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Information technology — Telecommunications and information exchange between systems — Corporate Telecommunication Networks — Signalling interworking between QSIG and H.323 — Call completion supplementary services

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Réseaux de télécommunications de corps — Travail de signalisation entre QSIG et H.323 — Compléments de service d'achèvement d'appel

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 21991 was prepared by ECMA (as ECMA-326) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

Annex A forms a normative part of this International Standard. Annex B is for information only.

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Introduction

This International Standard is one of a series of Standards defining the interworking of services and signalling protocols deployed in Corporate telecommunication Networks (CNs). The series uses telecommunication concepts as developed by ITU-T and conforms to the framework of International Standards on Open Systems Interconnection as defined by ISO/IEC.

This International Standard defines the signalling protocol interworking for call completion supplementary services between a Private Integrated Services Network (PISN) and a packet-based private telecommunication network based on the Internet Protocol (IP). It is further assumed that the protocol for the PISN part is that defined for the Q reference point (QSIG) and that the protocols for the IP-based network are based on ITU-T Recommendation H.323.

This International Standard is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of ISO/IEC JTC 1, ITU-T, ETSI and other international and national standardization bodies. It represents a pragmatic and widely based consensus.

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Information technology — Telecommunications and information exchange between systems — Corporate Telecommunication Networks — Signalling interworking between QSIG and H.323 — Call completion supplementary services

1 Scope

This International Standard specifies signalling interworking between "QSIG" and "H.323" in support of call completion supplementary services within a Corporate telecommunication Network (CN).

"QSIG" is a signalling protocol that operates at the Q reference point between Private Integrated services Network eXchanges (PINX) within a Private Integrated Services Network (PISN). The Q reference point is defined in ISO/IEC 11579-1. A PISN provides circuit-switched basic services and supplementary services to its users. QSIG is specified in other Standards, in particular ISO/IEC 11572 (call control in support of basic services), ISO/IEC 11582 (generic functional protocol for the support of supplementary services) and a number of standards specifying individual supplementary services. ISO/IEC 13870 specifies the QSIG protocol in support of call completion services.

"H.323" is a set of signalling protocols for the support of voice or multimedia communication within a packet network, in particular a packet network that uses the Internet Protocol (IP) as its network layer protocol (IP network). H.323 signalling protocols operate between endpoints in an IP network, either indirectly via one or more gatekeepers, or directly. An endpoint can be a terminal or a gateway to another network. H.323 is an "umbrella" recommendation referring to various ITU-T recommendations, in particular Recommendations H.225.0 and H.245 (basic communication capabilities) and Recommendation H.450.1 (generic functional protocol for the support of supplementary services). Recommendation H.450.9 specifies the H.323 protocol in support of call completion services.

NOTE - H.450.9 applies only to the 1998 version of H.323 (also known as H.323 version 2) and to later versions.

In both ISO/IEC 13870 (QSIG) and ITU-Recommendation H.450.9 (H.323), the call completion supplementary services are Completion of Calls to Busy Subscribers (SS-CCBS) and Completion of Calls on No Reply (SS-CCNR). These supplementary services apply after a call establishment attempt has failed because the called user was busy or not available, and provide means to re-establish the call when the called user becomes available.

Interworking between QSIG and H.323 permits a call originating at a user of a PISN to terminate at a user of a private IP network, or a call originating at a user of a private IP network to terminate at a user of a PISN. In such a scenario, this International Standard allows the completion of calls when the called user becomes available after having been busy (SS-CCBS), or having not answered the original call (SS-CCNR).

Interworking between a PISN employing QSIG and a public IP network employing H.323 is outside the scope of this International Standard. However, the functionality specified in this International Standard is in principle applicable to such a scenario when deployed in conjunction with other relevant functionality (e.g., number translation, security functions, etc.).

This International Standard is applicable to any interworking unit that can act as a gateway between a PISN employing QSIG and a private IP network employing H.323.

2 Conformance

In order to conform to this International Standard, a gateway shall satisfy the requirements identified in the Implementation Conformance Statement (ICS) proforma in annex A.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 11572:2000, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Circuit mode bearer services — Inter-exchange signalling procedures and protocol*

ISO/IEC 11579-1:1994, *Information technology — Telecommunications and information exchange between systems — Private integrated services network — Part 1: Reference configuration for PISN Exchanges (PINX)*

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ISO/IEC 11582:1995, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Generic functional protocol for the support of supplementary services — Inter-exchange signalling procedures and protocol*

ISO/IEC 13870:2001, *Information technology — Telecommunications and information exchange between systems — Private Integrated Services Network — Inter-exchange signalling protocol — Call completion supplementary services*

ISO/IEC 21409:2001, *Information technology — Telecommunications and information exchange between systems — Corporate telecommunication networks — Signalling interworking between QSIG and H.323 — Generic functional protocol for the support of supplementary services*

ITU-T Rec. H.225.0, *Call signalling protocols and media stream packetization for packet-based multimedia communication systems*

ITU-T Rec. H.245, *Control protocol for multimedia communication*

ITU-T Rec. H.323, *Packet-based multimedia communications systems*

ITU-T Rec. H.450.1:1998, *Generic functional protocol for the support of supplementary services in H.323*

ITU-T Rec. H.450.9:2000, *Call Completion Supplementary Services for H.323*

4 Definitions

For the purposes of this International Standard, the following definitions apply.

4.1 External definitions

This International Standard uses the following terms defined in other documents:

- Call (ISO/IEC 21409)
- Corporate telecommunication Network (CN) (ISO/IEC 21409)
- Endpoint (ITU-T Rec. H.323)
- Gatekeeper (ITU-T Rec. H.323)
- Private Integrated Services Network (PISN) (ISO/IEC 21409)
- Private Integrated services Network eXchange (PINX) (ISO/IEC 11579-1)

Additionally the definitions in ISO/IEC 13870 and ITU-T Recommendation H.450.9 apply as appropriate.

4.2 Other definitions

4.2.1 Entity A

Signalling entity at the PINX or H.323 endpoint serving the calling user (user A).

4.2.2 Entity B

Signalling entity at the PINX or H.323 endpoint serving the called user (user B).

4.2.3 Gateway

A gateway as defined in H.323 specifically for the purpose of interworking with a network employing QSIG.

4.2.4 IP network

A network, unless otherwise stated a CN, offering connectionless packet-mode services based on the Internet Protocol (IP) as the network layer protocol.

4.2.5 Leg A

Call segment that lies between entity A and entity B.

4.2.6 Scenario A1

Interworking arrangement in which entity A (PINX A) is in the PISN and entity B is in the IP network.

4.2.7 Scenario A2

Interworking arrangement in which entity A (endpoint A) is in the IP network and entity B is in the PISN.

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5 Acronyms

APDU	Application Protocol Data Unit
CN	Corporate telecommunication Network
ICS	Implementation Conformance Statement
IP	Internet Protocol
PINX	Private Integrated services Network eXchange
PISN	Private Integrated Services Network
SS-CC	Supplementary Service Call Completion (either SS-CCBS or SS-CCNR)
SS-CCBS	Supplementary Service Completion of Calls to Busy Subscribers
SS-CCNR	Supplementary Service Completion of Calls on No Reply

6 Service architecture

6.1 Service architecture for invocation and operation

6.1.1 ISO/IEC 13870 service architecture

The QSIG protocol for call completion invocation and operation is based around two signalling entities or PINX types:

- entity A – the PINX serving the calling user (user A);
- entity B – the PINX serving the called user (user B).

Where a user is in another network, the role of entity A or entity B is performed by the other network, the gateway or the two in combination. However, from the QSIG point of view the role is performed by the gateway, which acts as a gateway PINX.

This can be represented diagrammatically as shown in figure 1.

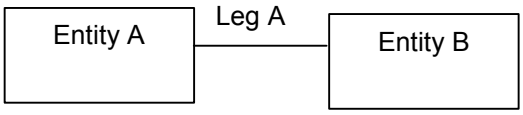

Figure 1 — Call completion architecture

From this it can be seen that there is only one segment or "leg" as far as the QSIG protocol is concerned (regardless of any transit entities through which the signalling may pass).

However, an instance of SS-CC consists of several consecutive phases, each phase being a separate instance of call related or call independent signalling. In other words, leg A in figure 1 represents several calls or call independent signalling connections between entities A and B, which all belong to a single instance of SS-CC but may take different routes through the network.

The typical course of action for an instance of SS-CC is:

- *Prerequisite*: unsuccessful call attempt because of busy or absent user B;
- *invocation of SS-CC*, using a call independent signalling connection (signalling phase 1);
- *monitoring of user B*; there is no (network) signalling involved during this phase;
- *user B available notification*, using call independent signalling, and *suspension/resumption* of SS-CC if user A is busy at this stage (signalling phase 2);
- *recall*, resulting in an automatically initiated basic call from user A to user B (signalling phase 3);
- *cancellation* of SS-CC, by the network (e.g. after timeout), or by user A or user B at any time (signalling phase 4).

NOTE - Interworking is only concerned with the phases that involve (network) signalling.

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6.1.2 H.450.9 service architecture

The architecture shown above for QSIG applies also to H.450.9, except that PINXs are replaced by H.323 entities as follows:

- entity A – the calling endpoint;
- entity B – the called endpoint.

Either entity can alternatively be located at a gatekeeper or proxy (as defined in H.450.9) acting on behalf of the respective endpoint, the signalling between endpoint and gatekeeper/proxy being outside the scope of H.450.9. In this case the gatekeeper/proxy performs the role of entity A or B, respectively. However, from the H.450.9 point of view the role is performed by the endpoint.

Where a user is in another network, the role of entity A or entity B is performed by the other network, the gateway or the two in combination. However, from the H.450.9 point of view the role is performed by the gateway.

6.1.3 Scenarios for interworking

The architectures for ISO/IEC 13870 and H.450.9 are very similar.

This means that the same architecture is applicable to the inter-networking situation between an IP network and a PISN, where one user involved is served by the IP network and the other is served by the PISN.

For the point of interworking, two scenarios arise, depending on which side of the interworking point the PISN lies:

- Scenario A1: Entity A (PINX A) in PISN, entity B (endpoint B) in IP network;
- Scenario A2: Entity A (endpoint A) in IP network, entity B (PINX B) in PISN.

The point of interworking will be implemented in a gateway, which acts as both an H.323 endpoint from the point of view of the IP network and a gateway PINX from the point of view of the PISN.

6.1.4 Selection of the same gateway for all phases

Since the different phases of an SS-CC instance in general use separate signalling paths, messages belonging to different phases may pass through different gateways. In this situation it does not make sense for a gateway to maintain SS-CC related states on either side, unless it can be assured that all signalling for a particular SS-CC instance passes through the same gateway. This is the case if there is only one gateway available for connecting the particular pair of users A and B at any time, but usually not if the load is shared dynamically between several gateways.

One possible way to always choose the same gateway is by means of addressing. If the gateways themselves are addressable entities with their own alias addresses / PISN numbers – in contrast to being only indirectly addressed via the alias addresses / PISN numbers of users reachable through the gateway – a specific gateway can be selected:

- on the IP side of the gateway, by using both elements *destinationAddress* (=gateway address) and *remoteExtensionAddress* (=PISN user address) within the relevant address fields of the H.450.9 APDUs or the Setup message;
- on the PISN side of the gateway, by using a (temporary) gateway number, selected (by the gateway) to represent the remote user in this instance of SS-CC at this gateway. The gateway then has to map between the temporarily assigned number and the pair of elements *destinationAddress* / *remoteExtensionAddress*.

However, the interworking procedures specified in this International Standard do not by themselves require the use of the same gateway for all signalling related to a particular instance of SS-CC.

NOTE - It will be required if connection retention and connection release methods have to be interworked (see 6.2 and 8.1 for more information).

6.2 Options

SS-CC can be – and has been – implemented in different ways. Both QSIG and H.323 offer several options, mainly for ease of interworking with existing implementations in other networks.

The following options of SS-CC can be selected by implementations both in QSIG and in H.323:

- **Service retention**: If a CC call attempt fails because user B is busy again, SS-CC may either re-enter the monitoring phase (service retention) or be cancelled (service non-retention).
- **Connection retain/release method**: A call independent signalling connection may or may not be maintained between entities A and B during monitoring phases, i.e. phases without signalling.

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For both options negotiation is possible, and both can be interworked between QSIG and H.323.

The following option is only available in QSIG:

- **Path reservation/non-reservation**: A network path is established for the CC call before informing user A (path reservation), or user A is informed first and the CC call is then established as a basic call upon acceptance by user A (path non-reservation).

H.323 supports only path non-reservation, therefore path reservation cannot be directly interworked.

7 Protocol interworking – General requirements

Protocol interworking between H.323 and QSIG for call completion supplementary services shall be in accordance with ISO/IEC 21409, as modified by the requirements of clause 8.

When transmitting an APDU in one protocol as a result of receiving the corresponding APDU in the other protocol, the mapping of elements in the received APDU to corresponding elements in the transmitted APDU shall be in accordance with ISO/IEC 21409, where applicable. Optional elements of one protocol that have no corresponding element in the other protocol shall be discarded if received.

8 Protocol interworking – Messages and APDUs

In the rules specified below for the different scenarios, the following apply:

1. If the required action is to transmit a QSIG or H.323 FACILITY message but the call state does not permit a FACILITY message to be sent at that time, the action to be taken is an implementation matter.
2. If the required action is to include an APDU in a transmitted QSIG or H.323 message conditional upon that message being transmitted and that message is not to be transmitted (owing to basic call interworking considerations), the action to be taken is an implementation matter.
3. If the required action is dependent on the call independent signalling connection extending or being able to be extended into the other network and this cannot be achieved, the action to be taken is an implementation matter.

8.1 Signalling phase 1 - invocation of call completion

The invocation procedure of call completion uses a call independent signalling connection, which may be retained for signalling phase 2 onwards (see below) or released at the end of signalling phase 1.

The interworking rules imply that the signalling connection is either retained on both sides or released on both sides of the gateway. Interworking scenarios where the connection is released on one side and retained on the other are not provided for.

NOTE 1 - Element retain-sig-connection in the ccbsRequest / ccnrRequest invoke APDU will be passed on by the gateway if present and allows entity A to ask for a specific method. Entity B will honour this request unless further interworking requires a different method. If the element is not present entity B will choose the method.

NOTE 2 - A possible reason for "mixed" scenarios is a concatenation of networks some of which are neither H.323 nor QSIG. An implementation may support such scenarios in a proprietary way. In this case the side without signalling connection must be able to locate the gateway initially used (which has retained the connection on the other side). 6.1.4 shows how this could be achieved.

Service retention is negotiated end-to-end between entities A and B.

8.1.1 Scenario A1

A gateway that supports scenario A1 shall behave in accordance with the rules of table 1, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of a QSIG message from entity A, or receipt of an H.323 message from entity B.

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Table 1 — Message and APDU handling requirements for signalling phase 1, scenario A1

Rule	Condition	Required action
1.1	Receipt of a QSIG SETUP message for a call independent signalling connection, containing a QSIG *ccbsRequest* or *ccnrRequest* invoke APDU.	If the call independent signalling connection can be extended into the IP network, transmit an H.323 SETUP message for a call independent signalling connection, containing an H.323 *ccbsRequest* or *ccnrRequest* invoke APDU.
1.2	Receipt of an H.323 CONNECT message containing an H.323 *ccbsRequest* or *ccnrRequest* return result APDU.	If a QSIG CONNECT message is to be transmitted, include in the QSIG CONNECT message a QSIG *ccbsRequest* or *ccnrRequest* return result APDU.
1.3	Receipt of an H.323 RELEASE COMPLETE message containing an H.323 *ccbsRequest* or *ccnrRequest* return result APDU.	Transmit a QSIG RELEASE message containing a QSIG *ccbsRequest* or *ccnrRequest* return result APDU if the QSIG call state permits.
1.4	Receipt of an H.323 RELEASE COMPLETE message containing an H.323 *ccbsRequest* or *ccnrRequest* return error APDU.	Transmit a QSIG RELEASE message containing a QSIG *ccbsRequest* or *ccnrRequest* return error APDU if the QSIG call state permits.

8.1.2 Scenario A2

A gateway that supports scenario A2 shall behave in accordance with the rules of table 2, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of an H.323 message from entity A, or receipt of a QSIG message from entity B.

Table 2 — Message and APDU handling requirements for signalling phase 1, scenario A2

Rule	Condition	Required action
1.1	Receipt of an H.323 SETUP message for a call independent signalling connection, containing an H.323 *ccbsRequest* or *ccnrRequest* invoke APDU.	If the call independent signalling connection can be extended into the PISN, transmit a QSIG SETUP message for a call independent signalling connection, containing a QSIG *ccbsRequest* or *ccnrRequest* invoke APDU.
1.2	Receipt of a QSIG CONNECT message containing a QSIG *ccbsRequest* or *ccnrRequest* return result APDU.	If an H.323 CONNECT message is to be transmitted, include in the H.323 CONNECT message an H.323 *ccbsRequest* or *ccnrRequest* return result APDU.
1.3	Receipt of a QSIG RELEASE message containing a QSIG *ccbsRequest* or *ccnrRequest* return result APDU.	Transmit an H.323 RELEASE COMPLETE message containing an H.323 *ccbsRequest* or *ccnrRequest* return result APDU if the H.323 call state permits.
1.4	Receipt of a QSIG RELEASE message containing a QSIG *ccbsRequest* or *ccnrRequest* return error APDU.	Transmit an H.323 RELEASE COMPLETE message containing an H.323 *ccbsRequest* or *ccnrRequest* return error APDU if the H.323 call state permits.

8.2 Signalling phase 2 – user B available notification

The procedures of this phase use either the retained call independent signalling connection or a new one if the previous one was released after signalling phase 1.

If user A is busy at this stage, SS-CC will be suspended and resumed when user A becomes free, which will result in monitoring the status of user B again, and signalling phase 2 will eventually be re-entered. However, in scenario A2 there is a slight danger of incompatible protocol states at entities A and B caused by one specific combination of options where QSIG and H.323 deviate. The procedures below specify a method to resolve this conflict with a high probability of success.

If user A is not busy the service will proceed from signalling phase 2 to signalling phase 3 (or signalling phase 4 in case of failure).

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8.2.1 Scenario A1

A gateway that supports scenario A1 shall behave in accordance with the rules of table 3, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of a QSIG message from entity A, or receipt of an H.323 message from entity B.

Table 3 — Message and APDU handling requirements for signalling phase 2, scenario A1

Rule	Condition	Required action
2.1	Receipt of an H.323 SETUP message for a call independent signalling connection, containing an H.323 *ccExecPossible* invoke APDU.	If the call independent signalling connection can be extended into the PISN, transmit a QSIG SETUP message containing a QSIG *ccExecPossible* invoke APDU.
2.2	Receipt of an H.323 FACILITY message containing an H.323 *ccExecPossible* invoke APDU.	Transmit a QSIG FACILITY message containing a QSIG *ccExecPossible* invoke APDU if the QSIG call state permits.
2.3	Receipt of a QSIG FACILITY message containing a QSIG *ccSuspend* invoke APDU.	Transmit an H.323 FACILITY message containing an H.323 *ccSuspend* invoke APDU if the H.323 call state permits.
2.4	Receipt of a QSIG RELEASE message containing a QSIG *ccSuspend* invoke APDU. (Note)	Transmit an H.323 RELEASE COMPLETE message containing an H.323 *ccSuspend* invoke APDU if the H.323 call state permits.
2.5	Receipt of a QSIG CONNECT message containing a QSIG *ccSuspend* invoke APDU.	If an H.323 CONNECT message is to be transmitted, include in the H.323 CONNECT message an H.323 *ccSuspend* invoke APDU.
2.6	Receipt of a QSIG FACILITY message containing a QSIG *ccResume* invoke APDU.	Transmit an H.323 FACILITY message containing an H.323 *ccResume* invoke APDU if the H.323 call state permits.
NOTE - This should not occur as it is a path reservation specific procedure, but causes no harm on the H.323 side.		

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8.2.2 Scenario A2

A gateway that supports scenario A2 shall behave in accordance with the rules of table 4, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of an H.323 message from entity A, or receipt of a QSIG message from entity B.

Table 4 — Message and APDU handling requirements for signalling phase 2, scenario A2

Rule	Condition	Required action
2.1	Receipt of a QSIG SETUP message for a call independent signalling connection, containing a QSIG *ccExecPossible* invoke APDU.	If the call independent signalling connection can be extended into the IP network, transmit an H.323 SETUP message containing an H.323 *ccExecPossible* invoke APDU.
2.2	Receipt of a QSIG FACILITY message containing a QSIG *ccExecPossible* invoke APDU.	Transmit an H.323 FACILITY message containing an H.323 *ccExecPossible* invoke APDU if the H.323 call state permits.
2.3	Receipt of an H.323 FACILITY message containing an H.323 *ccSuspend* invoke APDU.	Transmit a QSIG FACILITY message containing a QSIG *ccSuspend* invoke APDU if the QSIG call state permits.
2.4	Receipt of an H.323 RELEASE COMPLETE message containing an H.323 *ccSuspend* invoke APDU.	Transmit a QSIG RELEASE message without a QSIG *ccSuspend* invoke APDU if the QSIG call state permits. (Note 1)
2.5	Receipt of an H.323 CONNECT message containing an H.323 *ccSuspend* invoke APDU.	If a QSIG CONNECT message is to be transmitted, include in the QSIG CONNECT message a QSIG *ccSuspend* invoke APDU.
2.6	Receipt of an H.323 FACILITY message containing an H.323 *ccResume* invoke APDU.	Transmit a QSIG FACILITY message containing a QSIG *ccResume* invoke APDU if the QSIG call state permits.
2.7	Receipt of an H.323 SETUP message for a call independent signalling connection containing an H.323 *ccResume* invoke APDU.	Return a *ccExecPossible* invoke APDU (omitting the argument or including it in the short form) in an H.323 FACILITY message, followed by an H.323 RELEASE COMPLETE message. (Note 2)

NOTE 1 - Sending of a *ccSuspend* invoke APDU in a RELEASE message would be possible in QSIG, but then the following CC call is expected to use path reservation. The suppression of *ccSuspend* at the gateway in this case avoids inconsistent protocol states at entities A and B at the expense of a possible (implementation specific) timeout in entity B.

NOTE 2 - The *ccResume* cannot be passed on in a SETUP message on the QSIG side. Due to the likely protocol state at entity B, inviting entity A to initiate signalling phase 3 offers the best chance of successfully completing the service. In this case the gateway is responsible for clearing the signalling connection on the H.323 side and suppressing a *ccSuspend* invoke APDU which may be received (in a FACILITY message) in response to *ccExecPossible*.

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8.3 Signalling phase 3 – CC call establishment

The procedures of this signalling phase are call related.. Because H.450.9 does not specify a path reservation method, the actions specified below result in the rejection of a QSIG path reservation request.

8.3.1 Scenario A1

A gateway that supports scenario A1 shall behave in accordance with the rules of table 5, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of a QSIG message from entity A, or receipt of an H.323 message from entity B.

Table 5 — Message and APDU handling requirements for signalling phase 3, scenario A1

Rule	Condition	Required action
3.1	Receipt of a QSIG SETUP message containing a QSIG *ccRingout* invoke APDU.	If an H.323 SETUP message is to be transmitted, include in the H.323 SETUP message an H.323 *ccRingout* invoke APDU.
3.2	Receipt of an H.323 RELEASE COMPLETE message containing an H.323 *ccRingout* return error APDU.	Transmit a QSIG DISCONNECT message containing a QSIG *ccRingout* return error APDU if the QSIG call state permits.
3.3	Receipt of a QSIG SETUP message containing a QSIG *ccPathReserve* invoke APDU.	No mapping, return a QSIG DISCONNECT message including a *ccPathReserve* return error APDU with value 'failedDueToInterworking'.

8.3.2 Scenario A2

A gateway that supports scenario A2 shall behave in accordance with the rules of table 6, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of an H.323 message from entity A, or receipt of a QSIG message from entity B.

Table 6 — Message and APDU handling requirements for signalling phase 3, scenario A2

Rule	Condition	Required action
3.1	Receipt of an H.323 SETUP message containing an H.323 *ccRingout* invoke APDU.	If a QSIG SETUP message is to be transmitted, include in the QSIG SETUP message a QSIG *ccRingout* invoke APDU.
3.2	Receipt of a QSIG DISCONNECT message containing a QSIG *ccRingout* return error APDU.	Transmit an H.323 RELEASE COMPLETE message containing an H.323 *ccRingout* return error APDU if the H.323 call state permits.

8.4 Signalling phase 4 – cancellation of SS-CC

This phase covers the unsuccessful termination of an SS-CC instance either through an explicit request for cancellation or through exception handling (e.g. timeout). It does not occur if an instance of SS-CC terminates successfully. The cancellation procedures apply anytime after signalling phase 1 is completed. They use call independent signalling.

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8.4.1 Scenario A1

A gateway that supports scenario A1 shall behave in accordance with the rules of table 7, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of a QSIG message from entity A, or receipt of an H.323 message from entity B.

Table 7 — Message and APDU handling requirements for cancellation, scenario A1

Rule	Condition	Required action
4.1	Receipt of a QSIG SETUP message for a call independent signalling connection, containing a QSIG *ccCancel* invoke APDU.	If the call independent signalling connection can be extended into the IP network, transmit an H.323 SETUP message containing an H.323 *ccCancel* invoke APDU.
4.2	Receipt of a QSIG RELEASE message containing a QSIG *ccCancel* invoke APDU.	Transmit an H.323 RELEAE COMPLETE message containing an H.323 *ccCancel* invoke APDU if the H.323 call state permits.
4.3	Receipt of an H.323 SETUP message for a call independent signalling connection, containing an H.323 *ccCancel* invoke APDU.	If the call independent signalling connection can be extended into the PISN, transmit a QSIG SETUP message containing a QSIG *ccCancel* invoke APDU.
4.4	Receipt of an H.323 RELEASE COMPLETE message containing an H.323 *ccCancel* invoke APDU.	Transmit a QSIG RELEASE message containing a QSIG *ccCancel* invoke APDU if the QSIG call state permits.

8.4.2 Scenario A2

A gateway that supports scenario A2 shall behave in accordance with the rules of table 8, by carrying out the required action when a given condition occurs. Each condition applies to the receipt of an H.323 message from entity A, or receipt of a QSIG message from entity B.

Table 8 — Message and APDU handling requirements for cancellation, scenario A2

Rule	Condition	Required action
4.1	Receipt of an H.323 SETUP message for a call independent signalling connection, containing an H.323 *ccCancel* invoke APDU.	If the call independent signalling connection can be extended into the PISN, transmit a QSIG SETUP message containing a QSIG *ccCancel* invoke APDU.
4.2	Receipt of an H.323 RELEASE COMPLETE message containing an H.323 *ccCancel* invoke APDU.	Transmit a QSIG RELEASE message containing a QSIG *ccCancel* invoke APDU if the QSIG call state permits.
4.3	Receipt of a QSIG SETUP message for a call independent signalling connection, containing a QSIG *ccCancel* invoke APDU.	If the call independent signalling connection can be extended into the IP network, transmit an H.323 SETUP message containing an H.323 *ccCancel* invoke APDU.
4.4	Receipt of a QSIG RELEASE message containing a QSIG *ccCancel* invoke APDU.	Transmit an H.323 RELEAE COMPLETE message containing an H.323 *ccCancel* invoke APDU if the H.323 call state permits.

9 Protocol interworking – content of APDUs

This clause contains the requirements for the mapping of elements that are not covered by the general requirements in clause 7. Rules are provided

- for elements that are mandatory in at least one of the protocols (optional elements that cannot be mapped may be discarded if received);
- for elements which require a specific setting due to interworking between QSIG and H.323;
- for elements which have no equivalent in the other protocol.

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9.1 APDU content mapping from QSIG to H.323

9.1.1 ccbsRequest/ccnrRequest invoke APDU mapping

When transmitting an H.323 *ccbsRequest/ccnrRequest* invoke APDU as a result of receiving a QSIG *ccbsRequest/ccnrRequest* invoke APDU, a gateway shall map elements in accordance with table 9.

Table 9 — ccbsRequest/ccnrRequest invoke APDU mapping from QSIG to H.323

element name	QSIG element type "(M)" denotes mandatory element	H.323 element type "(M)" denotes mandatory element	Mapping requirement
service	PSS1InformationElement (M) with embedded BC[,LLC][,HLC] Information transfer capability: speech unrestr. digital information 3.1 kHz audio	BasicService (ENUMERATED) (M) speech unrestrictedDigitalInformation audio3100Hz	Ignore LLC and HLC Map if BC contains coding standard = 'ITU-T', transfer mode = 'circuit mode' and information transfer rate = '64kbit/s', otherwise reject operation Further mapping rules are outside the scope of this International Standard
can-retain-service	BOOLEAN	BOOLEAN (M)	Set to 'FALSE' if not present

9.1.2 ccbsRequest/ccnrRequest return result APDU mapping

When transmitting an H.323 *ccbsRequest/ccnrRequest* return result APDU as a result of receiving a QSIG *ccbsRequest/ccnrRequest* return result APDU, a gateway shall map elements in accordance with table 10.

Table 10 — ccbsRequest/ccnrRequest return result APDU mapping from QSIG to H.323

element name	QSIG element type "(M)" denotes mandatory element	H.323 element type "(M)" denotes mandatory element	Mapping requirement
retain-service	BOOLEAN	BOOLEAN (M)	Set to 'FALSE' if not present

9.1.3 ccCancel/ccExecPossible invoke APDU mapping

When transmitting an H.323 *ccCancel* or *ccExecPossible* invoke APDU with argument *longArg,* as a result of receiving a QSIG *ccCancel* or *ccExecPossible* invoke APDU with argument *fullArg* (in a SETUP message), a gateway shall map element *service* in accordance with table 9 above.

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9.2 APDU content mapping from H.323 to QSIG

9.2.1 ccbsRequest/ccnrRequest invoke APDU mapping

When transmitting a QSIG *ccbsRequest/ccnrRequest* invoke APDU as a result of receiving an H.323 *ccbsRequest/ccnrRequest* invoke APDU, a gateway shall map elements in accordance with table 11.

Table 11 — ccbsRequest/ccnrRequest invoke APDU mapping from H.323 to QSIG

element name	H.323 element type "(M)" denotes mandatory element	QSIG element type "(M)" denotes mandatory element	Mapping requirement
service	BasicService (ENUMERATED) (M) speech unrestrictedDigitalInformation audio3100Hz	PSS1InformationElement (M) with embedded BC[,LLC][,HLC] Information transfer capability: speech unrestr. digital information 3.1 kHz audio Coding standard = 'ITU-T', Transfer mode = 'circuit mode' Information transfer rate = '64kbit/s'	Do not generate LLC and HLC Map BC as indicated Further mapping rules are outside the scope of this International Standard

9.2.2 ccbsRequest/ccnrRequest return result APDU mapping

When transmitting a QSIG *ccbsRequest/ccnrRequest* return result APDU as a result of receiving an H.323 *ccbsRequest/ccnrRequest* return result APDU, a gateway shall map elements in accordance with table 12.

Table 12 — ccbsRequest/ccnrRequest return result APDU mapping from H.323 to QSIG

element name	H.323 element type "(M)" denotes mandatory element	QSIG element type "(M)" denotes mandatory element	Mapping requirement
no-path-reservation	–	BOOLEAN	Set to 'TRUE'

9.2.3 ccCancel/ccExecPossible invoke APDU mapping

When transmitting a QSIG *ccCancel* or *ccExecPossible* invoke APDU as a result of receiving an H.323 *ccCancel* or *ccExecPossible* invoke APDU with argument *longArg* (in a SETUP message), a gateway shall map elements in accordance with table 13.

Table 13 — ccCancel / ccExecPossible invoke APDU mapping from H.323 to QSIG

H.323 element name / type "(M)" denotes mandatory element	QSIG element name / type "(M)" denotes mandatory element	Mapping requirement
longArg (SEQUENCE): numberA numberB ccIdentifier service	fullArg (SEQUENCE): numberA (M) numberB (M) – service (M)	Discard APDU if one or more of the elements numberA, numberB, service are missing (further actions implementation dependent) map *service* as indicated in table 11 above

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Annex A

(normative)

Implementation Conformance Statement (ICS) proforma

A.1 Introduction

A.1.1 Purpose of an ICS proforma

The supplier of an implementation which is claimed to conform to this International Standard shall complete the following Implementation Conformance Statement (ICS) proforma.

A completed ICS proforma is the ICS for the implementation in question. The ICS is a statement of which capabilities and options have been implemented for a given specification.

The ICS can have a number of uses, including use:

- by the implementor, as a check list for implementations to reduce the risk of unintended non-conformance, e.g. through oversight;
- by the supplier and acquirer, or potential acquirer, of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the Standard's ICS proforma;
- by the user or potential user of the implementation, as a basis for initially checking the possibility of interworking with another implementation - while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible ICS;
- by a tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Instructions for completing the ICS proforma

A.2.1 General structure of the ICS proforma

The ICS proforma is a fixed format questionnaire divided into sub-clauses each containing a group of individual items. Each item is identified by an item reference, the description of the item (question to be answered), and the reference(s) to the clause(s) that specifies (specify) the item in the main body of this International Standard.

The "Conditions for Status" column contains a specification, if appropriate, of the predicate upon which a conditional status is based. The indication of an item reference in this column indicates a simple-predicate condition (support of this item is dependent on the support marked for the referenced item).

The “Status” column indicates whether an item is applicable and if so whether support is mandatory or optional. The following terms are used:

I	irrelevant or out-of-scope - this capability is outside the scope of the standard to which this ICS proforma applies and is not subject to conformance testing in this context;
M	mandatory (the capability is required for conformance to the standard);
N/A	not applicable - in the given context, it is impossible to use the capability; no answer in the support column is required;
O	optional (the capability is not required for conformance to the standard, but if the capability is implemented it is required to conform to the specification in this International Standard);

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O.<n> qualified optional - in this case, <n> is an integer that identifies a unique group of related optional items; if no additional qualification is indicated, the support of at least one of the optional items is required for conformance to this International Standard; otherwise, the qualification and logic of the selection among the optional items is defined below the table explicitly;

X excluded or prohibited - there is a requirement not to use this capability in a given context.

Answers to the questionnaire items are to be provided in the "Support" column, by simply marking an answer to indicate a restricted choice (Yes, No or N/A). In specific cases, the indication of explicit values may be requested. Where a support column box is left blank, no answer is required.

If a "prerequisite line" (see A.2.4 below) is used after a subclause heading or table title, and its predicate is false, no answer is required for the whole subclause or table, respectively.

A.2.2 Additional Information

Items of Additional Information allow a supplier to provide further information intended to assist the interpretation of the ICS. It is not intended or expected that a large quantity will be supplied, and an ICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations.

References to items of Additional Information may be entered next to any answer in the questionnaire, and may be included in items of Exception Information.

A.2.3 Exception Information

It may occasionally happen that a supplier will wish to answer an item with mandatory or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No pre-printed answer will be found in the Support column for this. Instead, the supplier is required to write into the support column an x.<i> reference to an item of Exception Information, and to provide the appropriate rationale in the Exception item itself.

An implementation for which an Exception item is required in this way does not conform to this International Standard. A possible reason for the situation described above is that a defect in the standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

A.2.4 Further indications of the ICS proforma tables

In addition to the columns of a table, the following information may be indicated:

"Prerequisite line"

A prerequisite line after a subclause heading or table title indicates that the whole subclause or the whole table is not required to be completed if the predicate is false.

"Qualification"

At the end of a table, a detailed qualification for a group of optional items may be indicated, as specified in the description of the status "qualified optional" in subclause in A.2.1.

"Comments"

This box at the end of a table allows a supplier to enter any comments to that table. Comments may also be provided separately (without using this box).

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A.3 Identification of the Implementation

A.3.1 Implementation Identification

Supplier (Note 1)	
Contact point for queries about the ICS (Note 1)	
Implementation Name(s) and Version(s) (Note 1, Note 2)	
Other information necessary for full identification - e.g., name(s) and version(s) for machines and/or operating systems; System name(s)	

NOTE 1 - Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

NOTE 2 - The terms Name and Version should be interpreted appropriately to correspond with a suppliers terminology (e.g. Type, Series, Model).

A.3.2 Specification for which this ICS applies

Title	Corporate telecommunication networks – Signalling interworking between QSIG and H.323 – Call completion supplementary services
Version	1.0
Corrigenda Implemented (if applicable)	
Addenda Implemented (if applicable)	
Amendments Implemented (if applicable)	
Have any exception items been required ?	No[ ] Yes[ ] (The answer Yes means that the implementation does not conform to this International Standard) (Note)
Date of Statement	
NOTE - In this case, an explanation shall be given of the nature of non-conformance either below or on a separate sheet of paper. Nature of non-conformance (if applicable):	

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A.4 Major capabilities

Table A.1 — Major capabilities

Item	Question: Does the implementation...	Conditions for status	Status	Reference	Support
MC 1	support scenario A1		M	6.1.3	[ ]Yes
MC 2	support scenario A2		M	6.1.3	[ ]Yes
MC 3	support selection of the same gateway for all phases		O	6.1.4	[ ]Yes [ ]No
MC 4	support the connection release method		M	6.2	[ ]Yes
MC 5	support the connection retention method		M	6.2	[ ]Yes
Comments:					

A.5 General requirements

Table A.2 — General requirements for protocol interworking

Item	Question: Does the implementation...	Conditions for status	Status	Reference	Support
GR1	perform protocol interworking in accordance with ISO/IEC 21409		M	7	[ ]Yes
Comments:					

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A.6 Message and APDU handling

A.6.1 Message and APDU handling for scenario A1

Table A.3 — Message and APDU handling for scenario A1

Item	Question: Does the implementation...	Conditions for status	Status	Reference	Support
MA1 1	behave in accordance with rule 1.1 for scenario A1		M	8.1.1	[ ]Yes
MA1 2	behave in accordance with rule 1.2 for scenario A1		M	8.1.1	[ ]Yes
MA1 3	behave in accordance with rule 1.3 for scenario A1		M	8.1.1	[ ]Yes
MA1 4	behave in accordance with rule 1.4 for scenario A1		M	8.1.1	[ ]Yes
MA1 5	behave in accordance with rule 2.1 for scenario A1		M	8.2.1	[ ]Yes
MA1 6	behave in accordance with rule 2.2 for scenario A1		M	8.2.1	[ ]Yes
MA1 7	behave in accordance with rule 2.3 for scenario A1		M	8.2.1	[ ]Yes
MA1 8	behave in accordance with rule 2.4 for scenario A1		M	8.2.1	[ ]Yes
MA1 9	behave in accordance with rule 2.5 for scenario A1		M	8.2.1	[ ]Yes
MA1 10	behave in accordance with rule 2.6 for scenario A1		M	8.2.1	[ ]Yes
MA1 11	behave in accordance with rule 3.1 for scenario A1		M	8.3.1	[ ]Yes
MA1 12	behave in accordance with rule 3.2 for scenario A1		M	8.3.1	[ ]Yes
MA1 13	behave in accordance with rule 3.3 for scenario A1		M	8.3.1	[ ]Yes
MA1 14	behave in accordance with rule 4.1 for scenario A1		M	8.4.1	[ ]Yes
MA1 15	behave in accordance with rule 4.2 for scenario A1		M	8.4.1	[ ]Yes
MA1 16	behave in accordance with rule 4.3 for scenario A1		M	8.4.1	[ ]Yes
MA1 17	behave in accordance with rule 4.4 for scenario A1		M	8.4.1	[ ]Yes
Comments:					

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A.6.2 Message and APDU handling for scenario A2

Table A.4 — Message and APDU handling for scenario A2

Item	Question: Does the implementation...	Conditions for status	Status	Reference	Support
MA2 1	behave in accordance with rule 1.1 for scenario A2		M	8.1.2	[ ]Yes
MA2 2	behave in accordance with rule 1.2 for scenario A2		M	8.1.2	[ ]Yes
MA2 3	behave in accordance with rule 1.3 for scenario A2		M	8.1.2	[ ]Yes
MA2 4	behave in accordance with rule 1.4 for scenario A2		M	8.1.2	[ ]Yes
MA2 5	behave in accordance with rule 2.1 for scenario A2		M	8.2.2	[ ]Yes
MA2 6	behave in accordance with rule 2.2 for scenario A2		M	8.2.2	[ ]Yes
MA2 7	behave in accordance with rule 2.3 for scenario A2		M	8.2.2	[ ]Yes
MA2 8	behave in accordance with rule 2.4 for scenario A2		M	8.2.2	[ ]Yes
MA2 9	behave in accordance with rule 2.5 for scenario A2		M	8.2.2	[ ]Yes
MA2 10	behave in accordance with rule 2.6 for scenario A2		M	8.2.2	[ ]Yes
MA2 11	behave in accordance with rule 2.7 for scenario A2		M	8.2.2	[ ]Yes
MA2 12	behave in accordance with rule 3.1 for scenario A2		M	8.3.2	[ ]Yes
MA2 13	behave in accordance with rule 3.2 for scenario A2		M	8.3.2	[ ]Yes
MA2 14	behave in accordance with rule 4.1 for scenario A2		M	8.4.2	[ ]Yes
MA2 15	behave in accordance with rule 4.2 for scenario A2		M	8.4.2	[ ]Yes
MA2 16	behave in accordance with rule 4.3 for scenario A2		M	8.4.2	[ ]Yes
MA2 17	behave in accordance with rule 4.4 for scenario A2		M	8.4.2	[ ]Yes
Comments:					

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A.7 APDU content mapping

Table A.5 — APDU content mapping

Item	Major capability: Does the implementation...	Conditions for status	Status	Reference	Support
MAP 1	behave in accordance with mapping from QSIG *ccbsRequest/ccnrRequest* invoke APDU to H.323 *ccbsRequest/ccnrRequest* invoke APDU	MA1 1	M	9.1.1	[ ]Yes
MAP 2	behave in accordance with mapping from QSIG *ccbsRequest/ccnrRequest* return result APDU to H.323 *ccbsRequest/ ccnrRequest* return result APDU	MA1 2 OR MA1 3	M	9.1.2	[ ]Yes
MAP 3	behave in accordance with mapping from QSIG *ccCancel/ccExecPossible* invoke APDU to H.323 *ccCancel/ccExecPossible* invoke APDU	MA2 5 OR MA1 14 OR MA2 16	M	9.1.3	[ ]Yes
MAP 4	behave in accordance with mapping from H.323 *ccbsRequest/ccnrRequest* invoke APDU to QSIG *ccbsRequest/ccnrRequest* invoke APDU	MA2 1	M	9.2.1	[ ]Yes
MAP 5	behave in accordance with mapping from H.323 *ccbsRequest/ccnrRequest* return result APDU to QSIG *ccbsRequest/ ccnrRequest* return result APDU	MA2 2 OR MA2 3	M	9.2.2	[ ]Yes
MAP 6	behave in accordance with mapping from H.323 *ccCancel/ccExecPossible* invoke APDU to QSIG *ccCancel/ccExecPossible* invoke APDU	MA1 5 OR MA1 16 OR MA2 14	M	9.2.3	[ ]Yes
Comments:					

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Annex B

(informative)

Message flow examples

This annex contains some examples of typical message sequences for the scenarios identified in this International Standard. Although the examples shown are typical, other valid message sequences are possible.

In the figures, the arrows indicate the direction of messages. For each message, only the message name and the contained APDU (if applicable) are shown. Other message contents are not shown.

The following abbreviations are used:

.inv invoke APDU

.res return result APDU

B.1 Scenario A1

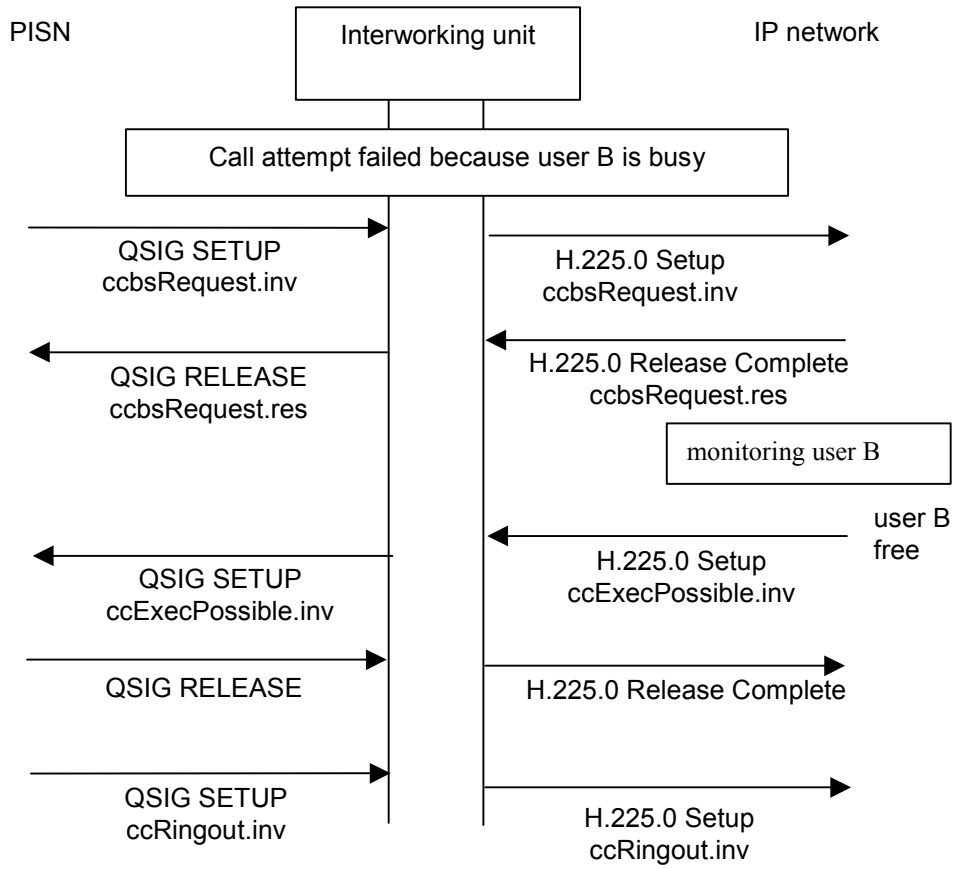

Figure B.1 — Example of scenario A1: successful call completion on busy, connection release option

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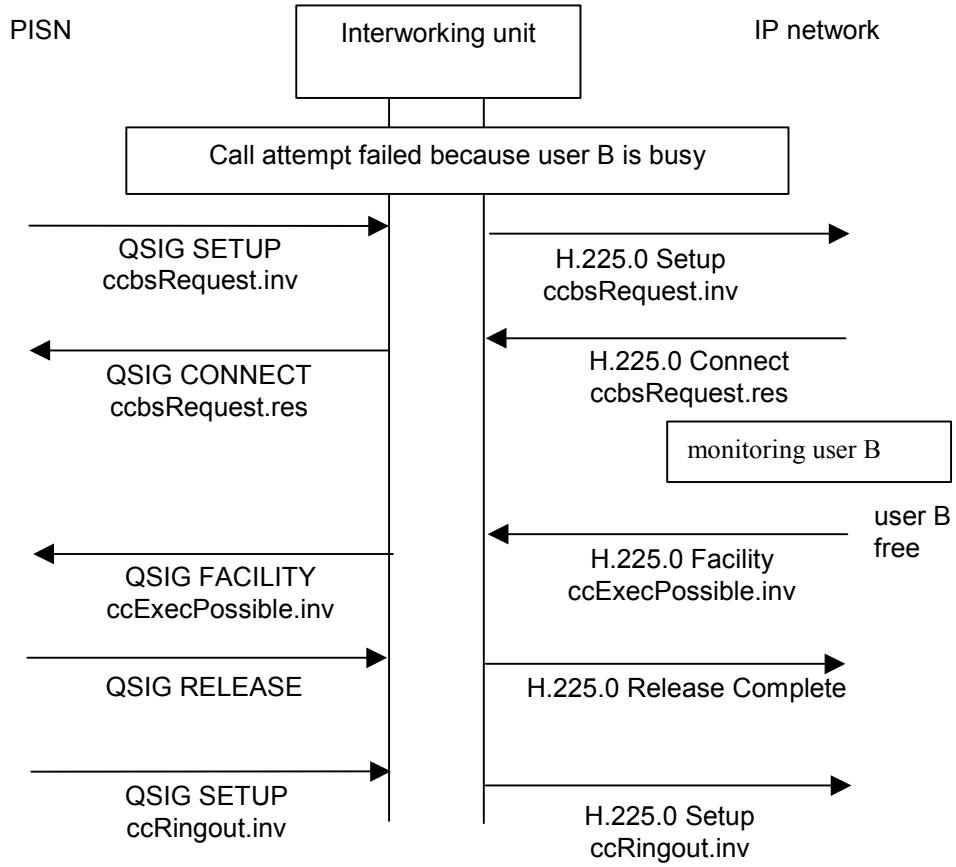

Figure B.2 — Example of scenario A1: successful call completion on busy, connection retention option

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B.2 Scenario A2

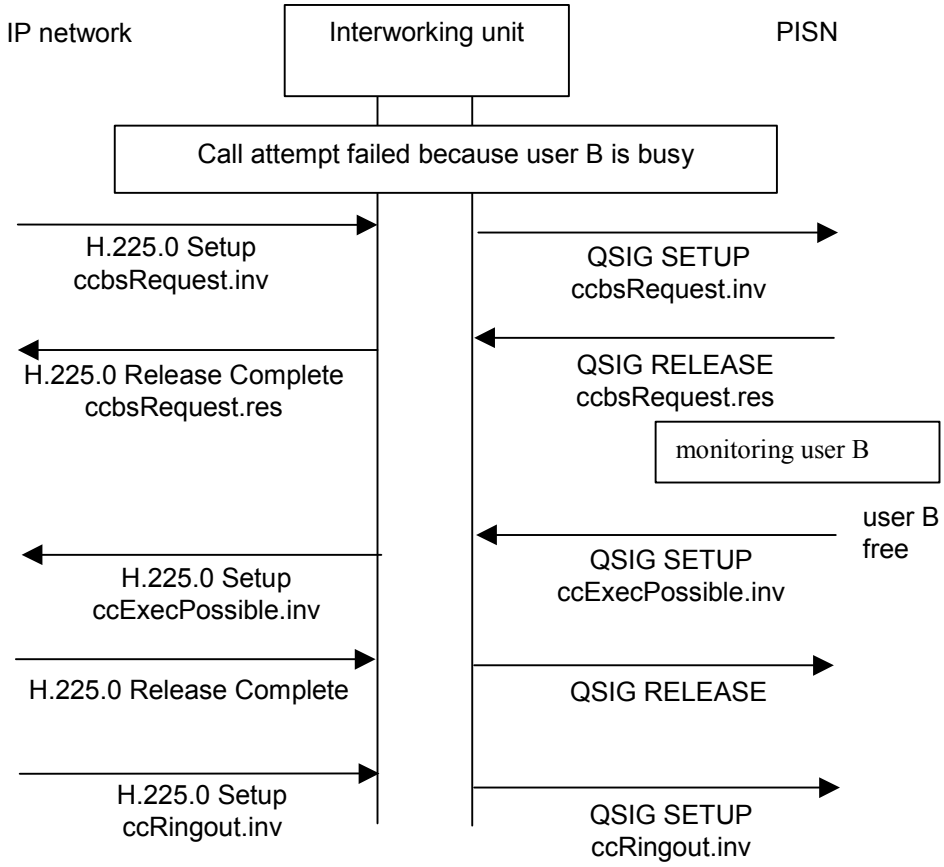

Figure B.3 — Example of scenario A2: successful call completion on busy, connection release option

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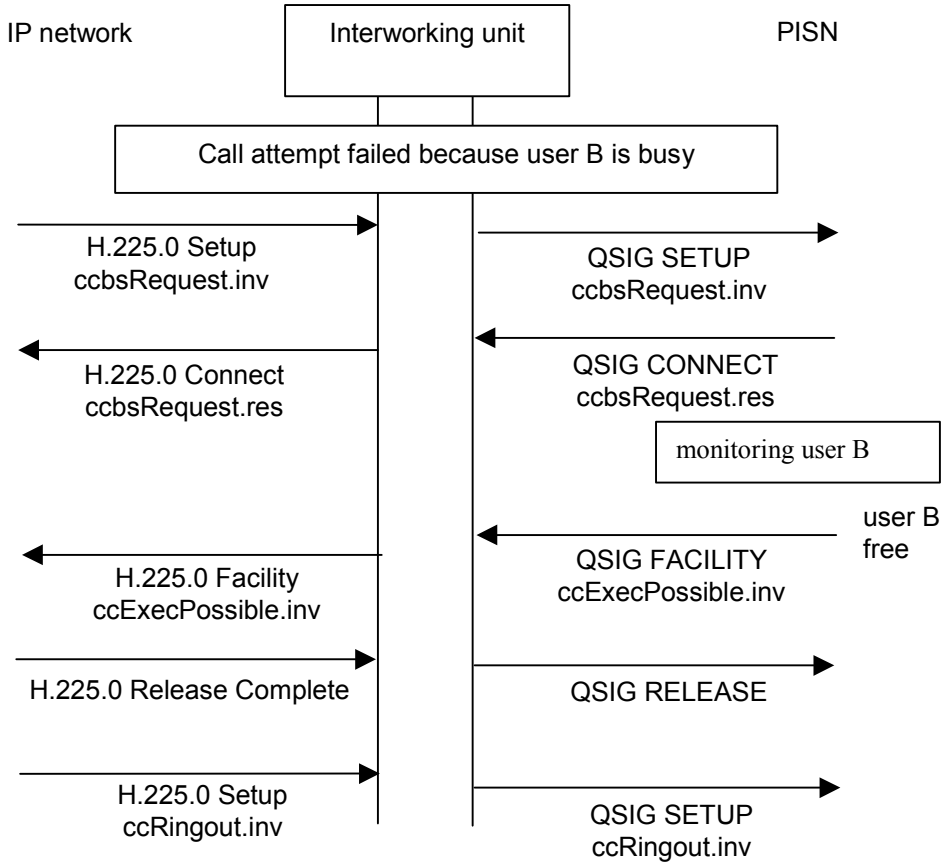

Figure B.4 — Example of scenario A2: successful call completion on busy, connection retention option

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