INTERWORKING OF ISDN ACCESS AND NETWORK SIGNALLING   Q.699

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1. GENERAL

1.1 Introduction

This document defines the interworking relationship between the D channel layer 3 functions and protocol employed across an ISDN user-network interface and the ISDN User Part functions and protocol of Signalling System No. 7.

The interworking between the above two signalling protocols typically may occur in an ISDN local exchange and is specified in the context of a typical call in a pure ISDN or mixed ISDN/non-ISDN environment.

1.2 Purpose

The purpose of the document is:

a) to define how the ISDN User-Network Interface protocol and SS No. 7 ISDN User Part protocols should be used in combination with call control functions, to support the basic bearer service;

b) to provide a logical bridge between the abstract signalling information flows, which are used in the description of ISDN services, and the corresponding messages and elements of procedure of the ISDN access and network signalling systems.

1.3 Scope.

This document is aimed at defining the interworking relationship between the call control protocol of the ISDN User-Network Interface Protocol and the ISDN User Part of Signalling System No. 7.

The document defines in detail the relationship between signalling information conveyed via the User-Network Interface Protocol and similar signalling information conveyed via the ISDN User Part of Signalling System No. 7. The above relationship is described within the context of supporting the provision of basic bearer service for a call within an ISDN or mixed ISDN/non-ISDN environment.

Note: Although sufficient information is included in the standard to allow implementation of the interworking functionality, not all possible combinations of interworking scenarios are documented explicitly.

2. METHODOLOGY

2.1 General

This chapter describes the methodology used to model and define interworking between the ISDN User Part and the User-Network Interface Protocol. The methodology is based on the layer service concepts prescribed by the Reference Model of Open System Interconnection (OSI) for CCITT Applications (Recommendation X.200) and uses the terms and conventions defined in Recommendation X.210 (OSI Layer Service Definition Conventions).

The methodology used is for description purposes only. It does not imply that this type of layering is essential in a real implementation.

The interworking model is described in section 2.2. Subsequent sections identify and review the diagrams and tables utilized in describing the model, its functions and the signalling information transfers between the call control functional entities.

2.2 The Interworking Model.

The interworking model encompasses 3 functional entities, including call control, the incoming signalling system and the outgoing signalling system, where incoming or outgoing refers to the direction of call setup. The signalling system entities may represent either the ISDN User Part or the User Network Interface Protocol.

The call control entity acts as an intermediary between the ISDN access and network signalling protocols. It typically invokes local call processing decisions/actions as a result of receiving a primitive from one signalling system (e.g. incoming access). As a result of that processing, it may send a primitive to the same signalling system and/or another signalling system (e.g. outgoing network). Local call processing decision/actions (e.g. routing and through connection) are independent of the type of signalling system used by call control entities to communicate with each other.

CALL CONTROL

indication   response

request   confirmation

Incoming
(Outg.)
Signalling
System

Outgoing
(Inc.)
Signalling
System
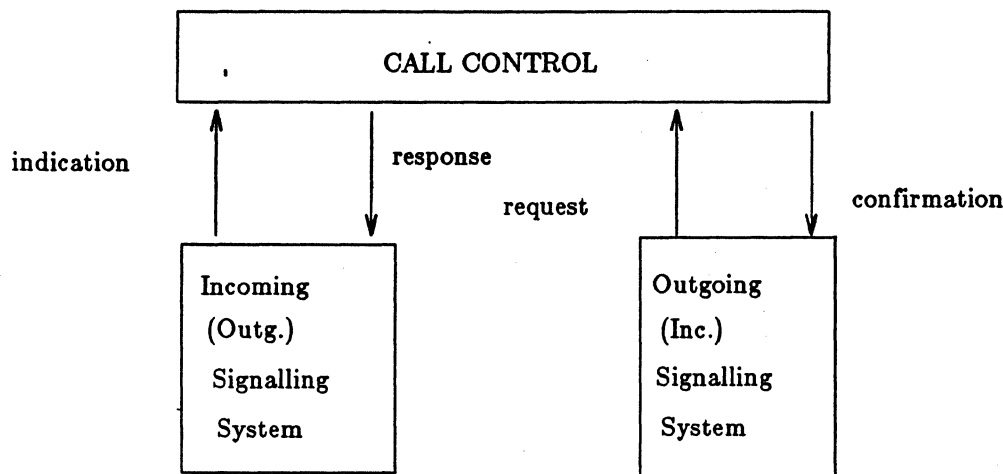
Figure 1
Model for signalling protocol interworking

There are 4 types of primitives:

a) Request: A primitive issued by a call control entity to invoke a signalling procedure and thereby transfer in information to a peer entity.

b) Indication: A primitive issued by the signalling protocol to invoke a call control procedure or indicate that procedure has been invoked by the peer call control entity.

c) Response: A primitive issued by call control (if required), to indicate completion of a procedure previously invoked by an indication

d) Confirm: A primitive issued by the signalling protocol to call control (if required) to indicate completion of a procedure previously invoked by a request from the same call control entity.

The descriptions of the incoming and outgoing signalling system functional entities are not part of this standard but are provided in specifications TR-TSY-000268 for the User-Network Interface Protocol and in Q.761-4 for the ISDN User Part.

2.3 Time Sequence Diagrams.

Time sequence or "Arrow" diagrams are provided to show the permitted temporal relationships between primitives and between primitives and signalling messages, and the time sequence of these relationships during the process of executing a call control procedure. The general format of an arrow diagram is shown in Figure 2.

Due to the multiplicity of optional possibilities in both the ISDN User Part and the ISDN User-Network Interface protocols not all possible cases are shown in the arrow diagrams. The diagrams which are included represent a sample of typical situations.

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```
                        Exchange
       |_____|

    +----------+        +----------+        +----------+
    |   Inc.   |        |          |        |   Out.   |
    |   Sig.   |        |   Call   |        |   Sig.   |
    |  System  |        | Control  |        |  System  |
    +----------+        +----------+        +----------+
         |                   |                   |
   A     |   ___Q_ind__>    (O)   ___Q_req__>    |   B
  --->   |   --------->      |    --------->     |  --->
         |                   |                   |
   D     |  <__Q_resp__     |  <__Q_conf__      |   C
  <---   |  <---------       |  <---------       |  <---
         |                   |                   |
   E     |  <__R_req____     |  <__R_ind___      |   G
  <---   |  <---------       )   <---------      |  <---
         |                   |                   |
   F     |   __R_conf_>      |   __R_resp_>      |   H
  --->   |   --------->      |    --------->     |  --->
```

A,B,C,D,E,F,G,H   - signalling messages
Q,R   - primitives
req.   - request primitive
ind.   - indication primitive
resp   - response primitive
conf.   - confirm primitive
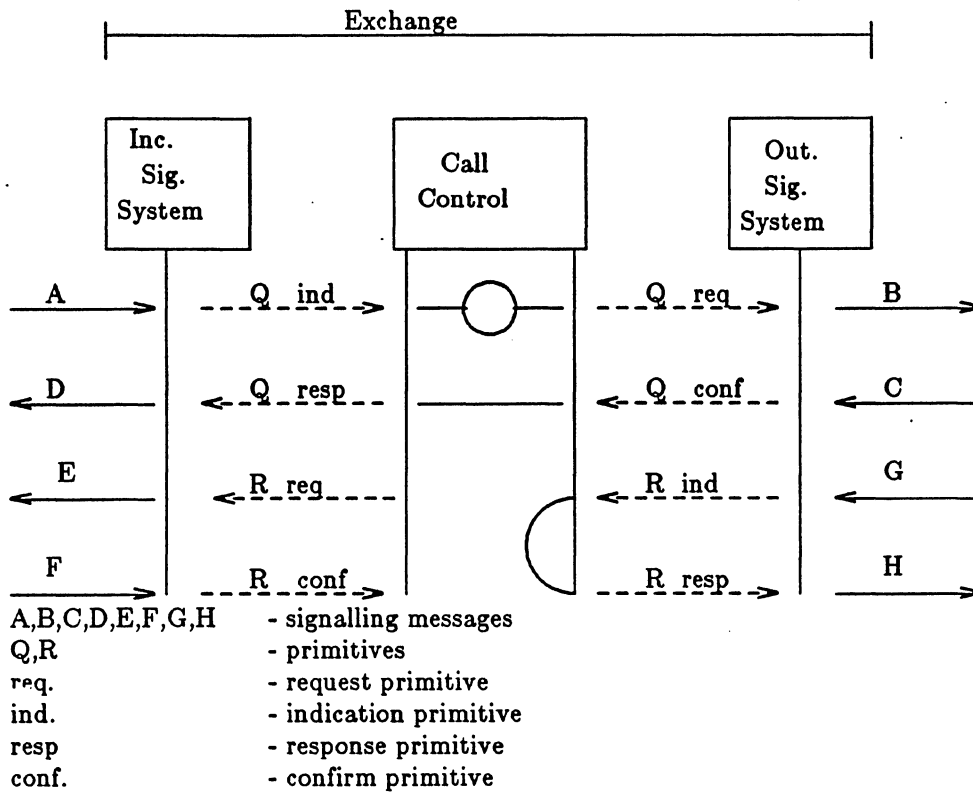
Figure 2
Example of a Time Sequence or Arrow diagram

Sequences of interactions are shown along vertical lines which represent increasing time in the downward direction.

Broken line arrows represent individual primitives and indicate their direction of propagation, i.e. to or from call control.

Solid line arrows represent signalling messages and indicate their direction of propagation, i.e. to or from the incoming or outgoing signalling system.

Wavy line arrows, if present, represent tones or announcements sent inband.

For call control the following symbols are used between vertical lines to indicate the relationship between the incoming and outgoing primitives (e.g. between B indication and B response) and possibly a call control action taken, where it is necessary to indicate clearly a particular function that is invoked by a received primitive.

Solid Line: The incoming and outgoing primitives are unconditionally related, i.e. the incoming primitive always triggers the sending of the outgoing primitive independent of the service context in which the incoming primitive is received.

Broken Line: The incoming and outgoing primitives are related only in the service context considered. In a different service context this relationship may not exist.

Wavy Line: The reception of the incoming primitive and the transmission of the outgoing primitive are unrelated. This is to indicate that although these primitives are shown as adjacent in the arrow diagram, the generation of the outgoing primitive is unrelated to the receipt of the incoming primitive.

○   Tone generation

⊗   Through-connection of the path in the backward direction

⊗   Through-connection of the path in the forward direction

⊗   Through-connection of the path in both directions

⊗   Disconnection of path through the exchange

○   Reservation of an incoming and outgoing signalling system

☒   Dissocation of incoming and outgoing signalling system

Where it is necessary to indicate the signalling system function performed on transmission or reception of a signalling message, the following symbols are shown below the concerned message:

X   Release of the channel

[____]   Release of the call reference (ISUP or Q.931 call reference)

A   Disconnection of channel from the user terminal

2.4 Mapping tables.

Mapping tables are provided to define the relationship between User-Network Interface Protocol messages and information elements on the one hand and ISDN User Part messages and parameters on the other hand.

One table is provided for each User-Network Interface Protocol message that maps onto an ISDN User Part message. The same table also specifies the mapping of elements of information which are carried by the concerned messages.

Elements of information that are of local significance only, i.e are not mapped onto elements of information in the other signalling system, are not shown.

3. Interworking Specification for Successful Call Set-up Procedures

3.1 Arrow Diagrams

This section contains the interworking arrow diagrams for successful call set-up procedures.

3.1.1 Enbloc, No Automatic-Answering Terminal. Figure 3.1 shows the sequence of messages for successful call where enbloc address signalling is used, the ADDRESS COMPLETE Message (ACM) is delayed until receipt of an alerting indication from the access, and the called party is not an automatic answering terminal.

3.1.2 Enbloc, Automatic-Answering Terminal. Figure 3.2 shows successful call with enbloc address signalling, and the address complete indication delayed until receipt of connect indication from an automatic answering terminal. In this case the address complete indication and connect indication

are combined in the ANSWER message (ANM) in the network.

3.1.3 Overlap Addressing, Originating Access. Figure 3.3 shows the sequence of messages when overlap addressing is used between the calling party and the originating local exchange, and enbloc addressing is used within the network. A non-automatic answering terminal is assumed in this case. Variations are possible as in Figure 3.2.

3.1.4 ISDN to Analog Subscriber. Figure 3.4 shows the sequence of messages for a call from an ISDN subscriber to an analog subscriber. The arrows between the local exchange and non-ISDN user indicate in-band signals that may vary with the access protocol.

3.1.5 Analog Subscriber to ISDN. Figure 3.5 shows the sequence of messages for a call from an analog subscriber to an ISDN subscriber. Again the arrows between non-ISDN user and local exchange indicate in-band signals that may vary with the access protocol. Procedures for ACM and ANM may vary as in Figure 3.2.

3.1.6 ISDN-PSTN Interworking. Figure 3.6 shows the interworking between ISDN and PSTN, in the case where the PSTN does not provide out-of-band address complete indication.

3.1.7 PSTN-ISDN Interworking. Figure 3.7 shows interworking in a call originating in the PSTN, where the PSTN does not provide out-of-band address complete indications.

3.1.8 Progress Message. Figure 3.8 shows the case where a PROGress message is used in the user-network interface protocol, e.g. to indicate interworking beyond the public network. In order to support the return of tones and announcements from the called user, the terminating exchange may provide through-connection in the backward direction on receipt of the PROGRESS message, as a service.

3.1.9 Call Delay. Figure 3.9 shows the case where the call is delayed at the terminating interface, e.g. due to processing by the receiving terminal. In this case, the ACM is returned with an indication of call delay, and subsequent progress indications (e.g. alerting) are conveyed using the Call Progress Message (CPG).

Notes for Figures 3.1 to 3.9

The following note applies to all interworking diagrams in this section:

— If continuity check occurs in the network, the SETUP request primitive in the terminating local exchange is not passed to the called user until continuity is verified.

The remaining notes apply where referenced in particular figures:

Note 1: This message may be sent by the user to achieve symmetrical working or to avoid timer expiry on response to SETUP.

Note 2: This message may be sent by the Q.931 protocol handler to achieve symmetrical working.

Note 3: Called party's status = subscriber free; ISDN Access indicator = ISDN Access.

Note 4: The number of INFORMATION messages and primitives shown is for example only. In practice the number may be zero or more; more detail is contained in TR-TSY-000268.

Note 5: Called party's status = subscriber free; ISDN User Part Indicator = ISUP used all the way; ISDN Access indicator = non-ISDN Access.

Note 6: Progress Indicator = 2 - destination address in non-ISDN.

Note 7: ISDN User Part Indicator = ISUP used all the way; ISDN Access Indicator = non-ISDN Access.

Note 8: Conditional on type of access.

Note 9: Progress Indicator = 3 - originating access in non-ISDN.

Note 10: Completion of transmission path is described in section 2.1.7.1 of Q.764.

Note 11: Called party's status = no indication; ISDN UP indicator = not ISUP-all-the-way.

Note 12: ISDN Access Indicator = non-ISDN; ISDN UP indicator = not ISUP-all-the-way.

Note 13: Called party's status = no indication; ISDN Access Indicator = ISDN Access; Access Transport parameter contains Progress Indicator.

Note 14: Through connection performed upon receipt of PROGRESS only if allowed by special arrangement (e.g. subscription). Otherwise, through connection is upon receipt of CONNECT.

Note 15: Called Party Status = Call delay.

Note 16: Event Information = Alerting.

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3.2 Mapping of Parameters

This section contains the mapping tables of messages and associated parameters and information elements for successful call setup. The following tables are provided:

3.2.1 Mapping of setup procedure parameters for ISDN call

3.2.2 Mapping of alerting indication for ISDN call

3.2.3 Mapping of interworking indication for ISDN-PSTN call

3.2.4 Mapping of answer indication

3.2.5 Mapping of user-generated progress indication

Table 3.2.1. Mapping of setup procedure parameters for ISDN call

	Calling User/Network	Network	Called User/Network
Message	SETUP	IAM	SETUP
Contents	Bearer capability	User service information	Bearer capability
	no mapping	Forward call indicators	no mapping(1)
	Progress indicator	Access transport(2)	Progress indicator
	Calling pty number	Calling pty number	Calling pty number
	Clg pty subaddress	Access transport	Clg pty subaddress
	Called pty number(3)	Called pty number	Called pty number
	Cld pty subaddress	Access transport	Cld pty subaddress
	Transit network sel.	Transit network sel.	no mapping
	Low layer compatib.	Access transport	Low layer compatib.
	High layer compatib.	Access transport	High layer compatib.
	User-user information	User-user information	User-user information

Note 1: In a PSTN-to-ISDN call, there is a mapping to the Progress Indicator information element. See section 3.3.

Note 2: The Access Transport parameter carries information elements transparently from one User/Network Interface to the remote User/Network Interface.

Note 3: The Keypad information element is used in overlap sending to carry called party number digits, rather than the Called Party Number.

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Table 3.2.2. Mapping of alerting indication

	Calling User/Network	Network	Called User/Network
Message	ALERTING	ACM	ALERTING
Contents	alerting (implicit)	Backwd call indicators (subscriber free)	alerting (implicit)
	Progress indicator	Access transport	Progress indicator
	User-user information	User-user information	User-user information

Table 3.2.3. Mapping of interworking indication for ISDN-PSTN call

	Calling User/Network	Network	Called User/Network
Message	PROGRESS	ACM	Not applicable
Contents	Progress indicator	Backward call indicators	

Table 3.2.4. Mapping of answer indication

	Calling User/Network	Network	Called User/Network
Message	CONNECT	ANM	CONNECT
Contents	Progress indicator	Access transport	Progress indicator
	User-user information	User-user information	User-user information

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Table 3.2.5. Mapping of user-generated progress indication

	Calling User/Network	Network	Called User/Network
Message	PROGRESS	ACM	PROGRESS
Contents	Progress (implicit)	Backward call ind (no indication)	Progress (implicit)
	Progress indicator	Access transport	Progress indicator

Table 3.2.6. Mapping of call delay indication

	Calling User/Network	Network	Called User/Network
Message	NOTIFY	ACM	not applicable
Contents	Notification indicator	Backward call ind (called party status)	

Table 3.2.7. Mapping of call progress in call delay case

	Calling User/Network	Network	Called User/Network
Message	ALERTING	CPG	ALERTING
Contents	Alerting (implicit)	Event information (Alerting)	Alerting (implicit)
	Progress indicator	Access transport	Progress indicator
	User-user information	User-user information	User-user information

3.3 Mapping of the Parameter Fields

This section contains the mapping tables of parameter subfields and values for the Progress Indicator of Q.931 and the associated fields in ISUP.

The following notes apply to all mapping tables in this attachment:

— The mapping of the Backward call indicator in the ANSWER Message only applies when this indicator is included in the ANSWER Message.

— For simplicity, these diagrams assume the case where the ACM is not sent out independently, and the called party is not an automatic-answering terminal. Other configurations are possible as shown in the arrow diagrams, but will not affect the parameter mapping rules.

— In these scenarios, if the PROGress message is returned by the called user in place of the ALERTing message, it is mapped to an ACM with called party's status "no indication" rather

- 9 -

than "subscriber free". Other indicator values are unchanged, and the Progress Indicator element
is mapped to the Access Transport parameter (ATP). At the calling access, the ACM with status
"no indication" and information in the ATP is mapped to a PROGress message.

The following scenarios are described:

3.3.1 Scenario 1: Parameter mapping for Q.931-ISUP-Q.931

3.3.2 Scenario 2: Parameter mapping for Q.931-ISUP-PSTN

3.3.3 Scenario 3: Parameter mapping for PSTN-ISUP-Q.931

3.3.4 Scenario 4: Parameter mapping for Q.931-ISUP-Analog User

3.3.5 Scenario 5: Parameter mapping for Analog User-ISUP-Q.931

3.3.6 Scenario 6: Parameter mapping for Q.931-ISUP-Q.931-Analog User

3.3.7 Scenario 7: Parameter mapping for Analog User-Q.931-ISUP-Q.931

Table 3.3.1. Scenario 1: Parameter Fields Mapping for Q.931-ISUP-Q.931

USER <- - - -Q.931- - -> O <- - -ISUP- - -> O <- - -Q.931- - -> USER

	Calling User/Network	Network	Called User/Network
Message	SETUP	IAM	SETUP

Content	no Progress ind.	Forward call ind.
		
		Bit D = 0, no interworking encountered
		    F = 1, ISUP used all the way
		    I = 1, originating access ISDN
			no Progress ind.

Message	ALERTing	ACM	ALERTing

Content	no Progress ind.	Backward call ind.
		
		Bit BC=01, subscriber free
		    I = 0, no interworking
		    K = 1, ISUP used all the way
		    M = 1, terminating access ISDN
			no Progress ind.

Message	CONNect	ANM	CONNect

Content	no Progress ind.	Backward call ind.
		
		Bit I = 0, no interworking encountered
		    K = 1, ISUP used all the way
		    M = 1, terminating access ISDN
			no Progress ind.

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Table 3.3.2. Scenario 2: Parameter Fields Mapping for Q.931-ISUP-PSTN

USER ⬸ - - Q.931 - - ⟩○⟨ - - - ISUP - - ⟩○⟨ - - PSTN - - ⟩○⟨ - - - - - ⟩USER

	Calling User/Network	**Network**	**Called User/Network**
Message	SETUP	IAM	N/A
Content	no Progress ind.	Forward call ind. Bit D = 0, no interworking encountered F = 1, ISUP used all the way I = 1, originating access ISDN	no mapping applied
Message	PROGress	ACM	N/A
Content	Progress ind. progress description = # 1, call is not end-to-end ISDN	Backward call ind. Bit BC=00, no indication I = 1, interworking K = 0, ISUP not used all the way M = 0, terminating access non-ISDN	no mapping applied
Message	CONNect	ANM	N/A
Content	Progress ind. progress description = # 1, call is not end-to-end ISDN	Backward call ind. Bit I = 1, interworking encountered K = 0, ISUP not used all the way M = 0, terminating access non-ISDN	no mapping applied

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Table 3.3.3. Scenario 3: Set-up Parameters Fields Mapping for PSTN-ISUP-Q.931

USER <------->O<------ PSTN ------>O<------ ISUP ------>O<------ Q.931 ------->USER

	Calling User/Network	**Network**	**Called User/Network**
Message	N/A	IAM	SETUP
Content	no mapping applied	Forward call ind. Bit D = 1, interworking encountered F = 0, ISUP not used all the way I = 0, originating access non-ISDN	Progress ind. progress description = # 1, call is not end-to-end ISDN
Message	N/A	ACM	ALERTing
Content	no mapping applied	Backward call ind. Bit BC=01, subscriber free I = 0, no interworking K = 1, ISUP used all the way M = 1, terminating access ISDN	no Progress ind.
Message	N/A	ANM	CONNect
Content	no mapping applied	Backward call ind. Bit I = 0, no interworking K = 1, ISUP used all the way M = 1, terminating access ISDN	no Progress ind.

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Table 3.3.4. Scenario 4: Parameter Fields Mapping for Q.931-ISUP-Analog User

USER ←- - Q.931 - -→ ◯ ←- - ISUP - -→ ◯ ←- - ANALOG - -→ USER

	Calling User/Network	Network	Called User/Network
Message	SETUP	IAM	N/A

Content	no Progress ind.	Forward call ind.
		
		Bit D = 0, no interworking
		  F = 1, ISUP used all the way
		  I = 1, originating access ISDN
			no Progress ind.

Message	ALERTing	ACM	N/A

Content	Progress ind.
	
	progress description
	= # 1, call is not
	address in non-ISDN
		Backward call ind.
		
		Bit BC=01, subscriber free
		  I = 1, interworking
		  K = 1, ISUP used all the way
		  M = 0, terminating access non-ISDN
			no mapping applied

Message	CONNect	ANM	N/A

Content	Progress ind.
	
	progress description
	= # 2, destination
	address in non-ISDN
		Backward call ind.
		
		Bit I = 0, no interworking
		      encountered
		  K = 1, ISUP used all the way
		  M = 0, terminating access non-ISDN
			no mapping applied

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Table 3.3.5. Scenario 5: Set-up Parameters Fields Mapping for Analog User-ISUP-Q.931

USER<-- - - - - -ANALOG- - - - ->◯<- - - - -ISUP- - - ->◯<- - - Q.931- - ->USER

	Calling User/Network	Network	Called User/Network
Message	N/A	IAM	SETUP
Content	no mapping applied	Forward call ind. Bit D = 0, no interworking encountered F = 1, ISUP used all the way I = 0, originating access non-ISDN	Progress ind. progress description = # 3, originating address in non-ISDN
Message	N/A	ACM	ALERTing
Content	no mapping applied	Backward call ind. Bit BC=01, subscriber free I = 0, no interworking K = 1, ISUP used all the way M = 1, terminating access ISDN	no Progress ind.
Message	N/A	ANM	CONNect
Content	no mapping applied	Backward call ind. Bit I = 0, no interworking K = 1, ISUP used all the way M = 1, terminating access ISDN	no Progress ind.

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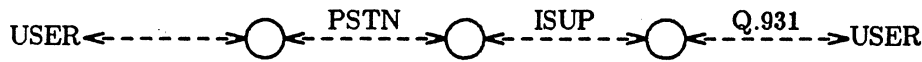**Table 3.3.6.** Scenario 6: Set-up Parameters Fields Mapping for Q.931-ISUP-Q.931-Analog User
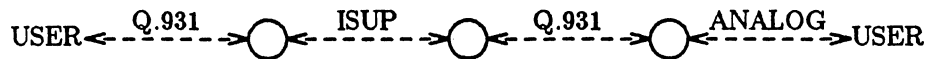
USER ← - - - $\underset{Q.931}{}$ - - → ◯ ← - - - $\underset{ISUP}{}$ - - → ◯ ← - - - $\underset{Q.931}{}$ - - → ◯ ← - - - - - $\underset{ANALOG}{}$ → USER

	Calling User/Network	**Network**	**Called User/Network**
Message	SETUP	IAM	SETUP

Content	no Progress ind.	Forward call ind.
		 Bit D = 0, no interworking
		     F = 1, ISUP used all
		        the way
		     I = 1, originating access ISDN
			no Progress ind.

Message	ALERTing	ACM	ALERTing

Content	Progress ind.
	
	 as received in
	 ATP (note)
		Backward call ind.
		 Bit BC=01, subscriber free
		     I = 0, no interworking
		     K = 1, ISUP used all
		        the way
		     M = 1, terminating access ISDN
		 ATP carries Progress indicator
			Progress ind.
			
			 progress description
			 = # 2, destination
			 address in non-ISDN
			
			 location = private
			 network

Message	CONNect	ANM	CONNect

Content	Progress ind.
	
	 as received in
	 ATP
		Backward call ind.
		 Bit I = 0, no interworking
		        encountered
		     K = 1, ISUP used all
		        the way
		     M = 1, terminating access ISDN
		 ATP carries Progress indicator
			Progress ind.
			
			 progress description
			 = # 2, destination
			 address in non-ISDN
			
			 location = private
			 network

Note: Timing of the indication of interworking to the calling user as
shown is for example only, and may vary.

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Table 3.3.7. Scenario 7: Parameters Fields Mapping for Analog User-Q.931-ISUP-Q.931

USER ←⟍ANALOG⟋O←⟍ Q.931 ⟋→O←⟍ ISUP ⟋→O←⟍ Q.931 ⟋→USER

	Calling User/Network	Network	Called User/Network
Message	SETUP	IAM	SETUP
Content	Progress ind. progress description = # 3, originating address in non-ISDN location = private network	Forward call ind. Bit D = 0, no interworking encountered F = 1, ISUP used all the way I = 1, originating access ISDN Access transport carries Progress ind.	Progress ind. as received from the ATP
Message	ALERTing	ACM	ALERTing
Content	no Progress ind.	Backward call ind. Bit BC=01, subscriber free I = 0, no interworking K = 1, ISUP used all the way M = 1, terminating access ISDN	no Progress ind.
Message	CONNect	ANM	CONNect
Content	no Progress ind.	Backward call ind. Bit I = 0, no interworking K = 1, ISUP used all the way M = 1, terminating access ISDN	no Progress ind.

4. Release Procedures

4.1 Arrow diagrams.

This section contains the arrow diagrams for the interworking of Call Release procedures. ISDN Access release procedures are described in TR-TSY-000268, SS7 Release procedures are described in Sec 2.3, Q.764.

4.1.1 End-to-End ISDN scenario. Figure 4.1 shows the normal call release procedure when ISDN signalling is available from end-to-end of the call.

In the local exchange of the user who initiated the release procedure, the user's ISDN DISCONNECT message is mapped into an ISUP RELEASE message (using the Disconnect Ind and Release Req interworking primitives). This procedure is mirrored in the other local exchange.

4.1.2 PSTN-to-ISDN Interworking Scenario. The following normal release procedures are illustrated for calls which originate in a PSTN and terminate in an ISDN. ISDN signalling is not available from end-to-end of the call.

Case 1:   Clear Backward: Figure 4.2, Case 1 shows the normal call release procedure being intiated at the terminating (ISDN) user by means of the DISCONNECT message. At the PSTN-ISDN interworking exchange, the RELEASE message is mapped into the appropriate backward signal in PSTN.

Case 2:   Clear Forward: Figure 4.2, Case 2 shows the normal call release procedure being initiated at the originated (PSTN) user by means of the Clear Forward signal. At the PSTN-ISDN interworking exchange, the Clear Forward signal is mapped into a RELEASE message to the ISDN exchange, which sends a DISCONNECT message to the ISDN user.

4.1.3 ISDN-to-PSTN Interworking Scenario. The following normal release procedures are illustrated for calls which originate in an ISDN and terminate in a PSTN. ISDN signalling is not available from end-to-end of the call.

Case 1:   Clear Forward: Figure 4.3, Case 1 shows the normal call release procedure being initiated at the originating (ISDN) user by means of the DISCONNECT message. At the ISDN-PSTN interworking exchange, the RELEASE message is mapped into the appropriate forward signal in PSTN.

Case 2:   Clear Backward: Figure 4.3, Case 2 shows the normal call release procedure being initiated at the terminating (PSTN) user by means of a Clear Back signal. At the ISDN-PSTN interworking exchange, the Clear Back signal is mapped into the SUSPEND (network) message with the Suspend/Resume indicator set to network initiated.

The controlling ISDN exchange starts Timer T13. Upon expiry of the timer, if the controlling exchange has not received a RESUME message, the controlling exchange initiates Clearing by sending a DISCONNECT message to the user and sending a RELEASE message to the preceding exchange.

Note for Figures 4.1 to 4.3

Note 1: This message is sent by the Q.931 Signalling System on receipt of the RELEASE message

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4.3 Mapping of Parameters

This section contains the mapping tables of messages and associated parameters and information elements for Normal Call Release. The following Tables are provided:

Table 4.2.1:   Mapping of Release Procedure Parameters: End-to-End ISDN

Table 4.2.2:   Mapping of Release Procedure Parameters: PSTN-to-ISDN Interworking (Case 1: Clear Back)

Table 4.2.3:   Mapping of Release Procedure Parameters: PSTN-to-ISDN Interworking (Case 2: Clear Forward)

Table 4.2.4:   Mapping of Release Procedure Parameters: ISDN-to-PSTN Interworking

Note: If the DISCONNECT message does not include a Cause information element, the network generates the Cause parameter in the ISUP RELEASE message (i.e., Normal Unspecified).

Table 4.2.1 Mapping of Release Procedure Parameters
End-to-End ISDN

	User/Network	Network	User/Network
Message	DISCONNECT	RELEASE	DISCONNECT
Contents	Cause	Cause	Cause

Note 1: This procedure is symmetrical; therefore, either the originating or terminating user may initiate Call Release.

Table 4.2.2 Mapping of Release Procedure Parameters
PSTN-to-ISDN Interworking (Case 1: Called party clears)

	PSTN	Network	Called User/Network
Message	Clear Backward Sig	RELEASE	DISCONNECT
Contents	No Mapping	Cause	Cause

Note: If User-to-User information is contained in the DISCONNECT message, the network will discard it.

Table 4.2.3 Mapping of Release Procedure Parameters
PSTN-to-ISDN Interworking (Case 2: Calling party clears)

	PSTN	Network	Called User/Network
Message	Clear Forward Sig	RELEASE	DISCONNECT
Contents	No Mapping	Cause # 16, Normal Call Clearing	Cause # 16, Normal Call Clearing

Table 4.2.4 Mapping of Release Procedure Parameters
ISDN-to-PSTN Interworking (Calliong party clears)

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	Calling User/Network	Network	PSTN
Message	DISCONNECT	RELEASE	Clear Forward Sig
Contents	Cause	Cause	No Mapping

Note: If User-to-User information is contained in the DISCONNECT message, the network will discard it.

5. Interworking Specification for Unsuccessful Call Set-up Procedures

5.1 Arrow diagrams.

This chapter contains arrow diagrams for unsuccessful call set-up procedures. The conventions applicable to arrow diagrams in this chapter are given in chapter 2.

5.1.1 Unsuccessful Call Set-up - Point to Point Data Link. Figure 5.1 shows the unsuccessful call setup procedure, where inband tones/announcements are not provided (e.g. 64 Kbits/S unrestricted bearer service). The RELEASE COMPLETE message at the destination exchange is mapped into the RELEASE message via the Reject Indication and Release Request primitives. At the originating exchange the RELEASE message is mapped via the RELEASE Ind and DISCONNECT Req primitives into the DISCONNECT message.

5.1.2 Unsuccessful Call Set-up - broadcast data link. Figure 5.2 shows the unsuccessful call setup procedure, where inband tones/announcements are not provided (e.g. 64 Kbits/S unrestricted bearer service), in the case where the called party is addressed via a broadcast data link. The returning of the RELEASE COMPLETE message is optional. In the case shown, the cause value is retained at the destination exchange on receipt of the RELEASE COMPLETE message, and the REJECT Indication primitive is not generated until the expiry of Timer T103 in order to allow for the possibility of another terminal accepting the call.

Note: Where the network does not receive any response to the initial SETUP message before the expiry of Timer T303, the SETUP message is retransmitted and T303 is restarted. If no further response is received by the network on the second expiry of Timer T303, the Reject Indication primitive is generated. The ISUP RELEASE message is then mapped from the REJECT Ind and RELEASE Req primitives. At the originating exchange, the RELEASE message is mapped via the RELEASE Ind and DISCONNECT Req primitives into the DISCONNECT message.

5.1.3 Unsuccessful Call Set-up - Tone/Announcement Applied at Originating Exchange. Figure 5.3 shows the unsuccessful setup procedure where tones or announcments are generated in the originating exchange towards the ISDN user as a result of receiving an RELEASE message. The cause field in the RELEASE message determines the tone or announcement to be applied. This could be, for example, a busy indication, network congestion, number allocated, etc.

The figure shows the case when the originating ISDN user releases prior to the tone/announcement expiring. If the tone/announcement is completed prior to the originating ISDN user releasing, then the Network initiates release using the DISCONNECT message.

5.1.4 Unsuccessful Call Set-up - Tone/Announcements Applied by Terminating Exchange. Figure 5.4 shows an unsuccessful call where certain tones and announcements can only be generated in the terminating exchange (or transit exchange) during call establishment. Alternatively, a specific announcement may be applied at a transit exchange to indicate, for example, that all circuits to a particular destination are busy.

The originating exchange sends a PROGRESS message to the calling user with Progress Indicator #8, thus indicating that inband information is available. Normal release procedures apply after the inband information has been connected.

5.1.5 ISDN-PSTN Interworking - Tone Applied by Terminating Exchange Within the PSTN. Figure 5.5 shows an unsuccessful call where the sending of tones and announcements are generated by the PSTN exchange during the call setup phase. In this case, an Address Complete Message is returned from the interworking point with indicators set as shown in Note 5. This is mapped to a Progress Message at the originating local exchange, with the Progress Indicator set to value 1, to indicate that inband information is expected. The sequence applies to failure occuring at any point within the PSTN.

5.1.6 Premature Release - Point to Point Data Link. Figure 5.6 shows a premature release   *
situation where release is received at the terminating local exchange prior to any terminal response. In   *
this situation a disconnect message is sent to the called user and the normal clearing procedure is   *
initiated.   *

Notes relating to the Section 5 Figures   *

Note 1: This procedure is applicable in those cases where in-band tones/announcements are not   *
         provided, e.g., 64kbit/s unrestricted bearer service.   *

Note 2: This message is delivered by a point to point data link.   *

Note 3: This message is sent by a broadcast data link.   *

Note 4: A customized announcement is provided by this exchange.   *

Note 5: ACM indicators set as follows: *
         ISDN Access Indicator = Non ISDN   *
         Protocol control indicator = Interworking   *
         Called line status indicator = No Indication   *

Note 6: See Q.764 Section 2.1.7.1 for through connect timing.   *

Note 7: In the case of point-to-multipoint, the DISCONNECT message is not sent. Terminals are   *
         released as they respond.   .*

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5.3 Mapping of Parameters

This section contains the mapping tables of messages and associated parameters and elements for Unsuccessful Call Setup Procedures. The following tables are provided:

Table 5.2.1   Mapping of release procedures for unsuccessful call, tone/announcement not provided.

Table 5.2.2   Mapping of release procedure parameters for unsuccessful call, tone/announcement provided at the originating exchange.

Table 5.2.3   This table applies for Figure 5.5 ISDN - PSTN interworking)

Table 5.2.1 Mapping of Release Procedure Parameters for Unsuccessful Call
Tone/Announcement not provided

	Calling User/Network	Network	Called User/Network
Message	DISC	RELEASE	RELEASE COMPLETE
Contents	Cause	Cause	Cause

Table 5.2.2 Mapping of Release Procedure Parameters for Unsuccessful Call
Tone/Announcement Provided at the Originating Exchange

	Calling User/Network	Network	Called User/Network
Message	PROGRESS	RELEASE	RELEASE COMPLETE
Contents	Cause	Cause	Cause

Note 1:   User-to-User information is contained in the DISCONNECT message, the network will discard it.

Table 5.2.3 Mapping of Release Procedure Parameters for Unsuccessful Call,
Tone/Announcement Applied by Terminating Exchange within the PSTN

	Calling User/Network	Network
Message	PROGRESS	ACM
Contents	Cause Progress indicator	inband information indicator

User	Local Exchange			Transit Exchange			Local Exchange			User
O/G SS Q.931	I/C SS Q.931	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS Q.931	I/C SS Q.931

Setup Req → SETUP → Setup Ind ⊗ Setup Req → IAM → Setup Ind ⊗ Setup Req → IAM → Setup Ind ○ Setup Req → SETUP → Setup Ind →

Proc Ind ← CALL PROC ← Proc Req

Proc Ind ← CALL PROC (note 1) ← Proc Req

Alert Ind ← ALERT ← Alert Req ← Alert Ind ← ACM (note 3) ← Alert Req ← Alert Ind ← ACM (note 3) ← Alert Req ← Alert Ind ← ALERT ← Alert Req

Setup Conf ← CONN ← Setup Resp ⊗ Setup Conf ← ANM ← Setup Resp ← Setup Conf ← ANM ← Setup Resp ⊗ Setup Conf ← CONN ← Setup Resp

CONN ACK → (note 2)

Setup Comp Req → CONN ACK → Setup Comp Ind →

Figure 3.1/Q.699. En Bloc addressing, no automatic answering terminal

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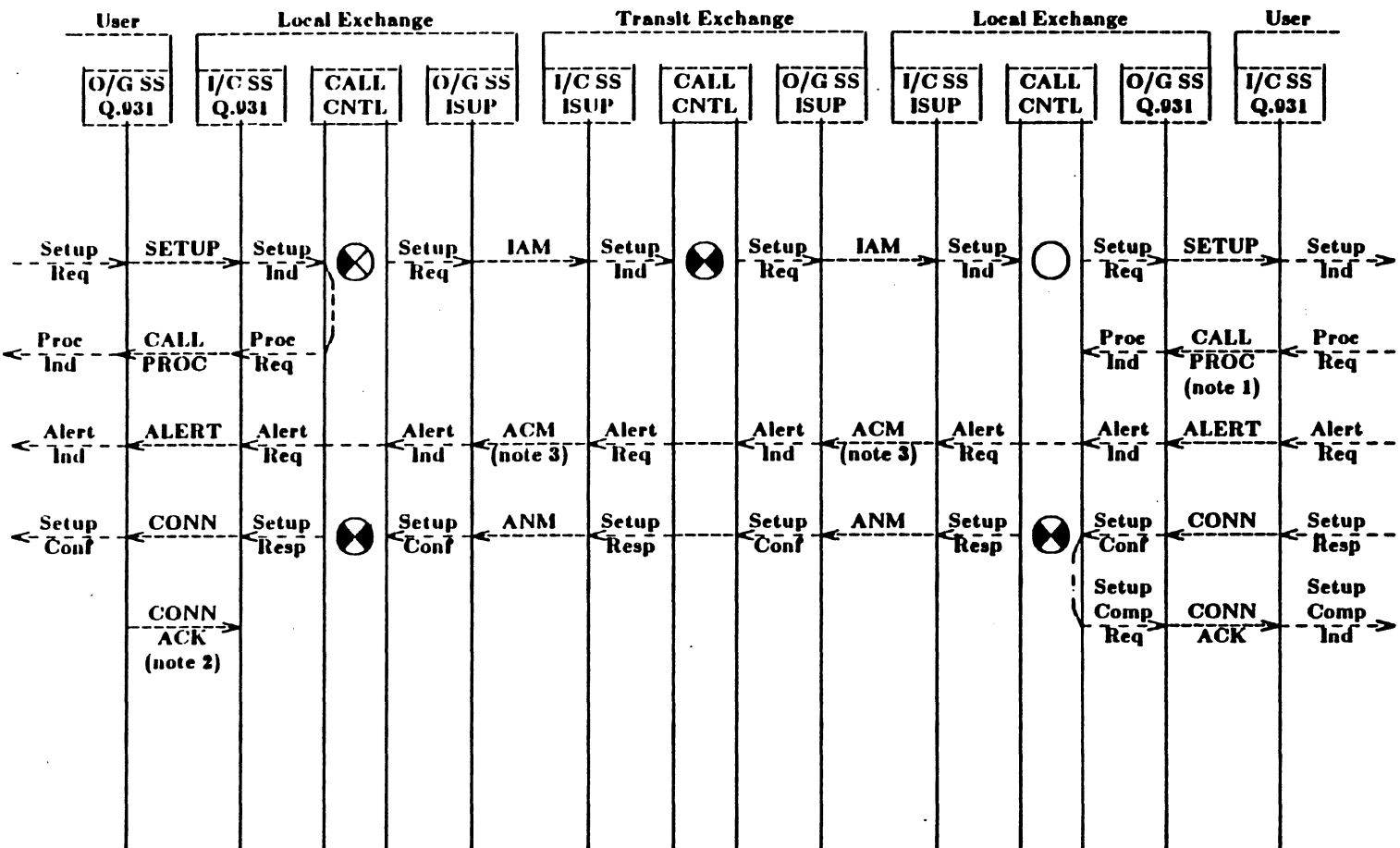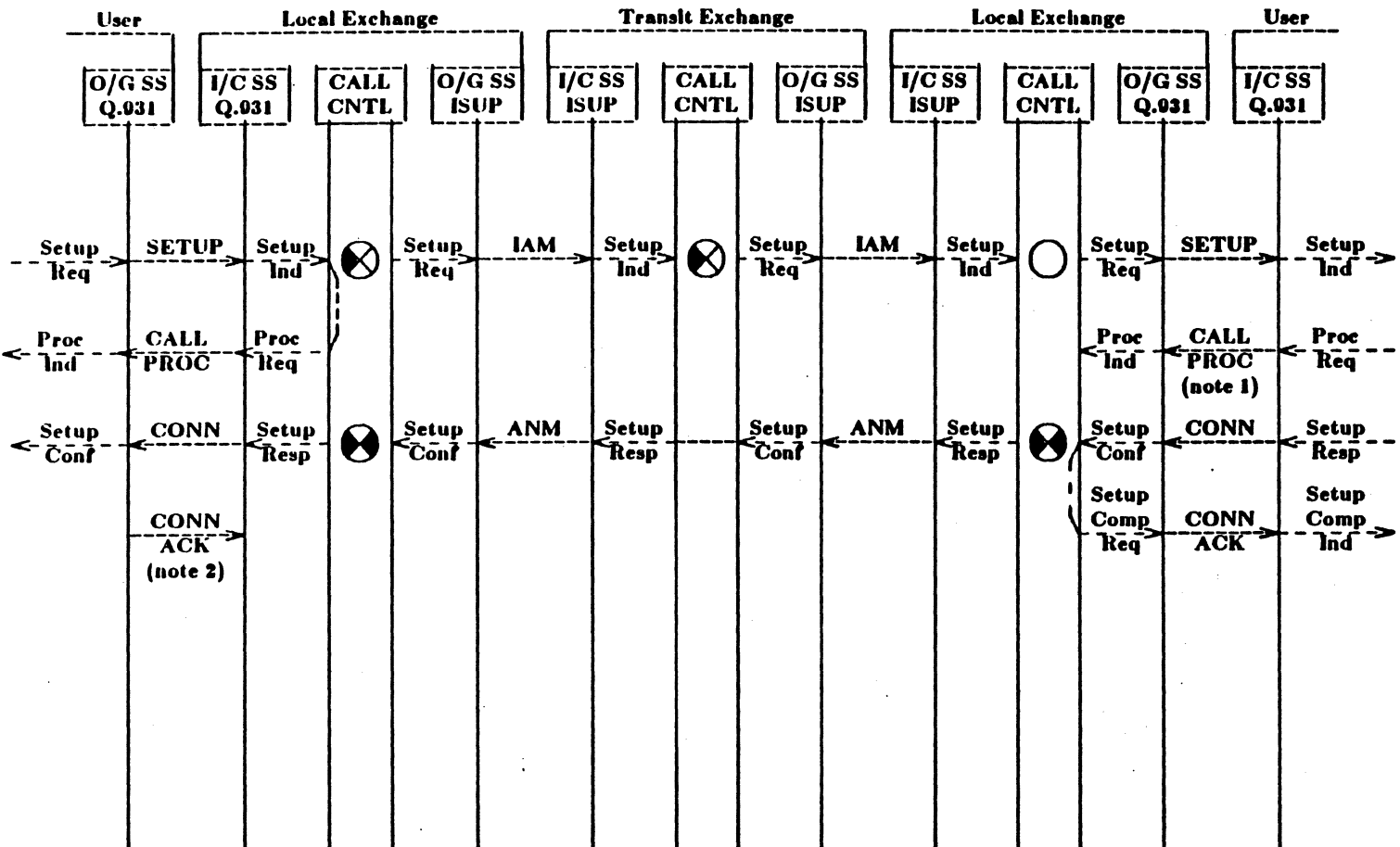| User	Local Exchange			Transit Exchange			Local Exchange			User
O/G SS Q.031	I/C SS Q.031	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS Q.031	I/C SS Q.031

Figure 3.2/Q.699. En Bloc addressing, automatic answering terminal
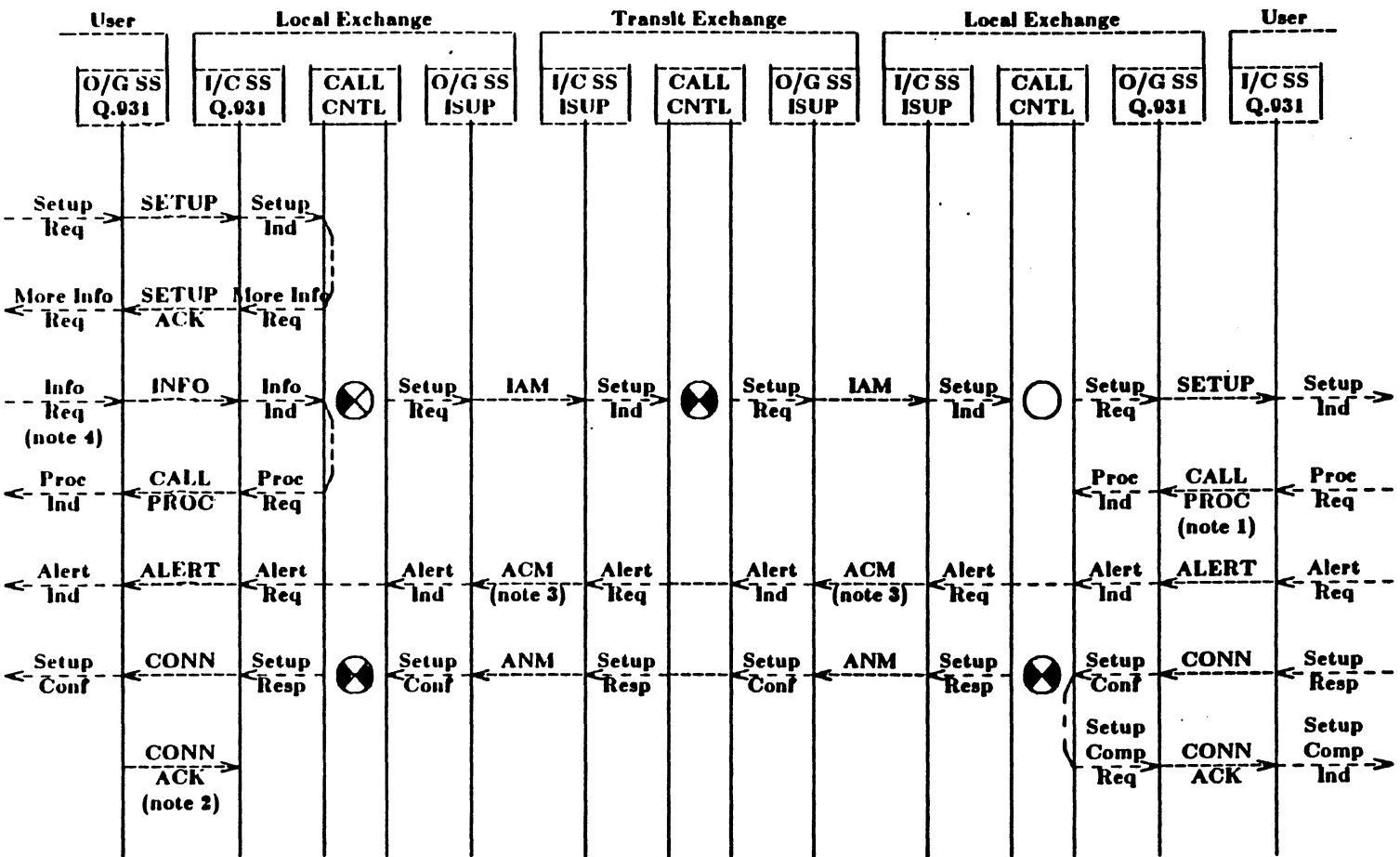
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Figure 3.3/Q.699. Overlap addressing, orig. access only

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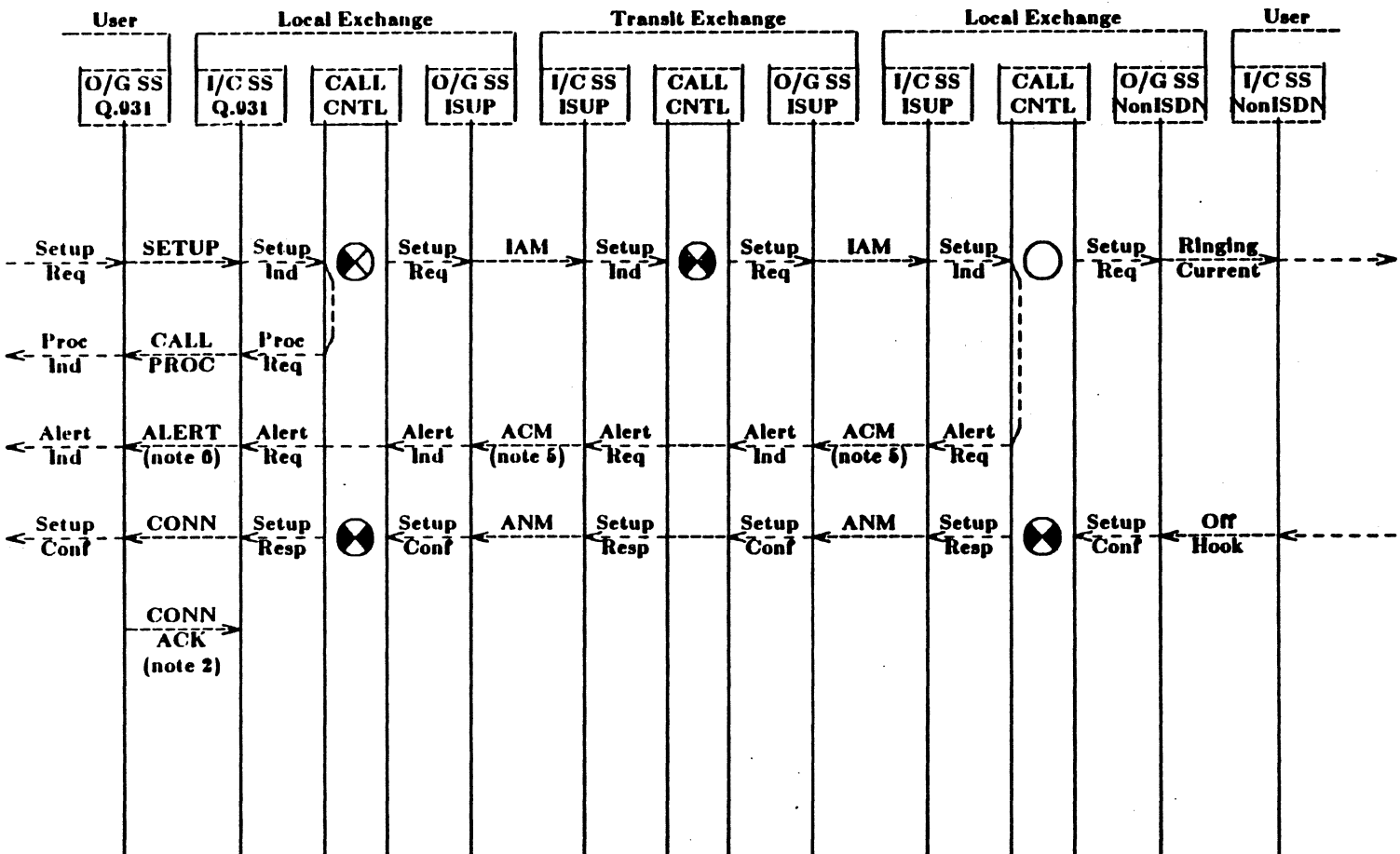INTERWORKING OF ISDN ACCESS AND NETWORK SIGNALLING

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User		Local Exchange				Transit Exchange				Local Exchange			User
O/G SS Q.931	I/C SS Q.931	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS NonISDN	I/C SS NonISDN

Setup Req → SETUP → Setup Ind ⊗ Setup Req → IAM → Setup Ind ⊗ Setup Req → IAM → Setup Ind ◯ Setup Req → Ringing Current →

← Proc Ind ← CALL PROC ← Proc Req

← Alert Ind ← ALERT (note 6) ← Alert Req ← Alert Ind ← ACM (note 5) ← Alert Req ← Alert Ind ← ACM (note 5) ← Alert Req

← Setup Conf ← CONN ← Setup Resp ⊗ ← Setup Conf ← ANM ← Setup Resp ← Setup Conf ← ANM ← Setup Resp ⊗ ← Setup Conf ← Off Hook ←

CONN ACK → (note 2)

Figure 3.4/Q.699. ISDN to analog subscriber
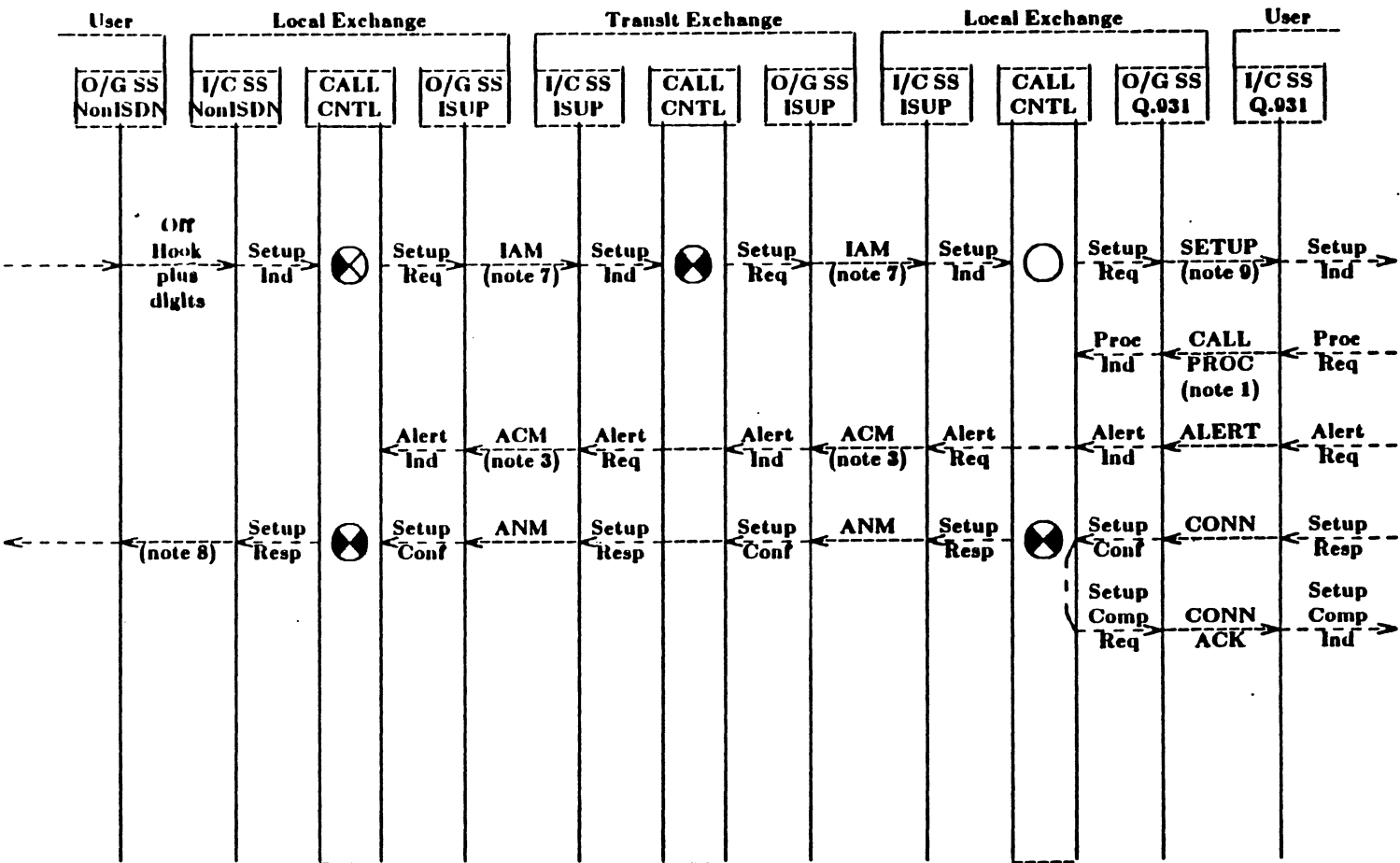
Figure 3.5/Q.699. Analog subscriber to ISDN

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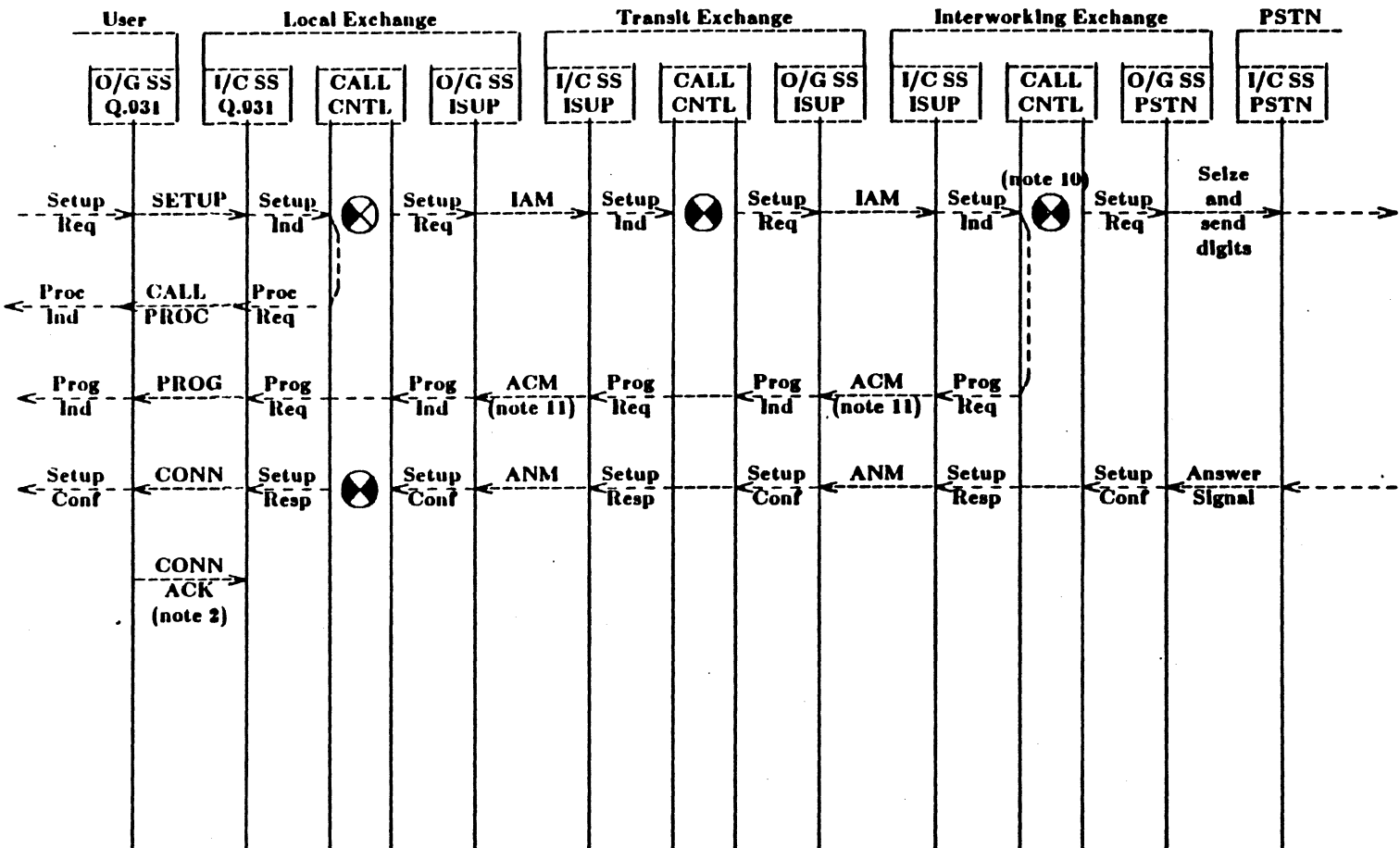
Figure 3.6/Q.699. ISDN-PSTN interworking

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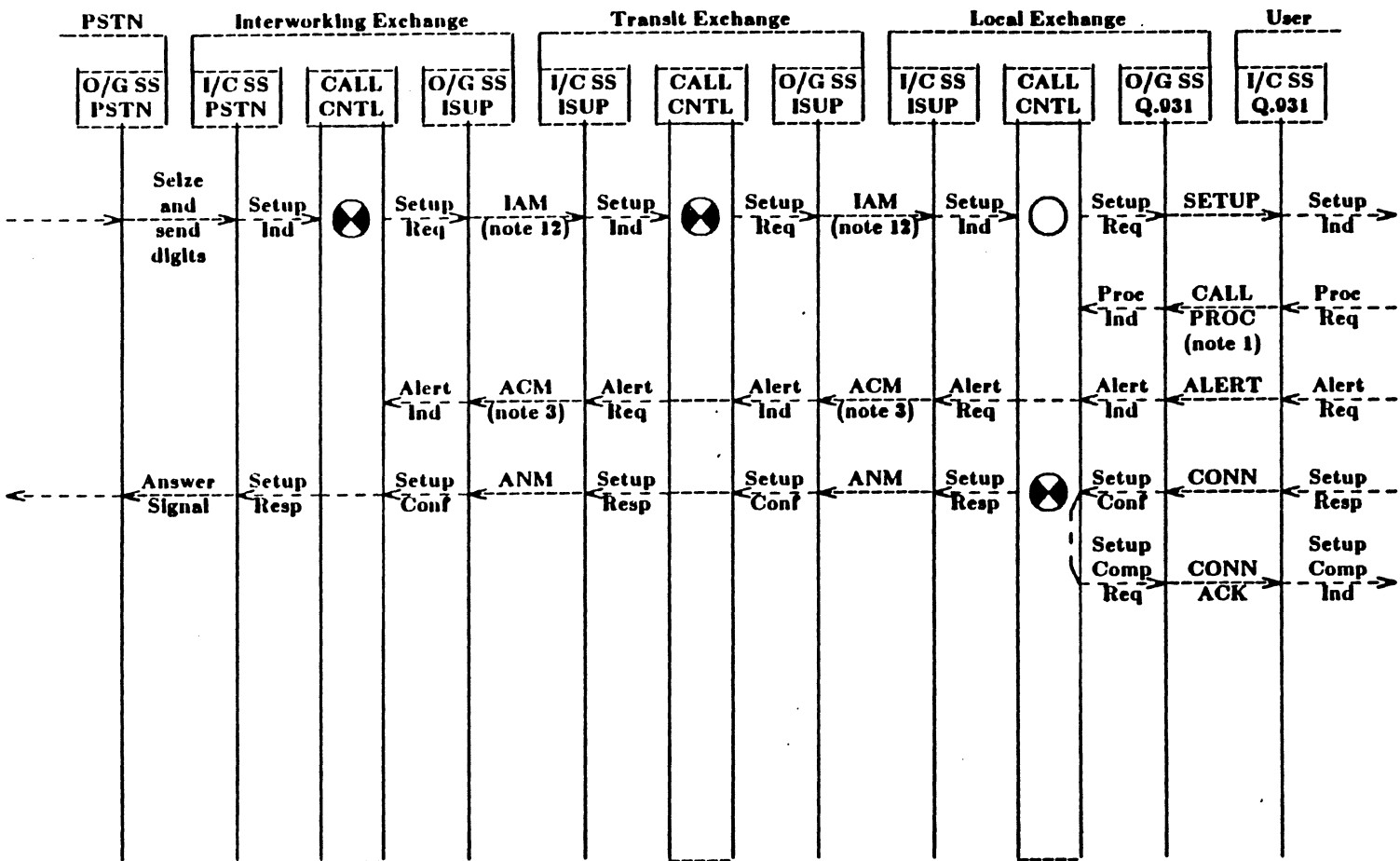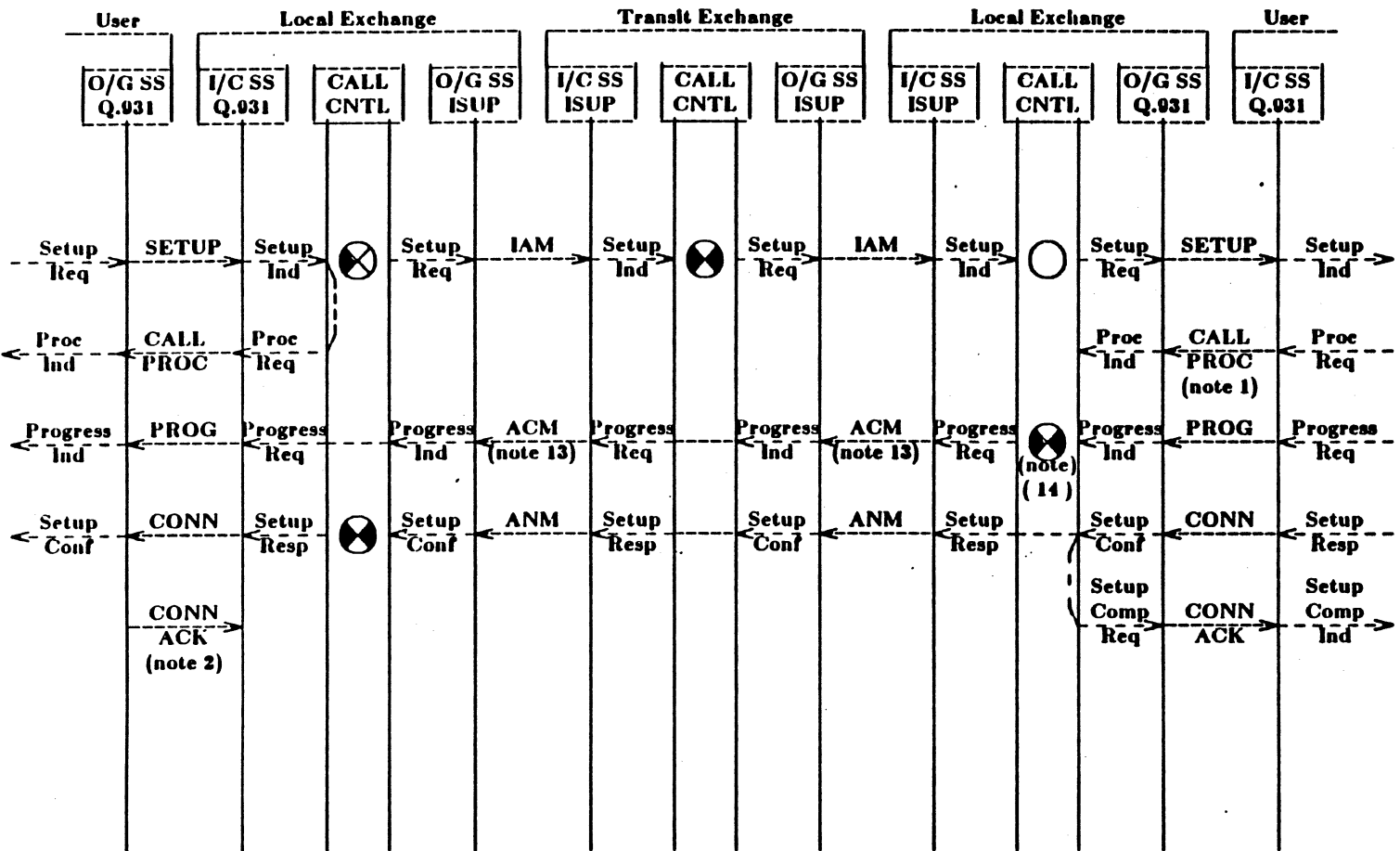INTERWORKING OF ISDN ACCESS AND NETWORK SIGNALLING

PSTN	Interworking Exchange			Transit Exchange			Local Exchange			User
O/G SS PSTN	I/C SS PSTN	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS Q.031	I/C SS Q.031

Seize and send digits → Setup Ind → ⊗ Setup Req → IAM (note 12) → Setup Ind → ⊗ Setup Req → IAM (note 12) → Setup Ind → ◯ → Setup Req → SETUP → Setup Ind

Proc Ind ← CALL PROC (note 1) ← Proc Req

Alert Ind ← ACM (note 3) ← Alert Req ← Alert Ind ← ACM (note 3) ← Alert Req ← Alert Ind ← ALERT ← Alert Req

Answer Signal ← Setup Resp ← Setup Conf ← ANM ← Setup Resp ← Setup Conf ← ANM ← Setup Resp ← ⊗ ← Setup Conf ← CONN ← Setup Resp

Setup Comp Req → CONN ACK → Setup Comp Ind

Figure 3.7/Q.699. PSTN-ISDN interworking

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User		Local Exchange			Transit Exchange			Local Exchange			User
O/G SS Q.931	I/C SS Q.931	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS ISUP	I/C SS ISUP	CALL CNTL	O/G SS Q.931	I/C SS Q.931	

Setup Req → SETUP → Setup Ind ⊗ Setup Req → IAM → Setup Ind ⊗ Setup Req → IAM → Setup Ind ○ Setup Req → SETUP → Setup Ind →

Proc Ind ← CALL PROC ← Proc Req

Proc Ind ← CALL PROC (note 1) ← Proc Req

Progress Ind ← PROG ← Progress Req ← Progress Ind ← ACM (note 13) ← Progress Req ← Progress Ind ← ACM (note 13) ← Progress Req ⊗ (note) (14) Progress Ind ← PROG ← Progress Req

Setup Conf ← CONN ← Setup Resp ⊗ Setup Conf ← ANM ← Setup Resp ← Setup Conf ← ANM ← Setup Resp Setup Conf ← CONN ← Setup Resp

CONN ACK → (note 2)

Setup Comp Req → CONN ACK → Setup Comp Ind →

Figure 3.8/Q.699. PROGRESS message returned from access

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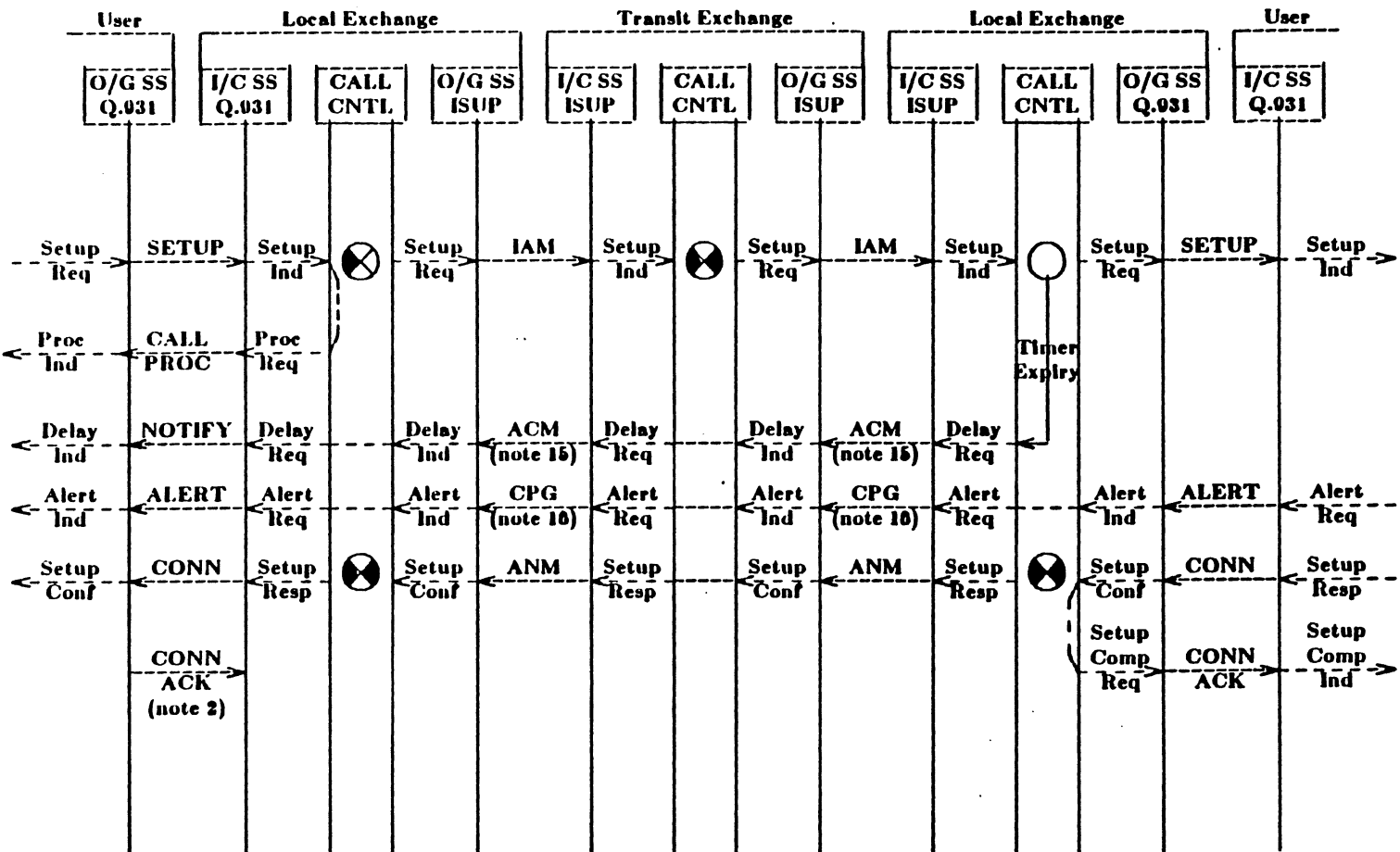
Figure 3.9/Q.699. Call Delay Scenario
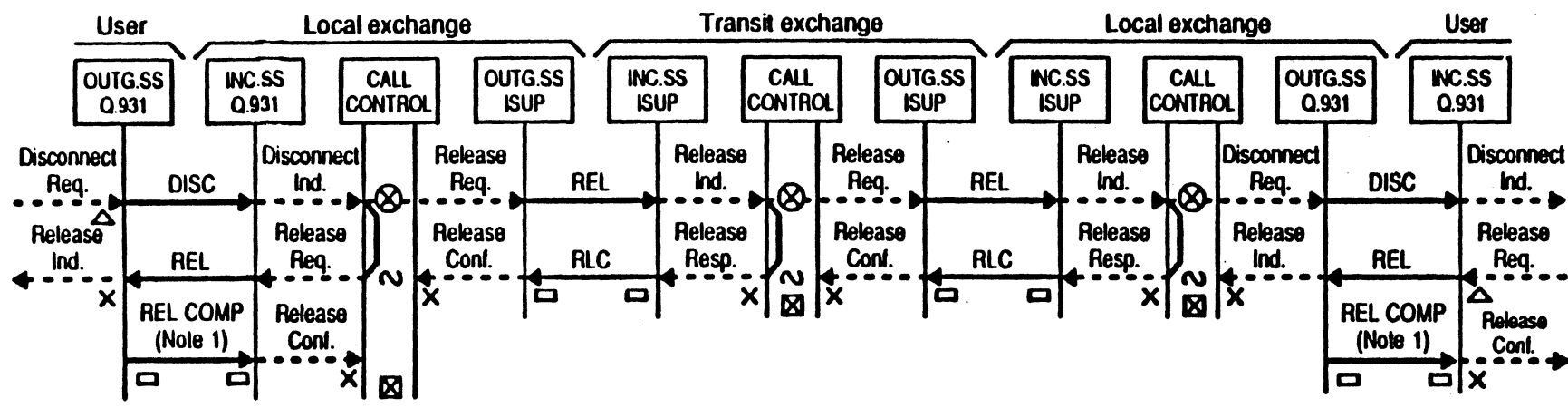
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Figure 4.1/Q.699. Normal Call Release Procedure with End-to-End ISDN
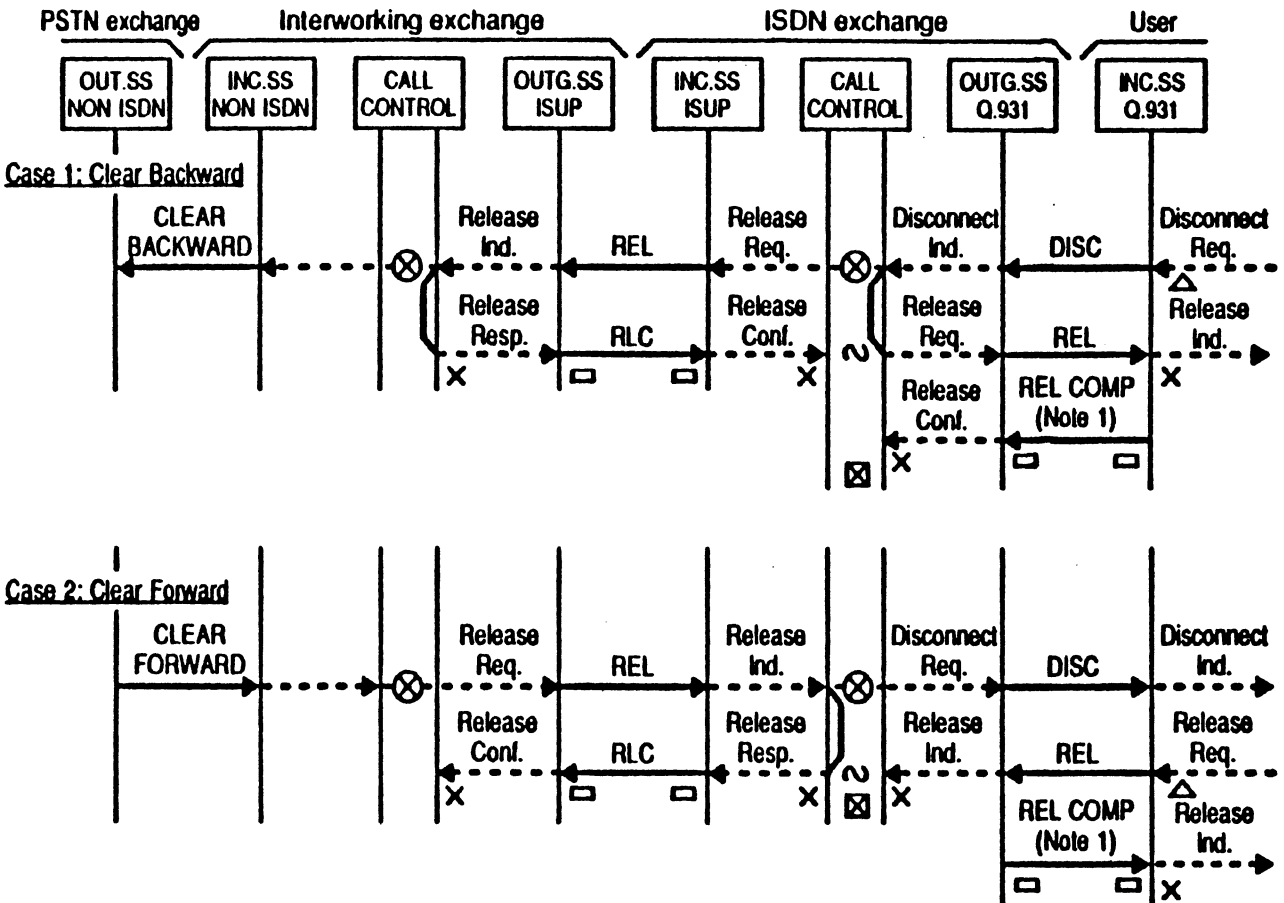
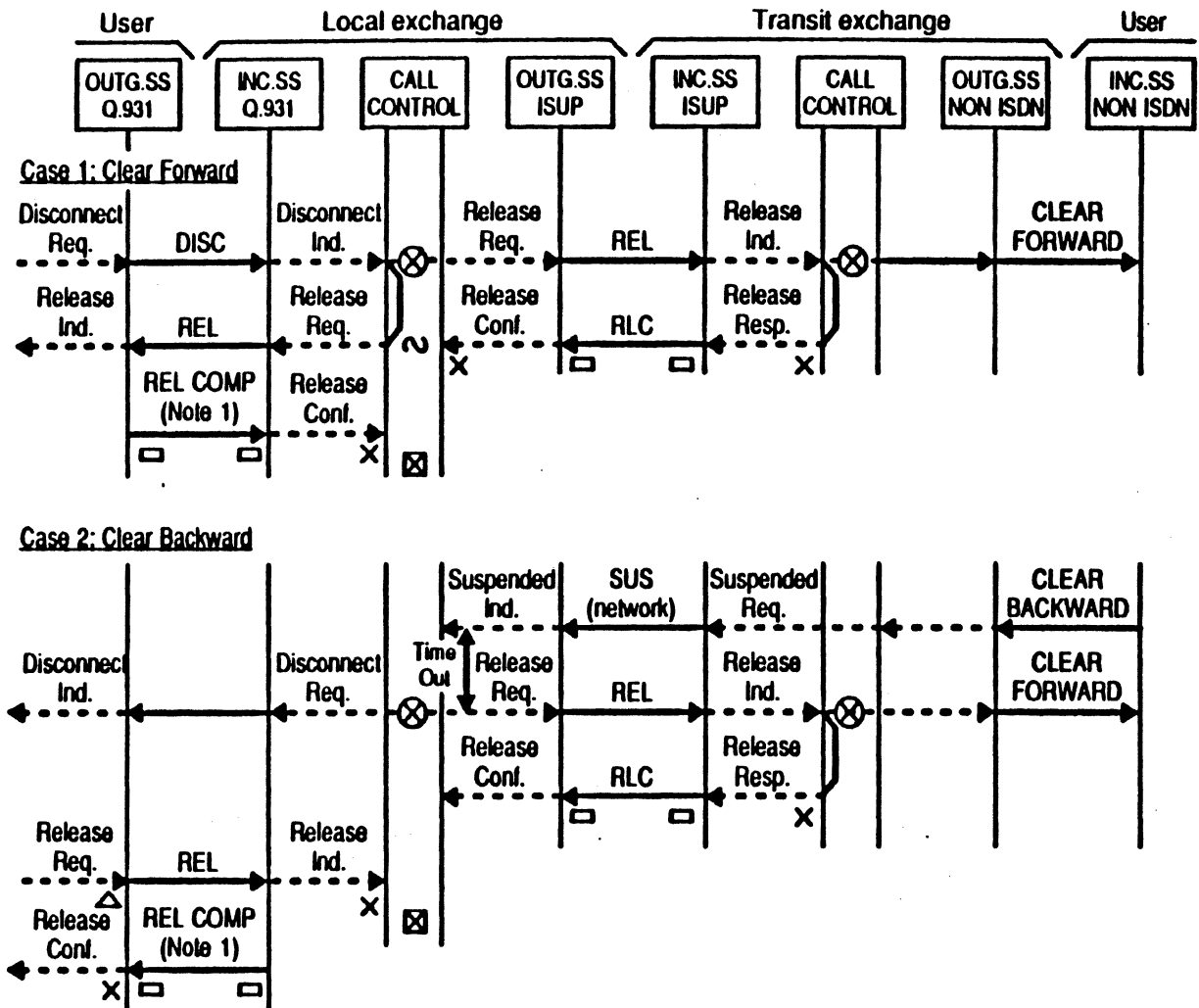Figure 4.2/Q.699. Normal Call Release Procedure for PSTN-ISDN Interworking

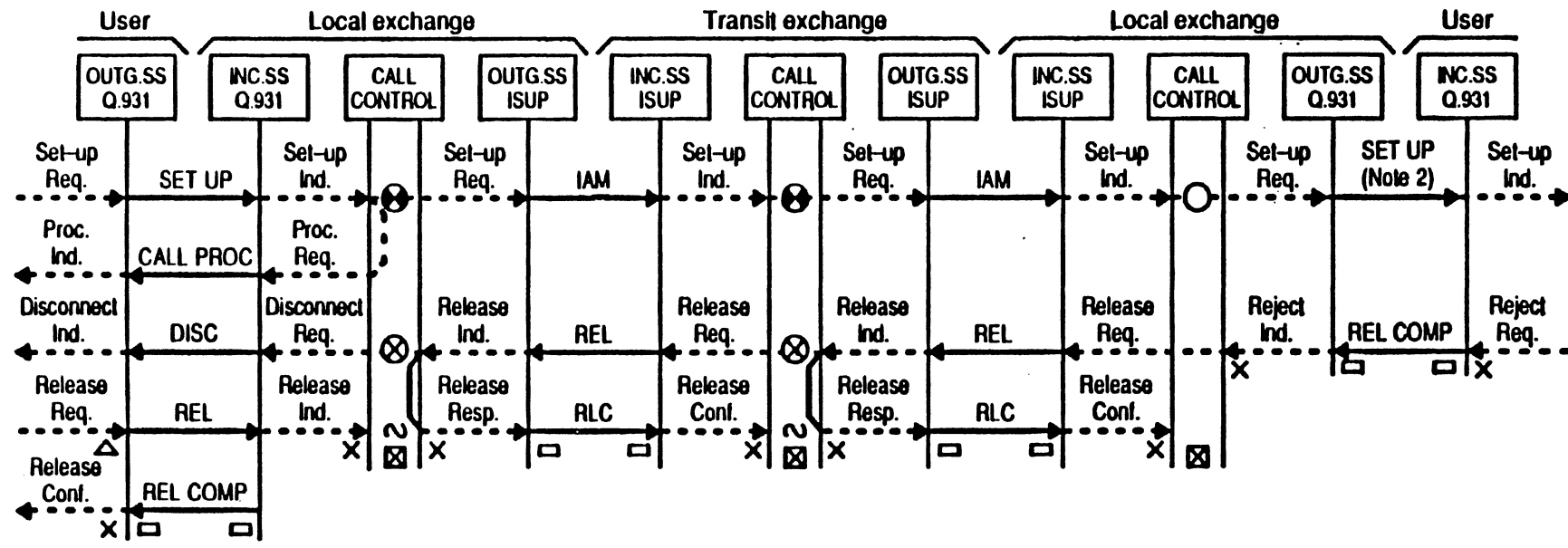Figure 4.3/Q.699. Normal Call Release for ISDN-PSTN Interworking

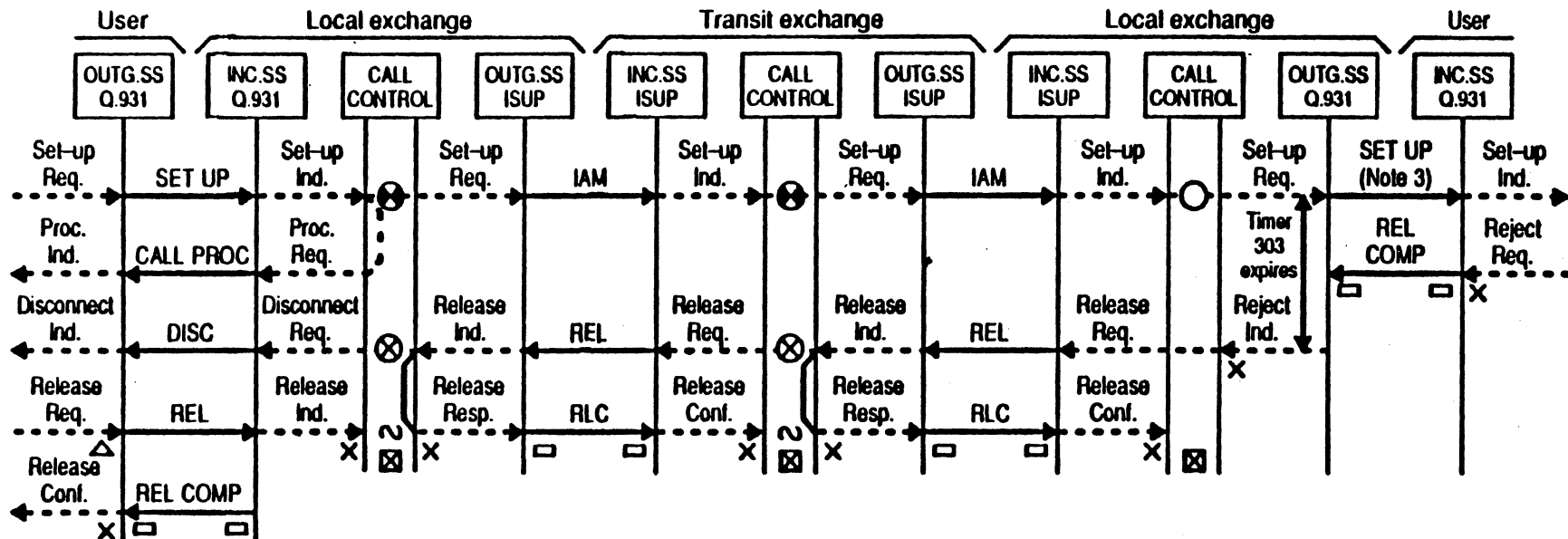Figure 5.1/Q.699. Unsuccessful Call Set-Up, Point-to-Point Data Link

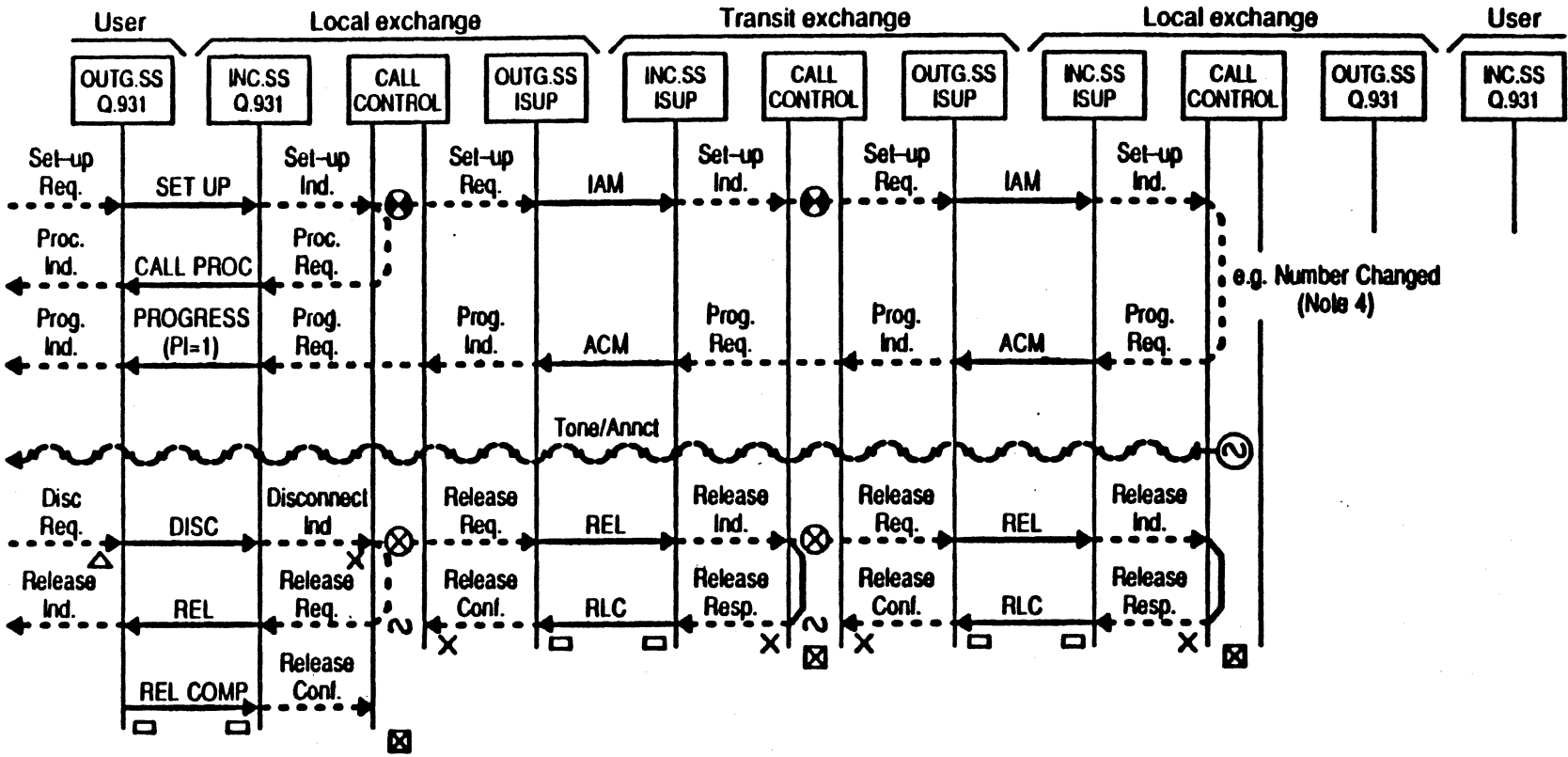**Figure 5.2/Q.699.** Unsuccessful Call Set-Up, Broadcast Data Link

Figure 5.3/Q.699. Unsuccessful Call Set-Up, Tone/Announcement Applied at Originating Exchange *

Figure 5.4/Q.699. Unsuccessful Call Set-Up, Tone/Announcement Applied at Terminating Exchange *
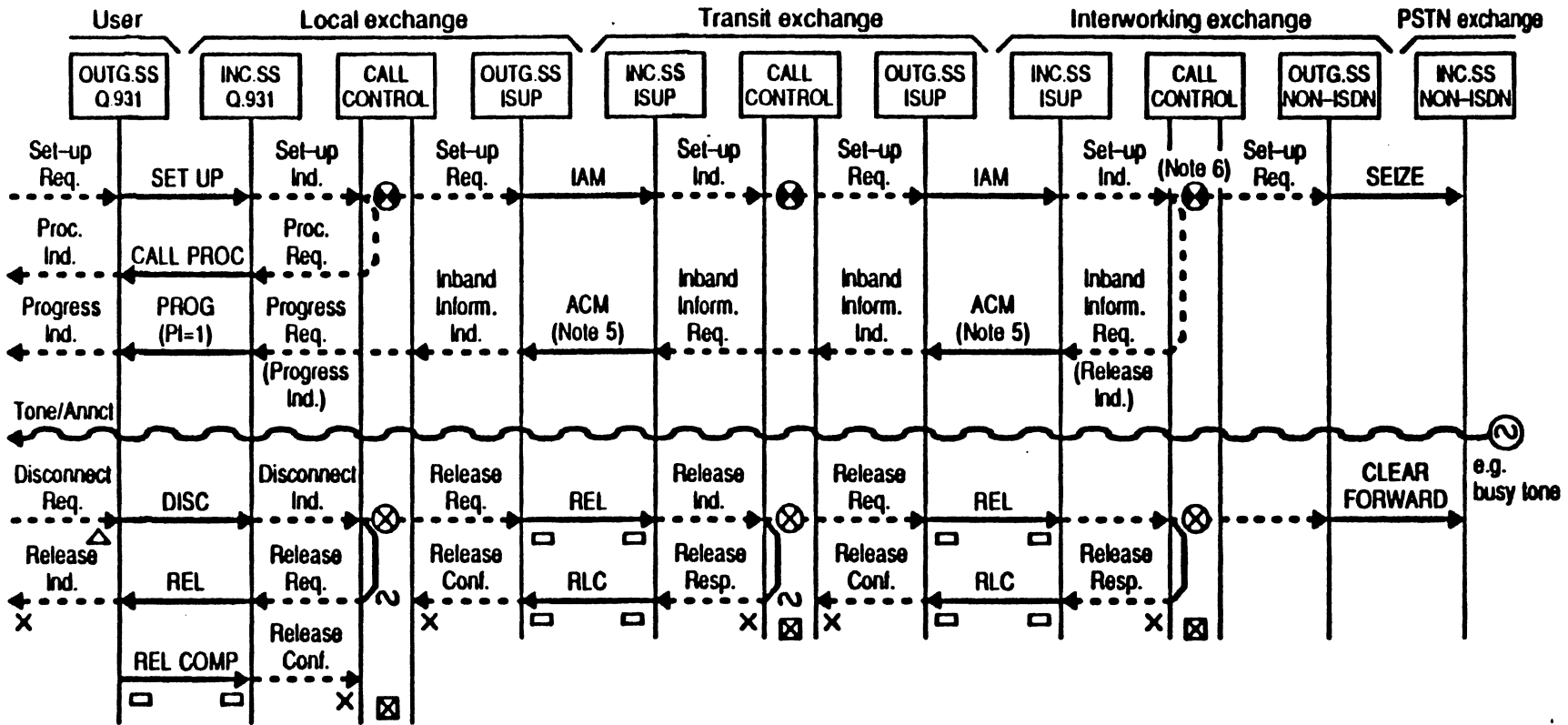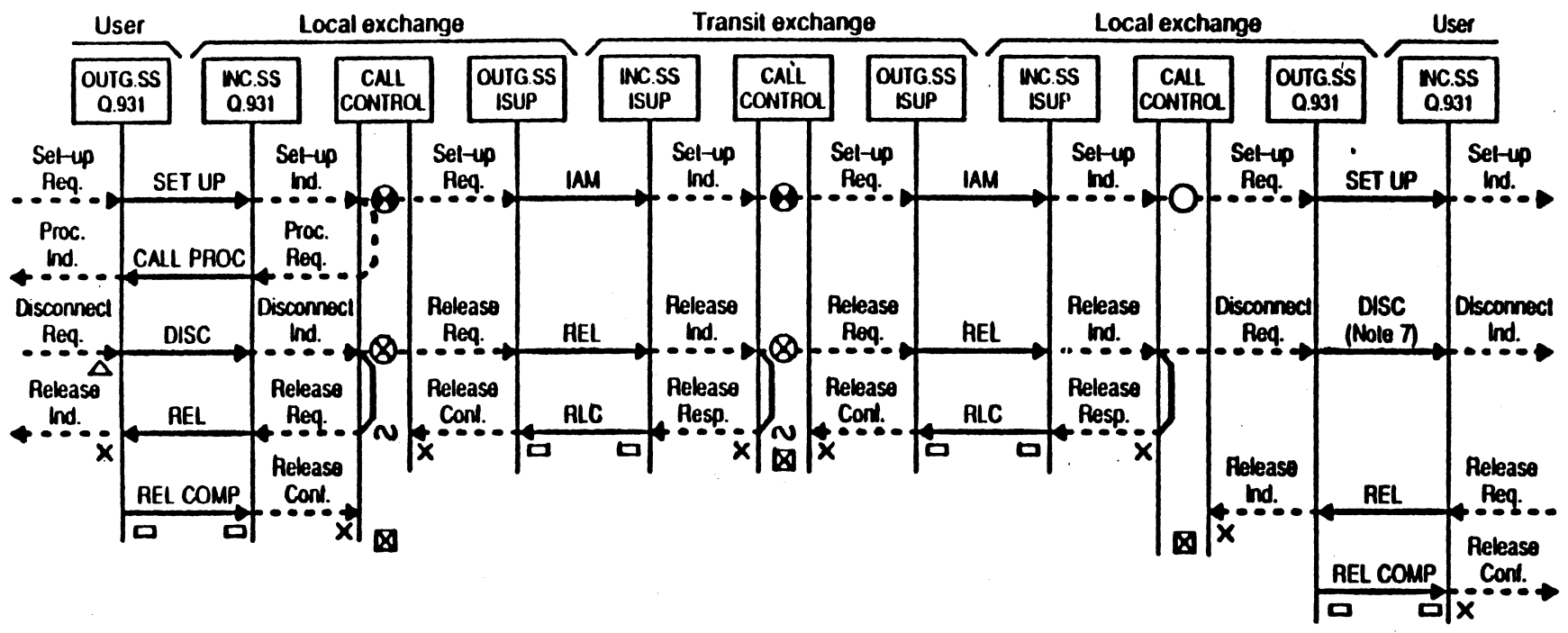
Figure 5.5/Q.699. ISDN-PSTN Interworking

Figure 5.6/Q.699. Premature Release