "desired". In all other messages, it shall be specified as "desired" or "supported". MLPP shall not be indicated as a "required" feature in ARQ, LRQ, or Setup because it is better to propagate the call without MLPP support than to have it blocked due to non-support.

The **genericData** is used to carry the MLPP parameters for a particular endpoint registration. It also provides the ability for an endpoint or Gatekeeper to indicate (in ARQ, LRQ, and Setup) that the MLPP feature is being used for a particular call. It implies support by the entity sending the message.

7.2 Parameter

This parameter is used to transport information between signalling entities within the MLPP **GenericData** element of requests and responses. In this Recommendation, "MLPP GenericData element" means a GenericData element which contains the MLPP feature identifier defined in Table 1.

Table 2/H.460.14 – MLPP information parameter

Parameter name:	MLPP Information
Parameter description:	This is the data sent in H.225.0 RAS and Call Signalling messages to indicate the use of MLPP. The contents is a raw field consisting of the ASN.1 encoded **MLPPInfo** as specified in Annex A. It shall be encoded in the basic aligned variant PER.
Parameter identifier type:	Standard
Parameter identifier value:	1
Parameter type:	raw
Parameter cardinality:	Once and only once

The MLPP information definition used within the MLPP information parameter in the GenericData is shown in Annex A.

8 Procedures

The elements defined above may be employed in several ways to effect the desired call behaviours under MLPP when operating with the direct endpoint call signalling or the gatekeeper-routed model.

8.1 Registration, Admission and Status (RAS)

8.1.1 Gatekeeper discovery

When an endpoint attempts to find its Gatekeeper by sending a GatekeeperRequest (GRQ), it may include the **featureSet** element to indicate that it requires or desires support for MLPP. Each Gatekeeper that supports MLPP should respond with a Gatekeeper Confirm (GCF) containing a **featureSet** element which indicates support for MLPP. If the endpoint has not indicated support for MLPP, but the Gatekeeper requires it, the Gatekeeper may reply with GCF, but should indicate the requirement therein. If a Gatekeeper indicates that MLPP is required and the endpoint cannot support it, the endpoint should not attempt to register to that Gatekeeper.

8.1.2 Registration

When the endpoint registers (sends RRQ), it may include the **featureSet** element to indicate its support for MLPP. The Gatekeeper may respond with RCF if it can provide compatible support, but it shall reject the registration (with an RRJ) if it (the Gatekeeper) requires MLPP support by the endpoint and the endpoint does not indicate support.

8.1.3 Call Admission Control (CAC)

H.323 supports two types of call admission: ARQ/ACF/ARJ for endpoint-to-Gatekeeper signalling, and LRQ/LCF/LRJ for inter-Gatekeeper signalling. Both sequences are defined as part of RAS, not as part of call signalling, and are quite similar. If a Gatekeeper is to monitor consumption of resources, the use of RAS is necessary in the direct endpoint call-signalling model. It is also useful in the Gatekeeper-routed model, especially between Gatekeepers. Even though any Gatekeeper in the route could simply refuse the Setup request, it is more efficient to reject an ARQ or LRQ. The CAC mechanisms may be illustrated with an MLPP call from endpoint A on Gatekeeper A to endpoint B on Gatekeeper B using the direct endpoint call-signalling model. This assumes all parties support MLPP.

In addition, the Access Request procedures defined in Annex G/H.225.0 may be used for inter-administrative domain address resolution. The parameters defined in this Recommendation may be included in the H.501 Messages.

Admission may be pre-granted at the time of registration.

A Direct Endpoint Call Signalling example

The first may be illustrated with an MLPP call from endpoint A on Gatekeeper A to endpoint B on Gatekeeper B using the direct endpoint call signalling model.

1) Endpoint A sends ARQ to Gatekeeper A, indicating endpoint B in the **destinationInfo** element and including an MLPP **genericData** element containing **precedence** with the desired value (2 for Immediate in this example).

2) Gatekeeper A examines the ARQ, and, if the request is allowed, replies with an ACF message. Gatekeeper A replies to endpoint A with ARJ if no facilities are available for calls of the requested precedence of 2. In that case, the ARJ contains an MLPP **genericData** element containing **mlppReason** with value 46 (callBlocked). The basis for this decision is beyond the scope of this Recommendation.

3) Endpoint A then establishes a call signalling channel to the address specified in the ACF (endpoint B's address in the direct endpoint call signalling model) and sends a Setup message to endpoint B as described in 8.2.1 containing an MLPP **genericData** element and **precedence** with value 2.

4) If endpoint B supports MLPP and is unable to accept the call (e.g., if it is busy with a higher precedence call), it applies the alternate party procedures if possible. Otherwise, it refuses the call by sending a Release Complete message containing a **reason** of **genericDataReason**, along with an MLPP **genericData** element with **mlppReason** with value 46 (CallBlocked) as described in 8.2.2.2.

   If endpoint B does not support MLPP and is unable to accept the call (e.g., it is busy), then it refuses the call by sending a Release Complete containing a **reason**, e.g., unreachable destination, without the MLPP **genericData** element.

5) If endpoint B is able to accept the offer of the call, it sends an ARQ to Gatekeeper B to gain permission. The ARQ contains an MLPP **genericData** element with **precedence** with the desired value (2 in this example).

6) If Gatekeeper B wishes to disallow the call due to precedence restriction, it returns an ARJ with an MLPP **genericData** element containing **mlppReason** with value 46 (call Bocked). The ARJ may contain an alternateParty structure. Endpoint B then sends a Release Complete back to endpoint A containing an MLPP **genericData** element with **mlppReason** with value 46 (callBlocked) and **alternateParty** as described in 8.2.2.2. If the call is rejected for some other reason, that reason is indicated by Gatekeeper B in **admissionRejectReason** and mapped back to the **releaseCompleteReason** returned to endpoint A, as appropriate.

7) If Gatekeeper B wishes to permit the call, it returns an ACF to endpoint B. If Gatekeeper B is able to identify a call that should be preempted, as might be the case if endpoint B is a trunk Gateway, this ACF contains an MLPP **genericData** element with a **releaseCall** structure which contains B, **releaseReason** set to 9 (preemption – facility reserved), and optionally **releaseDelay**. The Gatekeeper may also include the **alternateParty** structure if an alternate party is designated for endpoint B.

8) At this point, endpoint B is able to accept the call from endpoint A. If endpoint B is busy with another call that needs to be preempted, it carries out the release procedures prior to accepting the call from endpoint A by sending a Release Complete as described in 8.2.2.1. The first response it sends to endpoint A contains a **featureSet** which indicates whether or not endpoint B supports MLPP.

B Gatekeeper-routed example

If the above call were to be Gatekeeper-routed, then the following sequence would be used (assuming that discovery and registration were already done and admission was pre-granted during registration so that ARQ/ACF sequences are not used.)

1) Endpoint A sends a Setup to its Gatekeeper A, containing an MLPP **genericData** element containing **precedence** with the desired value (2 for Immediate, for example).

2) If Gatekeeper A cannot support the call at the indicated precedence, it returns a Release Complete with **reason** set to **genericDataReason**, along with an MLPP **genericData** element with **mlppReason** with value 46 (callBlocked).

3) If Gatekeeper A is able to support the call, it routes the call toward the destination via facilities that can admit a call of the indicated precedence (e.g., the precedence may be used to favour facilities that can support precedence over others that do not).

   If Gatekeeper A does not know which Gatekeeper will perform the function of Gatekeeper B for this call, it sends an LRQ message via multicast. If Gatekeeper A already knows the identity of the desired Gatekeeper B but not its signalling address, Gatekeeper A sends an LRQ message to Gatekeeper B on its RAS Channel TSAP Identifier. If Gatekeeper A already knows the identity and call signalling address of Gatekeeper B, it may send the Setup to it without first using the LRQ sequence.

   In any of the above three cases, the LRQ or Setup message contains an MLPP **genericData** element containing **precedence** with the desired value (2 for Immediate in this example).

4) When Gatekeeper B receives the LRQ, it determines whether or not it is able to admit a call based on the indicated precedence, and responds back to Gatekeeper A with an LCF if it is able, as defined in 7.2.3/H.323. If Gatekeeper B cannot support the call, it returns an LRJ message with an MLPP **genericData** element containing **mlppReason** with value 46 (callBlocked) or the appropriate **locationRejectReason** (e.g., **invalidPermission**).

   When Gatekeeper A receives the LRJ, it may attempt to route the call in a different manner, e.g., via a different Gatekeeper. If not, it returns a Release Complete to endpoint A with **reason** set to **genericDataReason**, along with an MLPP **genericData** element with **mlppReason** with value 46 (callBlocked).

5) When Gatekeeper A receives the LCF (with a call signalling address for Gatekeeper B and **featureSet** indicating support for MLPP), it sends a Setup message to that address containing an MLPP **genericData** element containing **precedence** with a value 2 (in this example) as described in 8.2.1.

6) When Gatekeeper B receives the Setup for the call, its actions depend on whether or not the intended endpoint B supports MLPP, which the Gatekeeper determined during registration.

   If endpoint B supports MLPP, Gatekeeper B sends a Setup to endpoint B and endpoint B performs the functions as described in 8.2.2. The Setup may contain the **releaseCall** structure if there is a call for endpoint B to preempt first and it may contain the **alternateParty** structure if an alternate party is assigned in case user B does not accept the precedence call.

   If endpoint B does not support MLPP, Gatekeeper B first performs any required preemption by sending a Release Complete on the call to be preempted, then sends a Setup, and provides timing for the alternate party as described in 8.2.2.

8.1.4 Call establishment and preemption

If a Gatekeeper receives a request to establish an MLPP call of a certain precedence, it may be necessary to terminate another call of lower precedence. This may be done by either a Gatekeeper or an endpoint. When terminating a call via a Release Complete, the terminating endpoint or Gatekeeper shall set the **reason** to **genericDataReason** and shall include an MLPP **genericData** element with **mlppReason** set to either 8 (to release all facilities) or 9 (to maintain facility reservations).

8.2 Call signalling procedures for H.450 endpoints

The procedures described in this clause apply to an endpoint using functional signalling, which is intended for endpoints which provide other Supplementary Services in accordance with the H.450-series of Recommendations.

These procedures require that the signalling channel for each call be maintained throughout the duration of the call. They also presume that the appropriate RAS procedures (discovery, registration and admission) are performed in the same way as for normal calls, with the addition of the indication of support for MLPP and the precedence level in the RAS messages. RAS actions are not included in this description, but are described in 8.1 and in ITU-T Rec. H.323.

While the text of this clause is written assuming the direct endpoint call signalling case, the actions stated for the endpoints may instead be performed by their Gatekeepers in the Gatekeeper-routed case. Further, the same signalling may be used between Gatekeepers and endpoints.

8.2.1 Actions at user A's endpoint

8.2.1.1 Normal procedure

To invoke MLPP for a new call, endpoint A shall perform the following actions (after any required RAS signalling as described in 8.1):

- Send a Setup message containing an MLPP **genericData** element with **precedence**, and enter state MLPP-Wait-Ack. The **precedence** shall convey the precedence level requested by the calling user.

In state MLPP-Wait-Ack, on receipt of a Connect message, endpoint A shall enter state MLPP-Idle. Establishment of media channels shall follow normal H.323 procedures. Normal call timers shall apply.

8.2.1.2 Exceptional procedure

In state MLPP-Wait-Ack, on receipt of a Release Complete message with or without any MLPP specific error, the MLPP call setup has failed and endpoint A shall enter state MLPP-Idle.

Failure of MLPP should be indicated to the calling user and the call shall continue in accordance with basic call procedures.

8.2.1.3 Procedure for completion of MLPP

In state MLPP-Wait-Ack, on receipt of Connect, either with or without an MLPP **genericData** element, the state MLPP-Idle shall be entered. If a **genericData** element contains **mlppNotification** with value **preemptionComplete**, the user at endpoint A shall be provided an indication of this.

8.2.1.4 Optional procedures for invocation of MLPP

In state MLPP-Wait-Ack, multiple Alerting messages may be received in the case of alternate party diversion at user B's endpoint. No further actions are required at user A's endpoint.

8.2.2 Actions at user B's endpoint

8.2.2.1 Normal procedure

If, while processing an incoming Setup message containing an MLPP **genericData** element with **precedence**, the called user is found to be busy, endpoint B shall check whether the called user is involved in a compatible active call (in the following, referred to as the "established call"), that the precedence level of that call is lower than the precedence level of the received call, and that there are no other reasons for denying preemption (e.g., if the established call is already being preempted or a requested option cannot be supported).

NOTE – The method by which endpoint B checks whether an active call is compatible with the new precedence call is outside the scope of this Recommendation.

If all conditions are met, endpoint B shall provide a notification of an impending preemption to the involved users. Endpoint B shall send on the established call (in a Facility message) and optionally also on the preempting call (in an Alerting message if possible, otherwise in a Progress or Facility message) an MLPP **genericData** element with **mlppNotification** set to value **preemptionPending**, shall start timer T6, and shall enter state MLPP-Dest-Notify. If endpoint B also provides a preemption warning tone, a Progress indicator information element with progress descriptor #8, *In-band information or an appropriate pattern is now available,* should be included in the Alerting or Progress message. If endpoint B does not provide tones, a Facility message should only be used. Execution of preemption shall commence on expiry of timer T6 in state MLPP-Dest-Notify.

8.2.2.2 Exceptional procedure

On receipt of a Setup message containing an MLPP **genericData** element with **precedence**, if the called user is not busy, the call shall continue according to basic call procedures, that is, endpoint B shall return normal Call Proceeding, Alerting, or Connect messages not containing any MLPP **genericData** element and shall remain in state MLPP-Idle.

If the called user is busy but invocation of MLPP is not possible (including the case where the precedence level of all calls at user B is too high), the preempting call shall be released. Endpoint B shall include an MLPP **genericData** element with **mlppReason** containing value 46 (callBlocked) in the Release Complete message and shall remain in state MLPP-Idle.

If, in the case of a normal preemption request during state MLPP-Dest-Notify, the called user becomes not busy and presentation of the preempting call becomes possible, normal call processing messages shall be returned to endpoint A, that is, Alerting, Connect, or Facility message, timer T6 shall be stopped, and state MLPP-Idle shall be entered.

Upon expiry of timer T6, endpoint B shall send a Release Complete message to endpoint C containing a **reason** of **genericDataReason** and an MLPP **genericData** element with **mlppReason** set to 8 (preemptionNoReservation). If an ARQ had been sent when this call was originally set up, endpoint B shall also send a DRQ to the Gatekeeper containing a **disengageReason** of **forcedDrop**, a **terminationReason** containing a **releaseCompleteReason** of **GenericDataReason**, and an MLPP **genericData** element with **mlppReason** containing value 9 (preemptionReservation).

8.2.2.3 Procedures for completion of MLPP

If the preempting call is released in any state, endpoint B shall enter state MLPP-Idle and stop any MLPP timer. If release occurs during state MLPP-Dest-Notify, the established call shall be restored to the state that existed prior to preemption and a Facility message containing an MLPP **genericData** element with **mlppNotification** set to value **preemptionEnd** shall be sent on the established call.

8.2.3 Actions at user C's endpoint

On receipt of a Facility message on an existing call containing an MLPP **genericData** element with **mlppReason** set to value 8 or 9, endpoint C may indicate the preemption status information to user C. It takes no other action.

On receipt of a Release Complete message, endpoint C releases the call with normal notification to the user. If the Release Complete contains the MLPP **genericData** element with **mlppReason** set to 8, endpoint C should notify the user of this.

9 Dynamic description

This clause provides a dynamic description of the operation of MLPP corresponding to the procedures described in 8.2 for the functional signalling case. It describes two cases:

– Direct endpoint call signalling model with endpoints directly exchanging functional signalling (without intervention by a Gatekeeper);

– Gatekeeper-routed model, with Gatekeepers exchanging functional signalling and performing service operations and signalling to endpoints via non-standardized (maybe stimulus) signalling.

The case of fully functional signalling between Gatekeepers as well as from Gatekeepers to endpoints is thereby possible using the procedures shown for the above two cases.

9.1 Operational model

Figure 6 shows the functional model for successful MLPP before and after MLPP invocation.

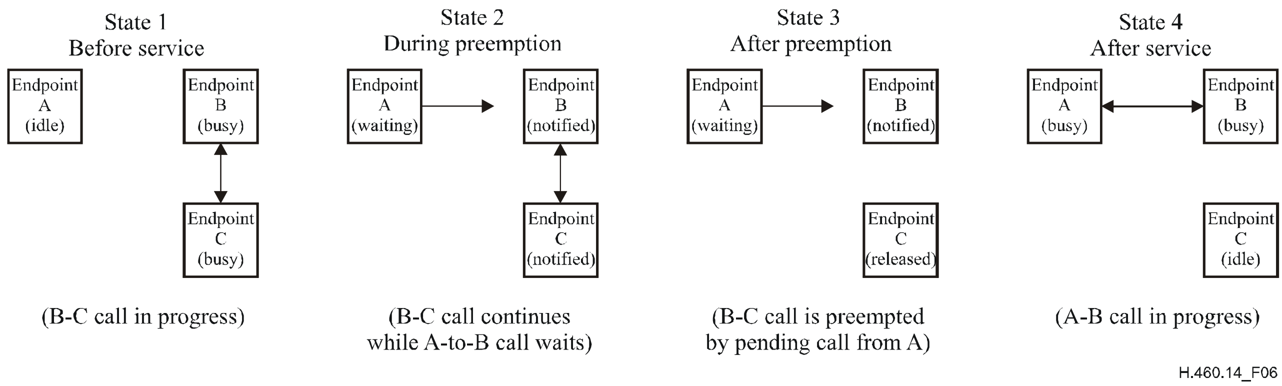


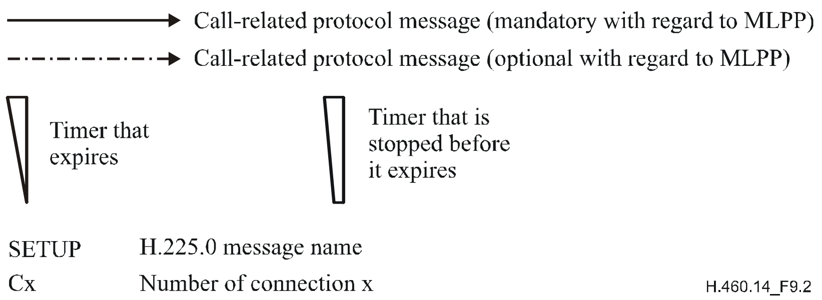
Figure 6/H.460.14 – Operational model for MLPP

NOTE – As defined in clause 4, "Preemption in Progress" includes states 2 and 3 in Figure 6.

9.2 Signalling flows

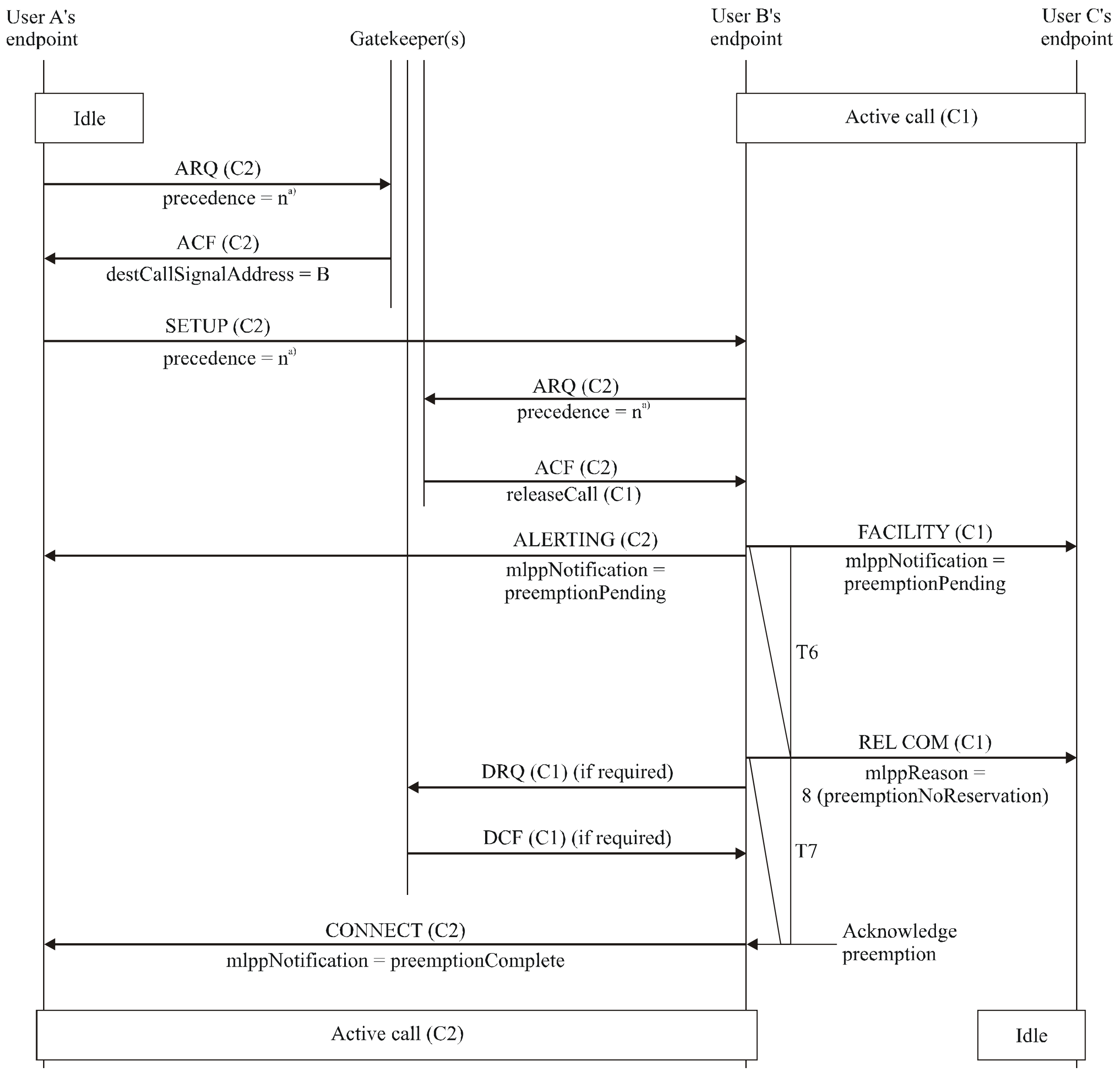
This clause describes some typical message flows for MLPP. The following conventions are used in the figures of this clause.

The following notation is used:



9.2.1 Successful MLPP – direct endpoint call signalling

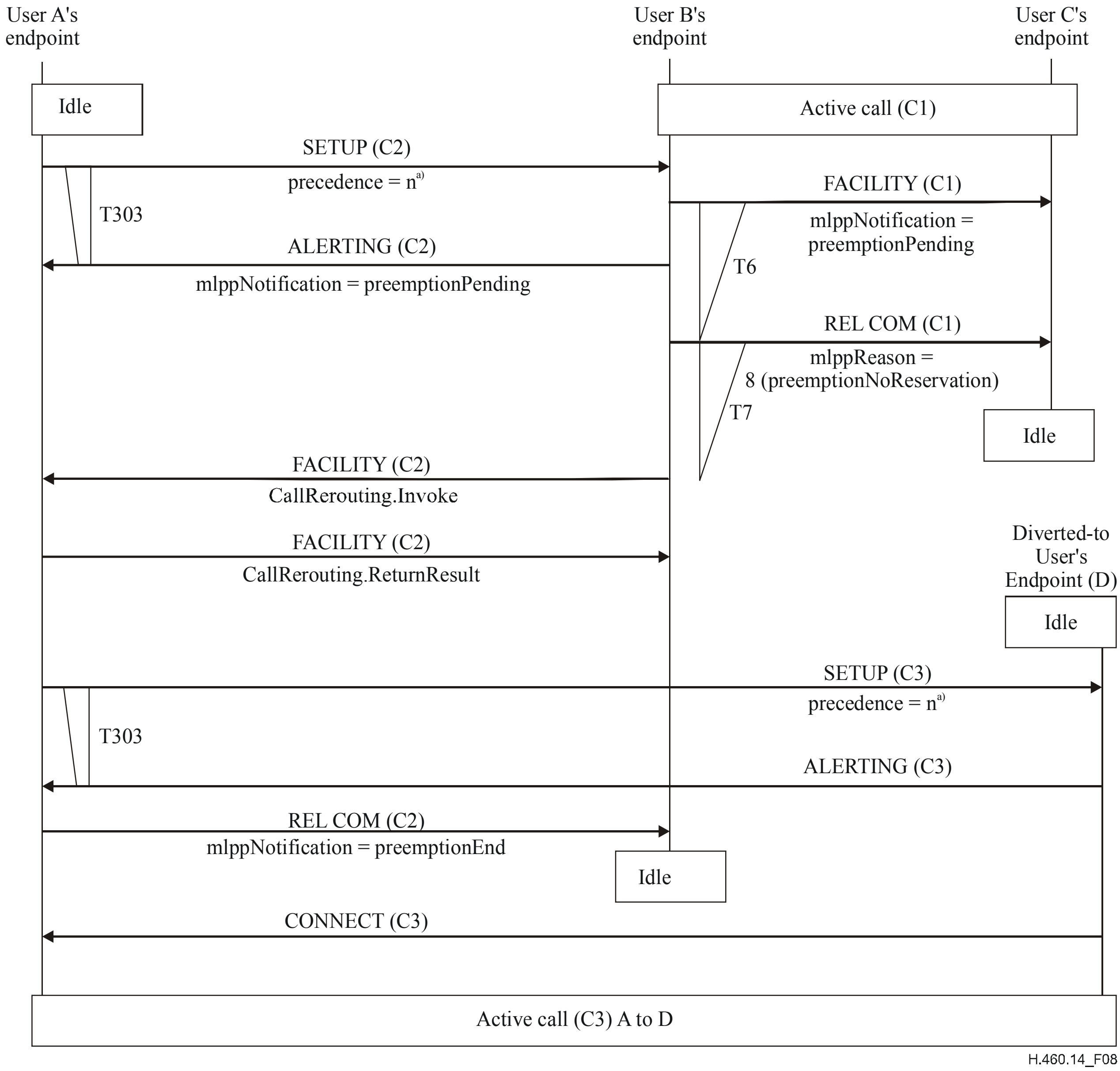
Figures 7 and 8 show example signalling flows for a successful MLPP invocation and operation for the direct endpoint call signalling case.



NOTE – Endpoints A and B may send the ARQs/DRQs to different Gatekeepers.

[a] n = 0 . . 4

Figure 7/H.460.14 – Example message flow for successful MLPP – direct endpoint call signalling, established call preempted



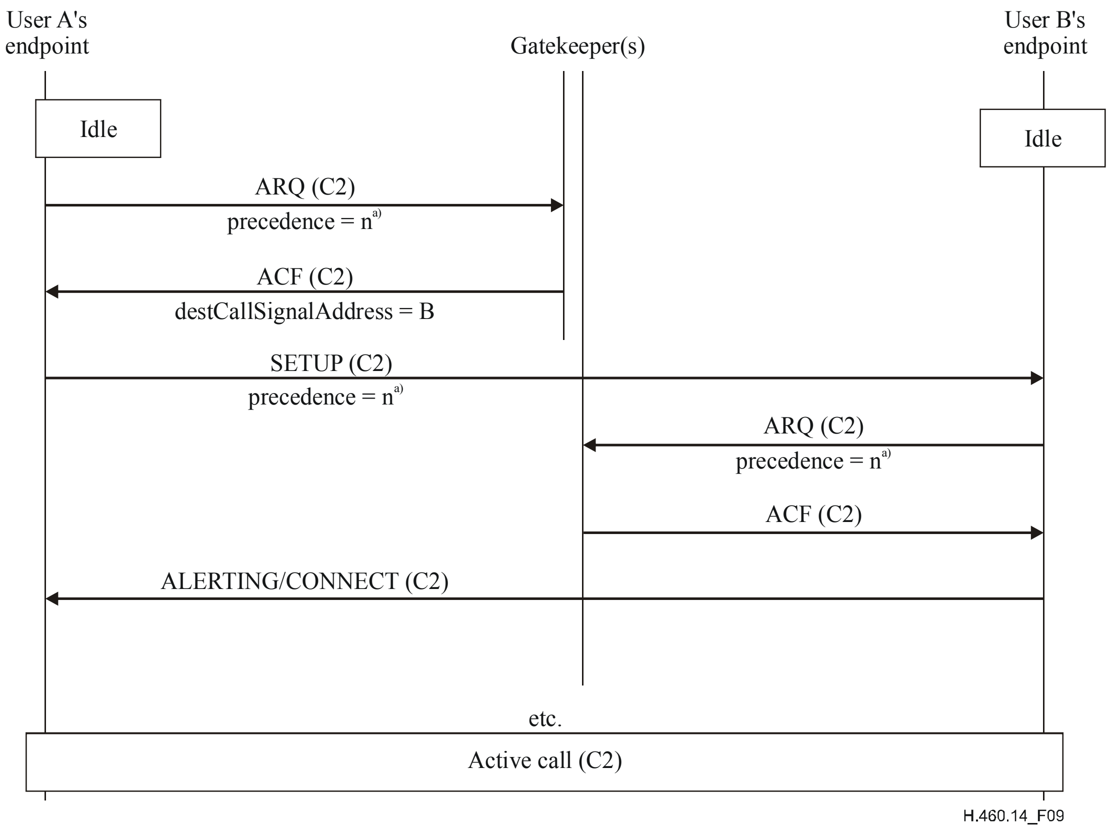
a) n = 0 . . 4

RAS signalling not shown – same as previous figure

Figure 8/H.460.14 – Example message flow for successful MLPP – direct endpoint call signalling, with timeout of acknowledgement and diversion

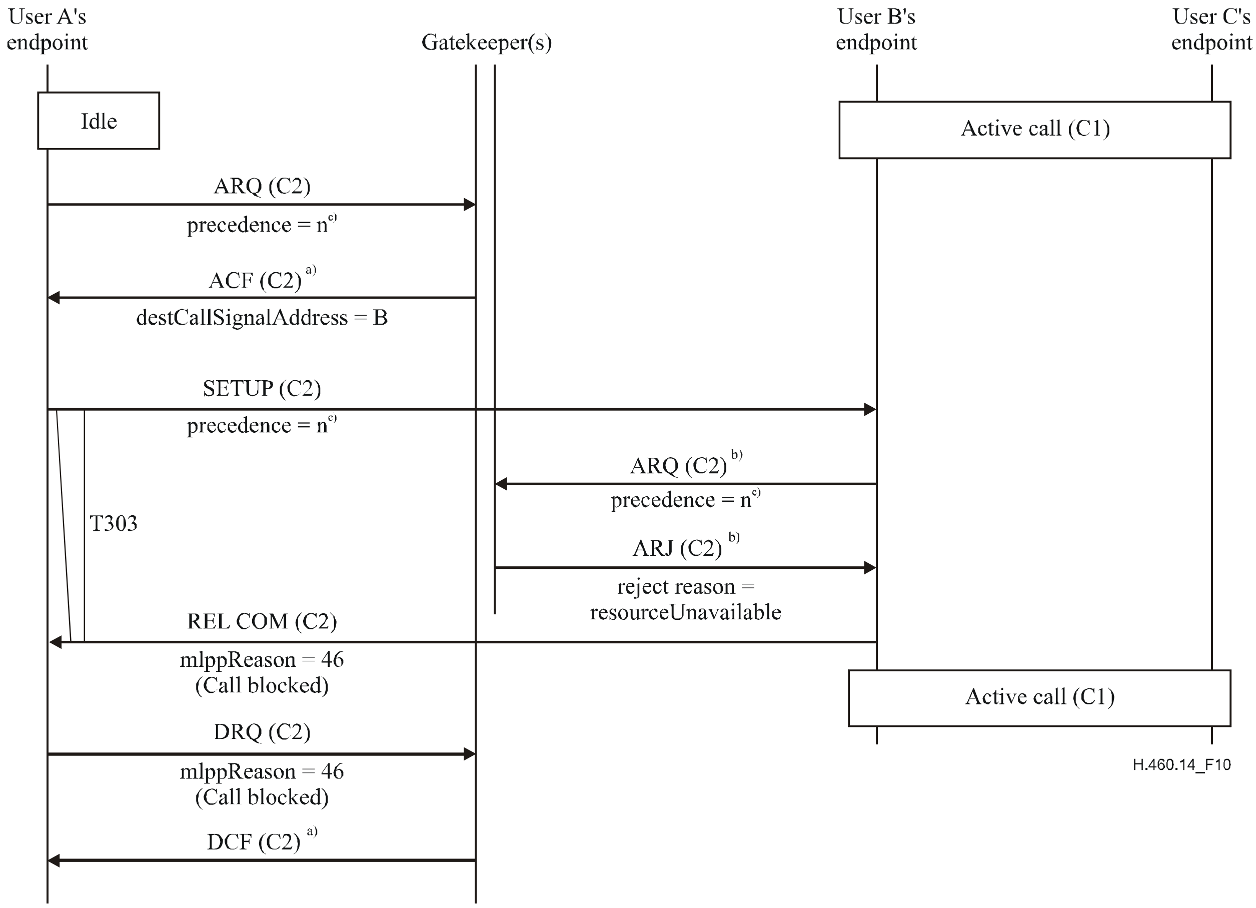
9.2.2 MLPP call without preemption – direct endpoint call signalling

Figures 9 and 10 show example signalling flows for MLPP invocation to an idle endpoint in the direct endpoint call signalling case. (It should be emphasized that, in the case shown in Figure 9, although the MLPP service is considered "unsuccessful" from the protocol viewpoint, the call setup is successful from the service operation viewpoint.)



a) n = 0 . . 4

Figure 9/H.460.14 – Example message flow for unsuccessful MLPP – direct endpoint call signalling with User B not busy



a) The gatekeeper may return ARJ if it knows that the active call is not preemptable.

b) Endpoint B may immediately return REL COM without first sending ARQ if it knows that the current call cannot be preempted.

c) n = 0 . . 4

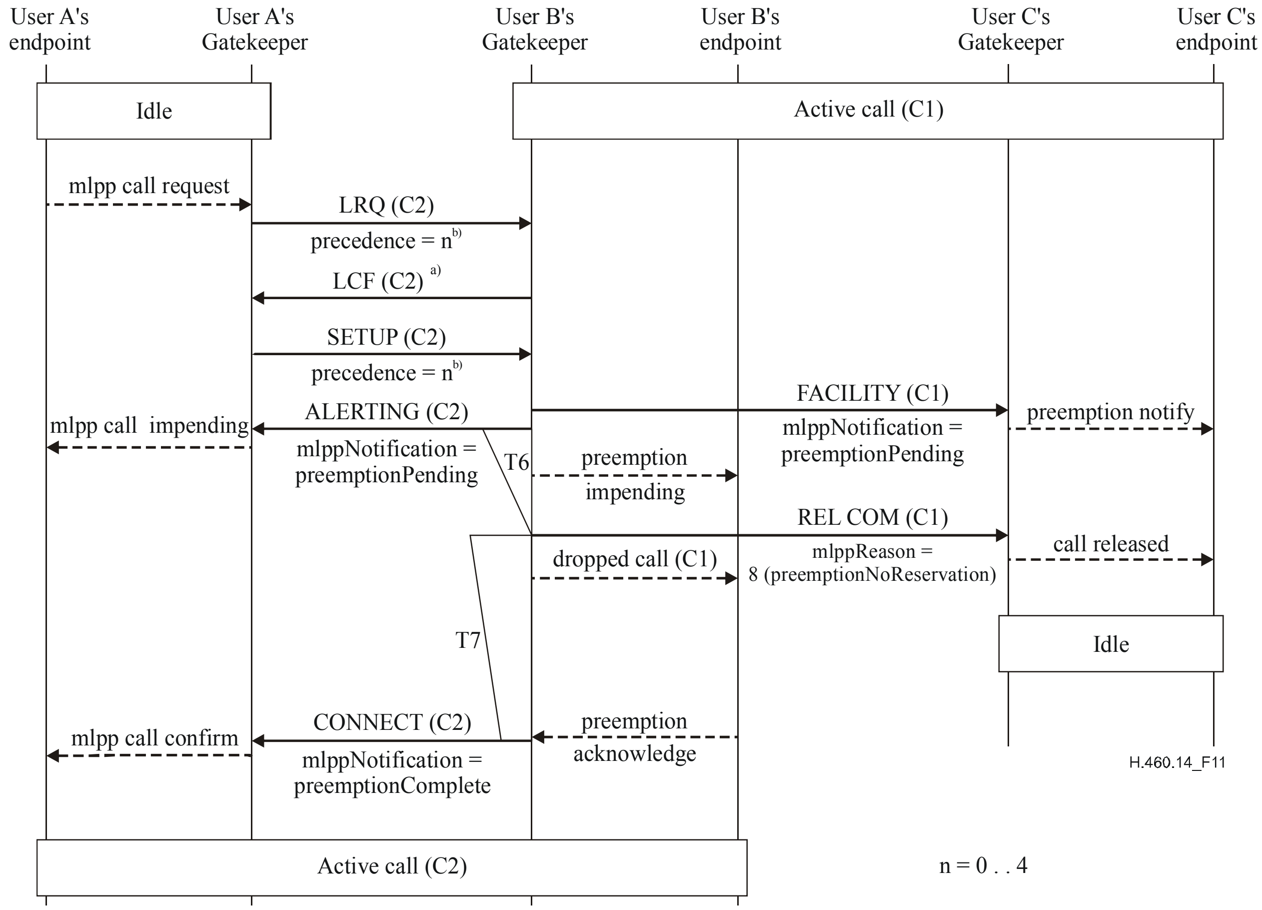
Figure 10/H.460.14 – Example message flow for unsuccessful MLPP – direct endpoint call signalling with insufficient precedence level (without alternate party diversion)

In the case shown in Figure 10, if endpoint B knows that it has no preemptable facilities and that there is no alternate party diversion, it may reject the call setup by sending the Release Complete without first sending the ARQ.

9.2.3 Successful MLPP – Gatekeeper – routed call signalling, stimulus signalling to endpoints

Figure 11 shows an example of the signalling flows for a successful MLPP invocation and operation with terminal endpoints A, B, and C not being capable of MLPP according to this Recommendation (e.g., H.323 terminals with stimulus feature control). In this example, a Gatekeeper or a proxy acts on behalf of each endpoint MLPP.

The terminal interfaces at endpoints A, B, and C are shown to illustrate the examples only. These interfaces are out of the normative scope of this Recommendation. Only the interfaces between each Gatekeeper/proxy and its associated endpoint are part of the normative scope of this Recommendation.



[a] LRJ (C2) with admissionRejectReason = resourceUnavailable if call cannot be accommodated.

[b] n = 0 . . 4

Figure 11/H.460.14 – Example message flow for successful MLPP – Gatekeeper-routed call signalling, non-standard signalling to endpoints

9.2.4 Successful MLPP – GK-routed call signalling, standardized functional signalling to endpoints

In the case of functional signalling to an endpoint, the Gatekeeper to Gatekeeper interactions are as shown in Figure 11 and the Gatekeeper to Terminal interactions are as shown in Figure 7 through Figure 10. In this case, either the Gatekeeper or the endpoint may perform the MLPP operations, for example, control of preemption, timing, and initiation of diversion.

9.3 Call states

The following states are defined only for the purpose of supporting the procedural descriptions and figures in clauses 8.2 and 10. An implementation is not required to use these actual states.

9.3.1 Call states at endpoint A

The procedures for endpoint A are written in terms of the following conceptual states existing within the MLPP signalling entity in association with a particular call.

MLPP state	Description
MLPP-Idle	This state exists if MLPP is not active.
MLPP-Wait-Ack	This state exists after an MLPP request while waiting for a response.

9.3.2 Call states at endpoint B

The procedures for endpoint B are written in terms of the following conceptual states existing within the MLPP signalling entity in association with a particular call.

MLPP state	**Description**
MLPP-Idle	This state exists if MLPP is not active.
MLPP-Dest-Notify	This state exists after an impending preemption warning is given while waiting for the preemption to occur.
MLPP-Wait-for-Ack	This state exists after releasing the first call and waiting for the called user to acknowledge the preemption.

9.3.3 Call states at endpoint C

The procedures for endpoint C are written in terms of the following conceptual states existing within the MLPP signalling entity in association with a particular call.

MLPP state	**Description**
MLPP-Idle	This state exists if MLPP is not active.

9.4 Timers

The following timers are required for the implementation of MLPP. Depending on the signalling model used, they may be implemented in endpoints or in controlling gatekeepers.

9.4.1 Origination timers

None, other than those defined in ITU-T Rec. H.225.0.

9.4.2 Destination timers

- **Timer T6**

  Timer T6 controls the delay between an impending preemption warning notification and the forced release of the established call.

  Timer T6 should have a value not greater than 10 seconds. Immediate release is achieved by setting this timer to 1 second (allowing time for the notification).

- **Timer T7**

  Timer T7 controls the wait for the called party to acknowledge (and accept) the preemption. Upon expiry, diversion to an alternate party occurs, if one has been designated.

  Timer T7 should have a value of 4-20 seconds.

10 Specification and Description Language (SDL) diagrams for MLPP

The functional signalling procedures for MLPP signalling entities are described in SDL form in Figures 13 through 16. The SDLs only show MLPP specific information transported on an H.225.0 connection. H.245 procedures (e.g., terminal capability exchange, master/slave determination, opening and closing of logical channels, etc.) are not shown. RAS signalling is not shown. In addition, interactions with other services are not shown.

In case of a conflict between SDLs and the text within the other clauses of this Recommendation, the text shall take precedence.

The symbols used in the following SDLs, irrespective of the direction of input and output signals, are defined in Figure 12.

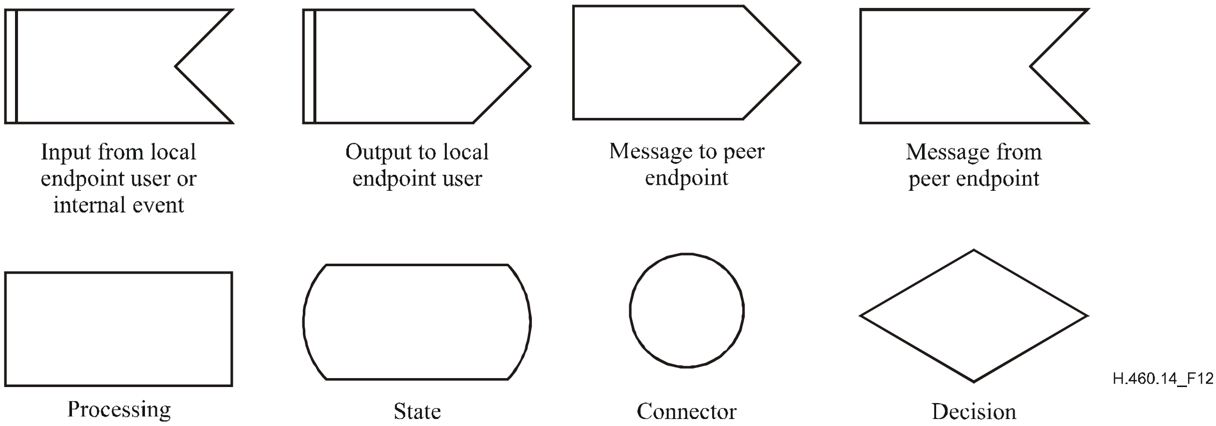


Figure 12/H.460.14 – SDL symbols

10.1 Behaviour of User A's endpoint

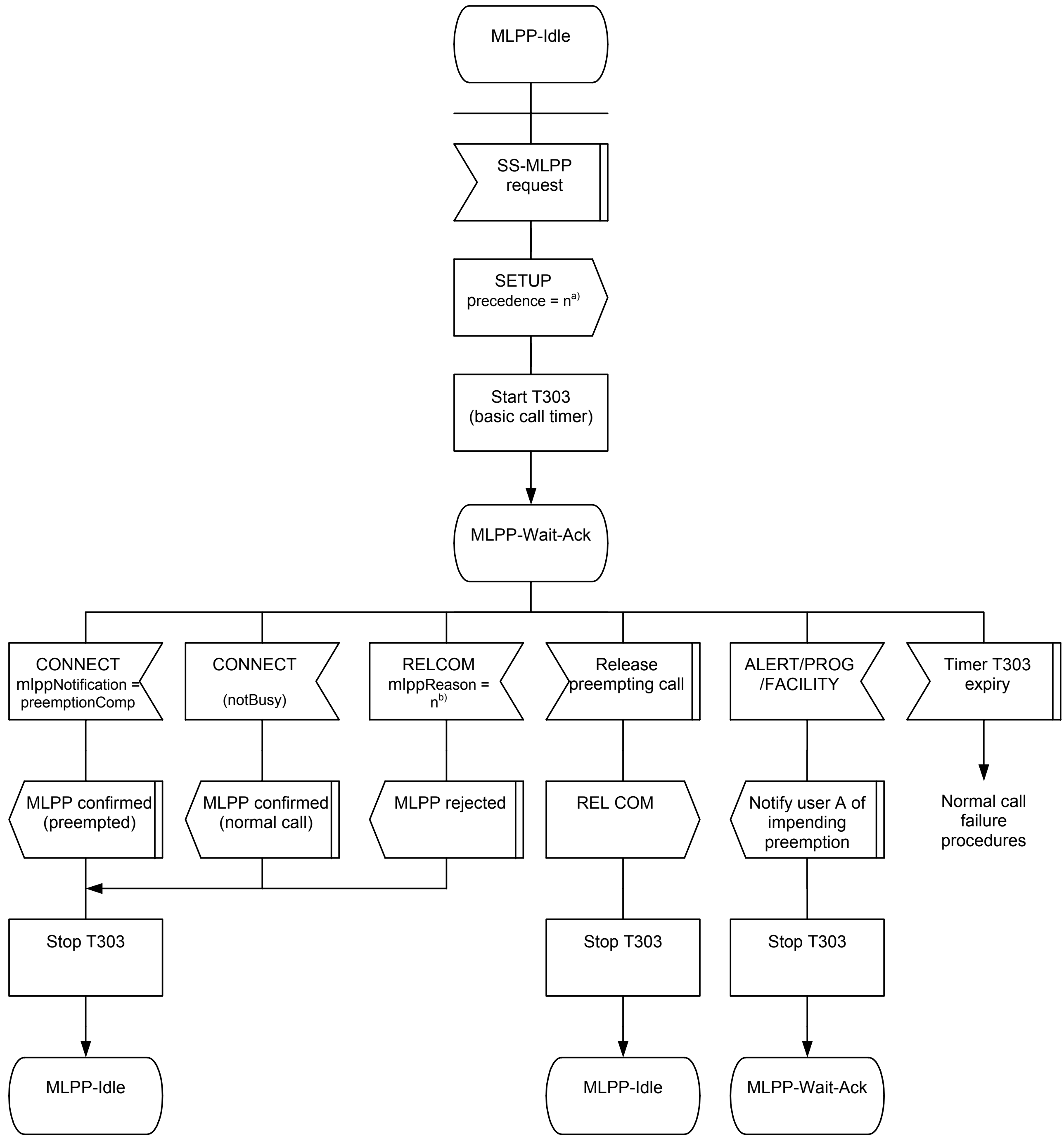
Figure 13 shows the behaviour of user A's endpoint.

Input signals from the left and output signals to the left represent:

- inputs from or indications and notifications to the user A;
- internal signals, e.g., timer expiry.

Input signals from the right and output signals to the right represent:

- messages from and to the called peer service control entity (i.e., in User A's Gatekeeper or User B's endpoint or Gatekeeper) which carry MLPP control information.



a) n = 0 . . 4

b) n ∈ MlppReason

Figure 13/H.460.14 – Endpoint A SDL

10.2 Behaviour of User B's endpoint

Figures 14 and 15 show the behaviour of User B's endpoint.

Input signals from the left and output signals to the left represent:

- messages from and to the calling peer service control entity (i.e., in User B's Gatekeeper or User A's endpoint or Gatekeeper) which carry MLPP control information;
- inputs from and indications and notifications to the called user (User B);
- internal signals, e.g., timer expiry.

Input signals from the right and output signals to the right represent:

- messages from and to the unwanted user's peer service control entity (i.e., in User B's Gatekeeper or User C's endpoint or Gatekeeper) which carry MLPP control information.

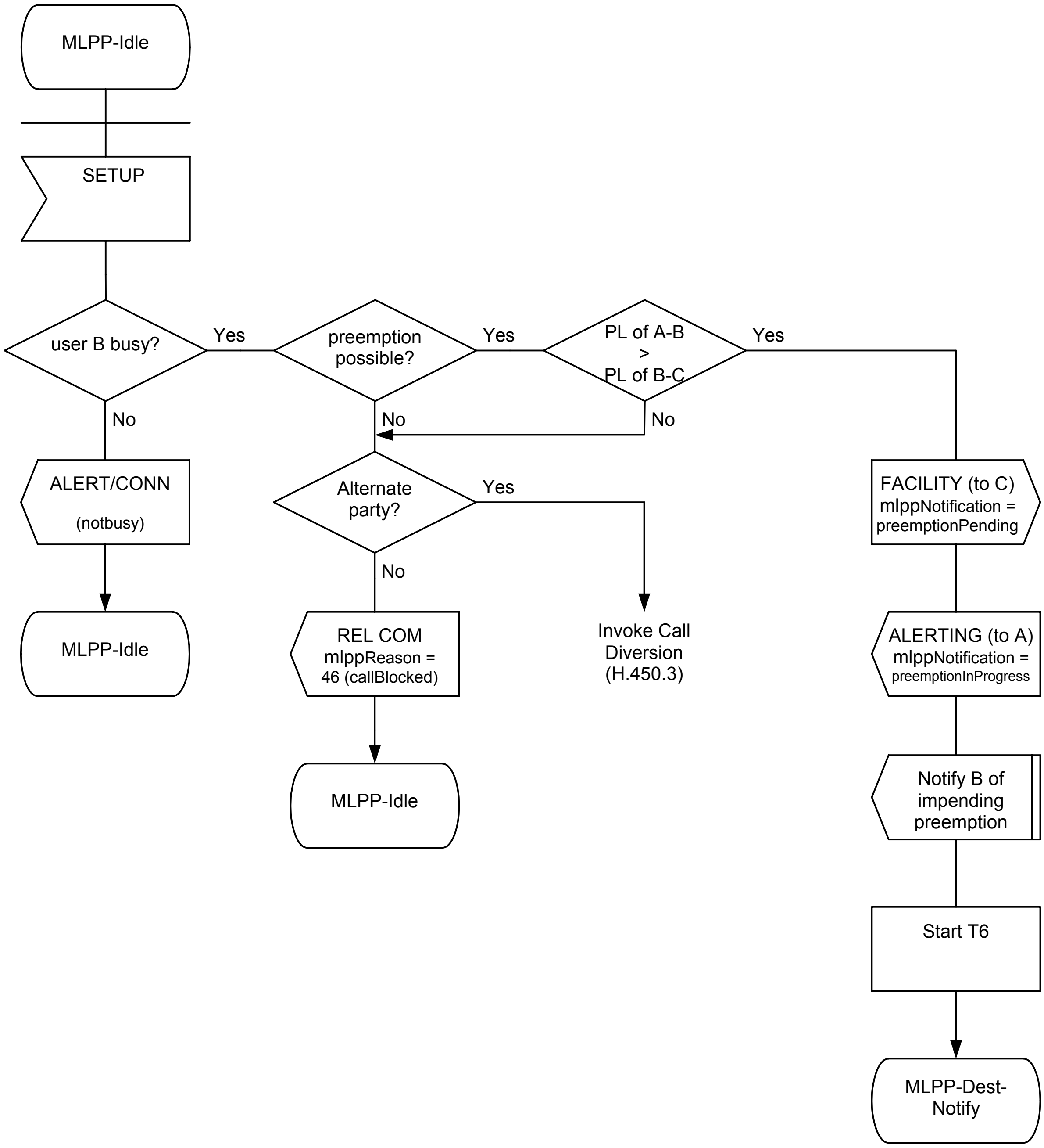


Figure 14/H.460.14 – Endpoint B SDL (*sheet 1 of 2*)

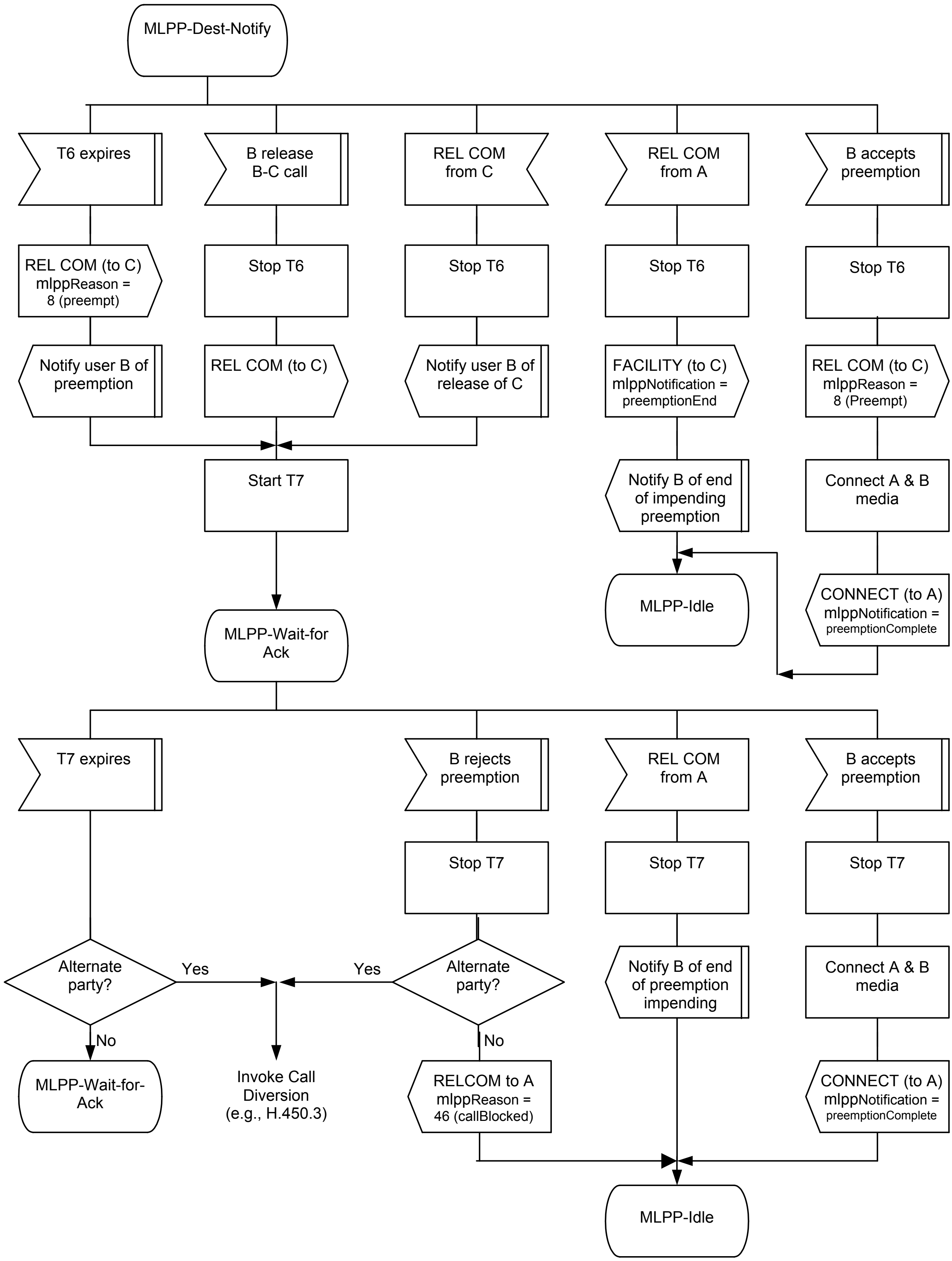


Figure 15/H.460.14 – Endpoint B SDL (*sheet 2 of 2*)

10.3 Behaviour of User C's endpoint

Figure 16 shows the behaviour of User C's endpoint.

Input signals from the left and output signals to the left represent:

- messages from and to the peer service control entity (i.e., in User C's Gatekeeper or User B's endpoint or Gatekeeper) which carry MLPP control information.

Output signals to the right represent:

- indications or notifications to the unwanted user (User C).

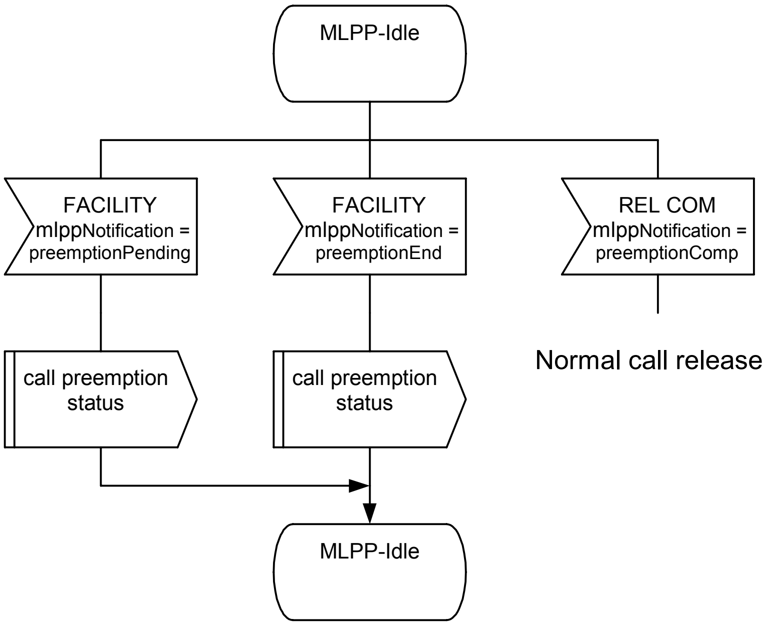


Figure 16/H.460.14 – Endpoint C SDL

11 Protocol interactions with other endpoint features

When other supplementary services are provided according to one or more of the following methods, the interactions of MLPP with the protocol used for those services shall be as follows:

11.1 Functional endpoints

Endpoints using H.450-series functional signalling for other services may utilize the procedures in this Recommendation to provide the MLPP service. They shall handle interactions with the protocols defined in the applicable Recommendations for those services as follows.

11.1.1 Call Transfer (SS-CT)

The following protocol interactions shall apply if SS-CT is supported in accordance with ITU-T Rec. H.450.2 and both SS-CT and MLPP are invoked on the same call:

If User A requests call transfer for two calls and MLPP is invoked on one or both calls, the actions of CT for transfer during alerting shall apply. The transferred-to endpoint may include a *callWaiting* invoke APDU (see ITU-T Rec. H.450.6) when sending the *callTransferSetup* return result APDU in an Alerting message to the transferred endpoint. The transferred-to endpoint may then also send a *remoteUserAlerting* invoke APDU in a Facility message to the transferred endpoint when the transferred-to user becomes not busy. If no *callWaiting* invoke APDU was sent, then also no *remoteUserAlerting* invoke APDU shall be sent. If the transferred-to user answers, a Connect message shall be sent to the transferred endpoint, but no MLPP **genericData** element shall be sent.

If the secondary call does not exist, the transferred endpoint may request MLPP against a transferred-to user by including in the Setup message an MLPP **genericData** element together with the *callTransferSetup* invoke APDU. The transferred-to endpoint shall then follow the procedures of 8.2.

11.1.2 Call Forwarding Unconditional (SS-CFU)

The following protocol interactions shall apply if SS-CFU is supported in accordance with ITU-T Rec. H.450.3 and both SS-CFU and MLPP are possible on the same call:

When executing call forwarding unconditional, the rerouting endpoint shall include in the Setup message to the diverted-to endpoint any **genericData** elements (including the ones for MLPP defined in this Recommendation) that were present in the Setup message received by the diverting endpoint, in addition to the *divertingLegInformation2* invoke APDU.

11.1.3 Call Forwarding Busy (SS-CFB)

The following protocol interactions shall apply if SS-CFB is supported in accordance with ITU-T Rec. H.450.3 and both SS-CFB and MLPP are possible on the same call:

When executing call forwarding busy, the rerouting endpoint shall include in the Setup message to the diverted-to endpoint any **genericData** elements (including any for MLPP) that were present in the Setup message received by the diverting endpoint, in addition to the *divertingLegInformation2* invoke APDU.

If a call including an MLPP **genericData** element arrives at a busy user who has activated SS-CFB, then SS-CFB shall be invoked.

11.1.4 Call Forwarding on No Reply (SS-CFNR)/Call Deflection (SS-CD)

No protocol interaction.

NOTE – This means that the rerouting endpoint does not include any MLPP **genericData** element in the new Setup message when executing call diversion (no reply/call deflection).

11.1.5 Call Hold

No protocol interaction.

11.1.6 Call Park/Call Pickup

No protocol interaction.

11.1.7 Call Waiting

No protocol interaction.

11.1.8 Message Waiting Indication

No protocol interaction.

11.1.9 Name Presentation

No protocol interaction.

11.1.10 Completion of Calls on Busy (SS-CCBS)/on No Reply (SS-CCNR)

No protocol interaction.

11.1.11 Call Offer (SS-CO)

The following protocol interactions shall apply if SS-CO is supported in accordance with ITU-T Rec. H.450.10 and both SS-CO and MLPP are invoked on the same call:

Endpoint A may include both the *callOfferRequest* and MLPP request in the Setup messages. In state MLPP-Wait-Ack, if a *callWaiting* invoke APDU is received in an Alerting or Progress message, endpoint A shall proceed with the Call Offer invocation procedures as defined in ITU-T Rec. H.450.10 instead of MLPP, as this occurs if the endpoint does not support MLPP. If any return error defined in this Recommendation is returned, endpoint A shall proceed with the procedures of this Recommendation.

Endpoint B shall respond positively as defined in this Recommendation rather than to the *callOfferRequest* invoke APDU. It shall respond to the *callOfferRequest* invoke APDU by returning a *callOfferRequest* return error APDU with error "*supplementatyServiceInteractionNotAllowed*" in the resulting Alerting or Connect message.

11.1.12 Call Intrusion (SS-CI)

No protocol interactions, since both services should not be invoked on the same call setup.

11.1.13 Common Information

No protocol interaction.

11.2 Stimulus-based endpoints

Feature interactions for stimulus-based endpoints shall be resolved in the controlling Gatekeeper or feature server. Generally, precedence calls should be forwarded, redirected, or transferred with their original precedence. In most cases, precedence calls follow the normal redirection procedures unless they are able to preempt an existing call at the called destination. Annex L/H.323 further describes the stimulus-based endpoint case.

11.3 Interworking with Switched Circuit Network

MLPP may interwork with corresponding supplementary services as defined by other standards by means of gateway interworking functions.

The specification of detailed gateway interworking procedures for MLPP is beyond the scope of this Recommendation and may be defined for various Switched Circuit Networks by other Recommendations.

Annex A

ASN.1 definition

```
MLPP DEFINITIONS AUTOMATIC TAGS ::=
BEGIN

IMPORTS
     CallIdentifier,
     AliasAddress
FROM H323-MESSAGES;  -- defined in H.225.0, Annex H

MLPPInfo  ::=  SEQUENCE  -- root for MLPP data ASN.1
{
     precedence          MlppPrecedence     OPTIONAL,
     mlppReason          MlppReason         OPTIONAL,
```

```
     mlppNotification   MlppNotification   OPTIONAL,
     alternateParty     AlternateParty     OPTIONAL,
     releaseCall        ReleaseCall        OPTIONAL,
     ...
}

MlppPrecedence  ::=  ENUMERATED
{
     flashOverride (0),
     flash (1),
     immediate (2),
     priority (3),
     routine (4),
     ...
}

MlppReason  ::=  ENUMERATED
     -- Indicates reasons that call is refused or released.
{
     preemptionNoReservation (8),
     preemptionReservation (9),
     callBlocked (46),
     ...
}

MlppNotification  ::=  CHOICE
     -- Provides various notification events in Call Signalling messages
{
     preemptionPending       NULL,
     preemptionInProgress    NULL,
     preemptionEnd           NULL,
     preemptionComplete      NULL,
     ...
}

AlternateParty  ::=  SEQUENCE
{
     altID         AliasAddress,
     altTimer      INTEGER (0..255) OPTIONAL, --seconds
     ...
}

ReleaseCall  ::=  SEQUENCE
     -- Identifies other call to be preempted first
{
     preemptCallID      CallIdentifier,
     releaseReason      MlppReason,
     releaseDelay       INTEGER (0..255) OPTIONAL, -- seconds to wait
     ...
}

END
```

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Series D	General tariff principles
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Printed in Switzerland
Geneva, 2004