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DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1

STAGE 3 SERVICE DESCRIPTION FOR CALL OFFERING SUPPLEMENTARY SERVICES USING DSS 1 – DIVERSION SUPPLEMENTARY SERVICES

ITU-T Recommendation Q.952

(Previously "CCITT Recommendation")

FOREWORD

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

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

ITU-T Recommendation Q.952 was prepared by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

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

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

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Recommendation Q.952

STAGE 3 SERVICE DESCRIPTION FOR CALL OFFERING SUPPLEMENTARY SERVICES USING DSS 1 – DIVERSION SUPPLEMENTARY SERVICES

(Helsinki, 1993)

The stage 3 services described below correspond to those of stage 1 which appeared in the I-Series Recommendations as follows:

- Call Forwarding Unconditional (CFU): Recommendation I.252.4
- Call Forwarding Busy (CFB): Recommendation I.252.2
- Call Forwarding No Reply (CFNR): Recommendation I.252.3
- Call Deflection (CD): Recommendation I.252.5

1 Definition

1.1 Scope

This Recommendation specifies the stage 3 of the diversion supplementary services for the Integrated Services Digital Network (ISDN) as provided by public telecommunications operators at the T reference point or coincident S and T reference point (as defined in Recommendation I.411 [1]) by means of the Digital Subscriber Signalling System No. 1 (DSS 1). Stage 3 identifies the protocol procedures and switching functions needed to support a telecommunications service (see Recommendation I.130 [2]).

In addition, this Recommendation specifies the protocol requirements at the T reference point where the service is provided to the user via an intermediate private ISDN.

This Recommendation does not specify the additional protocol requirements where the service is provided to the user via a telecommunications network that is not an ISDN.

The diversion supplementary services comprise the following services:

- Call Forwarding Unconditional (CFU)
- Call Forwarding Busy (CFB)
- Call Forwarding No Reply (CFNR)
- Call Deflection (CD)

The Call Forwarding Unconditional (CFU) supplementary service permits a served user to have the network send all incoming calls, or just those associated with a specific basic service, addressed to the served user's ISDN number to another number. The served user's originating service is unaffected. If this service is activated, calls are forwarded no matter what the condition of the termination.

The Call Forwarding Busy (CFB) supplementary service permits a served user to have the network send all incoming calls, or just those associated with a specific basic service, which meet busy and are addressed to the served user's ISDN number to another number. The served user's originating service is unaffected. The busy condition may be either network determined or user determined.

The Call Forwarding No Reply (CFNR) supplementary service permits a served user to have the network send all incoming calls, or just those associated with a specific basic service, which meet no reply and are addressed to the served user's ISDN number to another number. The served user's originating service is unaffected.

The Call Deflection (CD) supplementary service allows the served user to respond to an incoming call offered by the network by requesting redirection of that call to another number specified in the response. This redirection is only allowed before the called user has answered the call. The served user's originating service is unaffected.

The diversion supplementary services are applicable to all telecommunications services.

Further subclauses of this Recommendation specify the method of testing required to identify conformance to this Recommendation.

Annex A provides the ASN.1 definition of basic services in call fowarding supplementary service procedures.

This Recommendation is applicable to equipment, supporting at least one of the diversion supplementary services, to be attached at either side of a T reference point or coincident S and T reference point when used as an access to the public ISDN.

2 Description

2.1 General description

For a given ISDN number, the diversion supplementary services (including options) may be subscribed to for each basic service to which the user(s) of the number subscribes, or collectively for all the bearer service or/and teleservice to which the user(s) subscribes. Since subscription is on an ISDN number basis, the same diversion subscriptions will apply to all terminals using this number.

The served user can request a different forwarded-to number for each basic service subscription parameter value and diversion supplementary service to which he has subscribed.

An indication that a call forwarding service is activated on a number may, as subscription option, be given to the forwarding user who has forwarding activated, each time an outgoing call is made.

The CFNR supplementary service shall only apply when a SETUP message is sent by the network and at least one user responds with an ALERTING message, possibly subsequent to other valid call control message.

The deflection functions are implemented in the network and they are invoked by the terminal on a call by call basis.

2.2 Definitions

For the purposes of this Recommendation, the following definitions apply:

integrated services digital network (ISDN): See 2.3/I.112 [5], definition 308.

service; telecommunications service: See 2.2/I.112 [5], definition 201.

supplementary service: See 2.4/I.210 [17].

user: The DSS 1 protocol entity at the user side of the user-network interface.

network: The DSS 1 protocol entity at the network side of the user network interface.

served user: The DSS 1 protocol entity at the user side of the user-network interface used to subscribe to the specific diversion supplementary service; to register, to activate, to deactivate and the interrogate diversion supplementary services; to request and to control the diversion supplementary services.

forwarded-to user: is a user to which a call is to be forwarded. All procedures at the forwarded-to user are provided as part of the basic service; the forwarded-to user need not have subscribed to any specific call forwarding supplementary service.

deflected-to user: is a user to which the call shall be deflected.

diverted-to user: Refers either to the forwarded-to user or the deflected-to user.

calling user: is a user that initiated a call that has been diverted. All procedures at the calling user are provided as part of the basic service; the calling user need not have subscribed to any specific diversion supplementary service.

diverted-to number: is the ISDN number of the forwarded-to/deflected-to user.

forwarded-to number: is the ISDN number of the forwarded-to user.

deflected-to number: is the ISDN number of the deflected-to user.

diverting number: is the ISDN number of the forwarding/deflecting user.

forwarding number: is the ISDN number of the forwarding user.

deflecting number: is the ISDN number of the deflecting user.

activating user: is a user on a served user's access that initiates the activation procedures for a call forwarding service.

deactivating user: is a user on a served user's access that initiates the deactivation procedures for a call forwarding service.

call forwarding profile: is the set of data containing all the parameters pertaining to subscription and activation, involved in the decision process which leads to the forwarding of an incoming call.

ISDN number: a number conforming to the numbering plan and structure specified in Recommendation E.164 [14].

ISDN address: it is an ISDN number, and uses a sub-address, as specified if provided by that.

network determined user busy (NDUB): See 3.1.4/I.210 [17].

user determined user busy (UDUB): is specified for the case that the network offers the call to the subscriber and if no compatible terminal responds "positively" but one or more compatible terminal respond "user busy". This condition will be determined when the response-to-call offering timeout occurs.

invoke component: See Recommendation Q.932 [4].

return result component: See Recommendation Q.932 [4].

return error component: See Recommendation Q.932 [4].

reject component: See Recommendation Q.932 [4].

2.3 Abbreviations

ISDN	Integrated Services Digital Network
DSS 1	Digital Subscriber Signalling System No. 1
CFU	Call Forwarding Unconditional
CFB	Call Forwarding Busy
CFNR	Call Forwarding No Reply
CD	Call Deflection
CDA	Call Deflection Alerting
UDUB	User Determined User Busy
NDUB	Network Determined User Busy
ISPBX	ISDN PABX

2.4 State definitions

The following states are conceived for the call forwarding supplementary service management procedures at the served user's access and are applicable to the network and optionally the user:

- *Idle state* – The specific call forwarding supplementary service is idle for this ISDN number and/or particular basic service. This is the initial state on subscription of the particular call forwarding supplementary service.
- *Activate Request state* – The user has requested that a supplementary service is activated for this ISDN number and/or particular basic service.
- *Deactivate Request state* – The user has requested that an active supplementary service shall be deactivated for this ISDN number and/or particular basic service.
- *Interrogate Request state* – The user has requested that a supplementary service be interrogated.

A state machine may exist for each specific instance of the following parameter values:

- procedure;
- served user number;
- basic service.

3 Operational requirements

3.1 Provision/withdrawal

The CFU, CFB, CFNR and CD supplementary services shall be provided after prior arrangement with the network.

Each diversion supplementary service can be withdrawn separately by the network at the subscriber's request or for administrative reasons.

The diversion supplementary services can be offered separately with subscription options. Options apply separately to each bearer service or/and teleservice subscribed to on each ISDN number. For each subscription option, only one value can be selected. These subscription options form part of the diversion profile for the served user.

The subscription options for the CFU supplementary service are included in 3.1/I.252.4 [7].

The subscription options for the CFB supplementary service are included in 3.1/I.252.2 [8].

The subscription options for the CFNR supplementary service are included in 3.1/I.252.3 [9].

The subscription options for the CD supplementary service are included in 3.1/I.252.5 [10].

These requirements are summarized in Table 1.

TABLE 1/Q.952

Subscription options for diversion supplementary services

Subscription options	Value	Applicability
Allowable deflected to user numbers	All	CD
	Others (for further study)	
Calls which may be deflected	All	CD
	Others (for further study)	
Served user receives notification that a call has been forwarded	No	CFU
	Yes, with call offering information	CFB CFNR
Calling user receives notification that his call that his call has been diverted (forwarded or deflected)	No	CFU
	Yes, with diverted-to number	CFB
	Yes, without diverted-to number	CFNR CD
Served user receives reminder notification on outgoing calls that forwarding is currently activated	No	CFU CFB
	Yes	CFNR
Diverting number is released to diverted-to-user	Do not release diverting number information	CFU CFB
	Release diverting number information	CFNR CD
Length of call forwarding on no reply timer	Timer duration shall be between 5 to 60 seconds in steps of 5 seconds	CFNR

The following network provider options are available for the supplementary services.

The network options for the CFU supplementary service are included in 3.3.2/I.252.4 [7].

The network options for the CFB supplementary service are included in 3.3.2/I.252.2 [8].

The network options for the CFNR supplementary service are included in 3.3.2/I.252.3 [9].

The network options for the CD supplementary service are included in 3.2.2/I.252.5 and 3.3.3/I.252.5 [10].

These requirements are summarized in Table 2.

3.2 Requirements on the originating network side:

The procedures at the coincident S and T reference point of 5.1/Q.931 [3] and the notification procedures of 5.2.1 and 5.2.2 shall be applied.

3.3 Requirements on the destination network side

The procedures at the S and T reference point of 5.2/Q.931 [3], the common element procedures of 5.2.3 and the notification procedures of 5.2.4 shall be applied.

TABLE 2/Q.952

Network options for diversion supplementary services

Network provider options	Value	Applicability
Served user call retention cases: i) Served user call retention on invocation of diversion (forwarding or deflection)	Retain call until alerting begins at the diverted-to user	CFNR CD
	Clear call on invocation of diversion	
ii) Served user call retention when forwarding is rejected at forwarded-to user	Continue to alert the forwarding user (Note 1)	CFNR
	No action at the forwarding user (Note 2)	
iii) Served user call retention when deflection is rejected	Continue the call, this option shall be used for deflection after alerting has commenced	CD
	Clear the call	
Total number of all diversions for each call	Maximum number of diverted connections (with maximum value between 3 and 5)	CFU CFB CFNR CD
Call forwarding on no reply timer	Timer duration shall be a service provider option	CFNR
Partial rerouting	Yes	CFU CFB
	No	CFNR CD
Notification to calling user	Yes	CFU CFB
	No	CFNR CD

NOTES

1 This applies to the retention of the call at invocation of call forwarding.

2 This applies to the clearing call option on invocation of call forwarding.

TABLE 2 *bis*/Q.952

Network options for basic call used for diversion supplementary services

Network provider options	Value	Applicability
Transit network selection supported (see Annex C/Q.931)	Yes	CFU CFB
	No	CFNR CD
Network specific facility selection supported (see Annex R/Q.931)	Yes	CFU CFB
	No	CFNR CD

4 Coding requirements

4.1 Coding of the information elements

4.1.1 Coding of the Notification indicator information element

For the coding of the Notification indicator information element, see 4.5.21/Q.931 [3].

The additional notification description for the operation of the diversion supplementary services shall be coded as shown in Table 3.

TABLE 3/Q.952

Additional notification description for the operation of diversion

Bits 7 6 5	 4 3 2 1	Meaning
1 1 1	1 0 1 1	Call is diverting
1 1 0	1 0 0 0	Diversion activated
NOTE – All other values reserved.		

4.1.2 Coding of the Redirecting number information element

The purpose of the Redirecting number information element is to identify the number from which diversion was invoked.

The Redirecting number information element shall be coded as shown in Figure 1. The maximum length of this information element is 25 octets.

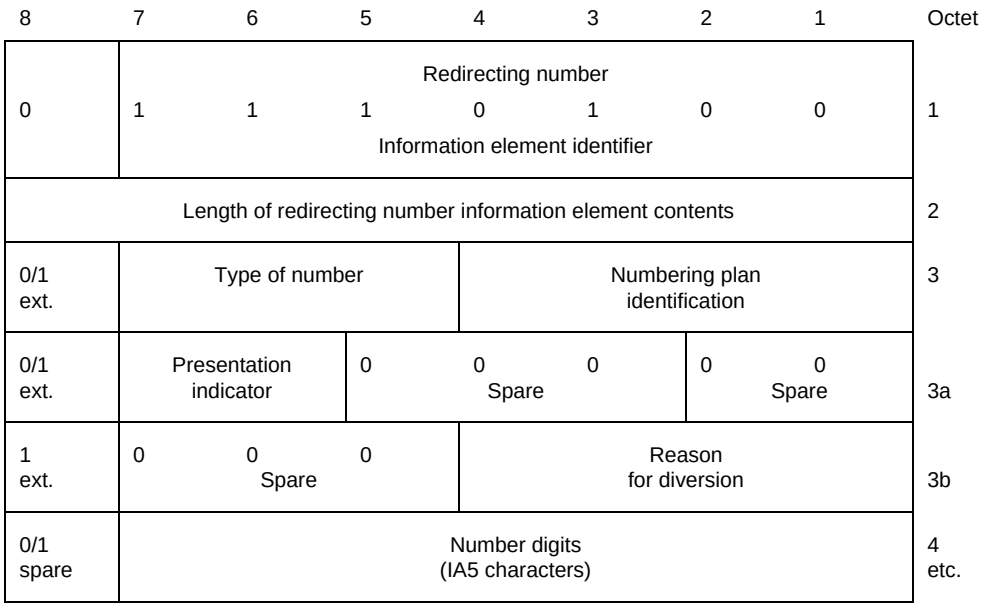


FIGURE 1/Q.952

Redirecting number information element

The various parts of the Redirecting number information element shall be coded as specified in 4.5.10/Q.931 [3] (for Calling party number information element) except for octet 3b which is defined below.

The reason for diversion (octet 3b) values are summarized in Table 4.

TABLE 4/Q.952

Reason for diversion codepoints

Bits 4 3 2 1	Meaning
0 0 0 0	Unknown
0 0 0 1	Call forwarding busy or called DTE busy (circuit-mode and packet-mode)
0 0 1 0	Call forwarding no reply (circuit-mode only)
1 1 1 1	Call forwarding unconditional or systematic call redirection (circuit-mode and packet-mode) call deflection or call forwarding by the
1 0 1 0	called DTE (circuit-mode and packet-mode)
NOTE – All other values are reserved.	

4.1.3 Coding of Redirection number information element

The purpose of the Redirection number information element is to identify the number towards which diversion was invoked.

The Redirection number information element shall be coded as shown in Figure 2. The maximum length of this information element is 24 octets.

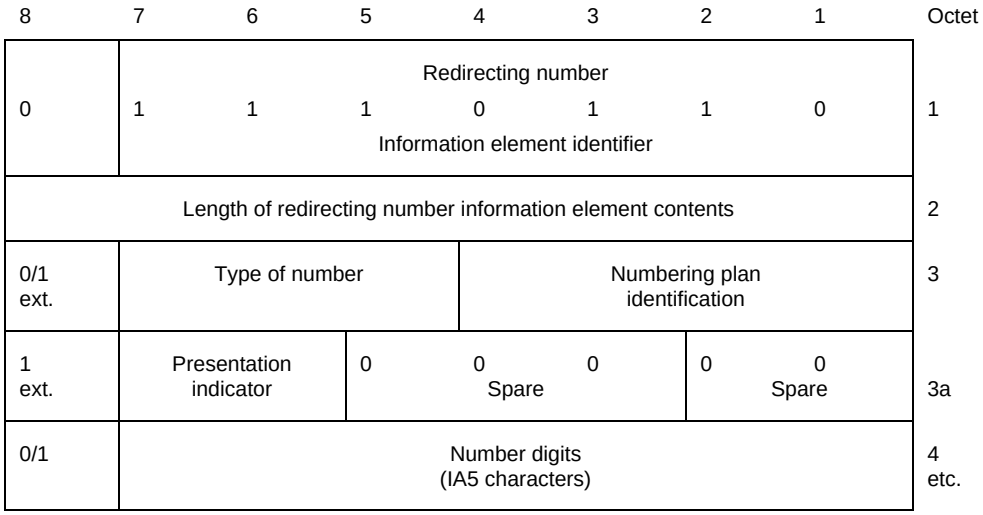


FIGURE 2/Q.952

Redirection number information element

The various parts of the Redirection number information element shall be coded as specified in 4.5.10/Q.931 [3].

4.2 Component coding for the Facility information element

Table 5 shows the definition of the operations and errors required for the diversion supplementary services using ASN.1 as specified in Recommendation X.208 [12] and using the OPERATION and ERROR macro as defined in Figure 4/X.219.

5 Signalling procedures at the coincident S and T reference point

Where the text in the following sections refers to an "XXX" invoke component, an invoke component is meant with the operation value set to the value of operation "XXX".

5.1 Activation/deactivation/interrogation

The procedures for activation/deactivation and interrogation only apply to the call forwarding supplementary services.

Within the network the CD supplementary service is activated for the whole subscription period, no activation/deactivation procedure is needed at the user-network interface.

5.1.1 Activation

5.1.1.1 Normal operation

Having subscribed to a specific call forwarding supplementary service (CFU, CFB, CFNR), in order to activate that service, the served user shall send an **activationDiversion** invoke component to the network, in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4] and shall start timer T (activate) and enter the Activate Request state. Timer T (activate) is specified in 9. The network, on receiving such an **activationDiversion** invoke component shall enter the Activate Request state.

TABLE 5/Q.952 (sheet 1 of 4)

ASN

```
Call-Diversion-Operations { ccitt Recommendation q 952 diversion (2) operations-and-errors (1) }

DEFINITIONS ::=

BEGIN

EXPORTS                 ActivationDiversionType,
                        DeactivationDiversionType,
                        ActivationStatusNotificationDivType,
                        DeactivationStatusNotificationDivType,
                        InvokeStatusType,
                        InterrogationDiversionType,
                        InterrogationDiversion1Type,
                        DiversionInformationType,
                        CallDeflectionType,
                        CallReroutingType,
                        DivertingLegInformation1Type,
                        DivertingLegInformation2Type,
                        DivertingLegInformation3Type;

IMPORTS                 OPERATION, ERROR            FROM Remote-Operation-Notation
                                                        { joint-iso-ccitt remote-operations (4)
                                                        notation (0) }

                        PartyNumber, PartySubaddress,Address,PresentationAllowedIndicator,
                        PresentedAddressScreened,PresentedAddressUnscreened,RoutingInformation,

                        PresentedNumberUnscreened   FROM Addressing-Data-Elements
                                                        { ccitt recommendation q 932 addressing-
                                                        data-elements (2) }
                        BasicService                FROM Basic-Service-Elements;
                                                        { ccitt recommendation q 952 diversion (2)
                                                        basic-service-elements (3) }
                        userNotSubscribed, notAvailable, basicServiceNotProvided, invalidServedUserNr,
                        resourceUnavailable,callFailure
                                                    FROM General-Errors-List
                                                        { ccitt recommendation q 932
                                                        general-error-list(1) }
                        Q931 InformationElement     FROM Embedded-Q931-Types
                                                        { ccitt recommendation q 932
                                                        embedded-q931-types(7) }

ActivationDiversionType ::= OPERATION

ARGUMENT SEQUENCE {
procedure               Procedure,
basicService            BasicService,
forwardedToAddress      Address,
servedUserNr            ServedUserNr }

RESULT

ERRORS                  { userNotSubscribed, notAvailable, invalidServedUserNr,
                        basicServiceNotProvided, resourceUnavailable, invalidDivertedNr,
                        operatorAccess, specialServiceNr, diversionToServedUserNr }
activationDiversion     ActivationDiversionType ::= 7

-- End of activationDiversion operation definitions
```

TABLE 5/Q.952 (sheet 2 of 4)

```
DeactivationDiversionType                ::= OPERATION

ARGUMENT SEQUENCE {
procedure                                Procedure,
basicService                             BasicService,
servedUserNr                             ServedUserNr }

RESULT

ERRORS { userNotSubscribed, notAvailable, invalidServedUserNr, notActivated }

deactivationDiversion                    deactivationDiversionType          ::= 8

-- End of activationDiversion operation definitions

ActivationStatusNotificationDivType      OPERATION

ARGUMENT SEQUENCE {

procedure                                Procedure,
basicService                             BasicService,
forwardedToAddress                       Address,
servedUserNr                             ServedUserNr }
activationStatusNotificationDiv          ActivationStatusNotificationDivType ::= 9

-- End of diversion activation StatusNotificationDiv operation definitions

DeactivationStatusNotificationDivType    OPERATION

ARGUMENT SEQUENCE {
procedure                                Procedure,
basicService                             BasicService,
servedUserNr                             ServedUserNr }

activationStatusNotificationDiv          ActivationStatusNotificationDivType ::= 10

-- End of diversion deactivation StatusNotificationDiv operation definitions

InvokeStatusType                         OPERATION

ARGUMENT SEQUENCE {
diversionReason                          DiversionReason,
basicService                             BasicService,
invokeFailure                            InvokeFailure }
invokeStatus                             InvokeStatusType                   ::= 16

-- End of InvokeStatus operation definitions

InterrogationDiversionType               OPERATION

ARGUMENT SEQUENCE {
procedure                                Procedure,
basicService                             BasicService DEFAULT AllServices,
servedUserNr                             ServedUserNr }

RESULT                          IntResultList

ERRORS { userNotSubscribed, notAvailable, invalidServedUserNr }

interrogationDiversion                   InterrogationDiversionType         ::= 11

-- End of interrogationDiversion operation definitions

InterrogationDiversion1Type              OPERATION

RESULT                          IntResultList1
ERRORS                          { userNotSubscribed, notAvailable }

interrogationDiversion1                  InterrogationDiversion1Type        ::= 17
```

TABLE 5/Q.952 (sheet 3 of 4)

```
DiversionInformationType                    OPERATION
ARGUMENT SEQUENCE {
diversionReason                                 DiversionReason,
basicService                                    BasicService OPTIONAL,
servedUserSubaddress                            PartySubaddress OPTIONAL,
callingAddress                          [0]     PresentedAddressScreened OPTIONAL,
originalCalledNr                        [1]     PresentedNumberUnscreened OPTIONAL,
lastForwardingNr                        [2]     PresentedNumberUnscreened OPTIONAL,
lastForwardingReason                    [3]     DiversionReason OPTIONAL ,
userInfo                                        Q931InformationElement OPTIONAL }
diversionInformation                            DiversionInformationType        ::= 12
-- End of diversionInformation operation definitions
CallDeflectionType                          OPERATION
ARGUMENT SEQUENCE {
deflectionAddress                           Address,
presentationAllowedDivertedToUser           PresentationAllowedIndicator OPTIONAL,
routingInformation                          RoutingInformation OPTIONAL }
RESULT
ERRORS {                                    userNotSubscribed, notAvailable, invalidDivertedNr, operatorAccess,
                                            specialServiceNr, diversionToServedUserNr,
                                            incomingCallAcceptedByOtherTerminal,
                                            numberOfDiversionCounterExceeded, userBarredAsEssentialCallFailure }
```

TABLE 5/Q.952 (sheet 4 of 4)

```
DivertingLegInformation2Type          OPERATION

ARGUMENT SEQUENCE {

diversionCounter                      DiversionCounter,
diversionReason                       DiversionReason,
divertingNr                           [1] PresentedNumberUnscreened OPTIONAL
originalCalledNr                      [2] PresentedNumberUnscreened OPTIONAL }

divertingLegInformation2              DivertingLegInformation2Type        ::= 15

-- End of divertingLegInformation2 operation definitions

DivertingLegInformation3Type          OPERATION

ARGUMENT PresentationAllowedIndicator

divertingLegInformation3              DivertingLegInformation3Type        ::= 19

-- End of divertingLegInformation3 operation definitions

InvokeFailure                         ::= ENUMERATED {

                                      uusReqAsEssential (0),
                                      invalidForwardingInvocation (1),
                                      maxNrOfForwardingsExceeded (2) }

IntResultList       ::= SET OF Size (0..16) IntResult

IntResult           ::= SEQUENCE {

servedUserNr                          ServedUserNr,
basicService                          BasicService,
procedure                             Procedure,
forwardedToAddress                    Address }

ServedUserNr                          ::= CHOICE { PartyNumber,
                                      AllNumbers }

AllServices         ::= NULL

AllNumbers          ::= NULL

DiversionCounter    ::= INTEGER (0..127)

SubscriptionOption  :: = ENUMERATED {
                    noNotification (0),
                    notificationWithoutDivertedToNr (1),
                    notificationWithDivertedToNr (2) }

Procedure ::= ENUMERATED { cfu(0), cfb(1), cfnr(2) }

IntResultList1 ::= SET OF Size (0..16) PartyNumber

DiversionReason ::= ENUMERATED { unknown(0), cfu(1), cfb(2), cfnr(3), cd(4), cdImmediate(5) }

invalidDivertedNr                     ERROR ::= 12
operatorAccess                        ERROR ::= 13
specialServiceNr                      ERROR ::= 14
diversionToServedUserNr               ERROR ::= 15
notActivated                          ERROR ::= 46
incomingCallAcceptedByOtherTerminal   ERROR ::= 23
numberOfDiversionCounterExceeded      ERROR ::= 24
uusReqAsEssential                     ERROR ::= 47

-- this is an error indication of call diversion failure due to the user to user supplementary
-- service request as essential

END -- of Diversion operation definitions
```

The **activationDiversion** operation is defined in 4.2.

NOTES

1 Verification of the forwarded-to number should be accomplished (if possible) before accepting the call forwarding request. This verification is done by a simple check of the forwarded-to number in the forwarding exchange to see if the number is within the allowed number range.

2 Although the activation request may succeed, there is no guarantee that the forwarded-to number is a valid ISDN number and that no other service problems exist with the number provided.

If the call forwarding service is successfully activated the network shall

i) send an **activationDiversion** return result component to the user in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4]; and

ii) send to all users **activationStatusNotificationDiv** invoke component following the procedures for status notification as given in 5.1.5. The **activationStatusNotificationDiv** operation is defined in 4.2; and

iii) shall enter the Activated state.

The user, on receiving an **activationDiversion** return result component shall stop timer T (activate) and enter the Activated state. On expiration of timer T (activate) the state machine will move to the Idle state and the user may repeat the **activationDiversion** invoke.

The user may activate call forwarding supplementary service data for the specified basic service according to the procedures above, thus causing any previous activation for the call forwarding supplementary service to be overridden.

If the user activates a call forwarding supplementary service for all basic services, then any activations for individual basic service for that call forwarding supplementary service, are altered accordingly.

If a diversion supplementary service was activated for all basic services, and subsequently a modifying activation is received for only one of those services, only that basic service specific data is changed.

5.1.1.2 Exceptional procedures

If the network is unable to activate the call forwarding supplementary service the network shall send an **activationDiversion** return error component to the user in an appropriate bearer independent transport message as described in 6.3.2.2/Q.932 [4]. The user, on receiving such an **activationDiversion** return error component shall stop timer T (activate) and return to the Idle state.

5.1.2 Deactivation

5.1.2.1 Normal operation

In order to deactivate a call forwarding supplementary service, the served user shall send a **deactivationDiversion** invoke component to the network, in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4], start timer T (deactivate) and enter the Deactivate Request state. Timer T (deactivate) is specified in clause 9.

The network, on receiving such a **deactivationDiversion** invoke component shall enter the Deactivate Request state.

The **deactivationDiversion** operation is defined in 4.2.

If a call forwarding service was activated for all basic services, and a **deactivationDiversion** invoke component is provided for a single basic service, only that basic service speech data is deactivated, the other basic services remain deactivated.

If a call forwarding supplementary service was activated for a single basic service, and a **deactivationDiversion** invoke component is provided for all basic services, the deactivated service shall be deactivated; the other basic services remain unaffected.

If the call forwarding service is successfully deactivated, the network shall

i) send a **deactivationDiversion** return result component to the user in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4]; and

ii) send to all users identified by the served user number a **deactivationStatusNotificationDiv** invoke component following the procedures for status notification as given in 5.1.5; and

iii) enter the Idle state.

The **deactivationStatusNotificationDiv** operation is defined in 4.2.

The user, on receiving such a **deactivationDiversion** return result component shall stop timer T (deactivate) and enter the Idle state. On expiration of timer T (deactivate) the state machine enters the Idle state and the user may repeat the **deactivationDiversion** invoke.

5.1.2.2 Exceptional procedures

If the network is unable to deactivate the call forwarding supplementary service, the network shall send a Facility information element containing a **deactivationDiversion** return error component to the user in an appropriate bearer independent transport message, as described in 6.3.2.2/Q.932 [4] and return to the Activated state. The network shall retain the call forwarding supplementary service specific data as stored before the deactivation request in the case.

The user, on receiving such a **deactivationDiversion** return error component shall stop timer T (deactivate) and return to the Activated state.

5.1.3 Interrogation

5.1.3.1 Normal procedures

If the user wants to obtain the numbers at his interface for which call forwarding has been activated, the served user shall send an **interrogationDiversion1** invoke component to the network, in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4]; start timer T (interrogate) and enter the Interrogate Request state. Timer T (interrogate) is specified in 9.

The **interrogationDiversion1** operation is defined in 4.2.

The network, on receiving such an **interrogationDiversion1** invoke component shall enter the Interrogate Request state.

After the user has requested this procedure, the network shall return a list of served user numbers for which call forwarding has been activated at his interface.

This requested data shall be sent in an **interrogationDiversion1** return result component to the user in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4]; and return to the previous state.

The user, on receiving such an **interrogationDiversion1** return result component shall stop timer T (interrogate) and return to the previous state.

In order to determine the current call forwardings, the served user shall send an **interrogationDiversion** invoke component to the network, in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4]; start timer T (interrogate) and enter the Interrogate Request state. Timer T (interrogate) is specified in clause 9.

The interrogation procedure enables the served user to obtain information about the call forwarding data stored in the network.

The **interrogationDiversion** operation is defined in 4.2.

If the user wants to make a general data request, he shall set the basicService to AllServices into the **interrogationDiversion** invoke component.

If the user wants to make a specific data request, he shall set the basicService to the bearer service or/and teleservice required into the **interrogationDiversion** invoke component.

For the procedures at the coincident S and T reference point, the PartyNumber shall be specified as the served user number in the **interrogationDiversion** invoke component.

For the procedures at the T reference point, the AllNumbers shall be specified in the **interrogationDiversion** invoke component addressing the whole interface.

The network, on receiving such an **interrogationDiversion** invoke component shall enter the Interrogate Request state.

After the user has requested this procedure, the network shall return the following information:

- in response to a general data request, the served user shall be given a list of all basic services for which call forwarding is active including the forwarded-to addresses (numbers and sub-addresses), the diversion procedure and the served user number; or
- in response to a specific request concerning one particular basic service, the served user shall be informed whether or not call forwarding is active for that basic service, and if so, to what forwarded-to address including the diversion procedure and the served user number.

If call forwarding is not active for a specific data request or call forwarding is not active for any of the basic services in a general data request, an empty list is returned.

This requested data shall be sent in an **interrogationDiversion** return result component to the user in an appropriate bearer independent transport message as specified in 6.3.2.2/Q.932 [4]; and return to the previous state.

The user, on receiving such an **interrogationDiversion** return result component shall stop timer T (interrogate) and return to the previous state.

5.1.4 Exceptional procedures

If the network is unable to provide the information requested it shall send to the served user an **interrogationDiversion** return error component to the user in an appropriate bearer independent transport message as described in 6.3.2.2/Q.932 [4] and return to the previous state.

The user, on receiving such an **interrogationDiversion** return error component, shall stop timer T (interrogate) and return to the state prior to the interrogation request.

5.1.5 Status notification

5.1.5.1 Normal operation

The status notification procedure enables the served user and all other users at the same interface to receive information about the present status of the access due to activation or deactivation of supplementary services (e.g. activation of call forwarding unconditional).

The status notification information is provided by the network at the instant and with the information content as specified in the individual notification operation of the supplementary services concerned. For encoding of the Facility information element see 8.2.5/Q.932 [4] and for treatment of existing Q.931 information elements as parameters within a component see 8.2.5.1.2/Q.932 [4].

For transport of bearer independent status notifications the procedures as specified in 6.3.2.3/Q.932 [4] are applicable. The status notification is usually carried as a class 5 operation (asynchronous, outcome not reported).

5.1.5.2 Exceptional procedures

On receipt of an unrecognized Facility information element or on receipt of mistyped components, the receiving entity shall apply the normal error handling procedures.

5.2 Invocation and operation

If allowed by the served user's subscriptions, the calling party, the served user and the diverted-to user may be informed of the diversion.

5.2.1 Notification of diversion to the calling user

5.2.1.1 Normal operation

When diversion is invoked, the calling users network will (contingent on the network's support of the option of sending notification to the calling user) receive in one or more appropriate network messages, the following information:

- the "calling user receives notification that his call has been diverted" subscription option (see Table 1);
- the "diverting cause" set to either CFU, CFB, CFNR, CDimmediate and CDalerting;
- the redirection number (diverted-to number) with presentation indicator always set to restricted.

The calling users network on receipt of the subscription option shall respect the restriction requirements of all diverting users currently in the diversion chain.

That is:

i) "no notification" overrides all later requirements; and

(ii) "notification without the diverted-to user number" overrides later requests to include the diverted-to user number.

On receipt of the "diverting cause", provided it is:

- the first diversion; or
- a subsequent diversion where the served user has reached the alerting [diverting cause is either CFNR or CD (alerting)]; and

provided the restriction requirements of all diverting users currently in the diversion chain is not set to "calling user does not receive notification", the network shall send an appropriate message to the calling user with the Notification Indicator information element coded to "call is diverting" and without the diverted-to number and presentation indicator parameters.

In the case of CFNR or CD (alerting) an ALERTING message may be received from the forwarded-to user after an ALERTING message has been passed from the forwarding user to the calling user.

In this case, the calling users network shall not pass a second or subsequent ALERTING message to the calling user but shall include the message content and shall send as indicated by the restriction requirements the diversion notifications either

- in the PROGRESS message if the progress indicator information is also received; or
- in the NOTIFY message if the progress indicator information is not received.

5.2.1.2 Exceptional procedures

Exception procedures at the calling user's interface shall be according to 5.8/Q.931 [3].

5.2.2 Identification of the forwarded-to user to the calling user

5.2.2.1 Normal operation

When a call reaches the diverted-to user (i.e. alerting commences), the calling users network may receive in an appropriate network message a presentation indicator set to allowed or not allowed in accordance with the called user COLR supplementary service. The sending in the network of this indicator is optional in case of any restrictions and mandatory in case of no restrictions.

At this time, the calling users network will take the following actions depending on the restriction requirements of all diverting users currently in the diversion chain:

i) If this restriction requirements indicate "calling user does not receive notification" or is "Notify calling user, without diverted-to number", no information is given to the calling user and the operation is as described in 5.1/Q.931 [3].

ii) If this restriction requirements indicate "Notify calling user, with diverted-to number", the following apply:

a) If the diverted-to number is available and presentation is allowed according to the presentation indicator supplied with the forwarded-to number, the network shall include the Redirection number information element in the ALERTING, CONNECT or other appropriate message at the time that permission to present is determined.

The presentation indicator shall indicate "presentation allowed". The numbering plan identification field shall be coded either as "ISDN/telephony numbering plan" (see Recommendation E.164/E.163) or "unknown".

The type of number shall be "national number", "international number" or, as a network option, "unknown".

NOTE – As a network option, the type of number may be coded "unknown", in which case, the number is organised to the network dialling plan, i.e. prefixes, or the absence of a prefix, shall be used to distinguish international numbers and national numbers from each other.

b) If the diverted-to number is available, but presentation is not allowed according to the presentation indicator, the network shall include the Redirection number information element in ALERTING, CONNECT or other appropriate message at the time that restriction is determined, sent to the calling user. The presentation indicator in the Redirection number information element shall indicate "presentation restricted". The type of number and the numbering plan identification shall be set to "unknown" and the number digits field shall not be included.

c) If the diverted-to number is not available, the network shall include the Redirection number information element in the ALERTING, NOTIFY, PROGRESS and CONNECT message sent to the calling user. The presentation indicator shall be set to "number not available due to interworking", the type of number and the numbering plan identification shall be set to "unknown" and the number digits field shall not be included.

In the case of CFNR or CD (alerting) an ALERTING message may be received from the forwarded-to user after an ALERTING message has been passed from the forwarding user to the calling user.

In this case, the calling users network shall not pass a second or subsequent ALERTING message to the calling user but shall include the message content and shall send as indicated by the restriction requirements the diversion notifications either

– in the PROGRESS message if the progress indicator information is also received; or

– in the NOTIFY message if the progress indicator information is not received.

5.2.2.2 Exceptional procedures

Exception procedures at the calling user's interface shall be according to 5.8/Q.931 [3].

5.2.3 Operation at the served user

5.2.3.1 Call forwarding unconditional procedures

5.2.3.1.1 Normal operation

When an incoming call is forwarded without being offered to the served user for call forwarding unconditional, the served user, as a subscription option, may receive notification of the call forwarding (but will not be able to answer the incoming call).

If a call to the served user is forwarded and if a multipoint terminal configuration exists at the user-network interface, the network serving the served user shall send to all users identified by the served user's number the **diversionInformation** invoke component (class 5 operation) with contents as described in 4.2. with the "Diversion reason" set to cfu using the call unrelated broadcast connectionless transport mechanism described in 6.3.2.3/Q.932 [4]. The served user number shall be included in the Called party number information element of the FACILITY message.

If the network has knowledge that a single point configuration exists at the interface, the network serving the served user shall send the **diversionInformation** invoke component (class 5 operation) with the contents as described in 4.2 with the "Diversion reason" set to cfu using the call unrelated connectionless transport mechanism described in 6.3.2.2/Q.932 [4] transmitted on a point-to-point data link. The served user number shall be included in the Called party number information element of the FACILITY message.

Since no SETUP message was sent to the served user, the **diversionInformation** invoke component will further contain:

- telecommunication or bearer service information indicated by basicService;
- user-to-user information in userInfo;
- served user sub-address in servedUserSubaddress if the served user has subscribed to SUB supplementary service;
- calling party address in callingAddress.

The callingAddress will have the PresentedAddressScreened type and depending on the following conditions will have the following type choices:

- AddressPresentationAllowedScreened – If the presentation of the calling address is not restricted and the served user has subscribed to CLIP; or
- PresentationRestricted – If the presentation of the calling address is restricted and the served user has subscribed to CLIP; or
- NumberNotAvailableDueToInterworking – If the calling address is not available due to interworking, and the served user has subscribed to CLIP.

No callingAddress shall be included if the served user has not subscribed to CLIP.

If multiple divertings have occurred, the served user may also receive:

- originally called number in originalCalledNr;
- last forwarding number in lastForwardingNr;
- cause for last forwarding in lastForwardingReason set as received from the network.

The originalCalledNr and lastForwardingNr will have the presentedNumberUnscreened type and depending on the following conditions will have the following type choices:

- NumberPresentationAllowedUnscreened – If the subscription option "Diverting number is released" indicates "release diverting number information"; or
- PresentationRestricted – If the subscription option "Diverting number is released" indicates "do not release diverting number information"; or
- NumberNotAvailableDueToInterworking – If the number is not available due to interworking.

NOTE – The served user's network will send the notification information to the calling users network when the diversion operation to the diverted-to user is invoked.

5.2.3.1.2 Exceptional procedures

If the call forwarding service is unsuccessfully invoked, the network shall send to all users identified by the served user number an **invokeStatus** invoke component following the procedures for status notification as given in 5.1.5. The **invokeStatus** operation is defined in 4.2.

5.2.3.2 Call forwarding busy "NDUB" procedures

5.2.3.2.1 Normal operation

When an incoming call is forwarded without being offered to the served user for call forwarding busy with network determined user busy, the served user, as a subscription option, may receive notification of the call forwarding (but will not be able to answer the incoming call). If a call to the served user is forwarded and if the multipoint terminal configuration exists at the user-network interface, the network serving the served user shall send to all users identified by the served user's number the **diversionInformation** invoke component (class 5 operation) with contents as described in 4.2. with the "Diversion reason" set to cfb using the call unrelated broadcast connectionless transport mechanism described in 6.3.2.3/Q.932 [4]. The served user number shall be included in the Called party number information element of the FACILITY message.

If the network has knowledge that a single point configuration exists at the interface; the network serving the served user shall send the **diversionInformation** invoke component (class 5 operation) with the contents as described in 4.2 with the "Diversion reason" set to cfb using the call unrelated connectionless transport mechanism described in 6.3.2.2/Q.932 [4] transmitted on a point-to-point data link. The served user number shall be included in the Called party number information element of the FACILITY message.

Since no setup message was sent to the served user, the **diversionInformation** invoke component will further contain:

- telecommunications service information indicated by basicService;
- user-to-user information in userInfo;
- served user sub-address in servedUserSubaddress if subscribed;
- calling party address in callingAddress.

The callingAddress will have the PresentedAddressScreened type and depending on the following conditions will have the following type choices:

- AddressPresentationAllowedScreened – If the presentation of the calling address is not restricted and the served user has subscribed to CLIP; or
- PresentationRestricted – If the presentation of the calling address is restricted and the served user has subscribed to CLIP; or
- NumberNotAvailableDueToInterworking – If the calling address is not available due to interworking, and the served user has subscribed to CLIP.

No callingAddress shall be included if the served user has not subscribed to CLIP.

If multiple forwardings have occurred, the served user may also receive:

- originally called number in originalCalledNr;
- last forwarding number in lastForwardingNr;
- cause for last forwarding in lastForwardingReason set as received from the network.

The originalCalledNr and lastForwardingNr will have the presentedNumberUnscreened type and depending on the following conditions will have the following type choices:

- NumberPresentationAllowedUnscreened – If the subscription option "Diverting number is released" indicates "release diverting number information"; or
- PresentationRestricted – If the subscription option "Diverting number is released" indicates "do not release diverting number information"; or
- NumberNotAvailableDueToInterworking – If the number is not available due to interworking.

NOTE – The served user's network will sent the notification information to the calling users network when the diversion operation to the diverted-to user is invoked.

5.2.3.2.2 Exceptional Procedures

If the call forwarding service is unsuccessfully invoked, the network shall send to all users identified by the served user number an **invokeStatus** invoke component following the procedures for status notification as given in 5.1.5. The **invokeStatus** operation is defined in 4.2.

5.2.3.3 Call forwarding busy "UDUB" procedures

5.2.3.3.1 Normal operation

As part of the basic call procedures specified in 5.2/Q.931 [3], an incoming call shall be offered to the served user in a SETUP message. If a multipoint terminal configuration is known to exist at the user-network interface, the call forwarding busy "user determined user busy" procedures will be initiated; when the condition for UDUB as defined in 2.3 is fulfilled then, the busy user shall reject the call by sending a RELEASE COMPLETE message, specifying cause # 17 "user busy", in accordance with 5.2.5.1/Q.931 [3].

If the served user has subscribed to "served user receives notification that the call has been forwarded", then the network shall also send to all users identified by the served user's number the **diversionInformation** invoke component (class 5 operation) with contents as described in 4.2 with the "Diversion reason" set to cfb using the call unrelated broadcast connectionless transport mechanism described in 6.3.2.3/Q.932 [4]. Since setup information will already have been provided to the served user, the "Diversion reason" information will only be given. The served user number shall be included in the Called party number information element of the FACILITY message.

If a single-point configuration is known to exist at the interface, a point-to-point data link shall be used to carry the SETUP message.

The call forwarding busy "user determined user busy" procedures will be initiated in the case where the user rejects the call by sending a RELEASE COMPLETE message, specifying cause # 17 "user busy", in accordance with 5.2.5.1/Q.931 [3]. Then the call to the served user shall be forwarded. If the served user has subscribed to "served user receives notification that the call has been forwarded", then the network shall also send to the served user the **diversionInformation** invoke component with the "Diversion reason" set to cfb using the call unrelated connectionless transport mechanism described in 6.3.2.2/Q.932 [4] using a point-to-point data link. The served user number shall be included in the Called party number information element of the FACILITY message.

NOTE – The served user's network will send the notification information to the calling users network when the diversion operation to the diverted-to user is invoked.

5.2.3.3.2 Exceptional procedures

If the call forwarding service is unsuccessfully invoked, the network shall send to all users identified by the served user number an **invokeStatus** invoke component following the procedures for status notification as given in 5.1.5. The **invokeStatus** operation is defined in 4.2.

5.2.3.4 Call forwarding no reply procedures

5.2.3.4.1 Normal operation

As part of the basic call procedures specified in 5.2/Q.931 [3], an incoming call shall be offered to the served user. If call forwarding no reply is active for the basic service requested by this call, the network, on receiving the first ALERTING message from a responding user, shall start timer T (cfnr). The value of T (cfnr) is a network option.

The network shall stop timer T (cfnr) on receiving a CONNECT message from a user and shall not forward the call.

If the calling user initiates clearing of the call while T (cfnr) is running, the network shall stop T (cfnr) and shall not forward the call. The network shall proceed with call clearing as defined in 5.3.4/Q.931 [3] with cause # 16.

If a single-point configuration is known to exist and a served user initiates clearing of the call while T (cfnr) is running, the network shall stop T (cfnr) and shall not forward the call. The network shall proceed with call clearing to the calling user as defined in 5.3.4/Q.931 [3] with cause # 16.

If a point to multipoint configuration is known to exist and all alerting users have released the call while T (cfnr) is running, the network shall stop T (cfnr) and shall not forward the call. The network shall proceed with call clearing to the calling user as defined in 5.3.4/Q.931 [3] with cause # 16.

If T (cfnr) expires before the network receives a CONNECT message, the network shall redirect the call to the forwarded-to address. The network shall then take the following actions:

– If the served user has subscribed to "served user receives notification that the call has been forwarded", then the network shall send to all users identified by the served user's number a **diversionInformation** invoke component with contents as described in 4.2, with the DiversionReason set to the cfnr value using the appropriate call unrelated connectionless transport mechanism as described in 6.2.1.2/Q.932 or 6.3.2.3/Q.932 [4]. The served user number shall be included in the Called party number information element of the FACILITY message. Since setup information will already have been provided to the served user, the "Diversion reason" information will only be given.

– If the network provider option "Served User call retention on invocation of diversion" is "Clear call on invocation", the network shall clear the call to the served user following the call clearing procedures as defined in 5.3.4/Q.931 [3] with cause # 31 with location set to "public network serving the local user".

NOTE 1 – The served user's network will send the notification information to the calling users network when the diversion operation to the diverted-to user is invoked.

– If the network provider option "Served User call retention on invocation of diversion" is "Retain call until alerting begins at diverted-to user", the network shall continue to offer the call to the served user. If the served user's network receives a CONNECT message from the served user before receiving an indication that the call is in the Call Received (N7), Connect Request (N8) or Active (N10) states at the forwarded-to users network, the network shall award the call to the served user and proceed as defined in 5/Q.931 [3]. The network shall initiate clearing toward the forwarded-to user as defined in 5.3/Q.931 [3] with cause # 31 with location set to "public network serving the local user".

NOTE 2 – The served user's network will send the notification information to the calling users network when it receives an alerting indication from the diverted-to users network.

When the served user's network receives an indication that the forwarded call is in the Call Received (N7) or Connect Request (N8) or Active (N10) states at the forwarded-to users network, the served user's network shall, if not done previously, initiate call clearing to the served user as defined in 5.3.4/Q.931 [3] with cause # 31 with location set to "public network serving the local user".

5.2.3.4.2 Exceptional procedures

If the call forwarding service is unsuccessfully invoked, the network shall send to all users identified by the served user number an **invokeStatus** invoke component following the procedures for status notification as given in 5.1.5. The **invokeStatus** operation is defined in 4.2.

If the forwarded call is not offered to the forwarded-to user (for example, the call may not be offered to the forwarded-to user because of NDUB, network congestion or when the maximum number of call forwardings has been reached), the network shall take the following actions:

– If the network offered the call to the served user while the call was forwarded, the network shall continue the call offering procedures defined in Recommendation Q.931 [3].

NOTE 1 – This applies to the retention of the call on invocation of call forwarding.

– If the network already cleared the served user, no action shall be taken.

NOTE 2 – This applies to the clearing call option on invocation of call forwarding.

5.2.3.5 Call deflection

5.2.3.5.1 Normal operation

The network offers incoming calls to the called user's installation according to the normal procedures described in 5.2/Q.931 [3].

Terminals which are compatible with the incoming call can request that the call be deflected to another address provided the CD supplementary service is subscribed, by invoking the call deflection service with an appropriate message.

An appropriate message shall contain a Facility information element with a **callDeflection** invoke component as described in 4.2.

The **callDeflection** invoke component shall contain the deflected-to address in the deflectionAddress. If the network option "Transit network selection supported" is yes or the network option "Network specific facility selection supported" is yes than optionally, the **callDeflection** invoke component may contain either a transit network selection or network specific facility selection in the routingInformation parameter. If this argument is missing, the network shall use the deflecting user's default subscription options to route the call.

Optionally, the **callDeflection** invoke component may contain a presentationAllowedDivertedToUser argument. If the presentationAllowedIndicator is included, the network shall use its value to determine whether the redirecting number shall be allowed to be presented to the deflected-to user. If this argument is missing, the network shall use the deflecting user's default subscription options to route the call.

This facility information element can be received in the network either

- Case A – While in the Call Present network state (N6) or in the Incoming Call Proceeding state (N9) or in the Overlap Receiving state (N25) in a FACILITY message (CD supplementary service with immediate response); or

- Case B – While in the Call Received network (N7) state in a FACILITY message. (CD supplementary service during waiting for answer.)

For case B dependent on a network provider option, the network will either

i) retain the call to the served user until alerting commences at the deflected-to user; or

ii) clear the call towards the served user on acceptance of the call deflection request.

For case A

- If a point-to-point configuration is known to exist the network shall act immediately on the deflection invocation request.

- If a point-to-multipoint configuration is known to exist the network shall invoke call deflection at the expiry of timer T303 while in network state N6 or at the expiry of time T310 while in network state N9, provided no other terminal at the served user interface sends an ALERTING or CONNECT message.

For case B the network will act immediately on the deflection invocation request without waiting for other messages from other terminals on the interface.

For both cases A and B, provided the user has subscribed to the service, the network shall perform the call deflection towards the indicated address.

If the service is successfully invoked, the network shall send a **callDeflection** return result component in a Facility information element in a DISCONNECT message with cause # 31 and location set to "public network serving the local user" to the served user with contents as described in 4.2.

For the CD supplementary service case without network connection retention options [case B, ii)], the DISCONNECT message from the served user's network shall be sent when call deflection towards the indicated address is invoked.

NOTE 1 – The served user's network will send the notification information to the calling users network when the diversion operation to the diverted-to user is invoked.

For the call deflection cases with network connection retention option [case A and case B, i)], the DISCONNECT message from the served user's network shall be sent when an indication is received that the deflected-to user has alerted the call.

NOTE 2 – The served user's network will send the notification information to the calling users network when it receives an alerting indication from the diverted-to users network.

When the served user's network receives an indication that the deflected call is in the Call Received (N7) or Connect Request (N8) or Active (N10) states at the deflected-to users network, the served user's network shall, if not done previously, initiate call clearing to the served user's interface as defined in 5.3.4/Q.931 [3].

5.2.3.5.2 Exceptional procedures

If the served user's network cannot accept the call deflection invocation request from the terminal, for the cases A and B of 5.2.3.5.1, as correctly requested with a FACILITY message containing a Facility information element, it shall send a Facility information element with contents as described in a **callDeflection** return error component.

Dependent of the network provider option "served user call retention when deflection is rejected" this Facility information element shall be sent either

- in a FACILITY message and the call is continued at the deflecting user; or
- in a DISCONNECT message with cause # 31 with location set to "public network serving the local user" "normal call clearing". The user, on receiving such a DISCONNECT message from the network, shall release the invoke identifier and release the call as specified in 5.3.4/Q.931 [3].

NOTE – It is a network option that diverted-to numbers are validated by the network serving the diverted-to user. Thus, although the invocation request may succeed, there is no guarantee that the diverted-to number is a valid ISDN number and that no other service problems exist with the number provided.

If the deflected call towards the deflected-to user cannot be completed (e.g. because of congestion or busy) and if the served user's network has not already cleared the served user (i.e. option A, "call retention at the served user until alerting commences at the deflected-to user's side"), the served user's network shall send a Facility information element with contents as described in the callDeflection error component with the value "callFailure" for congestion at the deflecting user's network. Else the cause value contained in the SS # 7-RELEASE from the deflected-to user's network shall be mapped into the embedded cause value.

Dependent of the network provider option "served user call retention when deflection is rejected" this Facility information element shall be sent either

- in a FACILITY message and the call is continued at the deflecting user; or
- in a DISCONNECT message with cause # 16 "normal call clearing". The user, on receiving such a DISCONNECT message from the network, shall release the call as specified in 5.3.4/Q.931 [3] with cause # 16.

If the network has already cleared the served user, no action shall be taken.

If the served user's network cannot accept the **callDeflection** invocation request from the terminal because the routing information included identifies a facility resource which is not available to the served user, the network shall send a Facility information element with the error value, notAvailable, in a return error component.

Dependent of the network provider option "served user call retention when deflection is rejected" this Facility information element shall be sent either

- in a FACILITY message and the call is continued at the deflecting user; or
- in a DISCONNECT message with cause # 31 with location set to "public network serving the local user". The user, on receiving such a DISCONNECT message from the network, shall release the invoke identifier and release the call as specified in 5.3.4/Q.931 [3].

5.2.4 Operation at the diverted-to-user

5.2.4.1 Normal operation

When single diversion has occurred, the Redirecting number information element shall contain details of the last diversion.

When multiple diversions have occurred, the network shall repeat the Redirecting number information element only once. These information elements shall not be preceded by the Repeat indicator information element.

The network shall code the first Redirecting number information element with details of the last diversion.

The network shall code the last Redirecting number information element with details of the first diversion, if

1) the last diversion is the result of a call deflection, and the "presentationAllowedDivertedToUser" argument was included in the **callDeflection** invoke component, and this argument was set to the value "TRUE"; or

2) if the "presentationAllowedIndicator" argument was not included in the **callDeflection** invoke component and the subscription option "Diverting Number is released" is set to "Release diverting number information" for the last diversion, then the network shall include in the SETUP message the served user number in the last Redirecting number with the presentation indicator set to "presentation allowed" and the diversion cause included in the "reason for diversion" field.

The "type of number" shall be set to international, national or unknown and the numbering plan identification set to "ISDN numbering plan, (see Recommendation E.164/E.163) or "unknown".

NOTE – As a network option the prefix is added to the number; in this case the diverted-to number is coded "unknown", if

1) the last diversion is the result of a call deflection, and the "presentationAllowedIndicator" argument was included in the **callDeflection** invoke component, and this argument was set to the value "FALSE"; or

2) if the "presentationAllowedDivertedToUser" argument was not included in the **callDeflection** invoke component and the subscription option "Diverting Number is released" is set to "Do not release diverting number information" for the last diversion, then the network shall set in the last Redirecting number of the SETUP message the presentation indicator to "presentation restricted", the type of number and the numbering plan shall be set to unknown and the number digits field shall not be included.

For both subscription options when multiple diversions occur, the last Redirecting number of the SETUP message will contain the information applicable for the first diversion with the "reason for diversion" field set to "unknown".

The reason for diversion shall be:

– "Unknown" – If redirecting number information is available but the reason for diversion is not known by the network.

– "Call forwarding busy" – If the network forwarded a call using the CFB supplementary service.

– "Call forwarding no reply" – If the network forwarded a call using the CFNR supplementary service.

– "Call forwarding unconditional" – If the network forwarded a call using the CFU supplementary service.

– "Call deflection" – If the network deflected a call using the CD supplementary service.

5.2.4.2 Exceptional procedures

Exception procedures at the diverted-to user's interface shall be according to 5.8/Q.931 [3].

5.3 Reminder notification to the served user

5.3.1 Normal operation

If the served user has activated a call forwarding supplementary service and an outgoing call with the same ISDN number, and with the same bearer service or teleservice, is initiated at that served user's interface, the network, as a subscription option, shall send a Notification indicator information element with a notification description value of "diversion activated" in the first call control message for that call sent from network to user.

6 Interaction with other supplementary services

6.1 Calling Line Identification Presentation

No impact on protocol.

6.2 Calling Line Identification Restriction

No impact on protocol.

6.3 Connected Line Identification Presentation

Impact, see 5.2.1.1.

6.4 Connected Line Identification Restriction

Impact, see 5.2.1.1.

6.5 Call Waiting

No impact on protocol.

6.6 Closed User Group

No impact on protocol.

6.7 Advice of Charge

See advice of charge interaction with call forwarding.

6.8 Direct-Dialling-In

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.9 Call Hold

No impact, i.e. neither supplementary service affects the operation of the other supplementary service.

6.10 Three-Party Service

See Three-Party Service interaction with Call Forwarding.

6.11 Conference Calling

No impact on protocol.

6.12 User-to-user signalling services

To be provided.

6.13 Malicious Call

No impact on protocol.

6.14 Call Transfer

No impact on protocol.

6.15 Freephone

No impact on protocol.

6.16 CCBS

No impact on protocol.

6.17 Terminal Portability

No impact on protocol.

6.18 Sub-addressing

No impact on protocol.

6.19 Multiple Subscriber Number

No impact on protocol.

7 Interactions with other networks

7.1 Interactions with non-ISDNs

If a call that has been forwarded encounters interworking, an indication of interworking shall be sent to the calling user. The notification of interworking shall be returned as defined in 5/Q.931 [3].

NOTE 1 – In the case of CFNR, the calling user may receive an indication of interworking after alerting has begun.

If a call has been forwarded using the CFNR supplementary service and the forwarded portion of the call encounters interworking, then in-band tones and announcements shall be passed on to the calling user. If alerting was continued at the served user, the network shall clear the call to the served user by sending a DISCONNECT message with cause # 16: "normal clearing" (location: public network serving the local user).

NOTE 2 – A non-ISDN calling user should not receive any notification that a call is forwarded.

7.2 Procedures for interworking with private ISDNs

7.2.1 Procedures where the forwarding point is an NT2 and notification is supplied to the calling user in the public network

The following is applicable when served user's network supports the option of sending notification to the calling user.

Where forwarding takes place at an NT2 (e.g. within a private network) after call delivery across a destination side user-network interface, one or more Facility information elements may be sent by the called user in any of FACILITY, PROGRESS, ALERTING or CONNECT messages. These messages are handled according to the procedures of 5.2/Q.931 [3] and 6/Q.932 [4].

A **divertingLegInformation1** invoke component shall be contained in the FACILITY, PROGRESS, ALERTING or CONNECT message in order to convey

- the diversion reason in diversionReason;
- the subscription option of the served user within the private ISDN in subscriptionOption; and
- possibly the diverted-to ISDN number in nominatedNr.

A **divertingLegInformation3** invoke component may also be contained in the FACILITY or CONNECT message in order to convey the presentation indicator, indicating whether or not the diverted-to ISDN number may be presented to the calling user.

The conveyed information is used by the notification procedures towards the calling user in the public network as explained in 5.2.1.

7.2.2 Presentation of a diverted call from a public ISDN to the private ISDN

If a diverted call is presented from a public ISDN to the private ISDN, then the SETUP message sent from network to user shall include a Facility information element containing a **divertingLegInformation2** invoke component to convey

- the number of diversions that the call has experienced so far (diversion counter);
- the last diversion reason;
- possibly the last diverting number (if presentation is allowed); and
- possibly the first diverting number (if multiple forwarding has occurred and presentation is allowed).

The network shall then expect either

a) an ALERTING or CONNECT message according to basic call control with a possible Facility information element containing a **divertingLegInformation3** invoke component when the permission to deliver the diverted-to number to the calling user is identified; or

b) a SETUP ACKNOWLEDGE or CALL PROCEEDING message according to basic call control with a Facility information element containing a reject component indicating an invoke problem.

If no information as specified in a) and b) above is received then the normal call handling procedures shall apply.

7.2.3 Procedures where a call, originated by a private ISDN or forwarded by a private ISDN into the public network, is subject to forwarding in the subsequent network(s)

The procedures as for 5.2.1 shall apply.

7.2.4 Diversion on a call presented from a private ISDN to the public ISDN

If a diverted call is presented from a private ISDN to the public ISDN, then the SETUP message sent from user to network shall include a Facility information element containing a **divertingLegInformation2** invoke component to convey

- the number of diversions that the call has experienced so far (diversion counter);
- the last diversion reason;
- possibly the last diverting number (if presentation is allowed); and
- possibly the first diverting number (if multiple forwarding has occurred and presentation is allowed).

The user shall then expect either

a) an ALERTING or CONNECT message according to basic call control with a Facility information element containing a **divertingLegInformation3** invoke component when the permission to deliver the diverted-to number to the calling user is identified; or

b) a SETUP ACKNOWLEDGE or CALL PROCEEDING message according to basic call control with a Facility information element containing a reject component indicating an invoke problem.

If no information as specified in a) and b) is received then the normal call handling procedures shall apply.

7.2.5 Procedures where the forwarding point is an NT2 and partial rerouting takes place in the public network

7.2.5.1 Normal procedure

Where call rerouting is requested by an NT2 (e.g. by a private network) as a result that forwarding or deflection is originated ISDNs a user-network interface, the private network shall send to the public network a **callRerouting** invoke component, in a Facility information element, with contents as described in 4.2 using the call related transport mechanism described in 8.3.1/Q.932 [4]. The “ReroutingReason” will be set to the appropriate value dependent on the type of diversion initiated by the user.

The **callRerouting** invoke component shall contain:

- The call rerouting reason in the reroutingReason. If multiple divertings have occurred, reroutingReason shall contain the call rerouting reason of the last diversion.
- The called address in calledAddress which shall also include the nominated number.
- The calling party sub-address may be included into callingPartySubaddress.
- The number of diversions will be indicated in the reroutingCounter.
- The served user may send the number of diversions in the reroutingCounter. If the public network stores the redirection counter and if it receives no information, it shall increment the redirection counter by 1. If the private network knows that only 1 diversion has occurred it does not need to send the reroutingCounter.
- The served user may send user-to-user information, HLC, LLC and BC information elements embedded, in the **callRerouting** invoke component. The public network shall as a minimum store the BC information. If the public network receives user-to-user information, HLC, LLC or BC information, the public network shall override any stored information for the call; otherwise it shall use the stored information in the diverted leg of the call.
- Optionally, the **callRerouting** invoke component may contain a presentationAllowedIndicator argument. If the presentationAllowedDivertedToUser is included, the public network shall use its value to determine whether the redirecting number shall be allowed to be presented to the deflected-to user. If this argument is missing, the public network shall use the deflecting user's default subscription options to determine whether the redirecting number shall be presented to the deflected-to user.
- If the network option "Transit network selection supported" is yes or the network option "Network specific facility selection supported" is yes, then, optionally, the **callRerouting** invoke component may contain either a transit network selection or network specific facility selection in the routingInformation parameter. If this argument is missing, the network shall use the served user's default subscription options to route the call.

If multiple divertings have occurred, the served user may also send the last forwarding number in lastReroutingNr;

The calling party number shall be stored in the public exchange and shall be passed to the diverted-to user exchange.

The originally called number shall be stored in the public exchange and shall be passed to the diverted-to user exchange. The lastForwardingNr will have the presentedNumberUnscreened type and depending on the following conditions will have the following type choices:

- NumberPresentationAllowedUnscreened if the subscription option "Diverting number is released" indicates "release diverting number information"; or
- PresentationRestricted if the subscription option "Diverting number is released" indicates "do not release diverting number information"; or,
- NumberNotAvailableDueToInterworking if the number is not available due to interworking.

The subscription option will be included in the SubscriptionOption so that the calling users network can receive this information together with the diverted-to number.

The Facility information element can be received in the public network either

- Case A – While in the Call Present network state (N6) or in the Incoming Call Proceeding state (N9) or in the Overlap Receiving state (N25) in a FACILITY message (this is the case for CFU, CFB and CD with immediate response); or
- Case B – While in the Call Received network (N7) state in a FACILITY message (this is the case for CFNR and CD with response during the alerting phase).

For Case B dependent on a network provider option, the public network shall either

i) retain the call to the private network until the diverted-to user has alerted the call; or

ii) clear the call towards the private network on acceptance of the call rerouting request.

For both cases A and B, the public network shall act immediately on the call rerouting invocation request and shall perform call rerouting towards the indicated address.

If the service is successfully invoked, the public network shall send a Facility information element in an appropriate message to the private network with contents as described in a **callRerouting** return result component.

The Facility information element will be sent in a DISCONNECT message for case A and for response during the alerting phase without public network connection retention option case [see B, ii)]. The Facility information element will be sent in a FACILITY message in case the network retention option until the diverted-to user has alerted the call applies [see case B, i)].

For case B, i), on receipt of a message from the diverted-to network indicating alerting or answer, the connection at the served user side shall be released by sending a DISCONNECT message according to the normal call clearing procedures specified in 5.3/Q.931 [3].

7.2.5.2 Exceptional procedures

If the public network cannot accept the call rerouting invocation request from the private network, for cases A and B of 5.4.5.1, as correctly requested with a FACILITY message containing a Facility information element, it shall send a Facility information element with contents as described in a **callRerouting** return error component (as described in 4.2) in the FACILITY message and release the invoke identifier.

If the public network cannot accept the **callRerouting** invocation request from the served user because the routingInformation included identifies a facility resource which is not available to the served user, the public network shall send a Facility information element with the error value, notAvailable, in a return error component. This Facility information element shall be sent in a FACILITY message and the call is continued at the served user.

7.2.6 Activation/deactivation/registration

The procedure at the coincident S and T reference point as specified in 5.1 shall apply with the following exceptions:

- the status notification operations shall not apply;
- the activation and deactivation shall only be applicable for the whole private network. All activation and deactivation requests not containing the indication “for all numbers” shall be rejected by sending an appropriate return error component to the private ISDN as specified in 5.1.

These procedures are applied where the private network wishes to divert all calls for that private network to an alternative destination. When both the private network and the public network invoke call forwarding (with the forwarding functionally provided in the public network), then the first decision in the public ISDN shall take effect. Subsequent call forwarding invokes will be ignored. The procedures for CFU (UDUB) are not applicable at the T reference point.

NOTE – These procedures are applied when the private network wishes to divert all incoming calls of a specific basic service to one alternative destination.

7.2.7 Notification to served user

The procedures at the coincident S and T reference point as specified in 5.2.3 for the notification to the served user shall be applied at the T reference point. In this case, the Called party number information element in the FACILITY message shall indicate the called user number. The servedUserSubaddress in the diversionInformation invoke component should indicate the called user sub-address, if available.

NOTE – These procedures are applied when the private network wishes to divert all incoming calls of a specific basic service to one alternative destination.

8 Signalling flows

See Figure 3 to 9.

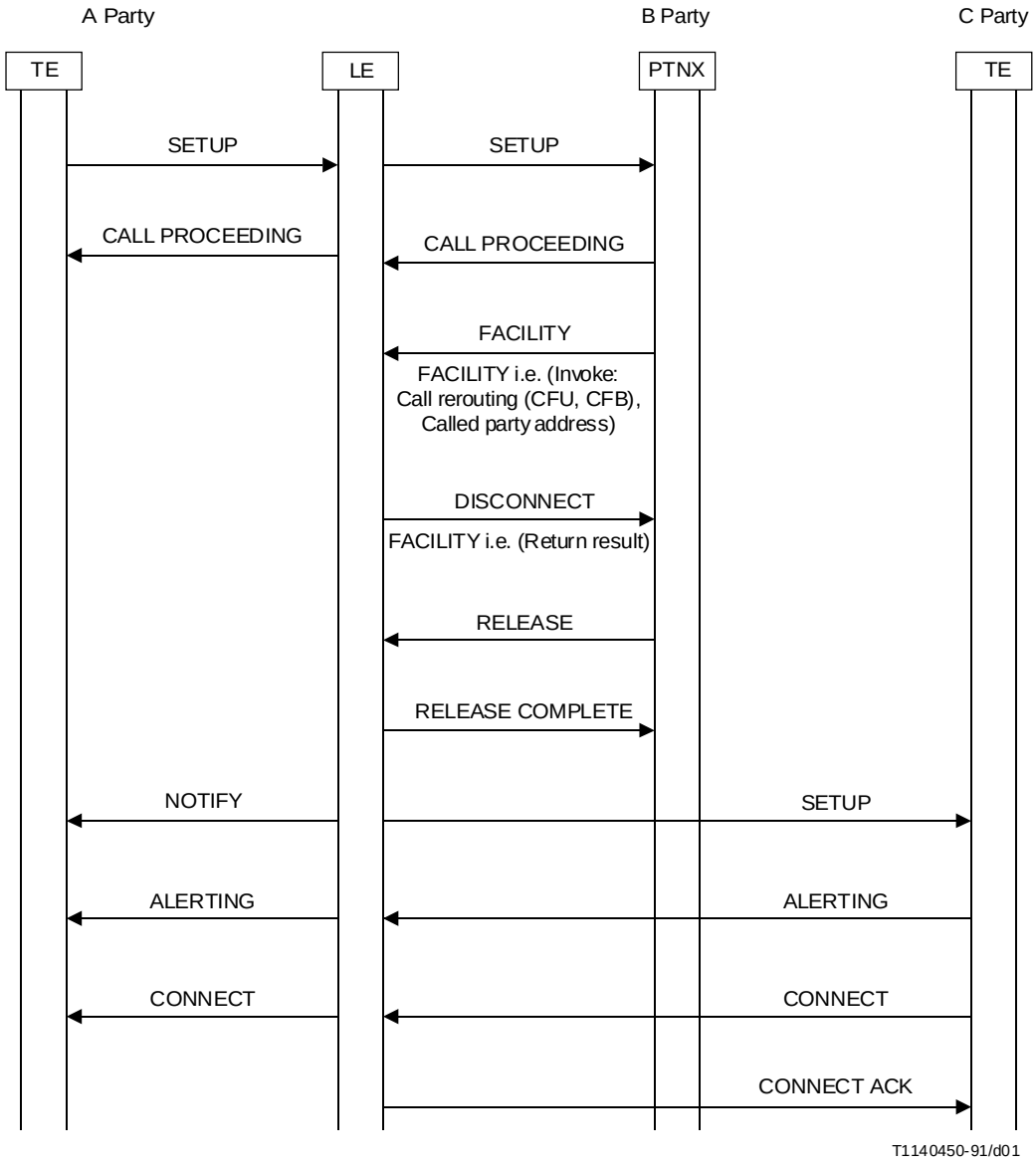


FIGURE 3/Q.952

Partial rerouting provided in PTNX triggered in case of CFU and CFB (network determined user busy)

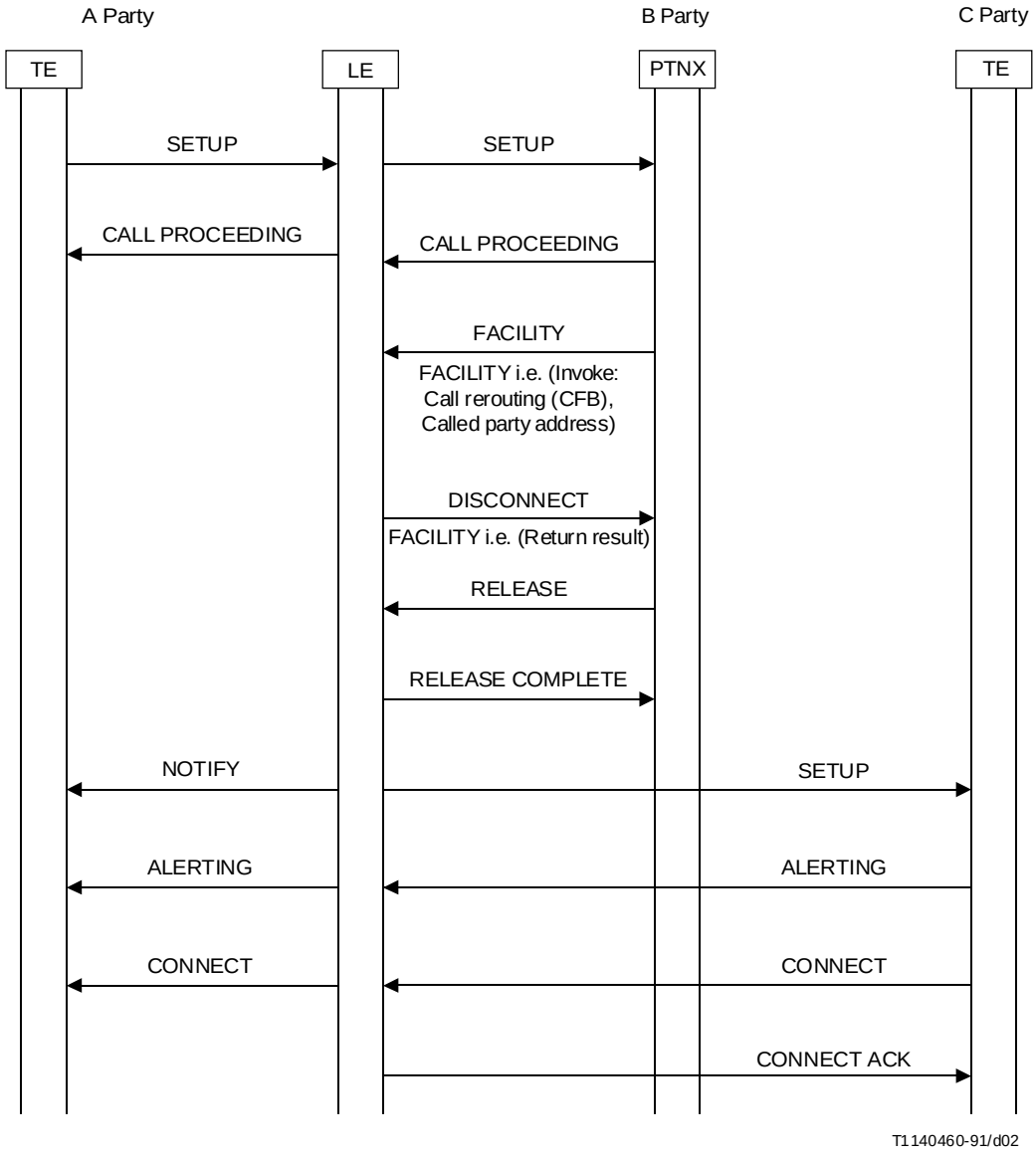


FIGURE 4/Q.952

Partial rerouting provided in PTNX triggered by CFB (user determined user busy)

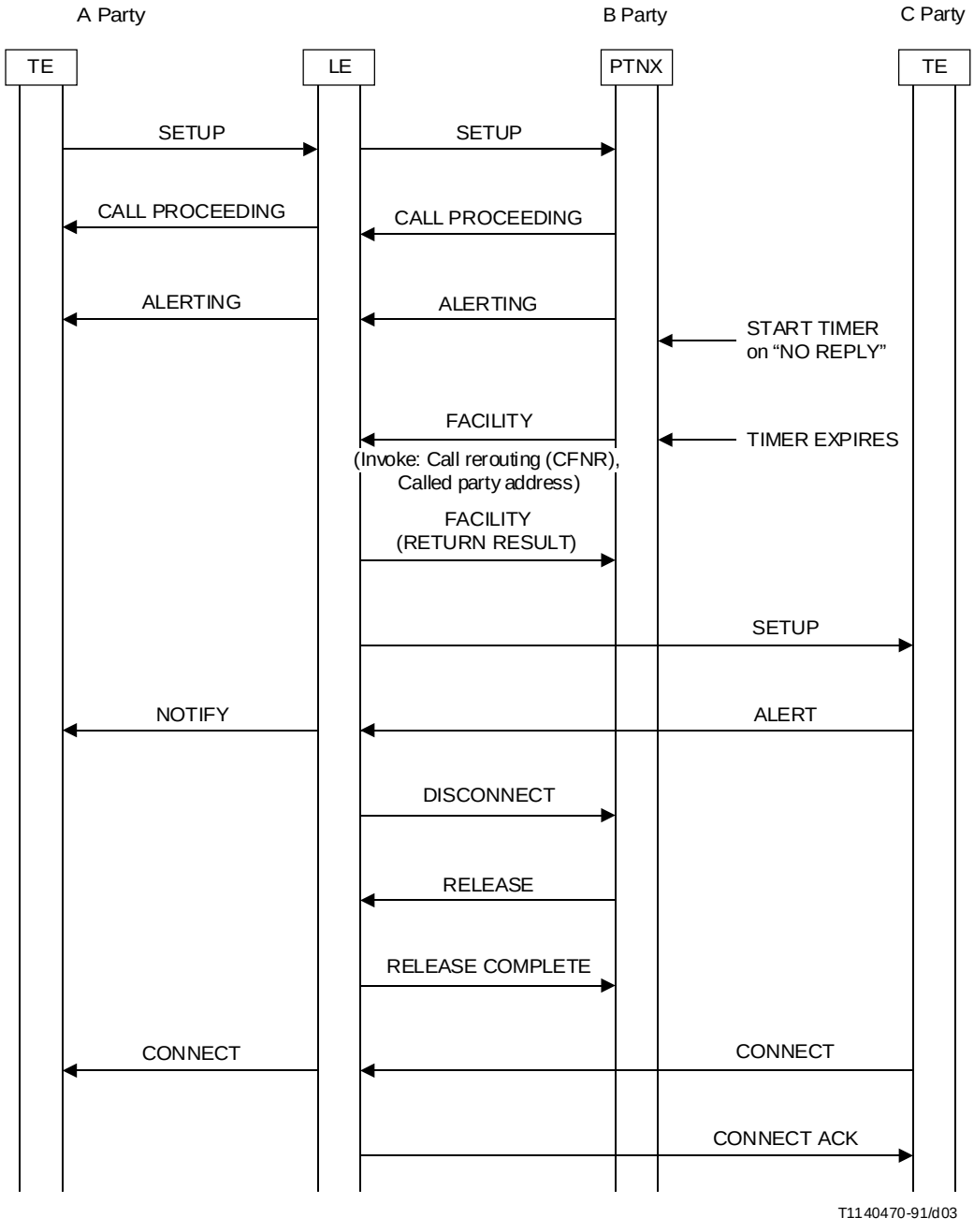


FIGURE 5/Q.952

Partial rerouting provided in PTNX triggered by CFNR – Late release

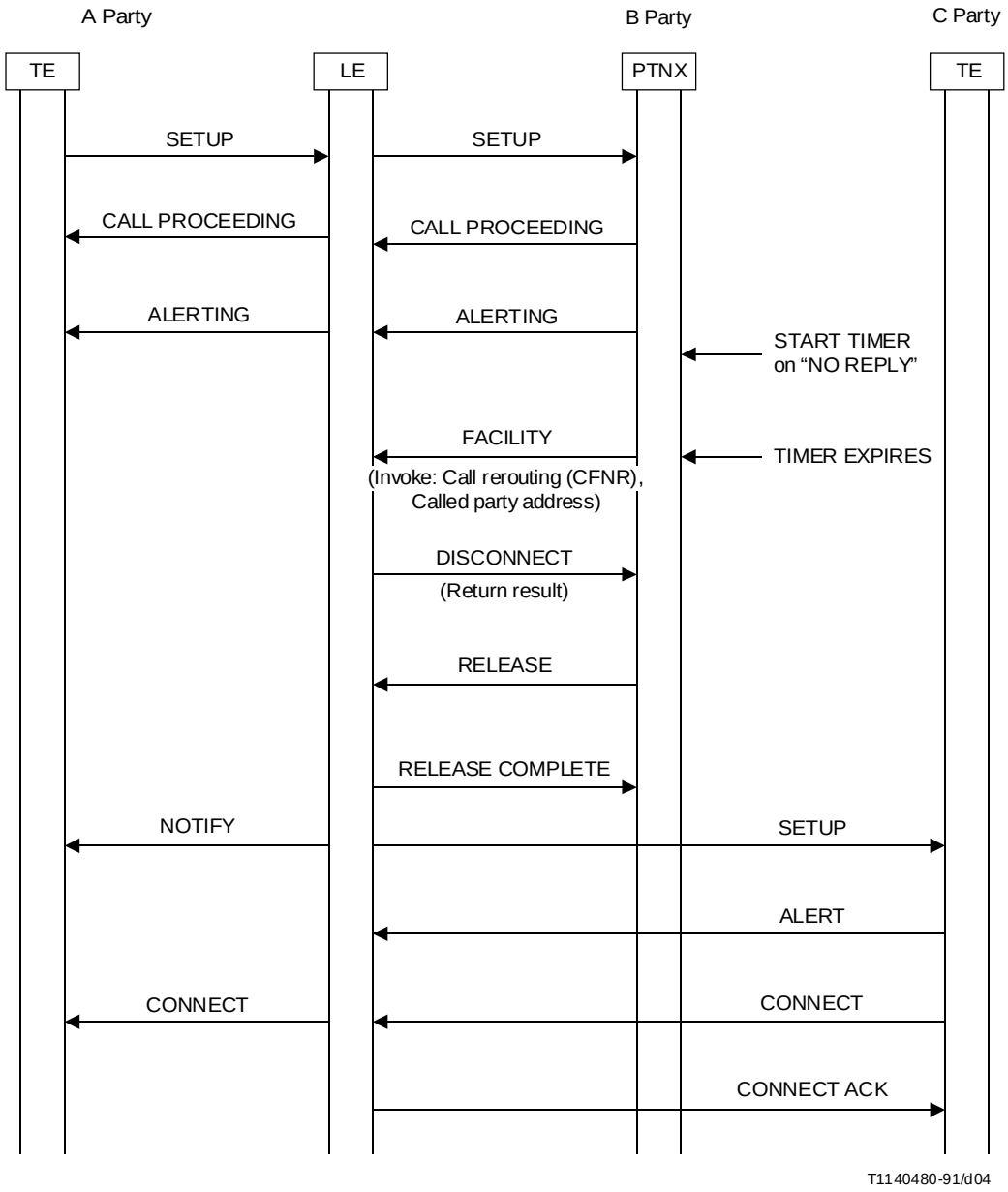


FIGURE 6/Q.952

Partial rerouting provided in PTNX triggered by CFNR – Early release

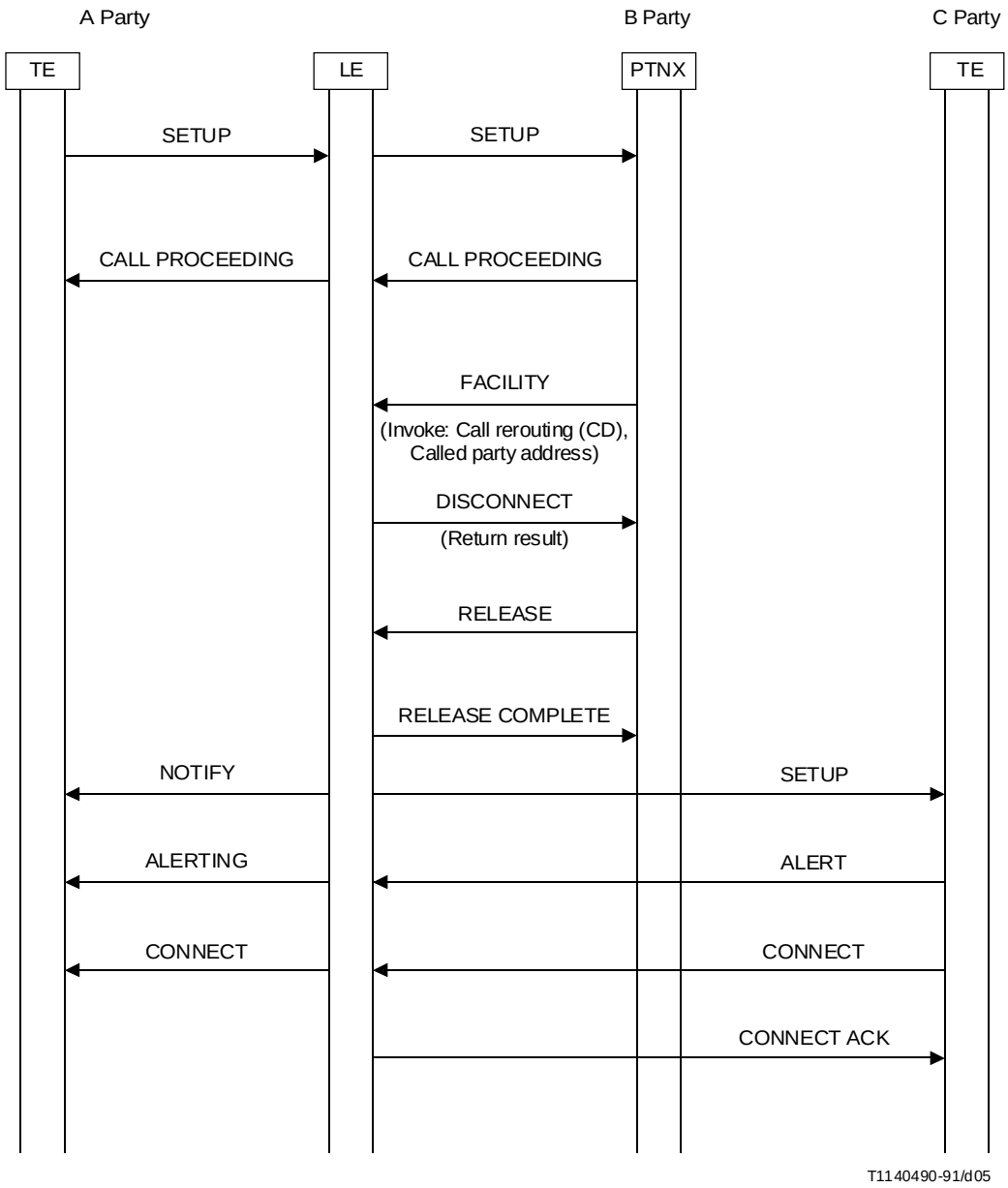


FIGURE 7/Q.952

Call Deflection provided in PTNX for immediate response – Early release

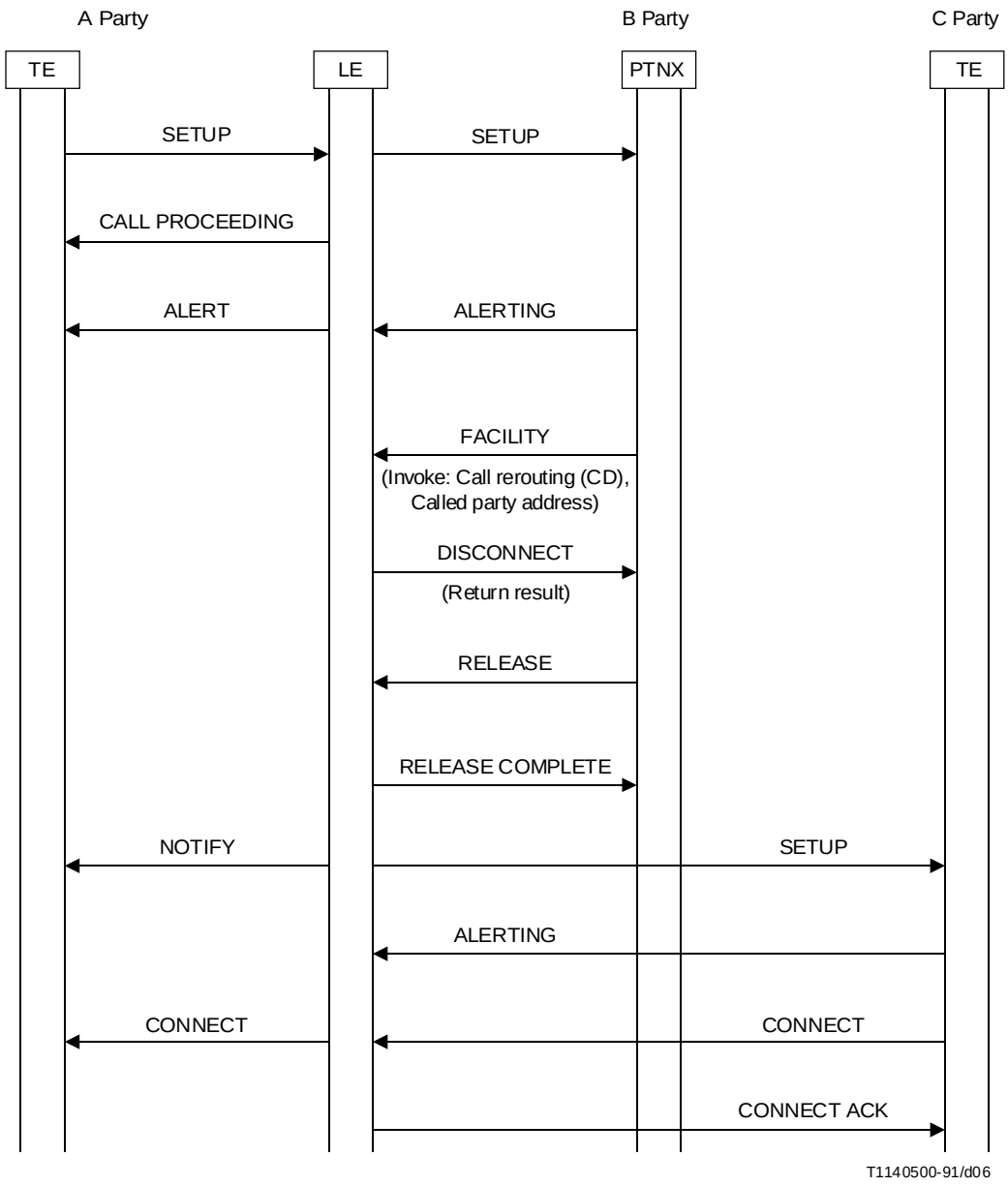


FIGURE 8/Q.952

Call Deflection provided in PTNX for response during alerting phase – Early release

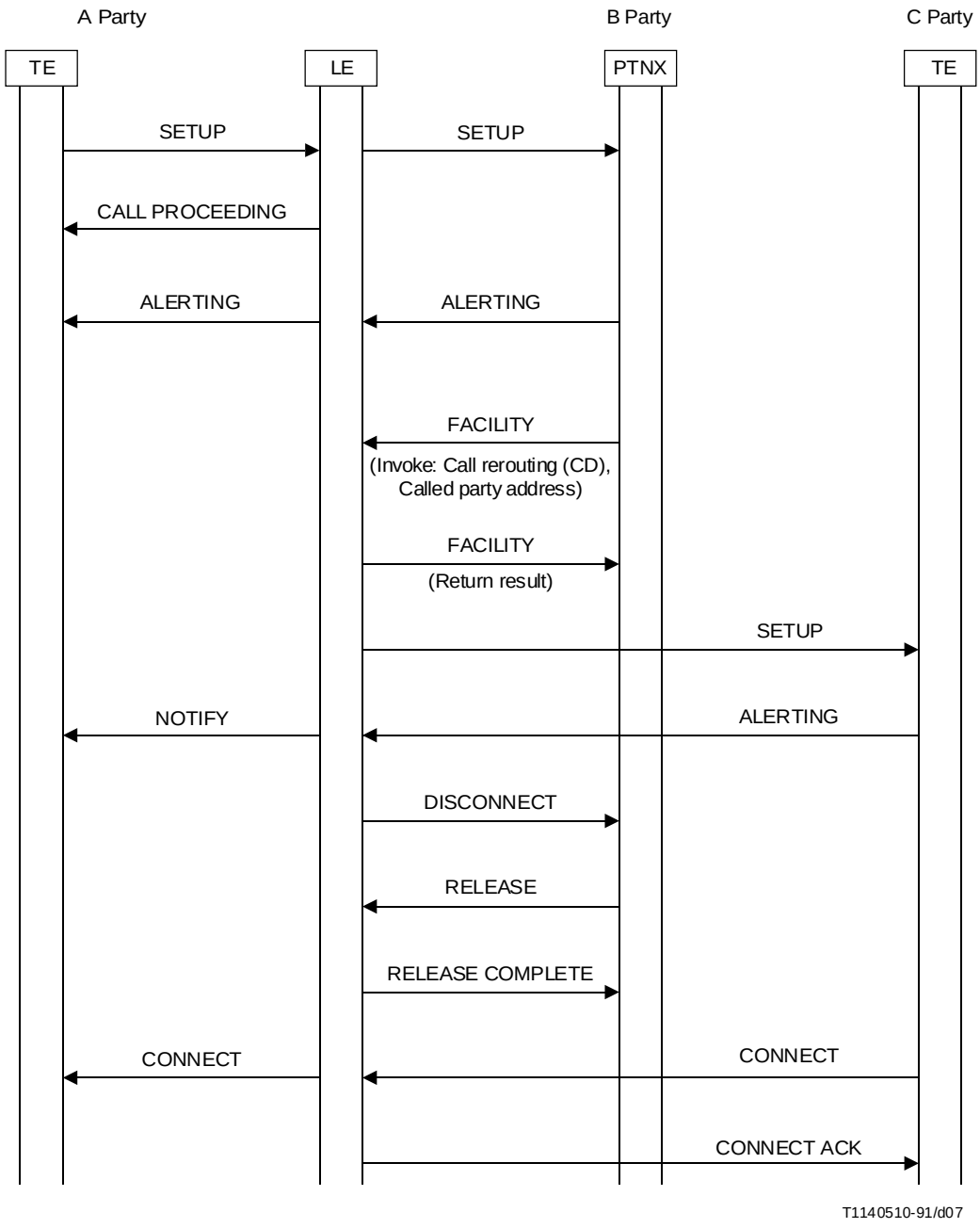


FIGURE 9/Q.952

Call Deflection provided in PTNX for response during alerting phase – Late release

9 Parameter values (timer)

The following timer has been identified in the procedures text for invocation and operation:

– *Network timer T (cfnr)* – This timer shall be started when the first alerting message is received from the served user. This timer shall be stopped when a connect message is received. On expiry, call forwarding is initiated. The duration of the timer shall be a service provider option.

The following states are conceived for the call forwarding supplementary service management procedures at the served user's access and are applicable to the network and optionally the user:

– *Idle state* – The specific call forwarding supplementary service is idle for this ISDN number and/or particular basic service. This is the initial state on subscription of the particular call forwarding supplementary service.

– *Activate Request state* – The user has requested that a supplementary service is activated for this ISDN number and/or particular basic service.

– *Deactivate Request state* – The user has requested that an active supplementary service shall be deactivated for this IDSN number and/or particular basic service.

– *Interrogate Request state* – The user has requested that a supplementary service be interrogated.

A state machine may exist for each specific instance of the following parameter values:

– procedure;

– served user number;

– basic service.

Table 6 shows the timers used for the call forwarding supplementary service management procedures.

TABLE 6/Q.952

Timer value	Time out value	Cause for start	Normal stop	At the first expiry
T (activate)	4 seconds	Activation invoke sent	Activation return result received	Return to idle
T (deactivate)	4 seconds	Deactivation invoke sent	Deactivation return result received	Remain in Activated state
T (interrogate)	4 seconds	Interrogation invoke sent	Interrogation return result received	Remain in the state prior to the invoke

10 Dynamic description (SDLS)

Figures 10 to 18 show the SDL diagrams for the diversion supplementary services at the public network side.

Figures 19 to 24 show the SDL diagrams for the diversion supplementary services at the ISPBX side.

Figure 25 shows the SDL diagrams for the diversion supplementary services at the terminal side.

The SDL diagrams are specified according to Recommendation Z.100 [5].

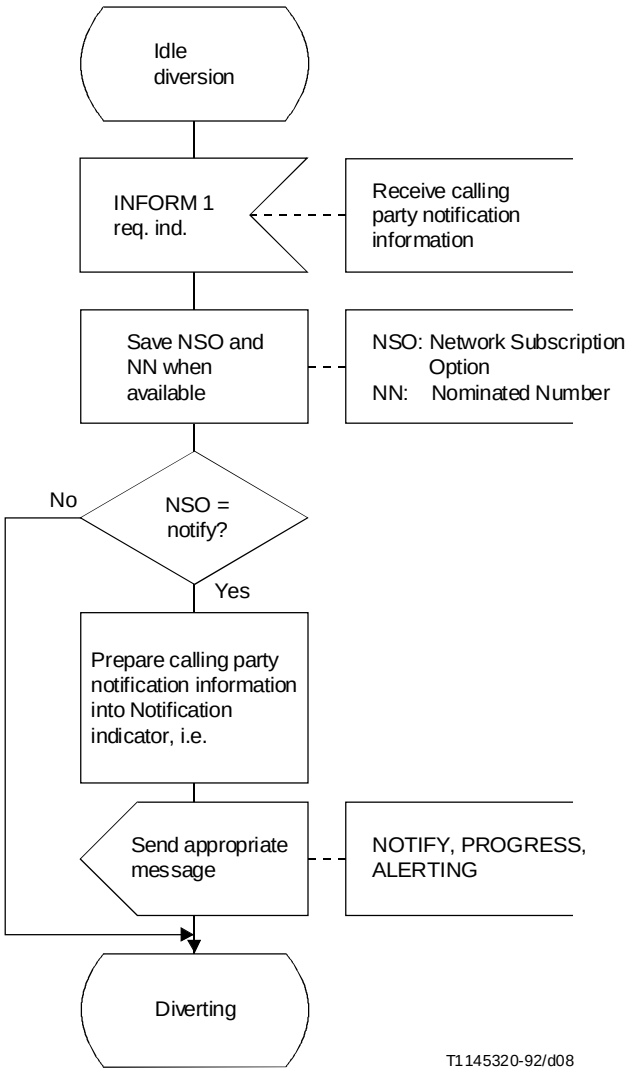


FIGURE 10/Q.952 (sheet 1 of 3)

Call Diversion Calling Party Notification – Network Side

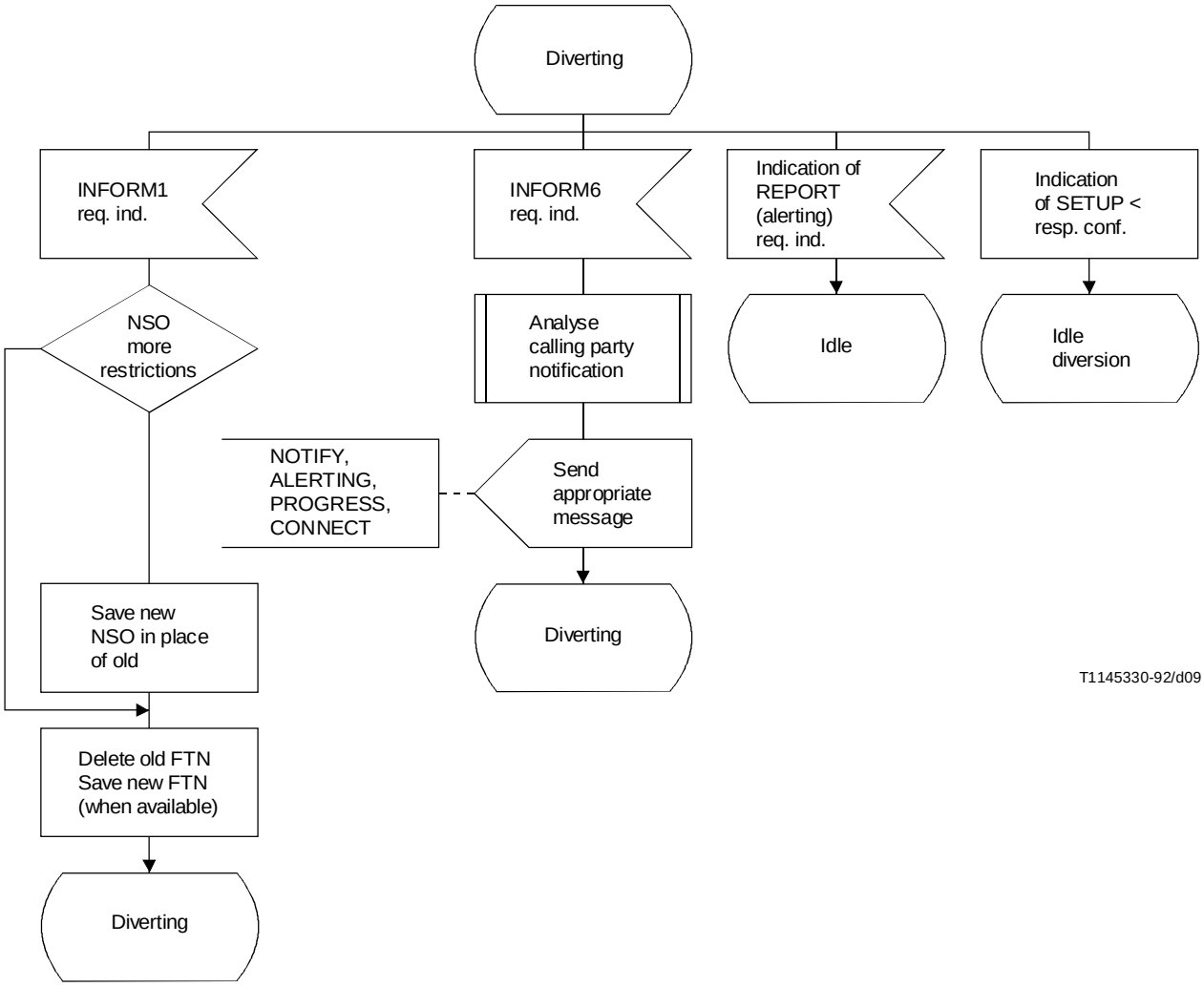


FIGURE 10/Q.952 (sheet 2 of 3)

Call Diversion Calling Party Notification – Network Side

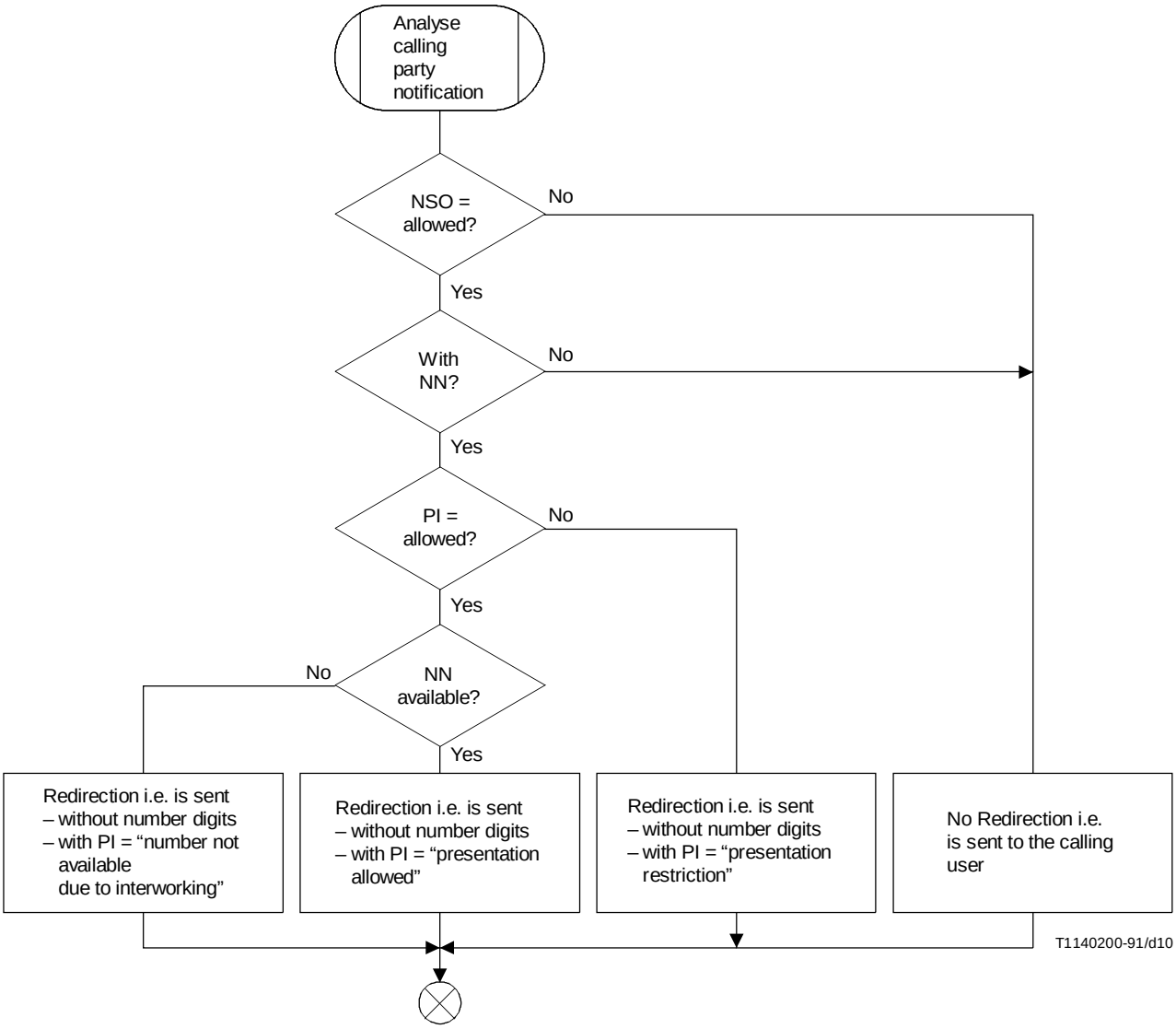


FIGURE 10/Q.952 (sheet 3 of 3)

Call Diversion Calling Party Notification – Network Side

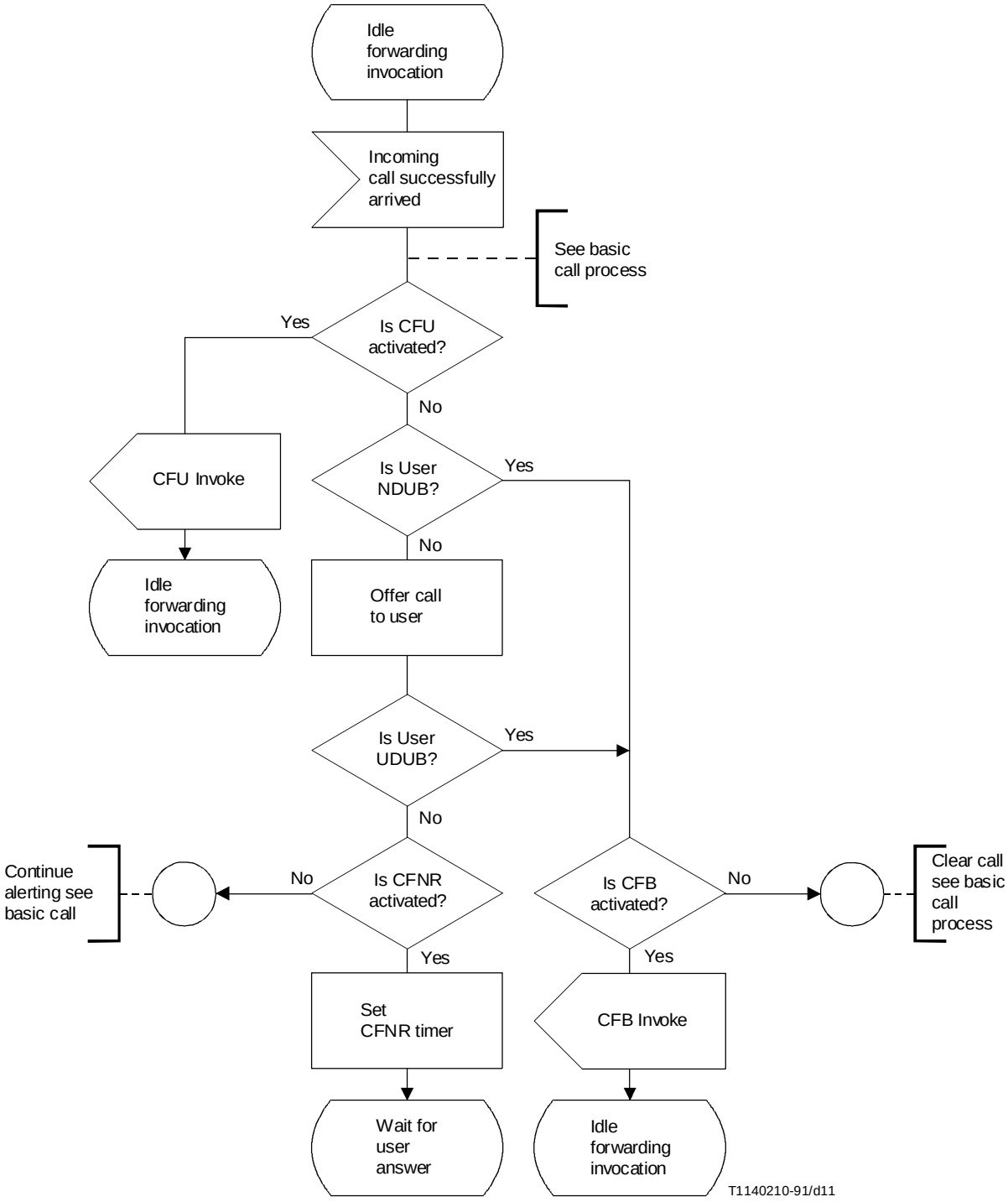


FIGURE 11/Q.952 (sheet 1 of 2)

General Call Forwarding Invocation – Public Network Side

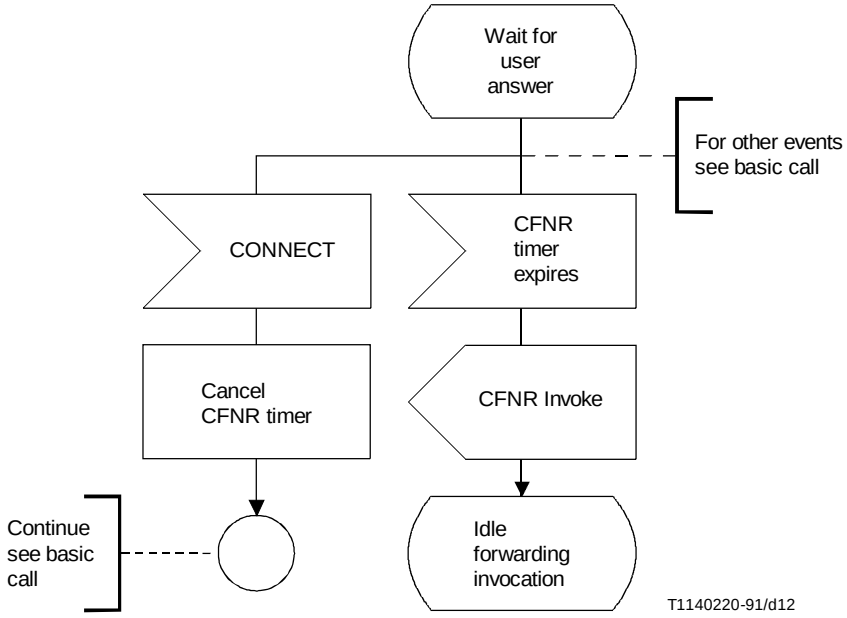


FIGURE 11/Q.952 (sheet 2 of 2)

General Call Forwarding Invocation – Public Network Side

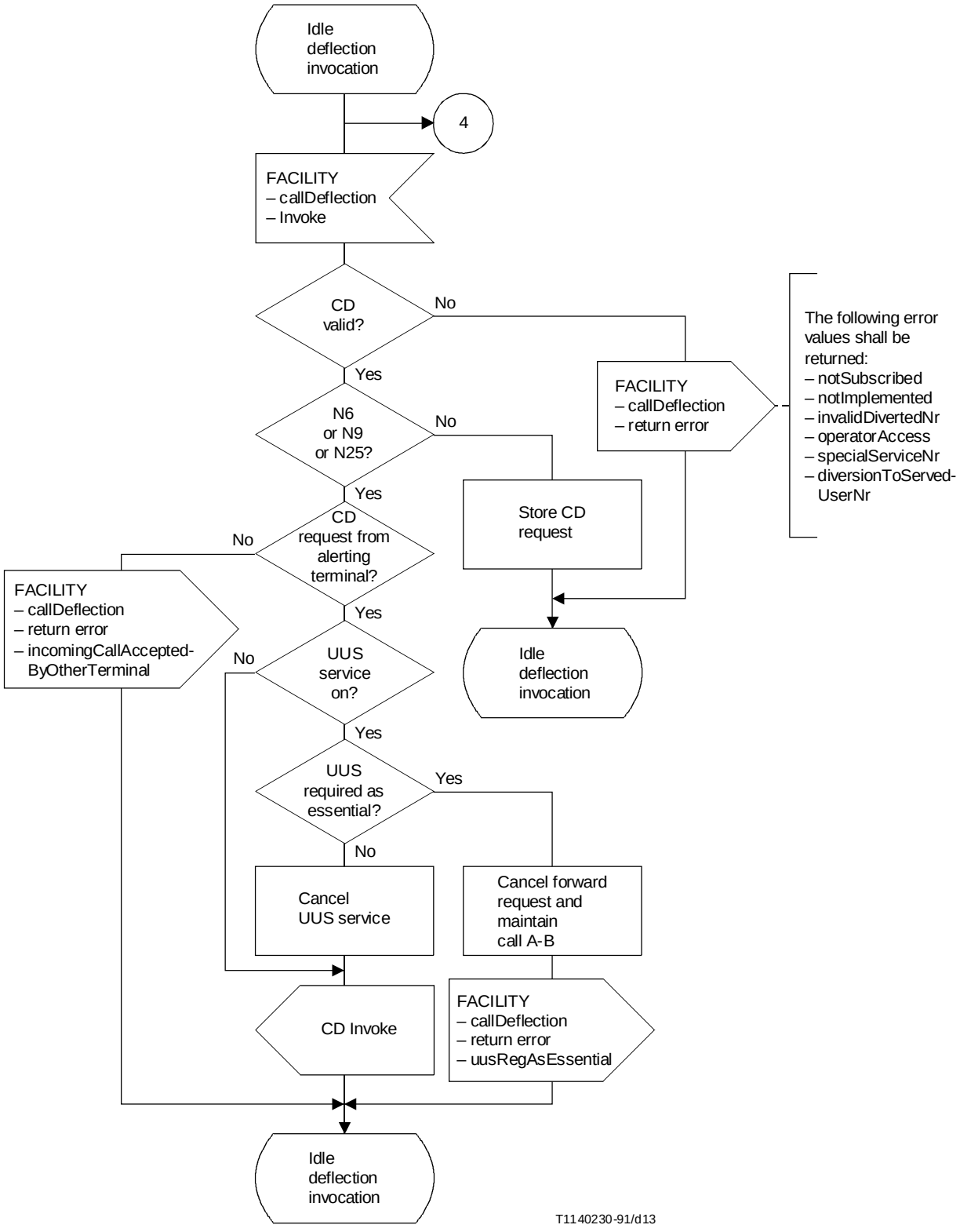


FIGURE 12/Q.952 (sheet 1 of 2)

General Call Deflection Invocation – Public Network Side

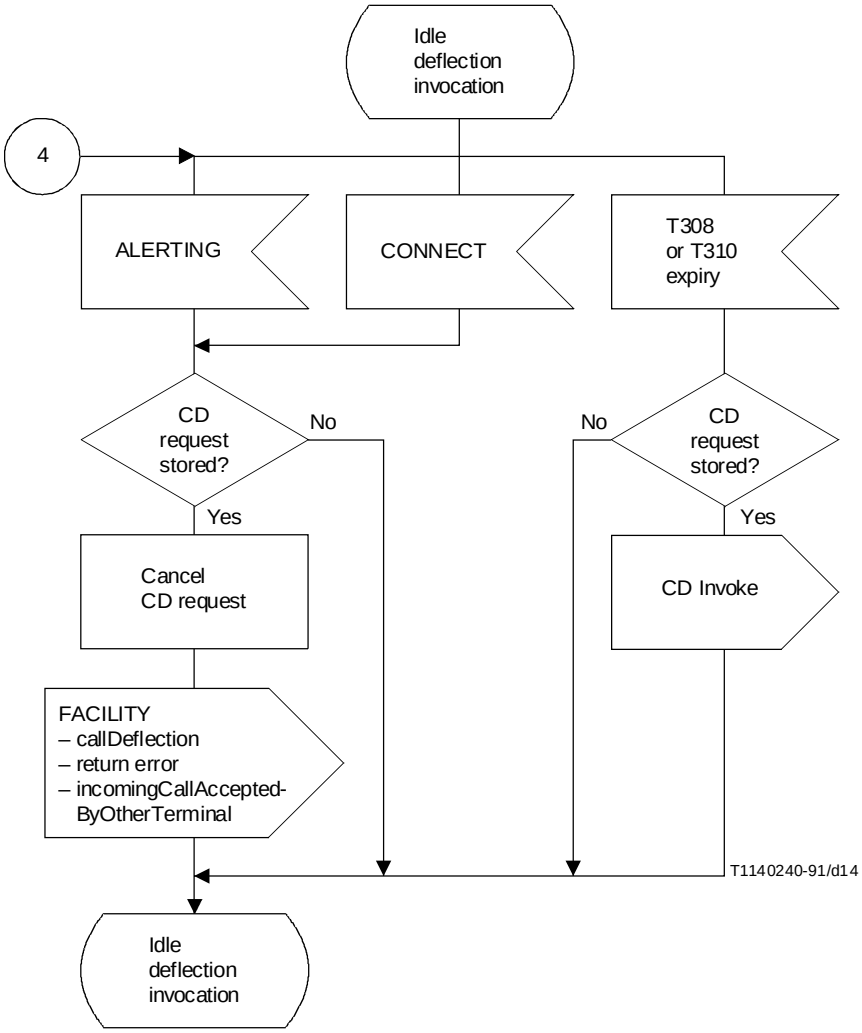


FIGURE 12/Q.952 (sheet 2 of 2)

General Call Deflection Invocation – Public Network Side

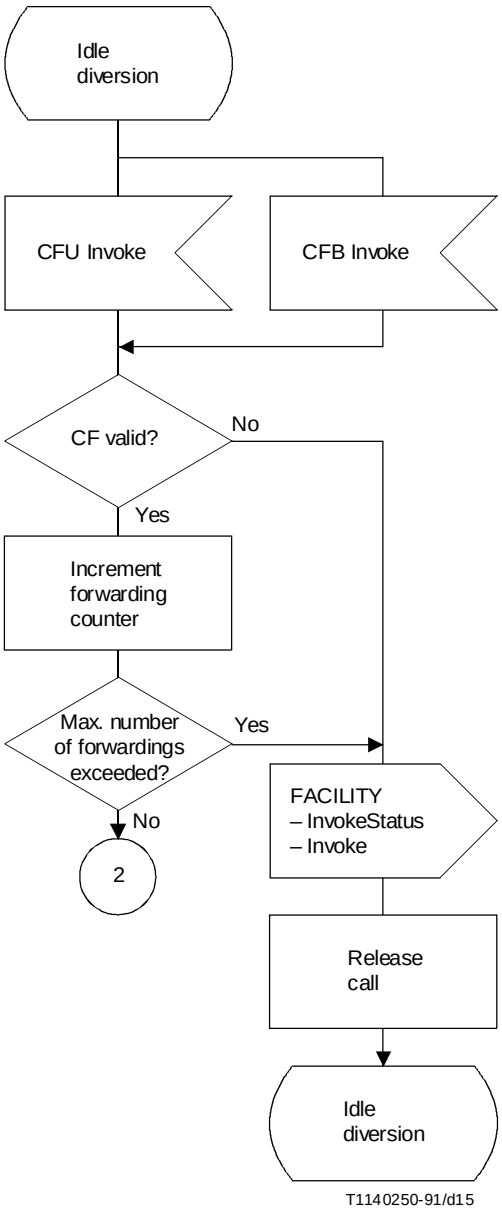


FIGURE 13/Q.952

CFU/CFB Served User Invocation – Network Side

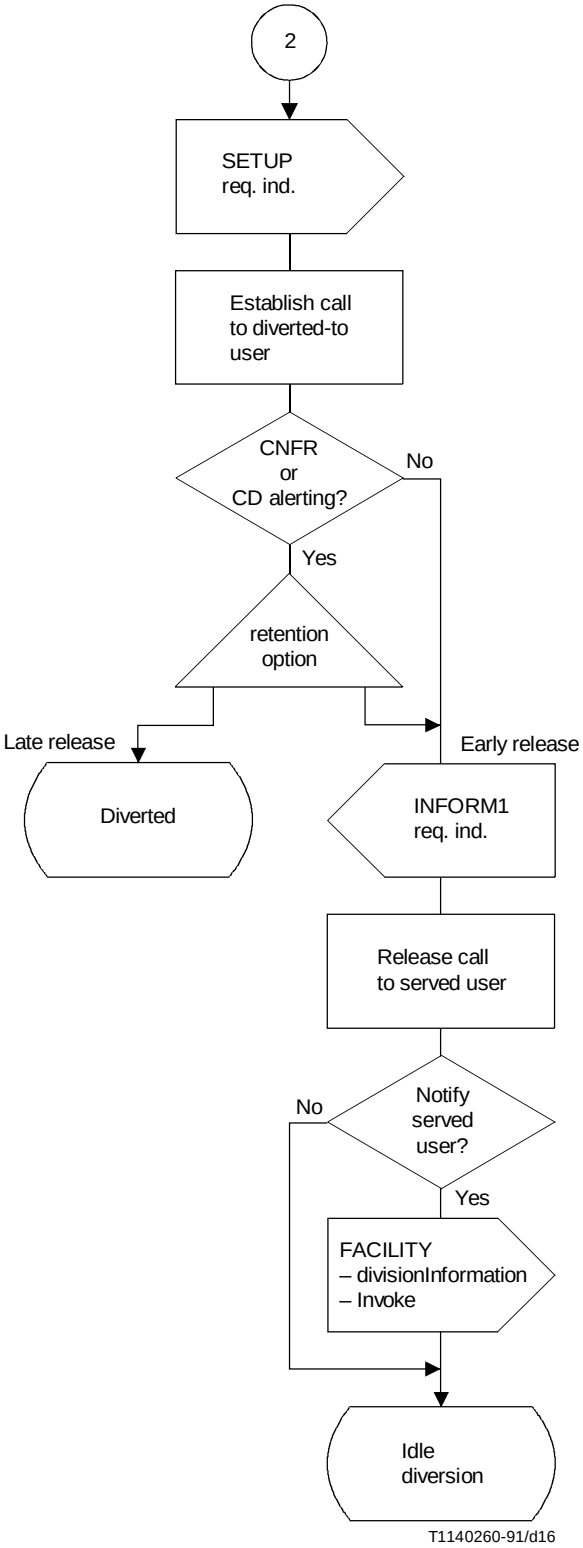


FIGURE 14/Q.952 (sheet 1 of 2)

Served user Invocation – Public Network Side

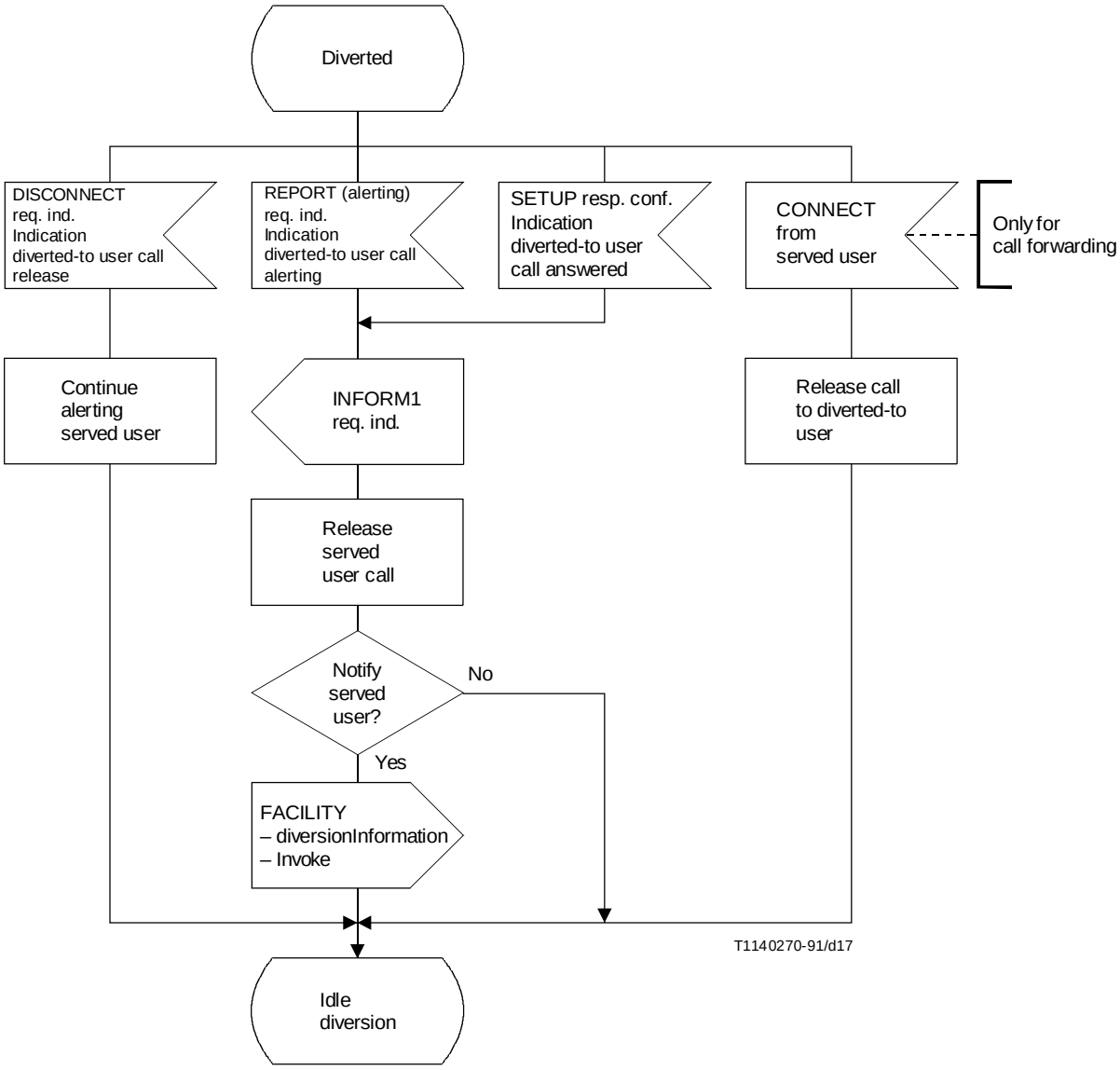


FIGURE 14/Q.952 (sheet 2 of 2)

Served user Invocation – Public Network Side

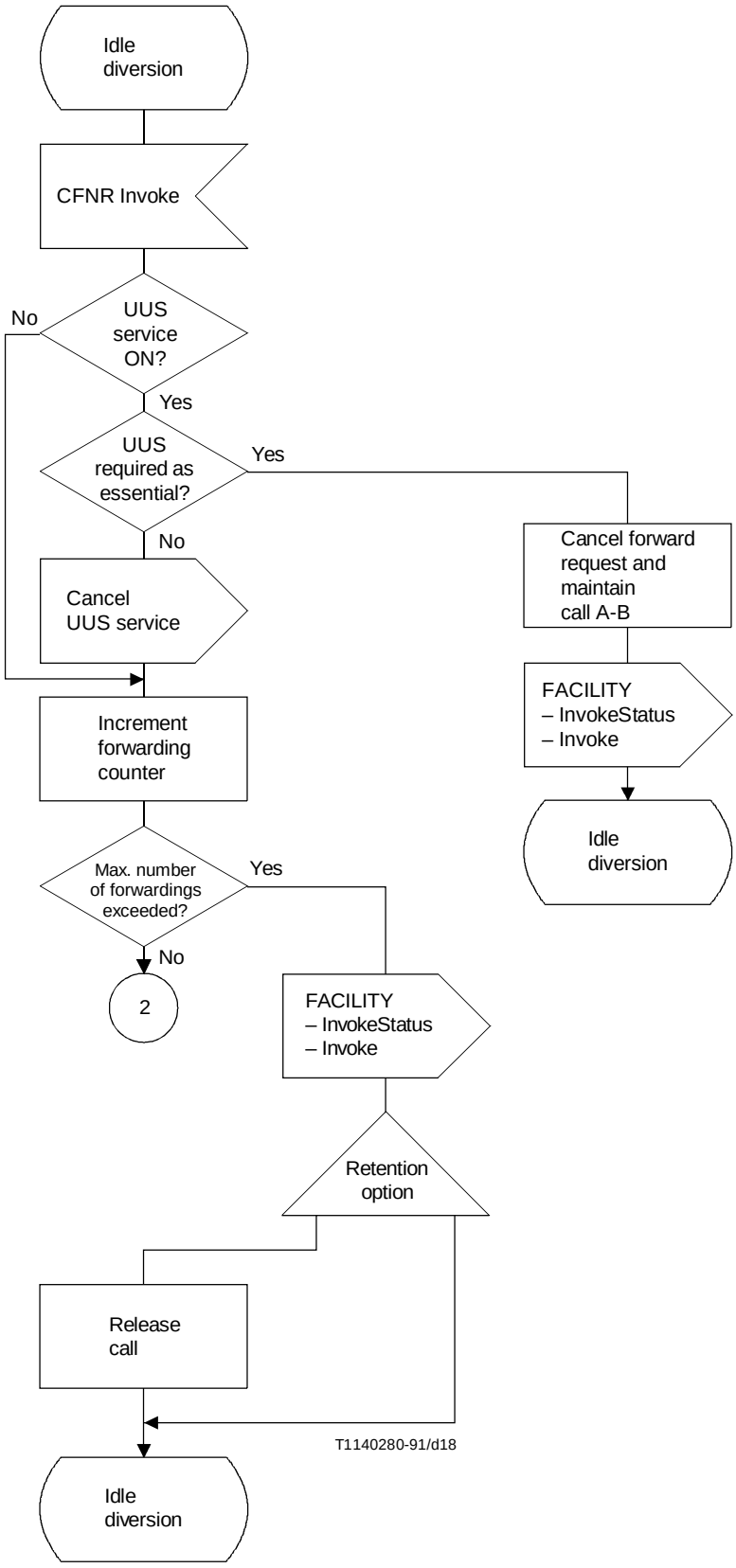
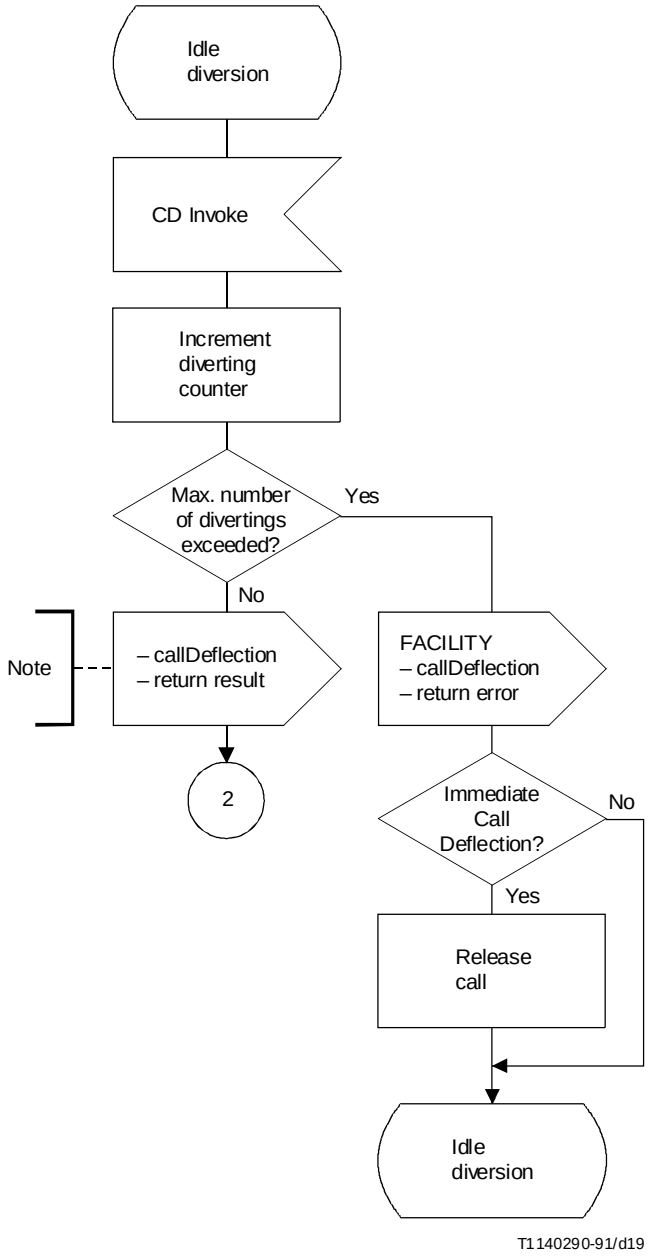


FIGURE 15/Q.952

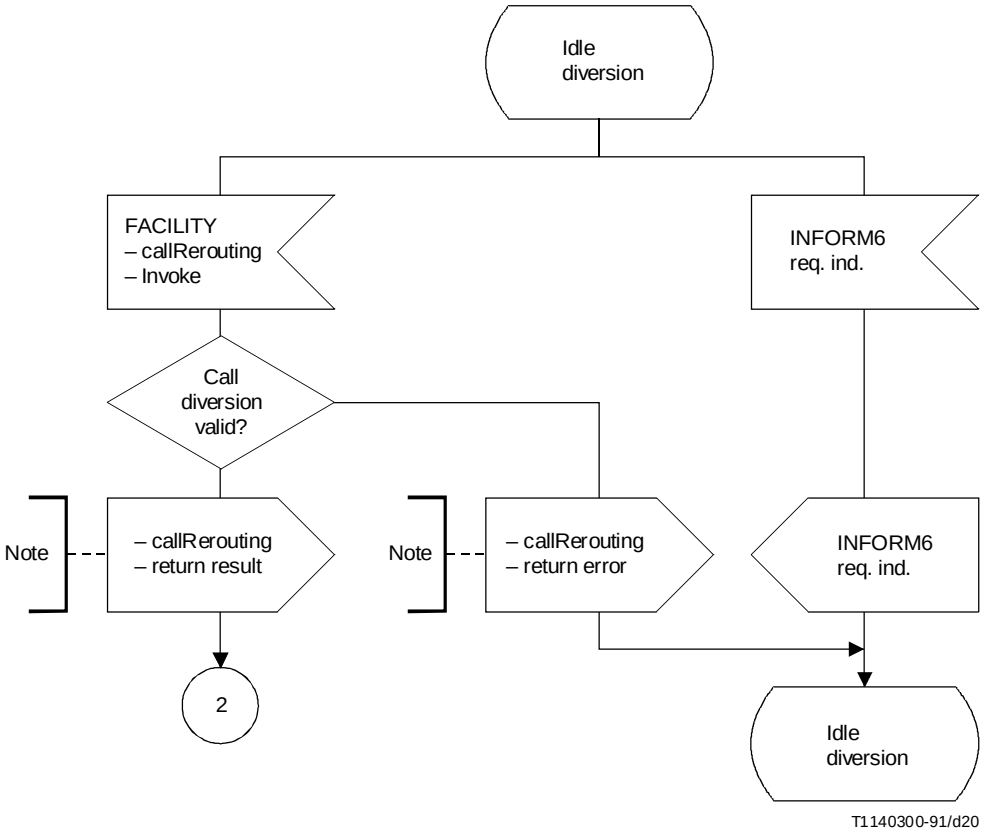
CFNR Served User Invocation – Network Side



NOTE – The callDeflection operation shall be sent in a FACILITY message for CD alerting (late release) and, shall be carried in a DISCONNECT message for CD immediate and CD alerting (early release).

FIGURE 16/Q.952

CD Served User Invocation – Network Side



NOTE – The callRerouting operation shall be sent in a FACILITY message for CFNR late release and CD alerting (late release) and, shall be carried in a Disconnect message for CFU, CFB, CFNR (early release), CD immediate and CD alerting (early release).

FIGURE 17/Q.952

Call Rerouting Handling – Network Side

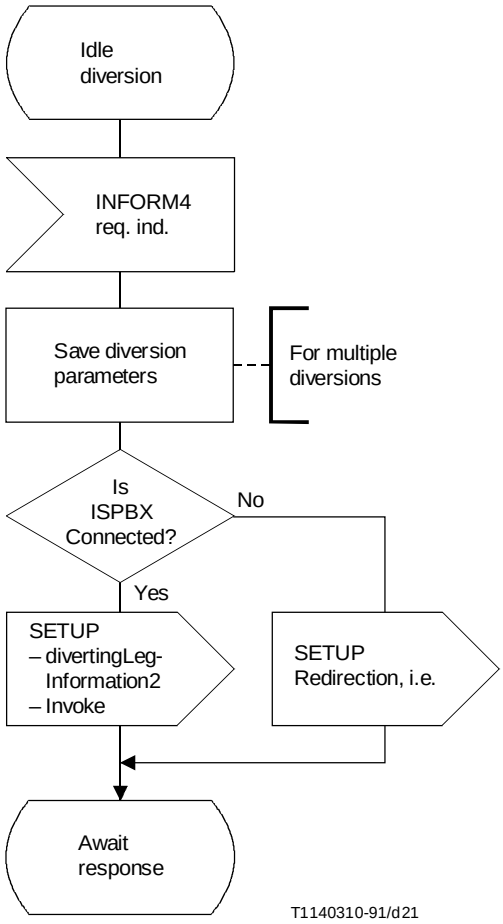


FIGURE 18/Q.952 (sheet 1 of 3)

Call Diversion at Diverted-to-User – Public Network Side

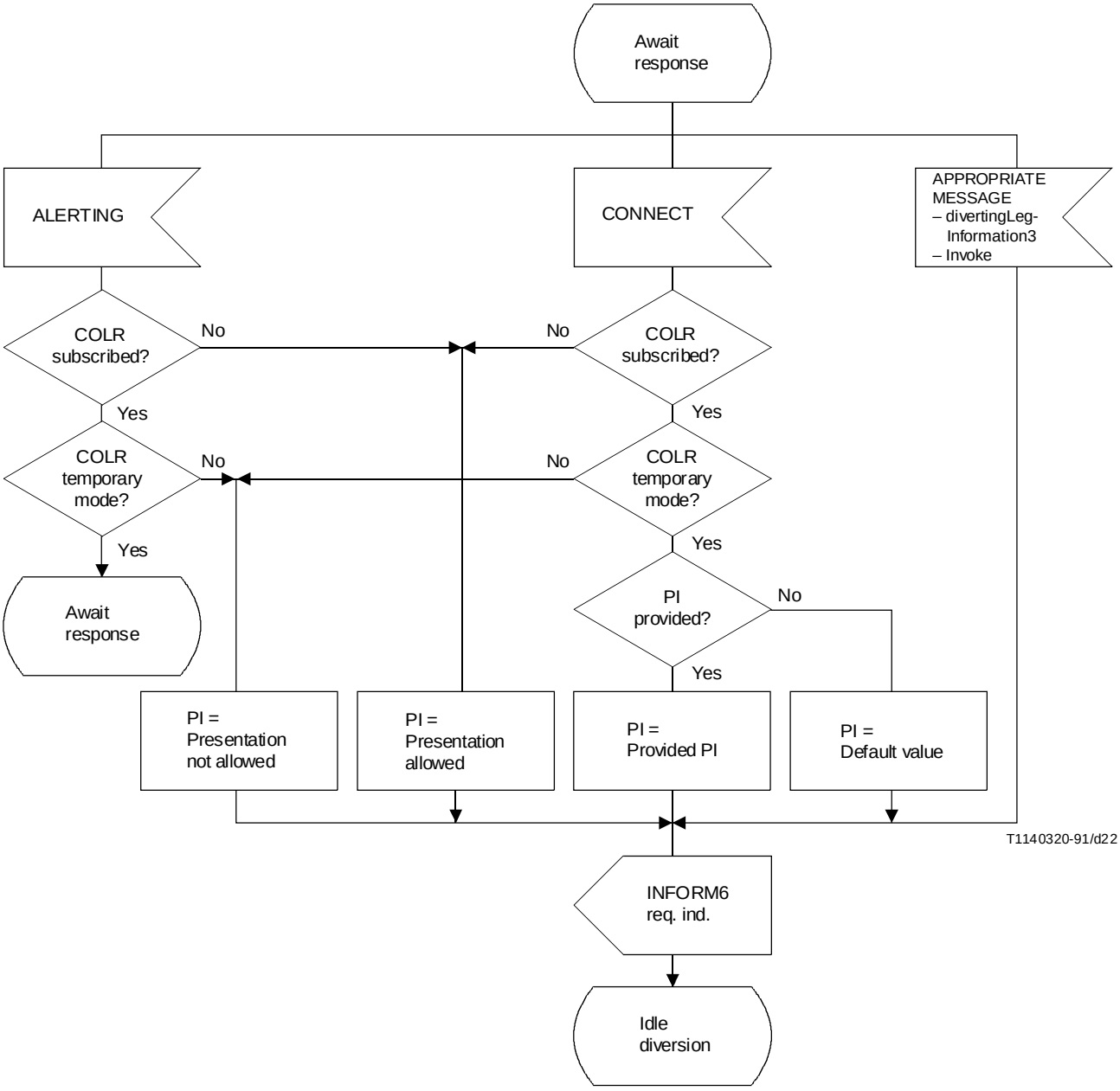


FIGURE 18/Q.952 (sheet 2 of 3)

Call Diversion at Diverted-to-User – Public Network Side

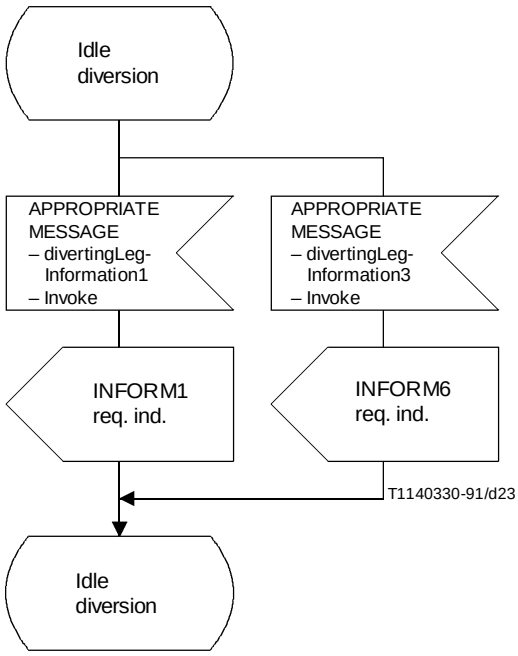
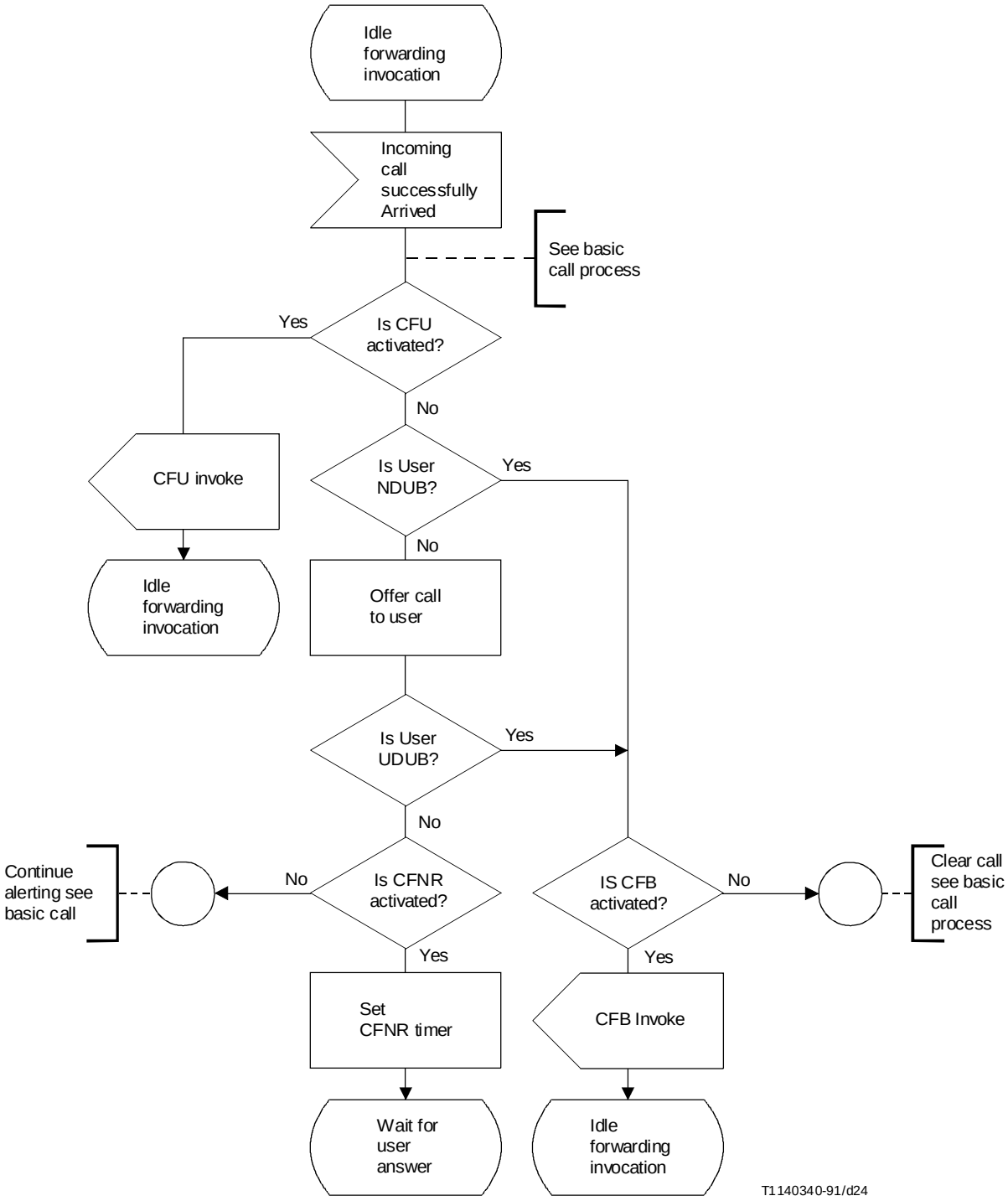


FIGURE 18/Q.952 (sheet 3 of 3)

Call Diversion at Diverted-to-User – Public Network Side



NOTE – The SDL information at the user side of the ISPLX is informative.

FIGURE 19/Q.952 (sheet 1 of 2)

General Call Forwarding Invocation – User Side (ISPX)

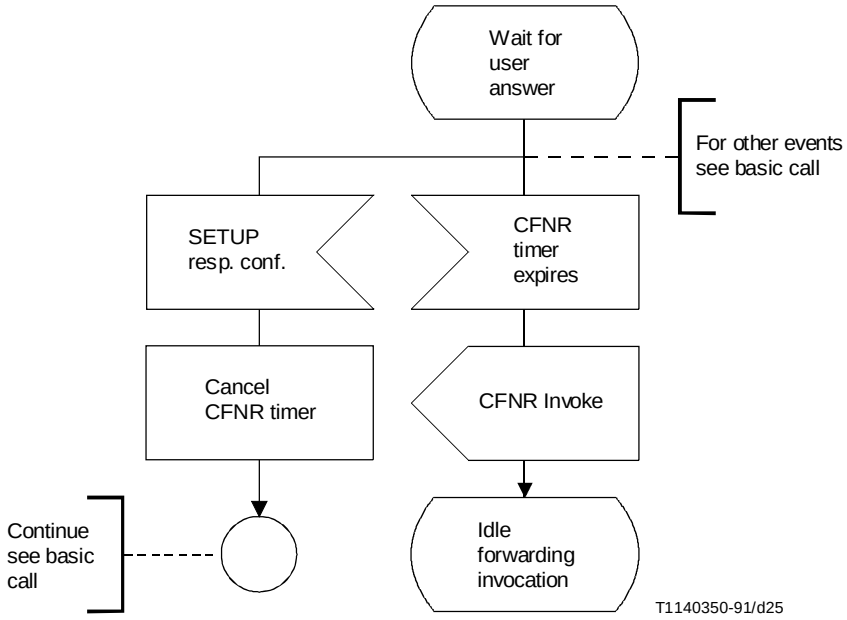


FIGURE 19/Q.952 (sheet 2 of 2)

General Call Forwarding Invocation – User Side (ISPX)

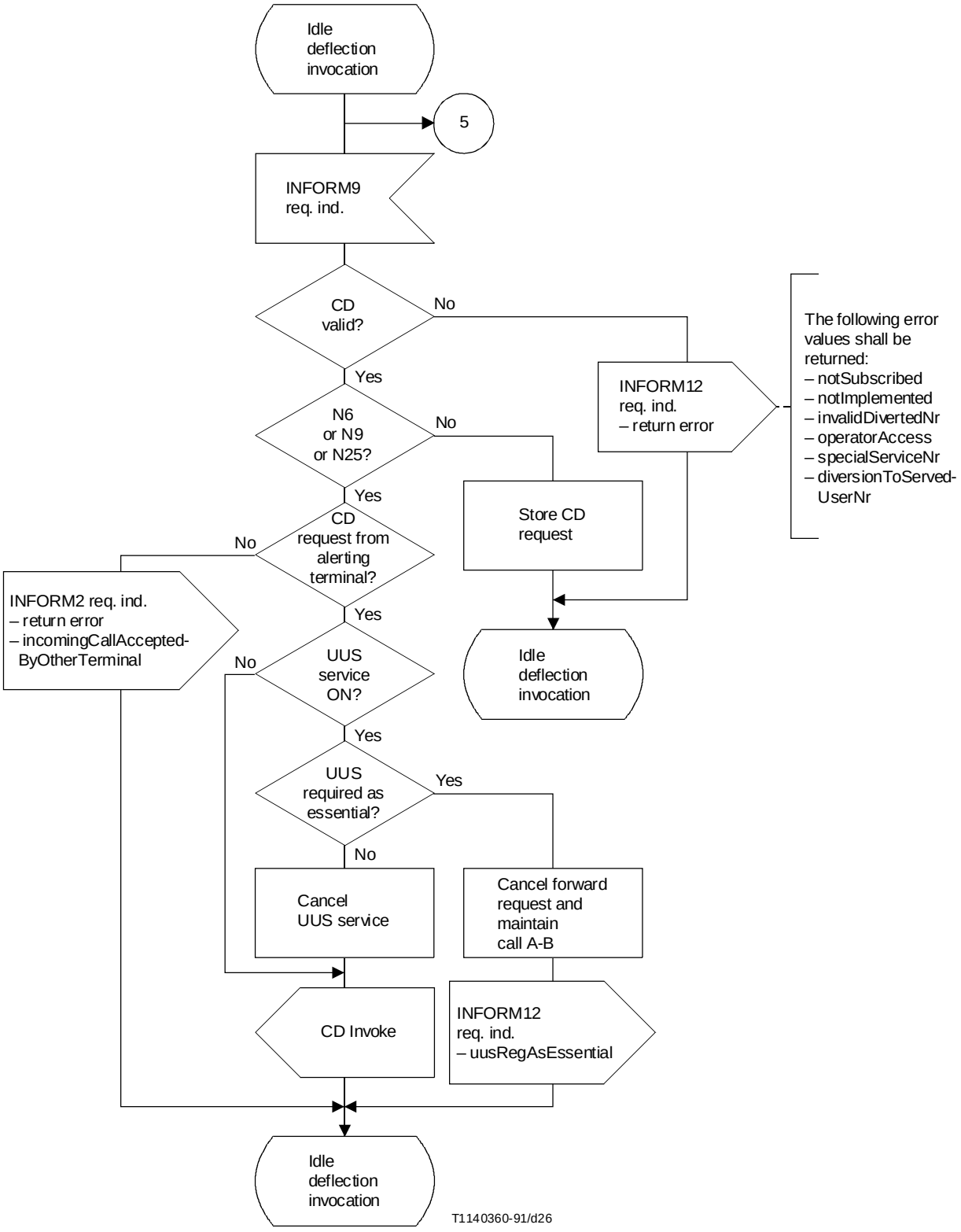


FIGURE 20/Q.952 (sheet 1of 2)

General Call Deflection Invocation – ISPBX Side

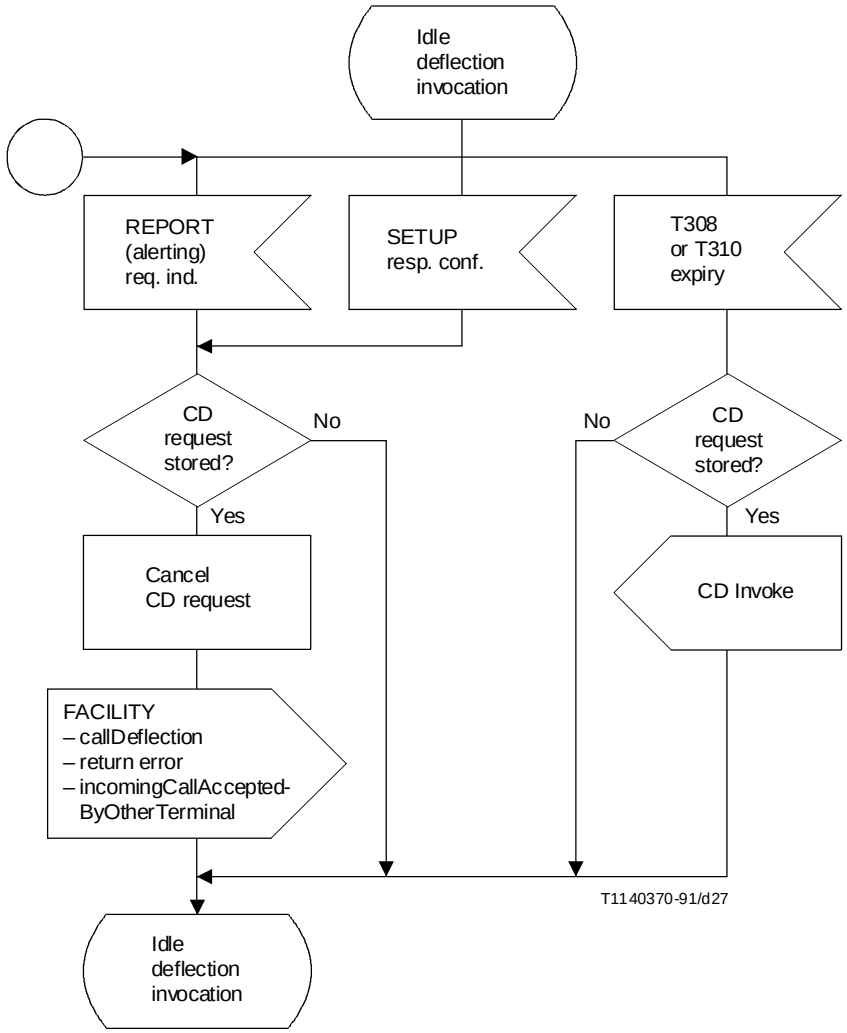


FIGURE 20/Q.952 (sheet 2 of 2)

General Call Deflection Invocation – ISPBX Side

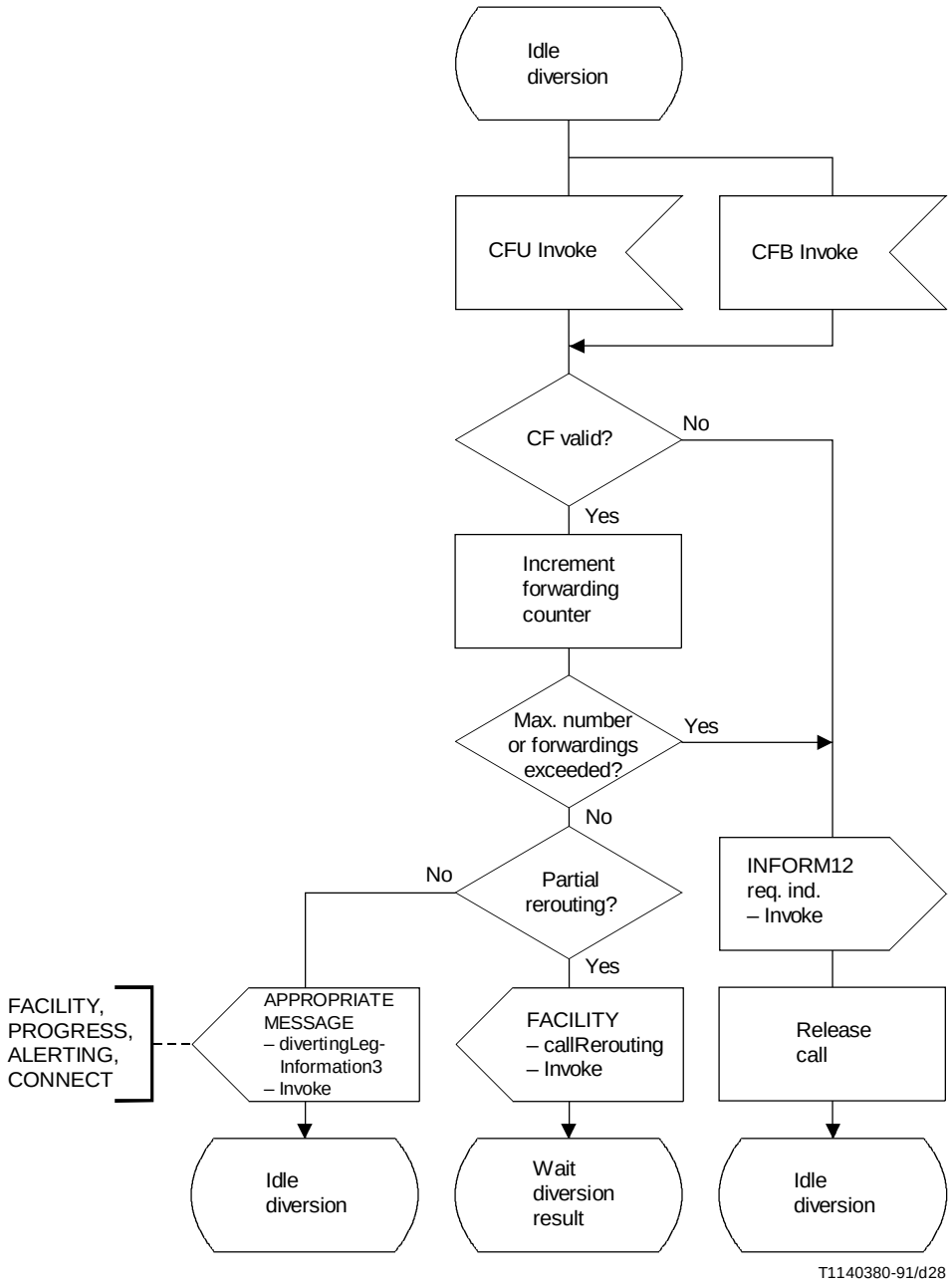
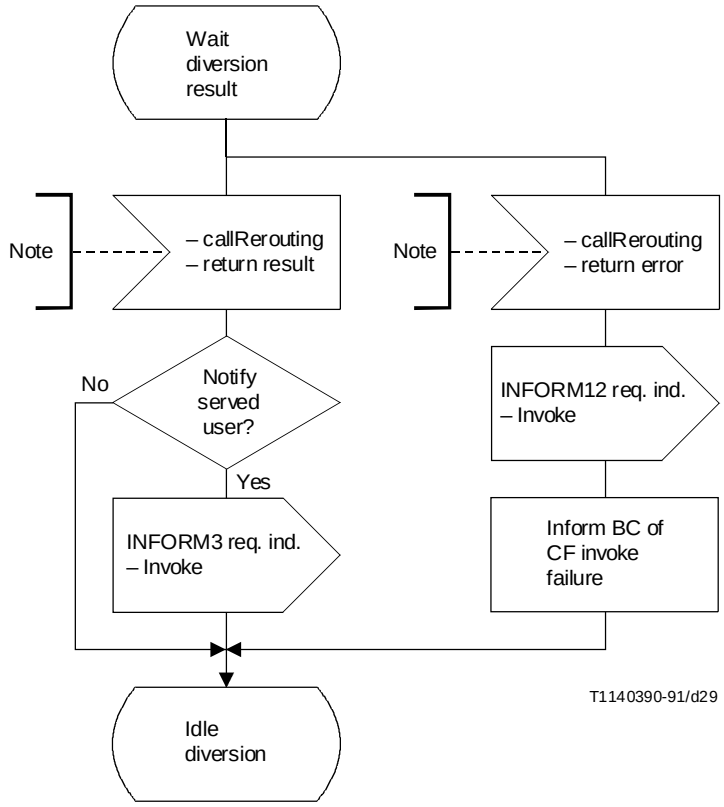


FIGURE 21/Q.952 (sheet 1 of 2)

CFU/SFB Served User Invocation – ISPBX Side



NOTE – The callRerouting operation shall be sent in a FACILITY message for CFNR late release and CD alerting (late release) and, shall be carried in a Disconnect message for CFU, CFB, CFNR (early release), CD immediate and CD alerting (early release).

FIGURE 21/Q.952 (sheet 2 of 2)

CFU/CFB Served User Invocation – ISPBX Side

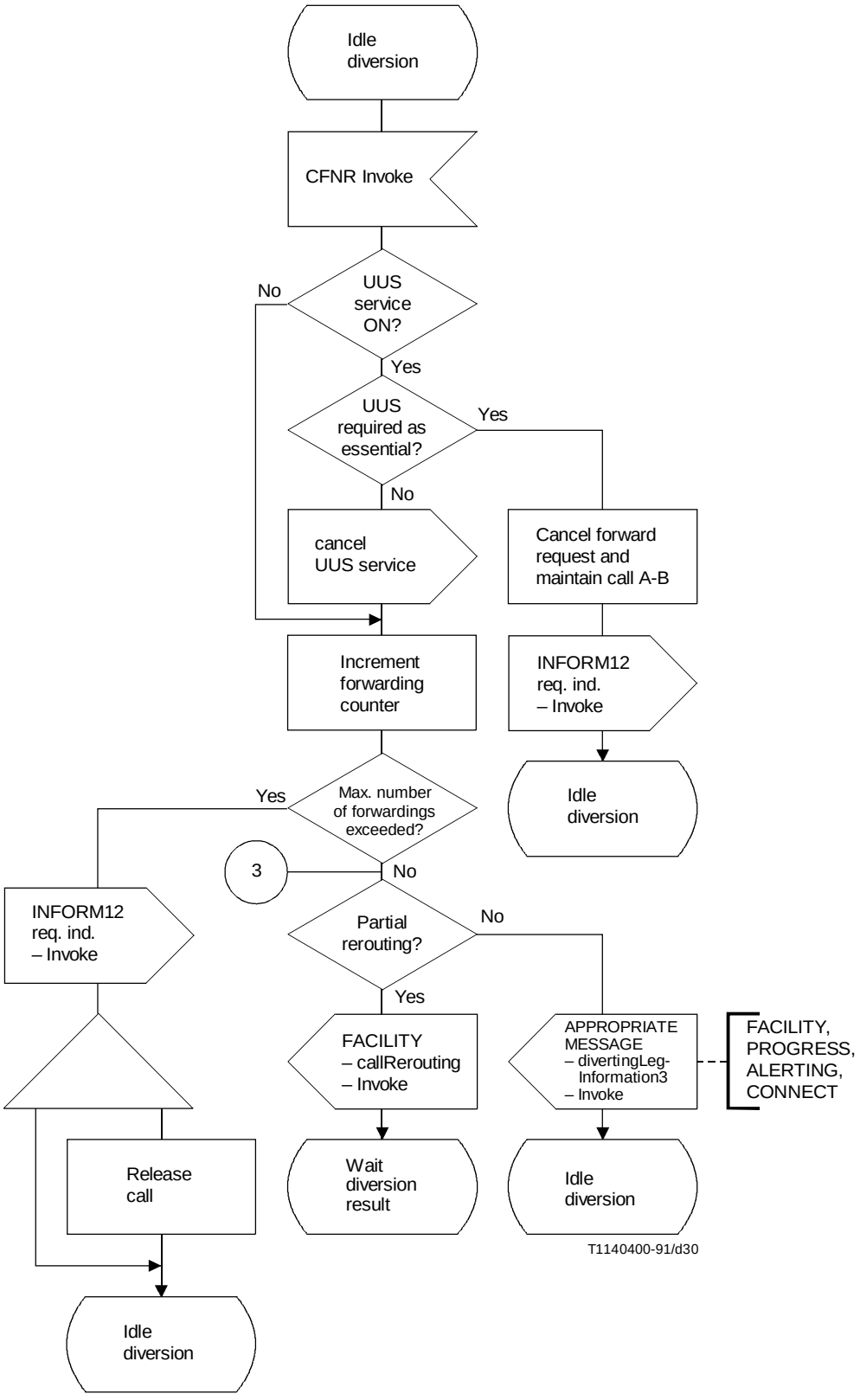
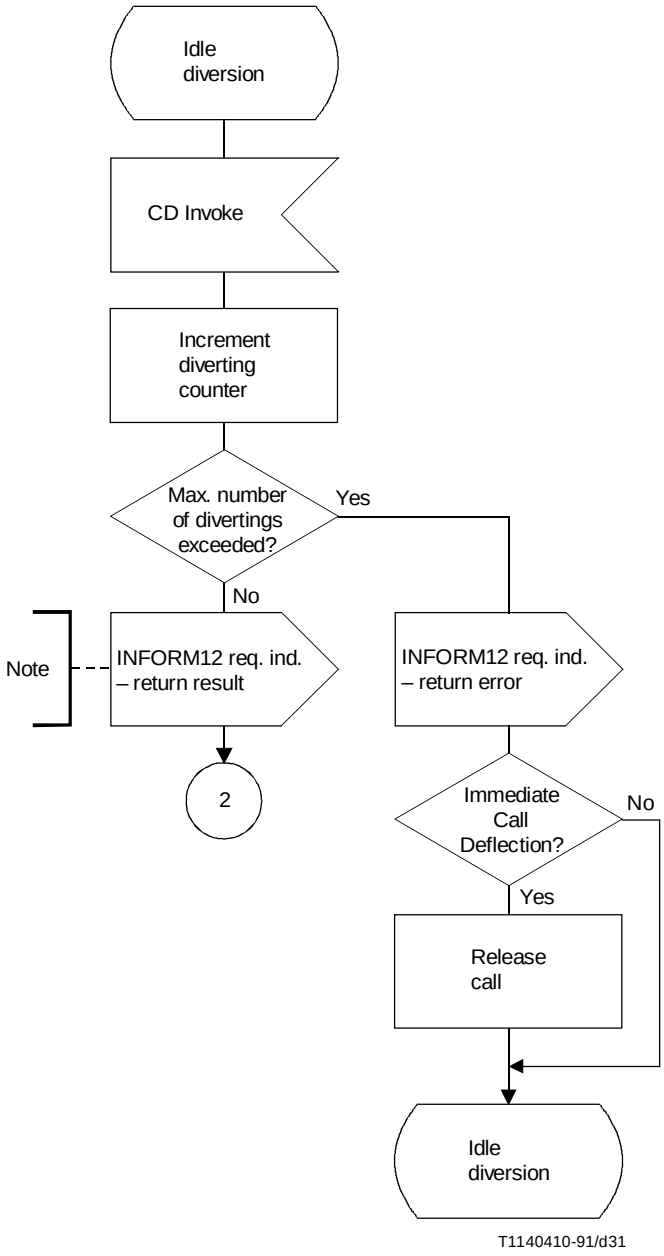


FIGURE 22/Q.952

CFNR Served User Invocation – ISPBX Side



NOTE – The callDeflection operation shall be sent in a FACILITY message for CD alerting (late release) and, shall be carried in a DISCONNECT message for CD immediate and CD alerting (early release).

FIGURE 23/Q.952

CD Served User Invocation – ISPBX Side

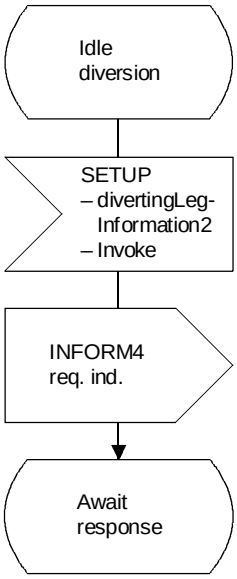


FIGURE 24/Q.952 (sheet 1 of 2)

Call Diversion at Diverted-to-User – ISPBX Side

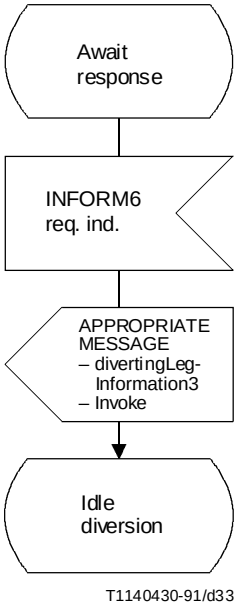


FIGURE 24/Q.952 (sheet 2 of 2)

Call Diversion at Diverted-to-User – ISPBX Side

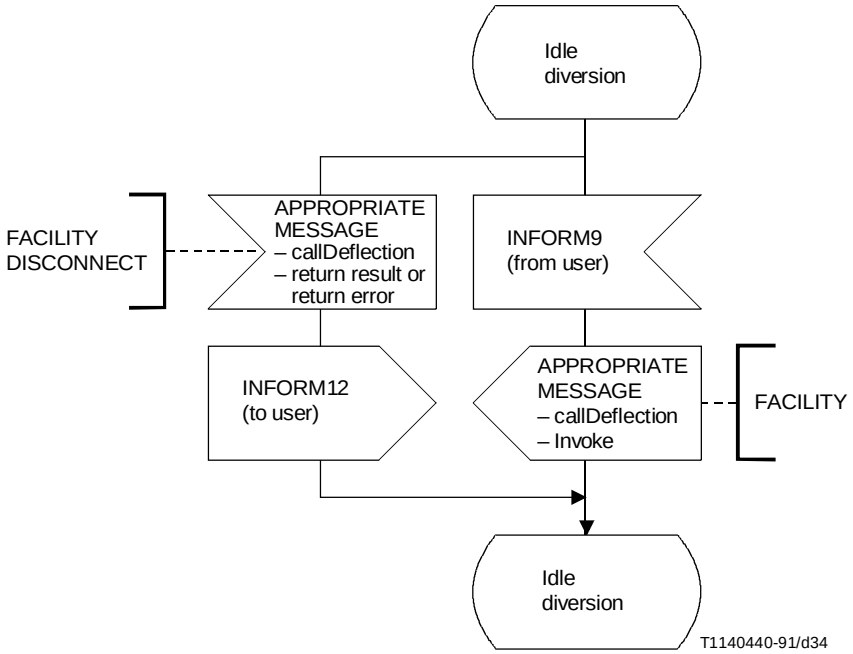


FIGURE 25/Q.952

Call Deflection at Served User Side

Annex A

(This annex forms an integral part of this Recommendation)

```
ASN.1 definition of basic services in call forwarding supplementary service procedures

Basic-Service-Elements { ccitt recommendation q 952 diversion (2)
        basic-service-elements (2) }

DEFINITIONS ::=

BEGIN

EXPORTS                         BasicService;

BasicService ::=                ENUMERATED {
                                allServices (0),
                                unrestrictedDigitalInformation (2),
                                audio3100Hz (3),
                                telephony (32),
                                teletex (33),
                                telefaxGroup4Class1 (34),
                                videotexSyntaxBased (35),
                                videotelephony (36) }

END -- of basic service elements
```

References

This Recommendation incorporates by dated or undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this Recommendation only when incorporated in it by amendment or revision. For undated references, the lastest edition of the publication referred to applies.

[1] CCITT Recommendation | *ISDN user-network interfaces – Reference configurations*, Rec. I.411, 1988.

[2] CCITT Recommendation | *Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN*, Rec. I.130, 1988.

[3] CCITT Recommendation | *ISDN user-network interface layer 3 specification for basic call control*, Rec. Q.931, 1990.

[4] CCITT Recommendation | *Generic Procedures for the control of ISDN supplementary services*, Rec. Q.932.

[5] CCITT Recommendation | *Vocabulary of terms for ISDNs*, Rec. I.112, 1988.

[6] CCITT Recommendation | *ISDN user-network interface layer 3 specification for basic call control – SDL diagrams*, Rec. Q.931.

[7] CCITT Recommendation | *Integrated Services Digital Network (ISDN), Call Forwarding Unconditional (CFU) supplementary service, service description*, Rec. I.252.4.

[8] CCITT Recommendation | *Integrated Services Digital Network (ISDN), Call Forwarding Busy (CFB) supplementary service, service description*, Rec. I.252.2.

[9] CCITT Recommendation | *Integrated Services Digital Network (ISDN), Call Forwarding No Reply (CFNR) supplementary service, service description*, Rec. I.252.3.

[10] CCITT Recommendation | *Integrated Services Digital Network (ISDN), Call Detection (CD) supplementary service, service description*, Rec. I.252.5.

[11] CCITT Recommendation | *Common Specific Characteristics of Services*, Rec. I.211, 1988.

[12] CCITT Recommendation | *Specification of Abstract Syntax Notation One (ASN.1)*, Rec. X.208, 1988.

[13] CCITT Recommendation | *Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)*, Rec. X.209, 1988.

[14] CCITT Recommendation | *Numbering plan for the ISDN era*, Rec. E.164, 1988.

[15] CCITT Recommendation | *Numbering plan for the international telephone service*, Rec. E.163, 1988.

[16] CCITT Recommendation | SDL *Specification Description Language*, Rec. Z.100, 1988.

[17] CCITT Recommendation | *Principles of Telecommunication Services supported by an ISDN and the means to describe them*, Rec. I.210, 1988.